DIVERSITY & DISEASE

THE DEMOGRAPHIC & SOCIO-ECONOMIC DETERMINANTS OF CHRONIC DISEASE IN SOUTH AFRICA

By

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Abstract

Chronic diseases are the leading cause of global mortality and morbidity. The already high rates of these diseases are predicted to increase even further, particularly in developing regions. Diabetes, hypertension and cardiovascular disease prove most common around the world, as well as in South Africa. The burden of such diseases may be far reaching, long lasting and multi-dimensional. Adverse outcomes include death and disability, decreases in labour force participation and in turn economic output, as well as increased pressure on health care facilities and services. In post-apartheid South Africa, only a few epidemiological studies have focused on uncovering the determinants of chronic diseases. As a result, this study aimed to identify the demographic and socio-economic determinants of diabetes, hypertension and cardiovascular disease in South Africa. The study used nationally representative data sourced from the National Income Dynamic Study (NIDS). Descriptive and inferential statistical analysis including multivariate logistic regression was used to assess prevalence and risk. Age was identified as a strong predictor of disease as the elderly exhibited the highest prevalence as well as risk. Similarly, sex was identified as an important predictor as females displayed higher prevalence and risk for all chronic diseases. Racial disparities were consistent over all chronic diseases as Whites, Asian/Indians, and Coloureds displayed higher prevalence and risk compared to African adults. In terms of marital status, widows/widowers and divorcees were identified to have high prevalence and risk of chronic diseases. Low levels of education were shown to increase disease prevalence and risk. Additionally, economically inactive adults presented the highest prevalence and risk for all chronic diseases. Both skilled and unskilled occupations as well as low and high income earners were found to be at increased risk. Furthermore, both formal and informal residency were identified as strong socio-economic predictors of disease. Health care programmes which specifically target high risk groups should be put in place to potentially decrease levels of chronic disease. More importantly however, broader initiatives promoting socio-economic equality may be a long term solution not only to high levels of chronic diseases, but a host of health problems commonly identified in the country.

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List of Acronyms

AIDS	Acquired Immune Deficiency Syndrome
CVD	Cardiovascular Disease
ETT	Epidemiological Transition Theory
HIV	Human Immunodeficiency Virus
ILO	International Labour Organization
ISCO	International Standard Classification of Occupations
NIDS	National Income Dynamic Study
SALDRU	Southern Africa Labour and Development Research Unit
WHO	World Health Organization

Table of Contents

List of Tables

List of Figures & Equations

Chapter 1 - Introduction

1.1 Background

In 2005, the World Health Organization (WHO) affirmed that chronic diseases have become a neglected health matter across the world (WHO, 2005). Of the 58 million deaths worldwide in the same year, 35 million had been associated to chronic diseases (WHO, 2005). More specifically, comprising 63% of all deaths, chronic diseases are by far the leading cause of global mortality (WHO, 2011). The most common chronic diseases include; hypertension, cardiovascular disease (including stroke), cancer (commonly lung and breast cancer), and diabetes mellitus (WHO, 2011).

The global burden of chronic diseases is noted to be on the rise (Yach et al., 2004). This increase in prevalence is most commonly and frequently observed in developing countries. Additionally, this already increasing rate is tipped to escalate even further over the next two decades, consequently adding to the current pressures exerted by chronic diseases. Subsequently, these types of diseases may lead to adverse outcomes such as disability and death (years of potential life lost), a decrease in labour force participation and economic output, as well as an increased burden on health care facilities and services (Strong et al., 2005; Wang et al., 2005).

Locally, actuarial projections suggest that the rate of chronic diseases will rise in South Africa (Steyn, Fourie & Temple, 2006). Furthermore, different chronic disease risk factors are fuelled by the countries previous political disparities. This has resulted in socio-economic differences between different population groups which serve to promote respective risk factors. Subsequently, the association between demographic and socio-economic variables in relation to health is cited as one of the oldest relationships in applied health research (Brown, Guy & Broad, 2005). Furthermore, studies dating back more than a century have identified strong linkages between these variables and a variety of health outcomes. In highlighting a possible gap through which the addition of knowledge may be conducted, Steyn, Fourie & Temple (2006) point out that few epidemiological studies have been conducted in South Africa since the country's transition into democracy in 1994. Thereafter, more than a decade and half into South Africa's democracy, the association between demographic characteristics, socio-economic status and the prevalence of chronic diseases would be important and interesting to note.

1.2 Chronic Diseases

The focus on the chronic diseases of diabetes, hypertension and cardiovascular disease may be justified as they are the most common chronic diseases worldwide (WHO, 2011). Similarly, this trend is also observed in South Africa (Steyn, Fourie & Temple, 2006). A South African Risk Assessment study revealed that diabetes, hypertension and cardiovascular disease were among the top ten leading causes of mortality in the country (Norman et al., 2007). These diseases cause approximately 65 000 deaths per year at the national level. As these diseases are so highly prevalent, and consequently exert the most pressure on health services, the factors that promote and facilitate them are of vital significance.

1.2.1 Diabetes

Diabetes is documented to affect approximately 194 million people across the globe. This figure is predicted to increase to 333 million/6.3% of the global adult population by 2025 (International Diabetes Federation, 2003). The disease is widely documented to be associated with socio-economic status in both developed and developing countries worldwide (Connolly et al., 2000). Additionally, diabetes gives rise to somewhat of a double barrel of effects. On the one hand, it may cause ill-health through its promotion of fluctuating insulin and blood sugar levels. On the other hand, diabetes has been widely documented as a risk factor promoting cardiovascular disease (Venkata & Ram, 1995; Lee et al., 2008; Misra et al., 2010). Of people diagnosed with diabetes, an estimated 75% will eventually die from cardiovascular related causes. In contrast, as little as 33% of people without diabetes die from cardiovascular related causes (Kapur et al., 2005). This double impact of diabetes solidifies its importance as one of the three leading chronic diseases in the world, in South Africa, and consequently, in this study.

1.2.2 Hypertension

Hypertension is estimated to account for 4.5% of the global burden of disease. At this level, hypertension is documented to cause approximately 7.1 million premature deaths annually (WHO, 2003; Pereira et al., 2009). In 2000, approximately 26.4% of the global adult population were living with hypertension. This accounted for 972 million adults worldwide, of which 333 million were in economically developed countries, and 639 million in economically developing countries. Hypertension causes an enormous economic burden on health care systems due to Governments' expenditure on treatments and the related complications associated with the disease (Arredondo & Zũńiga., 2006). The most common treatments include the constant use of medical drugs and required periodic tests (Johannesson & Le Lorier, 1996). The identification of those groups at risk for hypertension is needed to prevent mortality and morbidity as well as to implement effective treatment programmes. Importantly, as with diabetes, hypertension proves to be a major risk factor in cardiovascular disease (Kannel, 1996; Gregg et al., 2005; World Heart Federation, 2014). In this way, hypertension has a double effect; the first coming from the disease itself, and the second, its effect in facilitating cardiovascular disease.

1.2.3 Cardiovascular Disease

The prevalence of cardiovascular disease and its respective risk factors are documented to be increasing at the global level (Mittal & Singh., 2010). The disease is commonly highlighted as the leading cause of death in the developed world, and this trend is noted to soon follow in developing regions (Measham et al., 2006; Ezzati et al., 2005). Although mostly thought of as a disease of affluence, cardiovascular disease has increasing becoming a disease which sees no cast or creed (Trowell & Burkitt, 1981). Subsequently, many studies suggest that socio-economic status is a significant independent risk factor of cardiovascular disease, its etiology and progression (Kaplan & Keil, 1993; Morrison et al., 1997; Raphael, 2001). Similarly, literature from both the developed and developing world reveal that cardiovascular disease as well as its relative risk factors are socio-economically distributed (Gilberts, Arnold & Grobbee, 1994; Grotto, Huerta & Sharabi, 2008; Conen et al., 2009). As cardiovascular disease becomes free from discrimination, its potential target group increases the world-over. Therefore, it becomes an important chronic disease to consider in this study.

1.3 Objectives

The aim of this study is to investigate the association between demographic and socio-economic characteristics (age, sex, race, marital status, educational levels, employment status, occupation, income levels and residency) and the prevalence of chronic diseases among South African adults (15 years and older).

1.3.1 Key questions to be answered:

I. What is the prevalence of diabetes, hypertension and cardiovascular disease among South African adults (+15 years)?

II. What are the demographic characteristics and socio-economic indicators most associated with the prevalence of diabetes, hypertension and cardiovascular disease among South African adults?

III. Which groups are least associated with the prevalence of the chronic diseases, and what are the possible reasons for this?

1.4 Limitations of the research

Diabetes, hypertension and cardiovascular disease are primarily facilitated by preventable and modifiable risk factors such as tobacco usage, excess alcohol consumption, sedentary lifestyle, lack of physical activity/exercise, and unhealthy diet (increases in sugar and fat consumption) (WHO, 2005). At this point it is important to note that this study focuses on the proximate determinants of chronic diseases. Although the variables mentioned above are important determinants of health, their effects are classified as proximate rather than direct (Huynen, Martens & Hilderink, 2005). These variables act as channels through which respective behaviors may lead to different exposures, and subsequently particular health statuses. In turn, the more direct determinants of health include family history, biological composition and health care practices (McGinnis & Foege, 1993).

Lifestyle diseases are said to be those disease which manifest through people's daily habits as well as their interactions with their environment. These diseases are insidious in nature, and commonly take years to develop (Sharma & Majumdar, 2009). The diseases in this study may consequently be classified as chronic diseases of lifestyle.

1.5 Importance of the research

It is said that "documenting the social patterning of chronic disease risk factors is important for understanding the causes of increases…[and]…for targeting specific populations for the most effective interventions" (Fleischer et al., 2008: 924). Similarly, tracking the prevalence and social pattern of chronic diseases is an important step required in the planning of disease control and prevention programmes (Bradshaw et al., 2008; Van Minh, Huong & Giang, 2008). Many studies in the developed world have examined the relationship between socio-economic status and chronic diseases, however, this does not hold true in the developing context (Kaplan & Keil, 1993).

In South Africa, more than 50% of deaths from chronic diseases occur before the age of 65 years (Steyn, Fourie & Temple, 2006). This high proportion in conjunction with the countries world-renowned Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome (HIV/AIDS) epidemic sweeping across the working aged community may have dire health consequences (Dixon et al., 2002). This premature pattern of mortality primarily fueled by chronic diseases, has considerable social impacts such as facilitating orphan-hood, as well as economic impacts of decreasing labour force size, thereby detracting from the country's economic portfolio. It is important to uncover the main propellers of chronic diseases as well as the groups most vulnerable to these disease. This may aid in providing well targeted plans and strategies to effectively control and potentially dissipate this matter.

1.6 The Epidemiological Transition Theory (ETT)

Epidemiology is primarily concerned with the distribution and patterns of disease, and the determinants of these diseases among different groups (Omran, 1971). In South Africa, "the pattern of chronic disease is changing as the determinants and risk factors for chronic diseases develop in this society in transition – a process dubbed 'the epidemiological transition' by Omran" (Steyn, Fourie & Temple, 2006: 4). It is these patterns of determinants and risk factors that is of key interest to this study. Moreover, which groups are at higher risk of chronic diseases. The epidemiological transition is subsequently centred upon demographic and socio-economic changes (age differentials, sex, nutritional levels, lifestyle and exercise patterns, and environmental and living conditions). In South Africa, the pattern of chronic disease is being re-written by demographic and socio-economic development and increasing globalisation (Steyn, Fourie & Temple, 2006). Of interest is whether or not the pattern of chronic disease in South Africa mirror those found in more developed regions? Developing regions of the world? Or exist somewhere in between due to the country's high levels of inequality and economic duality. Chronic diseases initially emerged in higher social strata within wealthier countries. Thereafter, these diseases were anticipated to increase in poorer countries which were in a process of development, industrialisation and subsequently, an adoption of 'Western' ways of life (Omran, 1971; Chopra & Sanders, 2004). Consequently, by the end of the 20th century, these type of diseases were being seen more frequently among the poor.

It is said that, "The potential effect of different stages of epidemiological transition is especially evident in South Africa; this country of great diversity extends from highly industrialized cities with an urban-advanced economy lifestyle to remote rural regions with more traditional lifestyles" (Silwa, Wilkinson & Hansen, 2008 : 915).

Through South Africa's past of oppression, race may to a large degree act as a proxy for socio-economic status. Subsequently, it is identified that respective racial and socio-economic groups in South Africa are also representative of the different phases of the epidemiological transition (The African population = phase 1 - 2, White population = phase 2 - 3) (Steyn, Fourie & Temple, 2006). Similarly, in countries such as the Unites States of America where different racial groups co-exist, the epidemiological transition has been shown to be slower in Black Americans, compared to their White-counterparts (Omran, 1983). Thereafter, are chronic diseases congruent with the demographic and socio-economic determinants exhibited in the early, middle, or late phase of the epidemiological transition?

This study will draw on Omran's (1971) Epidemiological Transition Theory (ETT). The ETT focuses on "complex changes in the patterns of health and disease and on the interactions between these patterns and their demographic, economic and sociologic determinants" (Omran, 1971: 509). At the centre of the ETT, is the displacement of infectious diseases such as influenza, pneumonia, tuberculosis, diarrhoea and smallpox as the primary cause of mortality and morbidity, by modern degenerative diseases such as cardiovascular disease, cancer, hypertension and diabetes. Simply put, it is the transition from infectious to degenerative diseases as the main cause of mortality and morbidity. South Africa is faced with a double burden of disease (Steyn, Fourie & Temple, 2006). This manifests through high rates of poverty-related diseases (infectious) combined with the ever increasing prevalence of chronic diseases. It is this increasing presence of chronic diseases in South Africa which draws a resemblance to the notions embodied by the ETT.

Important to note is that as its name suggest, the ETT is in fact a transition; a movement, and is fluid in nature. These complex changes are said to span decades and in some cases centuries. As this study looks at static data, from one point in time, the premise of the theory, 'transition', proves too broad and complex. However, snapshots of particular phases of the theory will be used to understand chronic disease patterns in South Africa.

1.6.1 Phase 1: The Age of Pestilence and Famine

In categorizing the key phases, Omran (1971) illustrates three essential stages which embody the epidemiological transition. The first phase, 'The Age of Pestilence and Famine' is where mortality levels are high as well as fluctuating (resembles pre-modern agrarian societies). This inhibits sustained population growth. In this stage life expectancy is low (20-40 years). Residency in the age of pestilence and famine is predominantly rural, with a few cities. Poor and unsanitary living conditions is a norm for a large majority of the population. Societies are staunchly traditional, and mainly agrarian, depending on intensive manual labour and menial occupations. Formal education is low if not nonexistent. Consequential income and wages are low, and as with education, in many cases nonexistent. Luxuries and comforts are limited to only a select elite. Mortality patterns are higher in urban compared to rural areas. Prevalence of chronic diseases such as cardiovascular disease prove very low.

1.6.2 Phase 2: The Age of Receding Pandemics

The second phase, 'The Age of Receding Pandemics' is identified when mortality declines progressively (Omran, 1971). Additionally, the rate at which mortality declines increases as pandemic break-outs become less frequent. Population growth begins to be sustained and life expectancy gradually increases (30-50 years). As population growth is sustained, the population at this stage begins to show signs of exponential growth through population momentum. In the 'Early Phase' of the Age of Receding Pandemics residency is still generally rural, however, there is considerable movement away from farm work and living, to more factory orientated operations. Modest development in transportation and communication networks stimulate industrialisation, which in turn leads to industrial occupations. Living standards are still deemed low, but improvement has taken place. Advancement in agricultural techniques produce better quality foods and improves nutrition. Industrial health problems rise and no medical care systems compound these issues. In the 'Late Phase', a significant increase in rural to urban migration takes place, resulting in the growth of industrial centres, and large populations in urban areas. Living conditions and sanitation improve, however, conditions in city slums and informal urban areas become worse. Continued improvement in food technology increases the quality of produce. Health systems start to develop, but are still narrow in their scope and services.

1.6.3 Phase 3: The Age of Degenerative/Man-Made Diseases

The third phase, 'The Age of Degenerative/Man-Made Diseases' is characterized by the constant decline and stabilization of mortality at low levels (Omran, 1971). Furthermore, life expectancy surpasses 50 years. As mortality proves to be stable at this point, the demographic variable of fertility becomes crucial. Residency is increasingly urban with exponential growth in cities (megalopolitanism). The overcrowding in formal urban areas leads to staggering slum formations and subsequently environmental pollution. Increases in education levels, wider employment opportunities and higher employment lead to high mass consumption, increased consumer goods and services, and leisure spending. Better living conditions are available more widely across society. Individuals become conscious of nutrition, however, consumption of high-fat foods increases. Chronic diseases such as cardiovascular disease and diabetes become the prime health issues.

1.6.4 Phase 4: The Age of Delayed Degenerative Diseases

A possible fourth phase of the epidemiological transition has been identified. In describing the 'Age of Delayed Degenerative Diseases', Olshansky and Ault (1986) point out that in this stage the mortality rates attributed to major degenerative diseases undergo rapid declines. As degenerative diseases are being treated more effectively and efficiently, mortality patterns are shifting to older ages and thus greater proportions are surviving to these ages. This would be a crucial factor in contextualizing chronic disease prevalence among different age brackets.

1.6.5 The Protracted-Polarised Model of Epidemiological Transition

Based on trends observed in large middle income countries, Frenk et al (1989) put forth a revised edition of Omran's ETT, the 'Protracted-Polarised Model of Epidemiological Transition'. This model suggests a coexistence of both infectious and chronic diseases within the same population over an extended time frame. Furthermore, members of the higher social strata's of a population would have completed Omran's initial epidemiological transition. On the other hand, those at the economically lower end of society would still experience pre-transitional infectious diseases (Frenk et al., 1989). A juxtaposition of disease patterns across two ends of society would result. The current disease profile of South Africa is said to closely resemble the protracted-polarised model of epidemiological transition (Chopra & Sanders, 2004). Specifically, the high rates of infectious diseases among the poor, coupled with the high rates of chronic diseases experienced by both the poor and wealthy. The inclusion of infectious diseases is not of importance in this study, but is worth mentioning as it may offer a broader picture of disease patterns in South Africa and contextualize the revised ETT.

1.7 Structure of the Dissertation

This dissertation consists of five chapters. The first chapter will provide an overview and basic description of the chronic diseases relevant to this study. Additionally, the main research questions and theoretical framework will be presented. The second chapter will draw upon literature illustrating the association between demographic and socio-economic characteristics and the prevalence of diabetes, hypertension and cardiovascular disease. The third chapter will explore the methods of data analysis undertaken for this study. The rationale in choosing particular methods and techniques will be discussed as well as the strengths and limitations of these methods. The fourth chapter presents the detailed results of this study. This will include descriptive as well as inferential statistics. The fifth and final chapter will answer the specific research questions, place the findings within and alongside previous literature as well as highlight the linkages to the theoretical framework. It will also provide the limitations of this study, recommendations for future research as well as offer a brief note on which policy-makers may draw from.

Chapter 2 - Literature Review

2.1 Introduction

The following chapter provides a synthesis and evaluation of literature regarding the prevalence and risk of particular chronic diseases and their respective demographic and socio-economic determinants. Chronic diseases are said to have multiple risk factors. These risk factors may be classified as 'modifiable' and 'non-modifiable' (Puoane et al., 2008). Modifiable factors may be changed or altered. These include individuals' place of residence, living conditions, working conditions and socio-cultural factors. On the other hand, non-modifiable factors include determinants such as age, sex and genetic predisposition[1]. In this study, the modifiable and non-modifiable risk factors may then be separated into an array of themes classified by demographic and socio-economic variables. Thereafter, the respective relationships of these variables to the prevalence of diabetes, hypertension and cardiovascular disease will be illustrated in the developed nation context, followed by that of the developing context. This will provide a platform from which to clearly identify possible similarities and differences in the literature. As South Africa presents a 'duality' in its economic structure through the countries well documented high levels of inequality, it may in part exhibit aspects of both 'developed' and 'developing' locations (Bradshaw & Steyn, 2001; Gumede, 2007). By clearly understanding the relationships in the formally classified developed and developing world, the situation in South Africa may be better understood, and health trends in the country may be clearly observed in relation to the rest of the world.

2.2 Demographic Variables:

2.2.1 Age

There is a commonly observed association between socio-economic status and health experience across the world. This association is not only found during particular periods of life course, but instead observed to span throughout an individual's entire life (Marmot, Kogevinas & Elston, 1987). The strength of such an association however, differs in accordance to respective life stages and age brackets. The adult age groups associated with

[1] Sex and genetic make-up are increasingly becoming modifiable through advancements in science and medical technology. However, these factors are understood as non-modifiable in this study.

the highest and lowest prevalence of chronic diseases prove to be a key demographic determinant in this study.

In the developed world, lower socio-economic status is often associated with increased levels of mortality and morbidity attributed to chronic diseases. The strength of this relationship is identified to reach its peak within the middle adult age bracket (45-65 years) (Lantz et al., 1998). Similarly, in an array of developed European countries, socio-economic health inequalities were observed for both the working age bracket (25-59) and the elderly age bracket (60-79) (the former referring to adults who are of legal working age but not eligible for a State old age pension/grant). However, greater prevalence of chronic disease was identified among the working age group (Dalstra et al., 2005). Thereafter, a greater prevalence of hypertension, cardiovascular disease and diabetes was observed among the working age bracket of the adult population. As the working age bracket proves to be most affected by chronic diseases, it should be acknowledged that this age group may then be significantly linked to socio-economic variables such as employment status and occupation. The latter two variables will be discussed in the sections that follow. The interlinking nature of demographic and socio-economic variables should be acknowledged and the consequential layered nature of disease determinants and prevalence identified.

Findings from a joint World Health Organization and World Economic Forum report (2008) point out that in both developed and developing countries such as, Russia, China, Indian and Brazil, approximately 20 million years in productive life is lost annually as a direct result of chronic diseases. This figure is expected to increase by 65% in 2035. The chronic diseases in question include diabetes, hypertension and cardiovascular disease; those chronic diseases significant to this particular study. Moreover, a large number of years of productive life is lost through chronic diseases in the working age bracket. Subsequently, this group may be highlighted as exhibiting a considerable prevalence of chronic disease.

In Bangladesh findings from 2008 indicate that 63% of all diabetics in the country are younger than 55 years (Rahman & Islam, 2008). The findings would suggest that a considerable proportion of the working ages are being adversely affected by chronic diseases. To an extent, these findings sit in opposition to traditional thoughts of health, which sees the deterioration of health alongside ageing (Ho, Li & Lui, 2009). Although the direct relationship between health deterioration and age may hold true for a host of health conditions, the relationship may not always necessarily be observed with all chronic diseases.

Staying with developing countries, studies in Vietnam reveal a contrasting image. The prevalence of cardiovascular disease, hypertension and diabetes all proved to be substantially higher in older age groups among both males and females (Van Minh et al., 2005). Moreover, in a study aimed to establish the socio-demographic characteristics of hypertension in an ethnic minority in China, the prevalence of hypertension proved to have a direct relationship with age (Huang et al., 2011). Consequently, hypertension prevalence rose in each increasing age bracket (7.1% in the 20 year old age group, to 63.1% in the 60 year old age group). This finding sits in opposition to other developing countries where a higher prevalence is observed among younger adult age groups.

In summary, generally trends in the developed context, show those in the middle adult age brackets (45-65) have the highest prevalence of hypertension, cardiovascular disease and diabetes. The developing context on the other hand produces somewhat of a duality in trends. In countries such as Bangladesh, chronic disease prevalence proves to be higher among those younger than 55 years. This may closely resemble the prevalence patterns observed in the developed context. On the other hand, in other developing countries such as Vietnam, chronic disease prevalence proves to be higher among the aged population.

2.2.2 Sex

Sex is an important factor promoting various health behaviors (Ho, Li & Lui, 2009). Accordingly, males and females frequently exhibit different patterns of health. This arises as each sex may display different health behaviors and/or risk factors.

In the United Kingdom, a higher prevalence of Type 2 diabetes was found among those with a lower socio-economic status (Connolly et al., 2000). A steeper gradient was found among females as opposed to males, suggesting a greater prevalence of diabetes among females when compared to males of the same socio-economic status. Similarly, in a study conducted in Spain, Larrañaga et al (2005) attempt to uncover the relationship between socio-economic status and the prevalence of Type 2 diabetes. Staying with the trend observed in developed nations, a higher prevalence of diabetes was found among those with a lower socio-economic status. In relation to sex differentials, females at all corresponding levels of socio-economic status were identified to have a higher prevalence of diabetes than their male counterparts.

In a study assessing the prevalence of hypertension in Turkey, it was found that females had a higher prevalence of hypertension compared to males (Erem et al., 2009). A more recent study in the same Turkish region came to a similar conclusion (Doğan et al., 2012). Females in the latter study were identified to have a hypertension prevalence of 31.3%, whereas prevalence in males stood at roughly half, only 14.1%. However, it should be noted that in the latter study the marital status of the participants were not factored in. This could potentially have considerable impacts on the prevalence of hypertension, and other chronic diseases. Again, the interlinking nature of different variables on the prevalence of chronic disease should be noted. The effects of marital status on disease prevalence will be discussed in the sections that follow.

In the Bavi district of Vietnam, Van Minh et al (2005) attempt to estimate the prevalence of, and uncover the associations between hypertension and various socio-demographic factors. One of the strongest relationships found, was between sex and disease prevalence. After adjusting for age, males had a higher prevalence of hypertension as compared to females (18.1% and 10.1% respectively). Although sex may have a considerable impact on chronic disease prevalence, its strength may be overshadowed by other variables. After controlling for socio-economic status, the association between sex and chronic disease prevalence weakened. Males in the highest economic group, and females in the lowest economic group accounted for the highest prevalence of hypertension (Van Minh et al., 2005). The important effects of economic status should therefore not be overlooked.

In a study conducted in Brazil, one of the world's poorest countries, females were 17% more likely to be hypertensive compared to males (Costa et al., 2007). This held true even after controlling for other risk factors such as race, age, education level and income level. Consequently, a duality in trends found in developing countries becomes evident.

In summary, patterns in the developed context illustrate higher prevalence of chronic diseases among females than males. However, in the developing context, the results are reversed at times. Males in developing nations such as Vietnam exhibit higher prevalence rates of chronic diseases such as hypertension than their female counterparts. However, in other developing nations such as Brazil, females may be more likely to be hypertensive than males. As with the age variable, there is a duality in the impact of the sex variable on disease prevalence in developing nations.

2.2.3 Race

It is believed that any attempt to establish race as a causal factor determining particular health problems and/or conditions is prone to logical and technical flaws (Cooper & Kaufman, 1998). These flaws stem from the concept of 'race' being an ambiguous biological and to an extent, social construct. Similarly, many scientists have suggested that there is insufficient evidence of race having biological or genetic significance (Bhopal & Donaldson, 1998; Fullilove, 1998; Schwartz, 2001). This being said, racial variation within socio-economic status has been widely documented (Cooper & Kaufman, 1998). Medical research is increasingly paying attention to the difference in the quality and access to health care, risk factors of diseases, and health outcomes in relation to race (Davis, Cull & Holman, 2001; Karter, 2003).

African Americans disproportionately experience greater cardiovascular disease, hypertension and diabetes than White Americans (Gokce et al., 2001; Fiscella & Holt, 2008; Schwandt et al., 2010). In the United States of America, cardiovascular disease is the leading cause of death. The rates are highest among the African American population (Bernstein, Makuc & Bilheimer, 2007). A well-established precursor to cardiovascular disease, namely hypertension, is documented as a leading contributor to racial disparities in mortality rates (Wong et al., 2002). Early studies conducted in the United States have shown that African Americans have higher prevalence rates of hypertension than their White American counterparts (Cornoni-Huntley et al., 1989). Subsequently, age-adjusted mortality rates arising from hypertension are higher in the African American population (39%) than the White American population (29%) (Ong et al., 2007). Similarly, African Americans are shown to have an earlier onset of, a greater prevalence, and more severe hypertension than non-Hispanic White Americans (Burt et al., 1995 & Klag et al., 1997). Additionally, African Americans are documented to also have greater risk of cardiovascular disease compared to their non-Hispanic White counterparts (Wong et al., 2002; Bravata et al., 2005).

A study conducted in the United States aimed to uncover the relationship between race and hypertension using participants from different racial backgrounds, but with a similar socio-economic status (Thorpe et al., 2008). Even after controlling for demographic and socio-economic factors, African Americans were at higher risk for hypertension than non-Hispanic Whites.

In other studies conducted in the United States, diabetes was found to be 50% more common among African Americans as opposed to White Americans (Brancati et al., 1996). Similarly, other American studies show that, African Americans are disproportionately affected by diabetes compared to White Americans (Centre for Disease Control and Prevention, 2014). The cause of the disparity is unclear, however, genetic predisposition to obesity, a lack of physical activity and poor diet are said to have a possible influence. Other possible factors are said to stem from racial differences in socio-economic status. Consequently, socio-economic status and in turn education is said to play an important role in attitudes towards, access to, and usage of health care services (Brancati et al., 1996). These services may in turn foster a culture of health awareness and healthy living, or in contrast, give rise to a culture unaware of healthy living practices.

Moving away from the United States, Brazil is another country which is comprised of different racial groups. Studies conducted in this area have found that non-White subjects were approximately 25% more likely to have hypertension compared to their White counterparts (Costa et al., 2007). Consequently, the prevalence of hypertension for non-Whites stood at 28.1%, whereas prevalence of Whites was lower, at 22.6%.

Race as a socio-cultural construct may in turn form physical divides. This may result in residential separation between respective racial groups. It is this physical separation that may lead to different environmental exposures (LaVeist, 2005). These exposures may predispose groups to particular diseases and health conditions. Through this association, race is closely tied to socio-economic status in its entirety. Consequently, race may in many instances become a label not defining particular biological make-up, but instead defining socio-economic commonalities among a particular group of people within a particular setting. Racial segregation has been identified with inequalities in an array of outcomes such as hospital admissions, safe neighborhoods for exercise, availability of supermarkets as well as the availability of pharmaceuticals (Hart, 1997; Morrison et al., 2000). Through these factors, race may influence health outcomes, and more specifically, chronic disease prevalence and risk.

In summary, numerous studies in the Unites States show that African Americans exhibit a higher prevalence of hypertension than White/non-Hispanic White Americans. Linking closely to hypertension, cardiovascular prevalence is also documented to be higher among African Americans as opposed to White and non-Hispanic White Americans. These higher prevalence rates among African Americans also holds true in relation to diabetes. In developing countries such as Brazil, the trend continues, as non-Whites in Brazil have higher prevalence of chronic diseases compared to their White counterparts. In South Africa, race is not classified by White and non-White. Instead, the different effects if any, of not two, but four major racial groups would be interesting to note.

2.2.4 Marital Status

Over time, courts, laws and scholars have distinguished the institute of marriage from other relationships (Worthen, 2003). Underpinnings of the marriage concept may consequently lie within four main themes. These themes commonly include, societies interest in procreation; the facilitation and promotion of a particular 'moral' atmosphere; the promotion of individual well-being which in part may be realized through intimate relationships, as well as an interest in the equitable exchange of goods, services and benefits (Worthen, 2003). It may become difficult to define marriage when looking through different societal lenses. The underpinnings of marriage described above focuses on the concept through a legal and societal paradigm. However, marriage may symbolize many different things, in different contexts and cultures around the world.

According to the South African Department of Home Affairs (2013), the institute of marriage may be categorized into civil marriage, customary marriage and civil union. Customary marriage may be defined as a marriage "negotiated, celebrated or concluded according to any of the systems of indigenous African customary law which exist in South Africa" (Department of Home Affairs, 2013). Civil unions allow "anyone – regardless of their sexual orientation – to marry either through a civil union, a civil marriage or a customary marriage".

Over the past decades a wide-range of studies focusing on marital status and transition on health differentials have been conducted. However, only a few have focused on health status defined by chronic diseases (Lee et al., 2005). Marital status has indirect effects on health behavior, which in turn directly impacts health status (Kiecolt-Glaser & Newton, 2001). When focused on the general adult population, numerous studies found that married persons often exhibited higher levels of both physical and mental well-being, and consequently fewer health problems than unmarried persons (Gove, 1972; Gallagher & Waite, 2000). The higher levels of mental and physical well-being among married persons may stem from the support structure marriage is traditionally associated with. Financial, emotional, physical, and mental support may in turn promote better mental and physical health.

In a study conducted in Novosibirsk, Russia, the association between cardiovascular disease and marital status was in question (Malyutina et al., 2004). Novosibirsk is the third largest industrial city in Russia and exhibits common trends in social development and mortality patterns found in the country (Tchernina, 2000; Malyutina et al., 2002). The chosen location proved to be a good representation of the population. It was found that unmarried males and females had higher age-adjusted mortality from cardiovascular disease when compared to married males and females. Being married acted as a safeguard to good health. Unmarried males and females consisted of those who were currently single, divorced or widowed. However, the inclusion of divorced or widowed adults in the 'currently single' category may in fact inflate disease prevalence within this group.

A longitudinal study based in the United Kingdom revealed that being ‘single’ (never married, divorced or widowed) was directly linked to higher levels of mortality (Gardner & Oswald, 2004). The inclusion of the latter two groups should be noted, and the possible effects of these categories should not be over-looked. Consequently, in the study at hand (demographic and socio-economic determinants of chronic diseases in South Africa), marital status groups are defined to only include one set of martial statuses. Thus, the true effects of specific marital statues may be observed. In a cross-sectional study using data from a number of European countries, the institute of marriage was found to have a ‘protective’ role on individuals' health status (Murphy, Grundy & Kalogirou., 2007). Similarly, the general consensus sees marriage as a safe-guard from adverse health conditions, including chronic diseases (Kiecolt-Glaser & Newton, 2001).

In China, Wang (2005) set out to examine the relationship between initial marital status, marital transition, and the prevalence of hypertension among Chinese women aged between 20 – 59 years old. This could potentially introduce bias, as those women excluded from the study (those aged over 59 years and older) could either raise or lower the prevalence of chronic diseases. Consequently, the prevalence of chronic diseases among women would not be accurate. In the study at hand (demographic and socio-economic determinants of chronic diseases in South Africa), all adult women will be included so as to account for the potentially high widowed rates in South Africa (due to low male life expectancy in South Africa). In China a longitudinal study design was used to track the changes in marital status, if any. As the study at hand, is cross sectional in nature, only a static image of the relationship between marital status and chronic disease may be observed. The consequential direction or causal effect of marital status on chronic diseases may not be possible to identify. This should be acknowledged as a limitation of the 'marital status' variable. In China, it was found that women never married, widowed, divorced or separated exhibited a higher prevalence of hypertension compared to married women (Wang, 2005). Similarly, women with transitional marital statuses, either entering into, or exiting marriage proved to have a higher risk of developing hypertension relative to those women staying married. This could be caused through the stressors associated with the entry and exit of marriage.

In summary, being currently married is associated with better health status for both males and females. Marriage generally has a protective effect, providing support structures and protecting the health status of married couples. Being, single, divorced or widowed increased the risk of poor health. Similarly, transitioning from one relationship to another or from one relationship to being single, divorced or widowed also increases the risk of poor health.

2.3 Socio-economic Variables:

Socio-economic status is a multi-faceted, multi-layered and multi-dimensional indicator. It is often a combination of educational and income levels, in conjunction with employment status, type of occupation as well as residency (Mueller & Parcel, 1981). Accordingly, the health of an individual/group is said to be greatly influenced by social determinants of health (Raphael, 2006). The different components of socio-economic status are said to reflect and contribute to different forces affecting health. For example, educational attainment may impact employment and type of work, which may consequently influence income levels. Thereafter, income levels may relate to spending ability, residency and access to health care, as well as the quality of health care (Duncan, 1961; Susser, Watson & Hopper, 1985).

Socio-economic status has long been associated with differences in mortality and morbidity patterns arising from a host of health conditions and specifically chronic conditions (Kitagawa & Hauser, 1973; Black et al., 1980; Marmot, Shipley & Rose, 1984; Blaxter, 1987; Adler & Ostrove, 1999; Pamuk., 1999). On the same token, the most common health disparities are often a direct result of socio-economic disparities (Link & Phelan, 1995). This relationship is not only observed at either end of the socio-economic scale, but instead is identified throughout the socio-economic gradient (Marmot et al., 1991).

2.3.1 Educational Levels

Education is identified as one of the most basic, accurate and most effective measures of socio-economic status (Ross & Wu, 1996). The prestige of this socio-economic variable results through its ability to inform other aspects, such as occupation, earning potential, as well as knowledge relating to daily life and positive health behaviors. Additionally, education is known to influence other facets such as attitudes, beliefs and social and economic behaviors. Throughout the expansive studies conducted on socio-economic status and health status, education has solidified its place as a key socio-economic indicator and predictor of health (Liberatos, Link & Kelsey, 1988). The general consensus confirms that the higher the level of education an individual has, the better their health status (Low et al., 2005).

Studies conducted in developed European countries such as Finland, Denmark, Great Britain, France, Italy and Spain suggest that there is a strong inverse relationship between higher socio-economic status (depicted by the socio-economic indicator of education), and the prevalence of chronic diseases (Dalstra et al., 2005). The direction of the relationship saw a higher prevalence of chronic diseases among males and females with lower levels of education, and in contrast, lower prevalence among males and females with higher levels of education (greater years of schooling). Although this association was not common for the vast array of chronic diseases, such a relationship was clearly observed among three major chronic diseases, namely hypertension, cardiovascular disease as well as diabetes mellitus. Respondents varied from 3700, to 41 200 and were aged from 25-79 years. Those aged over 80 years were excluded as a large proportion of over 80 year olds were admitted to care facilities and mental institutions. Limitations to the study may result through the exclusion of those aged 80 years and older. Previous studies identify that individuals from a lower socio-economic status, and who are less healthy, are often institutionalized as a result of poor mental health (Breeze, Sloggett & Fletcher, 1999). Thereafter, by excluding this group, the relationship between low socio-economic status and chronic diseases may be watered-down and misrepresented. In the study at hand (demographic and socio-economic determinants of chronic diseases in South Africa), the entire adult population (those aged 15 years and older) is included. This may counter-act the bias of excluding particular age groups within the adult population. Similarly, another problem resulting from the European study arises through the diagnoses of chronic diseases through self-reporting. Thereafter, the prevalence of those with chronic diseases may be inaccurate, thus skewing the results. In contrast, in the study at hand, chronic diseases have been diagnosed by a health care professional. This may facilitate a more accurate measure of the prevalence of the chronic diseases in question.

In other developed countries such as the United Kingdom, the United States and Australia, an inverse relationship between educational levels and the prevalence of hypertension was identified (Colhoun, Hemingway & Poulter, 1998). A greater prevalence of hypertension was identified among individuals with the least number of years of schooling. In Canada, a strong inverse relationship was found between socio-economic status (measured by education and income levels) and the prevalence of diabetes among Canadian adults (Rabi et al., 2006; also see Robbins et al., 2001 & Stelmach et al., 2005). A higher prevalence of diabetes was reported among individuals in lower education levels and income quintiles compared to those ranked higher.

In Nigeria, Anyanwu et al (2010) evaluate the impact of different levels of education on hypertension. Education was categorized into 'primary' (those with no formal education and those with less than six years of formal primary education), 'secondary' (those who did not go beyond the secondary levels of education) and 'tertiary' levels (those with a tertiary education qualification). Education was found to have an inverse relationship with hypertension prevalence. In other words, the highest blood pressure readings were found among those at the primary level. In contrast, those with tertiary education (the highest level of education) had the lowest prevalence of hypertension. Similar trends were observed for studies conducted in other developing nations such as Mexico (Sánchez-Barriga, 2012).

In a study conducted in the Fujian province of China, the relationship between education levels and hypertension prevalence was under examination. It was found that with every increased level of education, the prevalence of hypertension began to gradually decrease (Huang et al., 2011). However, this relationship was found to be significant only when comparing the 'no formal schooling' category to other categories such as 'middle schooling', and 'elementary schooling'. Subsequently, the inverse relationship between education level and hypertension prevalence did not prove significant when the 'no formal schooling' category was omitted. Thereafter, having no formal schooling may have a considerable impact on hypertension prevalence, when compared to different levels of schooling, from primary, middle and elementary school.

In summary, in many developed nations such as the United Kingdom, France, Italy and Spain, an inverse relationship between educational level and chronic disease prevalence is identified. This result is also found in developing nations such as Nigeria, and Mexico. Thereafter, as education levels increase, the prevalence and risk of various chronic diseases declines. In some countries this result held true only when comparing groups with no formal schooling, to groups with formal schooling. However, when comparing groups within the category of having some sort of formal schooling, the strength of the association between education and chronic disease prevalence weakened.

2.3.2 Employment Status

According to Cannon (1980), socio-economic status, may be broken down in to a ‘class’ and ‘status’ component. Class may represent material wealth, spending ability and living conditions. Status on the other hand, may represent attitudes, lifestyle and knowledge. Income levels are associated with the class component, while occupation and education levels are linked to status. Educational levels may to a large extent inform occupation, and in turn income. However, prior to occupation and income, lies an important link, namely employment status. Employment status may then have far reaching impacts on other socio-economic factors. More often than not being employed is linked to a higher income levels (Hay, 1988). Consequently, income levels may play a crucial role in various socio-economic factors and in turn health.

Labour force participation is an important component of people's lives (Rueda et al., 2011). Approximately 40% of the hours individuals aged between 22 and 65 years spend awake, are spent in labour force participation (Mustard, Lavis and Ostry, 2005). Employment thus becomes a key determinant in health as it generally imposes a time structure on the lives of individuals, as well as promote, facilitate and/or restrict particular types of regular activity (Jahoda and Rush 1980 & Jahoda, 1981). Unemployment may have numerous negative impacts on individuals and their respective behavioral patterns. These may include loss of income, loss of health benefits, increased tobacco usage and alcohol consumption as well as a general deterioration in mental and physical well-being (Jacobson, LaLonde & Sullivan, 1993; Dorling, 2009).

The 'social causation hypothesis', views employment as a positive impact on health status (Turner & Wagenfeld, 1967; Hudson, 2005). In other words, employment leads to income and employment benefits, and consequently protects health status. On the other hand, the 'social selection hypothesis', understands health status as a primary determinant of employment status (Turner & Wagenfeld, 1967; Hudson, 2005). In other words, individuals need to be physically and mentally capable of working in order to work. In this particular study, the social causation hypothesis is of key interest, as the impact of employment status on health is in question.

In a study conducted in Poland, the effects of employment status on cardiovascular disease was assessed (Koziel et al., 2010). The study included both males and females and participants aged between 40 and 50 years old. As discussed in earlier sections, chronic diseases may appear more commonly in particular age ranges. Thus the age range of the participants in the Polish study may have had an impact on the results obtained. Among males, those who were classified as being unemployed exhibited the highest risk for cardiovascular disease. This result also held true for females. After controlling for demographic and socio-economic factors such as sex, body mass index (BMI) and level of education, employment status (unemployment) was shown to be strongly associated with increased risk of cardiovascular disease (Koziel et al., 2010).

Unemployment may have a major effect on mortality. Studies indicate that unemployed individuals with no history of illness were more likely to die at younger ages than employed individuals (Mathers & Schofield, 1998). Unemployment is commonly associated with increased levels of stress, which may in turn elevate blood pressure and promote hypertension and cardiovascular disease (Rozanski et al., 1999). Additionally, unemployment and stress are commonly associated with increases in alcohol consumption, tobacco usage, and poor diet; all proven risk factors for hypertension, cardiovascular disease and diabetes (Lipowicz & Lopus-Zańska, 2005).

In summary, individuals' employment status may influence other socio-economic factors such as income levels. Being employed is commonly associated with higher income levels and better health benefits. Studies indicate that unemployed individuals exhibit a higher risk and prevalence of chronic diseases such as cardiovascular disease. Additionally, unemployment may be associated with many chronic disease risk factors such as increased alcohol and tobacco usage, as well as poor diet.

2.3.3 Occupation

Occupation is a complex variable as it may relate to job description, rewards and benefits. These factors are linked to patterns of health and in turn mortality and morbidity (Gregorio, Walsh & Paturzo, 1997). Occupations at the lower ends of the socio-economic spectrum may commonly entail exposure to grueling physical labour, bodily harm as well as toxic substances. On the other hand, higher end occupations may require large time commitments, lack of sleep, great responsibility and high levels of stress. However, these are not clear cut boundaries and in many instances an overlapping of the duties and tasks may be found at either end of the spectrum. Consequently, both ends of the scale present strong arguments in promoting high chronic disease prevalence. Similarly, tangible factors present in the vicinity of the occupational environment contribute largely to health outcomes (Sharma & Majumdar, 2009). These factors commonly include, heat, cold, dust, fumes and pollutants. Additionally, other hazards may include high levels of noise, physically repetitive tasks, working in uncomfortable/painful positions and the pace at which work is carried out (Paoli & Merillie, 2001).

In a study conducted in the United States, the association between occupation and the prevalence of diabetes was of primary interest. A higher prevalence and risk of diabetes was found among those at lower occupational levels (Maty et al., 2005). Those participating in ‘blue collar’ work (primarily unskilled manual labour) exhibited a higher risk of developing diabetes than their 'white collar' counterparts. Blue collar men and women presented a 42% and 55% higher risk respectively of diabetes compared to white collar men and women. Possible reasons for this discrepancy was accounted for as blue collar workers commonly work under more hazardous conditions for much lower incomes than their white collar counterparts (Maty et al., 2005). At this point the relationship between occupation and income should be acknowledged. Presumably, unskilled and semi-skilled occupations at the lower end of the spectrum would generally generate less income compared to higher levels of professional employment. Consequently, the lines between occupation type and income may become blurred.

In Japan, studies point to a direct relationship between hypertension and socio-economic status (Shimamoto et al., 1989). Consequently, higher prevalence of hypertension was found among professional employees such as executives when compared to manual laborers. This is primarily associated with the higher levels of responsibility and stress common amongst professional groups. Staying with Japan, other studies based on hypertension indicate that working for an average of 11 hours per day over an extended period of 3 years increased the likelihood of hypertension (Nakanishi et al., 1999). Hypertension may arise through jobs with both high levels of responsibility and stress, as well as jobs that require large time commitments.

Another important aspect of occupation worth considering is that of shift work. Shift work may potentially disrupt individuals' normal social and biological patterns. More specifically, sleeping, eating, and physical activity patterns may be affected (Moore-Ede & Richardson, 1985). Shift work, and the consequential rotating of shifts may cause an increase in stress levels through the disruption of ‘normal’ life and routine (Coffey, Skipper & Jung, 1988).

In a study conducted in Finland, the association between cardiovascular disease and shift work was assessed (Tenkanen et al., 1997). It was found that shift workers had a higher rate of smoking, as well as higher blood pressure than day time workers. Smoking was a mechanism of stress relief. Subsequently, smoking and blood pressure are direct determinants of cardiovascular disease. Shift work may then become a proximate determinate of cardiovascular disease. Shift work is consequently associated with an increased incidence of cardiovascular disease, as well as increases in the onset of diabetes through disrupted eating and sleeping patterns (Van der Hulst, 2003).

In summary, the type of work an individual carries out may promote exposure to different working environments. These environments may in some instances promote health risk factors and in other circumstances promote better health. In some studies, chronic disease prevalence proves to be higher among individuals with lower level occupations (manual laborers). In other studies chronic disease prevalence was found to be higher among those at higher occupational levels (executives). Consequently, both ends of the occupational spectrum may possess health risk factors. However, the risk factors become context specific to the individual and group. Shift work is also another important type of occupation which generally serves to disrupt normal living patterns. This disruption in eating and sleeping patterns may be an important factor promoting higher risk of chronic disease.

2.3.4 Income

In today's modern society, income is the fundamental mechanism through which goods, products, services, and resources are distributed to individuals (Rueda et al., 2011). Income is an important indicator of socio-economic status as it may promote the purchasing of health care (services and medication), nutritionally rich foods (conversely nutrient deficient foods), access to education, as well as access to better standards of living (residency) (Fiscella & Franks, 1997; Kennedy et al., 1998). Moreover, income levels have been widely linked with differences in disease risk factors, mortality and morbidity patterns (Deaton, 2002).

Economic growth and its co-conspirators, industrialization and urbanization are identified as some of the main propellers of chronic disease risk factors. These include, increases in consumption of tobacco and alcohol products, greater intake of saturated fats and sugars, changes in food production, and decreases in physical activity (Beaglehold & Yach, 2003).

In Canada, using nationally representative census data, income was used to track the association between socio-economic status and the prevalence of various chronic diseases (Lee et al., 2009). Income was differentiated through income adequacy categories which sought to represent total family income in relation to the size of the household unit. This mechanism of measuring and categorizing income may have a short-coming as it may be skewed by the income patterns of children, young adults and the elderly. Thereafter, the study at hand (demographic and socio-economic determinants of chronic diseases in South Africa), focuses primarily on individual income and this measure will consequently be categorized per individual. In Canada , cardiovascular disease was noted to have increased significantly throughout all income levels. However, the greatest increase was reported in the lower-middle income category, while the lowest increase took place in the highest income level category. A similar trend was observed for diabetes, as its prevalence increased significantly in all income levels except the highest level. At this level, no increases in diabetes were documented. In contrast to cardiovascular disease and diabetes, hypertension had increased in all income levels, however, rather than the greatest increase taking place at the lowest income level, such an increase was noted to have taken place at the highest income level.

In Turkey, level of household income was negatively associated with prevalence of hypertension (Doĝan et al., 2012). As the level of income rose, hypertension prevalence decreased. In India, the income loss due to chronic diseases such as cardiovascular disease, diabetes and a host of others accumulated to $8.7 billion in 2005. This figure is project to increase to $54 billion by 2015 (Sharma & Majumdar, 2009). From this a reversal in the relationship between chronic diseases and income may be observed. As the prevalence of chronic diseases increase, employment and in turn income may then decrease. The dual direction between chronic diseases and income should be noted. In other words, low income may cause ill-effects on health, and in contrast, ill-health may restrict the ability to raise income levels (Case, 2004).

In summary, earnings may influence various chronic disease risk factors such as access to health and education, food consumption and residency. In some studies conducted in the developed world, chronic disease prevalence decreased as the level of income increased. Consequently, greater income enhanced health status, and acted as protection against ill-health. Conversely, greater income may also promote other chronic disease risk factors, such as increased consumption of saturated fats and sugars.

2.3.5 Residency

It is said that place of residence has not been usually identified as a predictor of an individual's health. However, the relationship between the two is steadily becoming apparent (Macintyre, Maciver & Sooman, 1993; Kaplan, 1996). Environments in different locations relate to and impact different health outcomes. Subsequently, residency may inform disease risk factors and health related behaviors such as physical activity, exposure to environmental pollutants and toxins, as well as quality of and access to health services (Haan, Kaplan & Camacho, 1987; Robert, 1998).

Urbanization is said to play a crucial role in the increased rates of chronic diseases (Popkin, 1998; Stern, Puoane & Tsolekile, 2010). Generally, the population and rate of urbanization, exceeds Governments' capacity to cater for the influx (Modie-Moroka, 2009). The movement of people from rural areas and townships, to more urban locations serve to promote inequalities among the rich and poor (Sanders et al., 2008). This primarily occurs through the unequal distribution and access to resources. These resources may include; piped sanitation, running water, affordable healthy foods and safe surroundings.

In Canada, a higher prevalence of diabetes was identified among those from a lower socio-economic status (Rabi et al., 2006). In terms of residency, those belonging to 'rich'/'wealthy' neighborhoods displayed a lower prevalence when compared to those from 'poor' neighborhoods. As Rabi et al (2006) conclude, a possible explanation of this may stem from those in higher socio-economic levels living in wealthier areas, having the knowledge and means (ability to afford and purchase healthier foods, and safer neighborhoods to exercise) to prevent the occurrence of diabetes as well as other chronic diseases.

Similarly, in a study conducted in the United States, it was found that those living in 'disadvantaged' areas were likely to develop coronary heart disease as opposed to those living in 'advantages' areas (Roux et al., 2001). This result did not waver after controlling for other socio-economic factors such as education and income levels. This pattern of disease may stem from a higher quality and greater access to health services present in wealthier locations.

In low-middle income countries, low prevalence of many chronic diseases seems to be slanted in the direction favoring rural locations (Ramachandran et al., 2008; Snehalatha & Ramachandran, 2009). In the developing nation of India, there seems to be a direct relationship between socio-economic status and the prevalence of chronic disease (Reddy et al., 2005). Most commonly these chronic diseases include hypertension, cardiovascular disease and diabetes. The prevalence of hypertension among adults over 20 years is noted to stand between 20% - 40% in urban areas (higher socio-economic status), and drop substantially to 12% - 17% in rural areas. The prevalence of cardiovascular disease is noted to be approximately 3% - 4% in rural areas as compared to 8% - 10% in urban areas. The prevalence of diabetes among adults in India is estimated at 3.8% in rural areas and 11.8% in urban areas. Similarly, other studies in India conclude that diabetes prevalence ranges between 8.3% and 19.5% in urban areas, and 2.0% and 3.1% in rural areas (Mohan et al., 2006; Gupta & Misra, 2007).

It becomes evident that the prevalence of these diseases is higher in urban areas and presumably higher among individuals with higher socio-economic status. Demographic, economic and social factors are the main determinants of disease. These factors are propelled by urbanization, industrialization and globalization (alluding to poor climate and working conditions and the adoption of Western lifestyles and diets) (Reddy et al., 2005).

According to the National Health Survey of Pakistan (1990-1994), hypertension prevalence was reported at approximately 23% in urban areas, and 8% in rural areas. Similarly, the prevalence of diabetes was found to be higher in urban settings as compared to rural locales (Shera, Jawad & Maqsood, 2007). In Bangladesh, similar results were observed. The prevalence of hypertension was 21.8% in urban areas, and 16.1% in rural areas (Parr et al., 2011). However, biases in the reporting process must be acknowledged. In rural areas, under-reporting may be a common occurrence due to the undeveloped infrastructure and restricted mobility within these regions. Diagnosis within these areas may be difficult to conduct, thus potentially deflating disease prevalence.

In summary, in developed regions chronic disease prevalence is generally high in poorer, disadvantaged areas. Unsafe surroundings may deter exercise and a shortage of healthy foods and lack of quality health care may increase chronic disease risk and prevalence. However, in developing regions of the world, the converse is found. In developing countries chronic disease prevalence is documented to be higher in richer, more developed areas as opposed to rural locations. In this context, urban living may be associated with increased consumption of fats and sugars, lack of physical activity through widespread transportation and decreased quality climate conditions. Rural areas on the other hand may be associated with increased physical activity through subsistence farming, fresher produce, and more nutrient rich foods.

2.4 South Africa – Around the world and back…

It is said that more than a decade and a half into South Africa's democracy, the country is in the midst of a health transition. This transition is accompanied by, and to an extent facilitated by a quadruple burden of disease (Mayosi et al., 2009). This is primarily fuelled by HIV/AIDS and tuberculosis, inter-personal violence and trauma, as well as non-communicable and chronic diseases (Bourne, Lambert & Steyn, 2002; Bradshaw, Norman & Schneider, 2007; Tollman et al., 2008). More specifically, chronic diseases like diabetes, hypertension and cardiovascular disease are all among the top ten causes of mortality and morbidity in the country (Puoane et al., 2008). Goals of promising health care policies adopted by the country's first democratically elected Government have not been entirely met. Poor quality of services as well as large health inequalities is at the forefront of these empty promises, and partly a manifestation of it (Puoane et al., 2008; Coovadia & Bland, 2008).

South African life expectancy at birth is documented to have fallen from 64.4 years to 51.4 years between 1995 and 2002 (Statistics South Africa, 2002). In 2013 this figure was documented to have increased to 59.6 years (Statistics South Africa, 2013). However, by 2015, average life expectancy at birth could potentially fall by 30% when compared to levels in 1996 (Dorrington et al., 2001). An increase in chronic diseases may take place through demographic shifts such as population ageing. This may cater for larger proportions of the population reaching older age brackets, and consequently extend the potential time at risk for chronic diseases. Surprisingly, demographic shifts such as population ageing are in full swing and not significantly off set by the HIV/AIDS epidemic (Puoane et al., 2008). Similarly, the increasing roll-out of anti-retroviral drugs extends the life expectancy of those living with HIV/AIDS, and as a result may increase exposure to and the risk of developing chronic diseases.

Over the last decade and a half, spanning South Africa's most well-documented political transition, chronic diseases in the country have been on the rise. The burden of such diseases is estimated to be 2 – 3 times greater than in developed countries (Mayosi et al., 2009). Additionally, South Africa's pattern of disease resembles disease patterns found in other countries in the Sub-Saharan African region (WHO, 2008). The increase in chronic diseases has been facilitated by the subsequent rise of risk factors in both rural and urban settings (Alberts et al., 2005; Groenewald et al., 2008). This escalation is most evident among the poor residing in urban areas (primarily urban informal areas). There are large volumes of migration from rural to urban areas, particularly among the younger adult age group. This often results in large informal settlements on the outskirts of formal cities (informal urban areas and slums) (Levitt et al., 2011). These patterns of movement give rise to changes in lifestyle, such as dietary changes, decreased physical activity, as well as increased stress promoted through poor living conditions. These increased risk factors may consequently facilitate chronic disease prevalence. This increase in disease serves to compound the pressure on respective health services in the country.

Social gradients are clear among chronic diseases in South Africa. This may in part stem from the high inequality over a number of economic and social indicators commonly observed in the country (Sen, 1992). The death and disease trends in South Africa closely reflect a country in which those of higher economic standing have successfully completed the epidemiologic transition (Sanders & Chopra, 2006). However, chronic diseases are known to affect both the 'have' and 'have not's' albeit this may occur at different intensities. An aged standardized study showed that people residing in the poor district of Khayelitsha situated on the outskirts of one of the country's major cities (Cape Town), had 856.4 deaths per 100 000, as compared to only 450 - 500 deaths per 100 000 in the wealthy Northern and Southern districts (Groenewald et al., 2008). Clear inequalities can thus be seen between different locations within the country (although higher mortality rates in poorer areas may be related more to violent crimes).

Urbanized living, respective practices and routines (unhealthy diets, lack of physical activity) prove to be commonly associated with the prevalence of chronic diseases in South Africa (Bradshaw & Steyn, 2001). In a study focusing on the way in which place of residence impacts chronic disease prevalence, the health status of individuals who had migrated from rural locations to the peri-urban settlement of Khayelitsha were tracked (Stern, Puoane & Tsolekile, 2010). The attractiveness of the move came from the appeal of an 'easier' life in urban environments. In rural locations, health, education, and transport were generally seen as fundamentally difficult to access. It was found that the move to the peri-urban settlement promoted an adoption of a more urban lifestyle. This primarily affected diet and physical activity. In terms of diet, participants in the study were documented to have eaten more, and specifically, foods high in saturated fats and sugars. Additionally, unhealthy fast foods were cheaper and held in higher esteem as it represented progression from rural living. Testament to this may be seen as the fat consumption of African individuals residing in urban areas is noted to have increased from 16.4% to 26.2% over the past 50 years (Mayosi et al., 2009). In contrast, Western diets are not only observed among individuals who move from rural to urban locations, but are increasingly also documented among rural groups themselves (Bourne, Lambert & Steyn, 2002). On the other hand, physical activity declined as people had greater access to transport and walking had been associated with 'labour' and rural living. These factors represent chronic disease risk factors and may promote increased prevalence of chronic disease among those living in urban and peri-urban locations.

In other South African studies assessing location and health it was found that although wealthy areas were further along the epidemiological transition than poor areas, both locations were still largely affected by chronic diseases (Bradshaw & Steyn, 2001). Cardiovascular disease proved to have one of the most significant impacts on mortality and morbidity across both locations. Moreover, those in poorer areas were identified as being exposed to more environment pollutants and toxins contributing to chronic disease risk factors. Additionally, in South Africa an estimated 56% of the population lives in urban centers (Kok & Collinson, 2006). This significant proportion of people in urban areas has promoted large shifts in health status (Puoane et al., 2008). This has resulted in the rising rate of chronic diseases in the country.

In a study conducted in Agincourt (Rural Northeast South Africa), an increase in chronic diseases was documented between the periods from 1992 - 2005 (Tollman et al., 2008). Increases were shown to be significant in males, but not so in females. Chronic diseases such as diabetes, hypertension and cardiovascular disease were more pronounced in individuals aged over 40 years (Tollman et al., 2008). Consequently, age is a crucial factor promoting chronic disease. Approximately 7.3% of the South African population is aged over 60 years. This figure is predicted to increase to approximately 21% by 2025 (Joubert, Bradshaw & Dorrington, 2009). This may potentially lead to an even larger prevalence of chronic diseases.

The prevalence of hypertension in South Africa is noted to stand at approximately 12.5% and 17.9% for men and women respectively (Department of Health, 2004). More specifically, the prevalence is substantially higher among White males (35.8%), and Indian women (29.1%) (Department of Health, 2004). Later studies reveal that the general prevalence of hypertension among South African adults aged over 15 years stands at 21% (Levitt et al., 2011). Between 1998 - 2008, prevalence of hypertension rose from 26% - 36% in females, and 23% - 31% in males (Bradshaw et al., 2007). In previous nationally representative studies hypertension prevalence was identified to be inversely associated with educational level (Steyn et al., 2008). As the number of years of education increased, hypertension prevalence fell. Furthermore, the disease was noted to be more frequently experienced among wealthier groups (Schneider et al., 2009). However, as upward social mobility occurs, those currently at the lower end of the socio-economic ladder are becoming more prone to the disease. In contrast, other studies reveal that prevalence was noted to have fallen as the wealth status of respective groups increased; however, the richest have a higher prevalence than the poorest group (Schneider et al., 2009).

Residency and race also have to be a major factor, as rural African/Blacks exhibited a significantly lower prevalence as compared to their White, and Coloured urban counterparts. The lower levels of disease prevalence among the rural African/Black compared to the White urban population is interesting to note. In less than a decade, from 1996 to 2002, the unemployment rate among the African/Black population increased from 42.5% to 50.0%. This, is in stark contrast to a White unemployment rate increase of 4.5% to 6.3% (Statistics South Africa, 2005). Thereafter, even with higher levels of unemployment, and greater increases in unemployment, the rural African/Black population still displays lower chronic disease prevalence than their White counterparts. This may potentially stem from lower health care facility attendance and subsequently lower testing and screening rates among the African/Black population.

South Africa's first demographic and health survey conducted in 1998, still remains an important study revealing crucial epidemiological data. In relation to the demographics of diabetes in South Africa, females documented a higher self-reported prevalence when compared to males (3.7% and 2.4% respectively); in terms of race, the Asian/Indian population displayed the highest prevalence, followed by the Coloured, White, and African/Black populations; prevalence among urban males and females (2.9% and 4.4%) were higher when compared to rural males and females (1.7% and 2.7%) (Steyn, Fourie & Temple, 2006).

While controlling for demographic and socio-economic variables may uncover important risk factors for particular chronic diseases, genetic predispositions may also have a significant effect. Subsequently, the South African Indian community is documented to be more insulin resistant than other racial groups in the country. This in turn increases the risk of diabetes as well as cardiovascular disease (Bajaj & Banerji, 2004). In contrast, studies conducted in Soweto, a large township in South Africa's Gauteng province focused on aspects of cardiovascular disease and its prevalence (Silwa, Wilkinson & Hansen, 2008). The genetic make-up of the African/Black population proved to be more resistant to cardiovascular disease than other racial groups. Thereafter, even as some groups may not be exposed to risk factors of a certain disease, genetic predisposition leave them exposed. In contrast, other groups may have heightened exposure, but their respective genetic make-up lowers their risk.

Along with demographic and socio-economic factors, socio-cultural factors should also be acknowledged as promoting possible risk factors. As commonly stated increased body weight and obesity may be strong risk factors for diseases such as diabetes and hypertension. However, socio-cultural factors such as body shape may promote risky health behaviour. In South African African/Black culture, increased body weight is commonly seen as desirable, and associated with affluence and better health (Mvo, 1999). Consequently, cultural beliefs and perceptions may play an important role in promoting chronic diseases in South Africa.

Many chronic diseases share common modifiable risk factors which may include, tobacco and alcohol consumption, unhealthy diet, physical inactivity and stressful lifestyles. The South African adult population exhibit many of these risk factors and consequently are prone to disease such as diabetes, hypertension and cardiovascular disease. In contrast, as these risk factors are modifiable, South African adults may potentially have the ability to decrease their risk and in turn prevalence of chronic diseases (Bradshaw, Norman, & Schneider, 2007).

Chapter 3 - Methodology

3.1 Introduction

The following chapter provides a synthesis, rationale, and evaluation of various quantitative protocols, procedures, and techniques used in this study. This is important as a 'blueprint' to data analysis will subsequently be established. Firstly, a background of the dataset will be highlighted. This will point out various factors validating the applicability, strengths and shortcomings of the dataset in question. Secondly, the variables used in this study will be discussed and their derivation from the data source highlighted. Additionally, a brief description of the ways in which variables were coded will be given. This is important so as to understand the strengths and weaknesses of particular variables, and in turn provide alternative means of deriving variables. Thirdly, statistical measures and methods of analysis will be discussed in detail. The applicability, strengths and shortfalls of these measures and methods should be acknowledged in order to achieve the most fair, accurate and context appropriate results.

The aim of this study is to investigate the association between demographic and socio-economic characteristics (age, sex, race, marital status, educational levels, employment, occupation, income and residency) and the prevalence of chronic diseases among South African adults (15 years and older; those focused on in the survey adult questionnaire).

3.2 NIDS - National Income Dynamic Study… A first in South Africa

This study uses quantitative data. The data in question, secondary in nature, is sourced from the National Income Dynamic Study (NIDS) Wave 1 2008 adult survey (Version 5.0, 2013). The NIDS "…[is]… the first national panel study to document the dynamic structure of a sample of household members in South Africa and changes in their incomes, expenditures, assets, access to services, education, health and other dimensions of well-being" (Liebbrandt, Woolard & de Villiers, 2009: 1). The organization tasked with implementing the NIDS is The Southern Africa Labour and Development Research Unit (SALDRU), based at the School of Economics at the University of Cape Town (UCT).

Figure 3.1: South African Map - Provincial & Capital Breakdown

Source: www.nationsonline.org

The data collection process of the survey began in 2008, where the sample size consisted of 7305 households. An important point to note is that the data collected does not exist in a vacuum; instead, it is nationally representative and along with the applied weights, the un-weighted sample data broadens the reach and applicability of this study. Post stratified weights are used in this study as this type of weight is effective in scaling up the sample to mirror the population (Wittenberg, 2009). Additionally, relationships which exist at the population level may hold true when using post stratified weights on the sample. The Stata command "*Pweight = wgt*" is initially used in the weighting process followed by the Stata "*Svy*" commands. When weighted, the 7305 households making up the sample is representative of the 2008 South African population at large[2]. This is important as results from this study may be used to make references and inferences to the South African

[2] It should be noted that the sample was not designed to be nationally representative at the provincial level, and subsequently, analysis at this level is not conducted.

population. However, unlike inferential statistics, only descriptive measures are weighted. Weighting inferential statistics may adversely affect the accuracy of the outcome and introduce instability to the results (Johnson, 2008).

As the NIDS is in fact a panel study, it is periodically repeated with the same individuals, even if these individuals were to re-locate to different parts of the country. This is important in shedding light on key issues such as migration within a country, school to work transitions, and the factors which shape the transition from youth to adulthood (NIDS, 2012). In this study, the use of prevalence as opposed to incidence of chronic diseases is of key importance (prevalence highlights point in time estimates, whereas incidence identifies the change between two periods of time). In turn, only one wave of data is used, classifying it as a cross-sectional study; a picture of South Africa at one moment in time (Wave 1, 2008).

Due to its design and array of questions, the NIDS is said to be effective in examining income, expenditure and consumption patterns of households over time. Additionally, other themes include; poverty levels and its various determinants, household structure and composition, fertility and mortality patterns, migration patterns and strategies, education, the vulnerability of particular groups as well as social capital, labour market participation, economic activity, and key to this particular study, health (NIDS, 2012). The collection of data alluding to well-being, labour market participation, economic activity, health, education and the base-line demographic characteristics is vital in the data analysis of this study.

Moreover, in the numeration process a range of measurements were taken, including height, weight, and waist measurements for each individual, as well as blood pressure readings (for all adults) and numeracy tests (12 years – 59 years) (Liebbrandt, Woolard & de Villiers, 2009). Weight, waist and blood pressure readings may be important indicators or risk factors for various chronic diseases and consequently these variables become important predictors. However, these variables have not been included in this study due to the scale of this project.

The sampling frame of the NIDS included, private households, residents in workers' hostels, and convents and monasteries in all nine South African provinces (Refer to Figure 3.1). Other collective living quarters such as student residences', old age homes, hospitals, prisons and military brigades were not included in the frame. This should be acknowledged as the data set in question omits important groups such as old age homes, hospitals and prisons, where chronic diseases may be highly prevalent.

The sample in this study focuses on the adult population. This includes those aged 15 years and older. The sample size can be separated into three segments. There are 607 adults in the sample diagnosed with diabetes, 2 490 adults diagnosed with hypertension, and 490 adults with cardiovascular disease (NIDS, 2012). The dependent variable is the prevalence of chronic diseases: diabetes, hypertension, and cardiovascular disease among South African adults. The independent variable/s constitutes a mixture of demographic characteristics and socio-economic status qualifiers. These include, age, sex, race, marital status, education levels, employment status, occupation, income and residency (rural vs. urban). Using descriptive statistics and multivariate analysis, the prevalence and risk of chronic diseases will be illustrated and discussed.

A stringent and thorough methodological process was carried out at each of the various stages in the NIDS. This ranges from the questionnaire pre-design and design stages, the construction of a sampling frame and concerns of representativeness, piloting and administering questionnaires, the translation of questionnaires and responses, as well as the collection and refinement of data[3]. The stringent processes at every level increase the strength and robustness of the NIDS data and may consequently bolster the applicability of findings from this study.

3.3 Variables:

3.3.1 Dependent Variables (DVs): Chronic Diseases

The dependent variable in this study is chronic disease diagnosis. Specifically, whether or not an individual has been diagnosed with diabetes, hypertension or cardiovascular disease. The main question which will be used to derive the dependent variables in this study is***: J13 "Have you ever been told by a doctor, nurse or health care professional that you have*** […]"

1. Tuberculosis/TB

2. High blood pressure

3. Diabetes or high blood sugar

4. Stroke

[3] For a detailed look at the methodological processes used in the NIDS see (Liebbrandt, Woolard & de Villiers, 2009) or (www.nids.uct.ac.za).

5. Asthma

6. Heart Problems

7. Cancer

These variables are coded into three separate dummy variables:

- diabetes: 0 - Not diagnosed with diabetes
  1 - Diagnosed with diabetes

- hbp: 0 - Not diagnosed with high blood pressure
  1 - Diagnosed with high blood pressure

- heart: 0 - Not diagnosed with cardiovascular disease
  1 - Diagnosed with cardiovascular disease

The bias stemming from the above question should be acknowledged. Those from a higher socio-economic status may have greater access to health care services and consequently may have a greater chance of being diagnosed with respective chronic diseases. The prevalence of chronic disease may then be inflated among those at a higher socio-economic standing, relative to those at lower socio-economic standings. A similar bias may stem from age, sex, race as well as other socio-economic differentials in visits to health care facilities. An array of literature sees females and older adults attending health care facilities more frequently than males and younger adults respectively (Bernstein et al., 2003). This could also inflate prevalence of chronic diseases among females and older aged individuals as they would exhibit higher probabilities of being diagnosed through higher health care facility attendance.

3.3.2 Independent Variables (IVs): Demographic & Socio-economic Indicators

Demographic Variables:

Respondents were asked the following question regarding their age:

Age:

B1 "What is your date of birth?". The variable relating to an individual's age is coded into two separate variables, a continuous and a categorical variable respectively.

- age: 15 years (adult specific) – 105 years (highest age recorded in the questionnaire).

- age_bracket:
  1 - Young adult 15 – 24
  2 - Middle adult 25 – 34
  3 - Prime adult 35 – 44
  4 - Older adult 45 – 59
  5 - Elderly 60+

<u>Sex:</u>

Respondents were asked the following question regarding their sex:

B2 "What is your gender?". The variable relating to an individual's sex is coded into a categorical variable.

- sex: 1 - Male
  2 - Female

<u>Racial Group:</u>

Respondents were asked the following question regarding their racial group:

B3 "What population group would you describe yourself belonging to?". The variable relating to racial group is coded into a categorical variable.

- race: 1 - African
  2 - Coloured
  3 - Asian/Indian
  4 - White

<u>Marital Status:</u>

Respondents were asked the following question regarding their marital status:

B5 "What is your current marital status?". The variable relating to marital status is coded into a categorical variable.

- marital: 1 - Married
  2 - Living with a partner
  3 - Widow/Widower
  4 - Divorced/Separated
  5 - Never married

<u>Socio-economic Variables:</u>

<u>Education Levels:</u>

Respondents were asked the following question regarding their education level:

H1 "What is the highest grade in school that you have successfully completed? Do not count the final year you were in school if you did not successfully complete the year". The variable related to education levels is coded into one categorical variable.

- edu_bracket:
  1 - No Schooling
  2 - Primary (Gr. 0 - 7)
  3 - Secondary (Gr. 8 - 11)
  4 - Matric
  5 - Tertiary
  6 - Other (certificate/diploma with less than matric)

Matric proves to be a benchmark in the South African schooling system (www.southafrica.info). Subsequently, it is important to separate this group from the broader Secondary (Gr. 8 - 11) and other category which includes adults with a certificate/diploma with less than matric.

<u>Employment Status:</u>

Respondents were asked the following questions regarding their employment status:

E1 "Are you currently being paid a wage or salary to work on a regular basis for an employer (that is not yourself) whether full time or part time? If you work for yourself, we will ask about this later"

E28 "Have you engaged in any self-employment activities during the last 30 days? For example, you might buy and sell goods, be a commercial farmer, work for yourself as a doctor or hairdresser or be a freelance consultant"

E63 "How long ago was it since you last worked?"

E65 "What was the main reason you stopped working in your last job/business?". The variable relating to employment status is into a categorical variable.

- empstat: 1 - Not Economically Active
  2 - Unemployed
  3 - Employed

Income Levels:

Respondents were asked the following questions regarding their income level:

E9 "How much was your take-home pay?"

E10 "Please would you look at the show card and point out the most accurate earnings category for last month's take home pay? Interviewer: Show the income categories on the show card and record the appropriate code for the respondent's monthly earnings". These two questions relating to income are coded into two separate variables, one continuous, and one categorical.

- income: R0 (per month) – R140 000 (per month)

- income_bracket:

  1 - Low Income 0 - 1000
  2 - Middle income 1000 - 3000
  3 - Upper middle income 3000 - 6000
  4 - High income 6000+

Coding income variables are generally prone to high number of missing values, non-responses and refusals due to the personal nature of the subject. Consequently, the point estimate in conjunction with the show card estimate of income is used to code the 'income' variable. The show card estimate provides a greater number of responses, and so using this data in conjunction with the point estimate provides a more robust estimation of income. The continuous 'income' variable is then recoded into a categorical variable, 'income_bracket'.

<u>Occupational Status:</u>

Respondents were asked the following question regarding their occupation:

E4 "What kind of work do you usually do in this job? In other words, what is your occupation or job title? Interviewer: Record at least two words: car sales person, office cleaner, vegetable farmer, primary school teacher, etc". The variable relating to occupational is coded into a categorical variable.

- occupation: 1 - Skilled Professional
  2 - Skilled Administrative
  3 - Semi-Skilled
  4 - Unskilled.

Using the International Standard Classification of Occupations (ISCO) guidelines, occupation in the NIDS data was originally coded into nine major streams[4] (International Labour Organization, 2010). Firstly, legislators senior officials and managers, professionals, technicians and associate professionals, are grouped together to form skilled professionals. Secondly, clerks and service workers and shop and market attendants form the skilled administrative group. Thirdly, skilled agricultural and fishery workers, craft and related trades workers and plant and machinery operators and assistants constitute semi-skilled adults. Lastly elementary occupations are classified as unskilled occupations.

<u>Residency/location:</u>

Respondents were asked the following question regarding their residency:

B14 "Where were you living in February 2006? Interviewer: If the same as current location, write 7777". The variable relating to geographic type/location is coded into a categorical variable. Each respective category comprises of a set of particular enumeration

[4] For a detailed look at the nine major occupational streams see (www.ilo.org)

area types[5] (EA). These area types include; traditional settlements, farms, small holdings, urban settlements, informal settlements, recreational areas, industrial locations, institutions, hostels, and vacant land (Statistics South Africa, 2003).

- location: 1 - Rural & Tribal
  2 - Urban formal
  3 - Urban informal

Note that particular variables are coded into both continuous and categorical as different variable types may be better suited to different types of statistical analysis. Thereafter, continuous variables may in certain cases produce more detailed results (regression analysis). However, categorical variables on the other hand may in some cases be better suited to descriptive statistics and comparisons between different groups. Although the inferential procedures (logistic regression) used in this study are equipped to deal with continuous variables, continuous variables such as age in years, years of education, and average income is only used descriptively. Subsequently, categorical variables offer a greater span over which to compare results and variable interaction across. Moreover, in compliance with logistic regression conditions, all categorical variables are coded into respective dummy variables. This is done by using the Stata shortcut command and '*id*" suffix, "*tab variable, gen(variableid)*".

3.4 Statistical Measures and Methods of Analysis:

Multivariate analysis – caters for the simultaneous investigation of an array of independent variables on their impact on a dependent variable/s. This is useful in producing richer outputs through many levels of analysis. For accurate analysis, a large number of subjects are required. As this study contains a large sample relative to the number of independent variables used, as well as the use of nationally weighted data, concerns of too small a sample size are dealt with.

[5] For a detailed look at the groupings of different EA types into particular areas see (Statistics South Africa - Census 2001 - Concepts and Definitions)

3.4.1 Logistic Regression:

Logistic regression is used to test for a significant relationship between demographic and socio-economic variables (independent variables) and the prevalence of relevant chronic diseases (dependent variable). Prevalence is dichotomous in nature as some individuals are diagnosed with a certain chronic disease and others are not. Consequently, in cases in which a set of possible predictors explains a dichotomous outcome, logistic regression is well suited (Pedhazur, 1997; Pampel, 2000; Menard, 2002).

Logistic regression analysis is understood through odds, probabilities and logits. These are measures/tools which describes how often an incident occurs relative to its opposite occurring. For example, dying or surviving, winning or losing, having a chronic disease or not having a chronic disease (Walker, 1996).

This study attempts to distinguish the variables that are most associated with, and possibly promote chronic diseases. In other words, what are the determinants of chronic diseases in South Africa? Subsequently, stepwise procedures are said to be best applied in situations which call for prediction and exploratory research (Menard, 2002). More specifically, stepwise procedures are useful when uncovering the predictors of a particular phenomenon, in this case, chronic disease group membership.

Stepwise procedures are used in the multivariate logistic regression model building process. Thereafter, bivariate logistic regressions are carried out for respective independent variables in relation to diabetes, hypertension and cardiovascular disease. Those variables deemed significant at a p-value ≤ 0.20 level are included in the respective main effects multivariate models. A relatively large p-value of 0.20 is used as this creates a substantial bandwidth through which important independent variables may be included (Menard, 2002). Additionally, the traditional cut of point of p-value ≤ 0.05 may be too narrow, and important variables which may be significant in the multivariate models may be excluded (Bendel & Afifi, 1977). In the bivariate regression analysis, all demographic and socio-economic variables across all three chronic diseases are statistically significant at $p \leq 0.20$ and are therefore included in respective multivariate model/s.

Three main effects multivariate models are created for each of the three chronic diseases. Demographic characteristics are included in model 1; socio-economic indicators are solely used in model 2, and both demographic and socio-economic factors are used in model 3.

This is done to understand the effects of demographic and socio-economic factors on their own at first, and thereafter the combined effects of both these groups of factors. Thereafter, Stata's '*linktest*' function is used to test the goodness of fit of each multivariate model. Insignificant '_hatsq' values (_hatsq > 0.05) is used to qualify models as well-fitted and correctly specified. All multivariate models yield insignificant linktest values, and are therefore classified as well fitted models.

The binary logistic models used in this study are based on the following equation:

Equation 3.1: Binary Logistic Regression Model

$$\mathbf{logit}[\mathbf{p}(\mathbf{x})] = \mathbf{log}\left[\frac{\mathbf{p(x)}}{\mathbf{1-p(x)}}\right] = \mathbf{a} + \mathbf{b_1 x_1} + \mathbf{b_2 x_2} + \mathbf{b_3 x_3} + \cdots \mathbf{b_k x_k}$$

Where:

$\boldsymbol{p(x)}$ is the probability that an individual is diagnosed with a particular chronic disease, $\boldsymbol{1-p(x)}$, the individual is not diagnosed with a particular chronic disease, $\boldsymbol{b_1} \dots \boldsymbol{b_k}$ regression coefficients, and $\boldsymbol{x_1} \dots \boldsymbol{x_k}$, predictor variables (demographic & socio-economic determinants).

All statistical analysis is performed on Stata version 12 by StataCorp. This quantitative statistical package has been a leader in the statistical software market for over two decades (www.stata.com).

3.5 Summary:

The National Income Dynamic Study is a rich and robust source of quantitative data. Variables in this study are coded into various variable types including, dummy, continuous and categorical. This is effective as different variable types are better suited to different types of analysis, consequently producing more accurate results. Binary logistic regression is used to assess the direction as well as magnitude of particular relationships and associations. More specifically, stepwise procedures are used to produce the most accurate results. Central to this study, are the relationships between the chronic diseases of diabetes, hypertension and cardiovascular disease and their respective demographic and socio-economic determinants.

Chapter 4 - Analysis & Results

4.1 Introduction

This chapter provides a detailed description of the main findings of the statistical analysis. Firstly, a demographic and socio-economic profile of the 2008 South African adult population will be presented. Secondly, an outline of the prevalence rates of diabetes, hypertension and cardiovascular disease will be highlighted. This is important in understanding which chronic diseases are most prevalent in the country. Thirdly, the prevalence of diabetes, hypertension and cardiovascular disease will be presented against the demographic and socio-economic variables used in this study. Fourthly, bivariate binary logistic regression analysis outcomes will be presented. This will uncover which categories within particular demographic and socio-economic variables are most likely at risk of chronic diseases. Lastly, multivariate binary logistic regression outcomes will be presented. This will be effective in uncovering groups most at risk of chronic diseases while taking individual demographic and socio-economic profiles into account.

The prevalence of chronic diseases against demographic and socio-economic factors, bivariate logistic regressions, as well as multivariate logistic regressions will be separated into three subsections, and respectively looked at for each of the three chronic diseases one at a time.

4.2 South African Adult Population Profile in 2008

4.2.1 Demographic Profile

Table 4.1.1 presents the demographic profile of the 2008 South African adult population using the NIDS dataset. Young adults aged 15 - 24 make up the bulk of the population (29.74%). This is followed by adults aged 25 - 34 (24.36%). Older adults aged 45 - 59 account for 17.74% of the adult population, which is followed closely by prime adults aged 35 - 44 (17.13%). In contrast to younger age groups, the elderly 60+ age bracket accounts for the lowest proportion of the population (11.02%).

Females account for a larger portion of the population than males. This higher proportion of females is to be expected due to the lower life expectancy of South African males. Among the different racial groups in South Africa, the African population account for the overwhelming majority (78.73%). Additionally, the White racial group account for the second largest proportion (10.43%). This is then followed by the Coloured group (8.37%), and lastly, the Asian/Indian group (2.47%). With regard to marital status, approximately half the adult population have never been married (49.80%). This may be related to the large proportion of young people in the population. On the other hand, current literature highlights trends in delayed marriage across the world as well as in South Africa (Martin, 2002; Kaufman, Wet & Stadler, 2001). Married persons account for 30.97% of the population, which is followed by those living with a partner (8.93%), widow/widowers (7.02%), and lastly, adults who are divorced/separated (3.28%).

Table 4.1.1: Demographic Profile of the 2008 South African Adult Population

	Determinants	Percentage (%)
Age Bracket		
	15 - 24	29.74%
	25 - 34	24.36%
	35 - 44	17.13%
	45 - 59	17.74%
	60+	11.02%
	Total	100%
	Total sample (n)	15616
Sex		
	Male	43.55%
	Female	56.45%
	Total	100%
	Total sample (n)	15574
Race		
	African	78.73%
	Coloured	8.37%
	Asian/Indian	2.47%
	White	10.43%
	Total	100%
	Total sample (n)	15641
Marital Status		
	Married	30.97%
	Living with partner	8.93%
	Widow/widower	7.02%
	Divorced/separated	3.28%
	Never married	49.80%
	Total	100%
	Total sample (n)	15527

Source: Own calculations based on data from NIDS (2013): Weighted

4.2.2 Socio-economic Profile

Table 4.1.2 presents the socio-economic profile of the 2008 South African adult population. In terms of education, over 90% of adults have at least primary schooling. Adults with no schooling or a Tertiary qualification represent around a tenth of the population (9.29% & 11.09% respectively).

With regard to employment status, close to half the adult population is considered to be employed (42.90%). Moreover, close to 40% of the population belongs to the not economically active group (38.09%), and roughly 20% are classified as unemployed (19.01%). In terms of primary occupation, unskilled and semi-skilled adults represent slightly over half the population (20.59% & 30.25% respectively). Additionally, skilled administrative and skilled professionals represent 24.12% and 25.04% respectively.

In terms of income, over 60% of adults earn within the low income to middle income bracket (24.38% & 37.12% respectively). Close to 40% of adults earn within the upper middle and high income brackets (18.78% & 19.72% respectively). Average monthly income stands slightly above 3000 ZAR (3145.44). This is marginally above the middle income bracket, and may be so, due to a few outliers within higher income groups. This may reflect the well documented high levels of economic inequality in the country. Slightly over half of the adult population reside in formal urban areas (50.40%). Almost 40% reside in rural and tribal areas (38.88%), while only 10.72% of the adult population live in informal urban areas.

Table 4.1.2: Socio-economic Profile of the 2008 South African Adult Population

	Determinants	Percentage (%)
Education Bracket		
	No schooling	9.29%
	Primary (Gr. 0 - 7)	19.42%
	Secondary (Gr. 8 - 11	40.48%
	Matric	18.08%
	Tertiary	11.09%
	Other	1.65%
	Total	100%
	Total sample (n)	15578

Employment Status		
	Unemployed	19.01%
	Not economically active	38.09%
	Employed	42.90%
	Total	100%
	Total sample (n)	15424
Primary Occupation		
	Unskilled	20.59%
	Semi-Skilled	30.25%
	Skilled Administrative	24.12%
	Skilled Professional	25.04%
	Total	100%
	Total sample (n)	3758
Income Bracket (ZAR)		
	Low income 0 - 1000	24.38%
	Middle income 1000 - 3000	37.12%
	Upper middle income 3000 - 6000	18.78%
	High income 6000+	19.72%
	Total	100%
	Total sample (n)	3310
Average income per month (ZAR)*		3145.44
	Total sample (n)	3310
Residency/Location		
	Rural & Tribal	38.88%
	Urban informal	10.72%
	Urban formal	50.40%
	Total	100%
	Total sample (n)	15641

*Unweighted (Weights do not apply to summary measures)
Source: Own calculations based on data from NIDS (2013): Weighted

4.3 Prevalence of Diabetes, Hypertension & Cardiovascular Disease

Table 4.2 presents the chronic disease prevalence among South African Adults in 2008. A total of 3.51% of the adult population is diagnosed with diabetes in South Africa. Moreover, 13.59% of the population is diagnosed with hypertension. Lastly, only 3.05% of the population is diagnosed with cardiovascular disease. In rank of descending prevalence, hypertension is followed by diabetes which is in turn followed closely by cardiovascular disease.

Table 4.2: Chronic Disease Prevalence among South African Adults in 2008

	Chronic Diseases		
	Diabetes	*Hypertension*	*Cardiovascular Disease*
Diagnosed (%)	3.51% (3.09 - 3.99)	13.59% (12.78 - 14.43)	3.05% (2.64 - 3.52)
Undiagnosed (%)	96.49% (96.01 - 96.91)	86.41% (85.57 - 87.22)	96.95% (96.48 - 97.36)
Total percent (%)	100%	100%	100%
Total sample (n)	15484	15519	15471

Source: Own calculations based on data from NIDS (2013): Weighted

4.4 Diabetes

4.4.1 Diabetes Prevalence across Demographic Variables

Table 4.3.1 presents the prevalence of diabetes among South African adults across various demographic variables. The overall trend observed is an increasing prevalence of diabetes with increasing age. Young adults aged 15 - 24 have the lowest prevalence (0.55%), while the highest prevalence is found in the elderly 60+ age group (10.96%). The prevalence of diabetes is relatively low among adults aged between 15 – 44, peaking at 2.53%. Thereafter, a substantial increase to 7.43% is observed in the older adult 45 - 59 age group. Simply put, diabetes is more prevalent among older age groups when compared to younger cohorts.

Females have a higher prevalence than males (4.34% & 2.45% respectively). This could possibly stem from the age distribution of both sexes and the higher proportion of females in older age groups. As mentioned above, diabetes is more prevalent among older adults. Due to the lower life expectancy of South African males, a smaller proportion of this group may reach older ages and in turn be exposed to the disease. In terms of race, the highest prevalence of diabetes is found among the Asian/Indian group (11.17%). This is followed by the White, Coloured and African group, which all exhibit a substantially lower prevalence (5.56%, 4.01% & 2.95% respectively).

With regard to marital status, the highest prevalence of the disease is observed among the widowed (10.19%), while the lowest prevalence is found among those never married (1.40%). High prevalence among the widowed category may again stem from age distributions and the high prevalence observed among those at older ages. Additionally, married persons exhibit a prevalence of 5.83%, while the prevalence for adults divorced/separated and living with a partner is around 2.00% (2.43% & 2.15% respectively).

Table 4.3.1: Prevalence of Diabetes across Demographic Variables among South African Adults in 2008

	Determinants	Diabetes Diagnosed (Row %)
Age Bracket		
	15 - 24	0.55% (0.22 - 1.34)
	25 - 34	1.57% (0.89 - 2.74)
	35 - 44	2.53% (1.83 - 3.50)
	45 - 59	7.43% (6.21 - 8.87)
	60+	10.96% (9.03 - 13.24)
	Total sample (n)	15470
Sex		
	Male	2.45% (1.98 - 3.02)
	Female	4.34% (3.70 - 5.07)
	Total sample (n)	15484
Race		
	African	2.95% (2.58 - 3.37)
	Coloured	4.01% (2.86 - 5.58)
	Asian/Indian	11.17% (6.51 - 18.51)
	White	5.56% (3.50 - 8.72)
	Total sample (n)	15484
Marital Status		
	Married	5.83% (4.85 - 6.98)
	Living with partner	2.15% (1.07 - 4.25)
	Widow/Widower	10.19% (8.19 - 12.61)
	Divorced/Separated	2.43% (1.27 - 4.61)
	Never married	1.40% (1.03 - 1.90)
	Total sample (n)	15437

Note: Confidence Interval in parenthesis
Source: Own calculations based on data from NIDS (2013): Weighted

4.4.2 Diabetes Prevalence across Socio-economic Variables

Table 4.3.2 presents the prevalence of diabetes among South African adults across various socio-economic variables. The highest prevalence of diabetes is found among adults with less than matric (including adults with other education). Importantly, adults with tertiary education follow with a prevalence close to 3% (2.94%).

With regard to employment, the highest diabetes prevalence is found among adults who are not economically active (4.56%). Thereafter, individuals who are not actively seeking employment have the highest prevalence of disease. Individuals who are employed have a prevalence of 3.18%, while unemployed adults have the lowest prevalence of only 2.34%. As unemployed individuals exhibit the lowest prevalence of diabetes, actively searching for employment but not being employed may potentially have a beneficial impact on health. This sits in opposition to the not economically active group who are not seeking employment and exhibit the highest prevalence. However, attention should be paid to the not economically active group. This group may have large proportions of scholars (generally younger ages), as well as older persons (including pensioners) and individuals bordered off from work, the latter two groups may inflate prevalence rates.

In relation to occupation, an interesting dynamic is observed at both ends of the scale. The highest prevalence of diabetes is observed among skilled professionals (3.08%) and unskilled adults (3.07%). Therefore, occupations focused on both high levels of responsibility as well as 'basic' work display high rates of disease. Semi-skilled adults have the lowest prevalence of diabetes falling slightly short of 2% (1.90%).

With regard to income, adults earning in the upper to high income brackets have the highest prevalence of diabetes (2.66% & 3.63% respectively). Middle income earners have the lowest prevalence (1.77%). In terms of place of residence, the highest prevalence of diabetes is found among those residing informal urban areas (4.19%). This is followed by those in formal urban areas (3.00%), and rural and tribal areas (2.78%).

Table 4.3.2: Prevalence of Diabetes across Socio-economic Variables among South African Adults in 2008

Determinants		Diabetes Diagnosed (Row %)
Education Bracket		
	No schooling	6.38% (5.02 - 8.08)
	Primary (Gr. 0 - 7)	5.39% (4.50 - 6.43)
	Secondary (Gr. 8 - 11)	2.40% (1.81 - 3.18)
	Matric	2.72% (1.74 - 4.22)
	Tertiary	2.94% (1.89 - 4.55)
	Other	5.65% (2.90 - 10.72)
	Total sample (n)	15432
Employment Status		
	Unemployed	2.34% (1.33 - 4.08)
	Not economically active	4.56% (3.87 - 5.37)
	Employed	3.18% (2.65 - 3.81)
	Total sample (n)	15350
Primary Occupation		
	Unskilled	3.07% (1.86 - 5.03)
	Semi-Skilled	1.90% (1.17 - 3.05)
	Skilled Administrative	2.15% 1.29 - 3.59)
	Skilled Professional	3.08% (1.91 - 4.95)
	Total sample (n)	3740
Income Bracket (ZAR)		
	Low income 0 - 1000	2.65% (1.63 - 4.29)
	Middle income 1000 - 3000	1.77% (1.07 - 2.91)
	Upper middle income 3000 - 6000	2.66% (1.55 - 4.54)
	High income 6000+	3.63% (2.01 - 6.45)
	Total sample (n)	3295
Residency/Location		
	Rural & Tribal	2.78% (2.36 - 3.29)
	Urban informal	4.19% (3.50 - 5.00)
	Urban formal	3.00% (1.83 - 4.87)
	Total sample (n)	15484

Note: Confidence Interval in parenthesis
Source: Own calculations based on data from NIDS (2013): Weighted

4.4.3 Diabetes Bivariate Binary Logistic Regression across Demographic Variables

Table 4.4.1 presents the bivariate logistic regression of diabetes across demographic variables among South African adults in 2008. Compared to those in the younger age, adults in every sequential age bracket have significantly higher odds of diabetes. This ranges from 2.73 in the 25 - 34 group, to odds of 37.02 in the 60+ age groups. Interestingly, among adults over 45 years, the odds of having diabetes increases substantially (OR: 25.00+).

Compared to males, females have slightly over one and a half times the odds of having diabetes (OR: 1.69). This again may be the result of more females reaching older age groups where chronic diseases are more prevalent. In terms of racial group, compared to the African adults, Coloured and White adults have roughly one and a half times the odds of having diabetes (OR: 1.35 & 1.60 respectively). Asians/Indians on the other hand, have close to four times the odds (OR: 3.62). When compared to married adults only widowed adults have significantly higher odds of having diabetes (OR: 1.84). The remainder of the marital status groups all have lower odds of having the disease, with the lowest odds found among never married adults (OR: 0.20).

Table 4.4.1: Bivariate Binary Logistic Regression of Diabetes across Demographic Variables among South African Adults in 2008

	Chronic Disease
	Diabetes Odds Ratio
Determinants	
Age Bracket	
15 - 24	Reference
25 - 34	2.73 (1.47 - 5.07)*
35 - 44	8.49 (4.94 - 14.62)*
45 - 59	25.50 (15.34 - 42. 37)*
60+	37.02 (22.27 - 61. 56)*
Total sample (n)	15471
Prob > chi2	0.000**
Sex	
Male	Reference
Female	1.69 (1.41 - 2.02)*
Total sample (n)	15484
Prob > chi2	0.000**
Race	
African	Reference
Coloured	1.35 (1.08 - 1.68)*
Asian_Indian	3.62 (2.38 - 5.01)*
White	1.60 (1.19 - 2.17)*
Total sample (n)	15484
Prob > chi2	0.007**
Marital Status	
Married	Reference
Living with partner	0.26 (0.17 - 0.39)*
Widow/Widower	1.84 (1.50 - 2.26)*
Divorced/Separated	0.68 (0.42 - 1.10)
Never married	0.20 (0.16 - 0.25)*
Total sample (n)	15437
Prob > chi2	0.000**

* Significant at the 0.05 level
** Significant at the 0.20 level
Note: Confidence Interval in parenthesis
Source: Own calculations based on data from NIDS (2013): Unweighted

4.4.4 Diabetes Bivariate Binary Logistic Regression across Socio-economic Variables

Table 4.4.2 presents the bivariate binary logistic regression of diabetes across socio-economic variables among South African adults in 2008. Compared to adults with no schooling, adults in every education bracket, besides those with other education (OR: 1.20) have lower odds of having diabetes. The lowest odds are seen among adults with a Secondary or Matric education (OR: 0.30 & 0.32 respectively).

With regard to employment, not economically active and employed adults exhibit significantly higher odds of having diabetes than their unemployed counterparts (OR: 3.44 & 2.37 respectively). In relation to occupation, compared to unskilled individuals, skilled professionals are the only group to have higher odds of diabetes (OR: 1.97). In contrast, semi-skilled adults have the lowest odds (OR: 0.75).

Compared to adults earning in the low income bracket, both upper middle and high income earners have higher odds of diabetes (OR: 1.59 & 2.71 respectively). Only middle income earners have lower odds of having the disease (OR: 0.90). Compared to adults living in rural and tribal areas, individuals in both informal and formal urban areas have higher odds of the disease (OR: 1.13 & 1.45).

Table 4.4.2: Bivariate Binary Logistic Regression of Diabetes across Socio-economic Variables among South African Adults in 2008

	Chronic Disease
	Diabetes **Odds Ratio**
Determinants	
Education Bracket	
No schooling	Reference
Primary (Gr. 0 - 7)	0.86 (0.69 - 1.06)
Secondary (Gr. 8 - 11)	0.30 (0.24 - 0.39)*
Matric	0.32 (0.23 - 0.44)*
Tertiary	0.59 (0.42 - 0.82)*
Other	1.20 (0.70 - 2.06)
Total sample (n)	15432
Prob > chi2	0.000**

Employment Status	
Unemployed	Reference
Not economically active	3.44 (2.50 - 4.72)*
Employed	2.37 (1.71 - 3.29)*
Total sample (n)	15350
Prob > chi2	0.000**
Primary Occupation	
Unskilled	Reference
Semi-Skilled	0.75 (0.43 - 1.31)
Skilled Administrative	0.98 (0.55 - 1.75)
Skilled Professional	1.97 (1.19 - 3.26)*
Total sample (n)	3740
Prob > chi2	0.002**
Income Bracket (ZAR)	
Low income 0 - 1000	Reference
Middle income 1000 - 3000	0.90 (0.51 - 1.57)
Upper middle income 3000 - 6000	1.59 (0.88 - 2.88)
High income 6000+	2.71 (1.54 - 4.77)*
Total sample (n)	3295
Prob > chi2	0.019**
Residency/Location	
Rural & Tribal	Reference
Urban informal	1.13 (0.79 - 1.60)
Urban formal	1.45 (1.23 - 1.72)*
Total sample (n)	15484
Prob > chi2	0.000**

* Significant at the 0.05 level
** Significant at the 0.20 level
Note: Confidence Interval in parenthesis
Source: Own calculations based on data from NIDS (2013): Unweighted

4.4.5 Diabetes Multivariate Binary Logistic Regression - Model 1 - Demographic Variables

Table 4.5.1 presents Model 1 of the multivariate binary logistic regression of diabetes across demographic variables among South African adults in 2008. After controlling for respective reference categories, all age groups display significantly higher odds of being diagnosed with diabetes. Odds range from a modest 2.63 among adults aged 25 - 34, to a considerably high 27.27 among adults over 60 years. Females have close to one and a half times the odds of males (OR: 1.42). Asian/Indians are the only race group to have significantly higher odds

(OR: 3.13). Lastly, widowed adults are the only marital status group to have higher odds of the disease (OR: 1.10).

Table 4.5.1: Model 1 - Multivariate Binary Logistic Regression of Diabetes across Demographic Variables among South African Adults in 2008

	Chronic Disease	
	Diabetes Odds Ratio	
Determinants		
Age Bracket		
15 - 24	Reference	
25 - 34	2.63 (1.41 - 4.92)*	
35 - 44	7.34 (4.17 - 12.92)*	
45 - 59	20.31 (11.83 - 34.89)*	
60+	27.27 (15.72 - 47.32)*	
Sex		
Male	Reference	
Female	1.42 (1.17 - 1.72)*	
Race		
African	Reference	
Coloured	1.18 (0.94 - 1.49)	
Asian_Indian	3.13 (2.00 - 4.89)*	
White	0.95 (0.70 - 1.30)	
Marital Status		
Married	Reference	
Living with partner	0.47 (0.31 - 0.72)*	
Widow/Widower	1.10 (0.88 - 1.39)	
Divorced/Separated	0.58 (0.36 - 0.94)*	
Never married	0.75 (0.58 - 0.97)*	
Total sample (n)	15424	
Prob > chi2	0.000*	
Linktest (_hatsq)		0.465

* Significant at the 0.05 level
Note: Confidence Interval in parenthesis
Source: Own calculations based on data from NIDS (2013): Unweighted

4.4.6 Diabetes Multivariate Binary Logistic Regression - Model 2 - Socio-economic Variables

Table 4.5.2 presents Model 2 of the multivariate binary logistic regression of diabetes across socio-economic variables among South African adults in 2008. After controlling for respective reference groups, adults in all education groups have lower odds of diabetes compared to adults with no schooling. Individuals with primary and secondary education have odds of 0.77 and 0.64, while those with matric or tertiary education have the lowest odds (OR: 0.36 & 0.29 respectively). Skilled professionals have close to one and a half times the odds of unskilled adults, while semi-skilled adults have the lowest odds (OR: 1.49 & 0.76 respectively). The odds of having diabetes increases with income. Middle income earners have lower odds, while upper middle and high income earners have significantly higher odds (OR: 0.96, 2.05 & 3.54 respectively). Both formal and informal urban dwellers have higher odds of diabetes (OR: 1.44 & 2.06).

Table 4.5.2: Model 2 - Multivariate Binary Logistic Regression of Diabetes across Socio-economic Variables among South African Adults in 2008

	Chronic Disease
	Diabetes **Odds Ratio**
Determinants	
Education Bracket	
No schooling	Reference
Primary (Gr. 0 - 7)	0.77 (0.34 - 1.75)
Secondary (Gr. 8 - 11)	0.64 (0.28 - 1.45)
Matric	0.36 (0.14 - 0.96)*
Tertiary	0.29 (0.10 - 0.83)*
Other	0.60 (0.14 - 2.50)
Primary Occupation	
Unskilled	Reference
Semi-Skilled	0.76 (0.42 - 1.39)
Skilled Administrative	0.98 (0.47 - 2.04)
Skilled Professional	1.49 (0.69 - 3.22)
Income Bracket (ZAR)	
Low income 0 - 1000	Reference
Middle income 1000 - 3000	0.96 (0.54 - 1.72)
Upper middle income 3000 - 6000	2.05 (1.02 - 4.11)*
High income 6000+	3.54 (1.59 - 7.86)*

Residency/Location		
Rural & Tribal	Reference	
Urban informal	2.06 (0.90 - 4.69)	
Urban formal	1.44 (0.85 - 2.44)	
Total sample (n)	3231	
Prob > chi2	0.011*	
Linktest (_hatsq)		0.164

* Significant at the 0.05 level
Note: Employment Status is omitted due to collinearity
Note: Confidence Interval in parenthesis
Source: Own calculations based on data from NIDS (2013): Unweighted

4.4.7 Diabetes Multivariate Binary Logistic Regression - Model 3 - Demographic & Socio-economic Variables

Table 4.5.3 presents Model 3 of the multivariate binary logistic regression of diabetes across both demographic and socio-economic variables among South African adults in 2008. After controlling for other variables, the odds of having diabetes increases in every sequential age bracket. Middle adults aged 25 - 34 have lower odds, while those aged 45 - 59 and 60+ have significantly higher odds (OR: 0.82, 4.41 & 6.92 respectively). Females have roughly the same odds as males (OR: 1.01). Asian/Indians are the only racial group to have higher odds of diabetes (OR: 1.10). In contrast, Whites have just over half the odds (OR: 0.62). In relation to marital status, only widowed adults have higher odds of having the disease (OR: 1.15). Adults living with a partner or divorced/separated have the lowest odds (OR: 0.47 & 0.50 respectively).

In terms of education, adults with tertiary or primary education have the lowest odds of having diabetes (OR: 0.85 & 0.89 respectively). Individuals with a secondary or other education have the highest odds (OR: 1.27 & 1.22 respectively). With regard to occupation, only semi-skilled adults have lower odds (OR: 0.90). Skilled administrative and professional adults have the highest odds (OR: 1.10 & 1.35 respectively). As income increases, so does the odds of having diabetes. Middle income earners have lower odds, while both upper middle and high income earners have higher odds (OR: 0.89, 1.42 & 2.12 respectively). Both formal and informal urban dwellers have higher odds (OR: 1.22 & 2.25 respectively).

Table 4.5.3: Model 3 - Multivariate Binary Logistic Regression of Diabetes across Demographic & Socio-economic Variables among South African Adults in 2008

	Chronic Disease
	Diabetes Odds Ratio
Determinants	
Age Bracket	
15 - 24	Reference
25 - 34	0.82 (0.25 - 2.74)
35 - 44	2.14 (0.69 - 6.65)
45 - 59	4.41 (1.39 - 13.97)*
60+	6.92 (1.73 - 27.76)*
Sex	
Male	Reference
Female	1.01 (0.62 - 1.66)
Race	
African	Reference
Coloured	0.96 (0.55 - 1.65)
Asian_Indian	1.10 (0.25 - 4.95)
White	0.62 (0.28 - 1.33)
Marital Status	
Married	Reference
Living with partner	0.47 (0.18 - 1.22)
Widow/Widower	1.15 (0.54 - 2.45)
Divorced/Separated	0.50 (0.17 - 1.44)
Never married	0.70 (0.38 - 1.28)
Education Bracket	
No schooling	Reference
Primary (Gr. 0 - 7)	0.89 (0.39 - 2.05)
Secondary (Gr. 8 - 11)	1.27 (0.54 - 2.99)
Matric	1.12 (0.39 - 3.23)
Tertiary	0.85 (0.27 - 2.63)
Other	1.22 (0.27 - 5.41)
Primary Occupation	
Unskilled	Reference
Semi-Skilled	0.90 (0.47 - 1.74)
Skilled Administrative	1.10 (0.52 - 2.32)
Skilled Professional	1.35 (0.60 - 3.01)

Income Bracket (ZAR)		
Low income 0 - 1000	Reference	
Middle income 1000 - 3000	0.89 (0.49 - 1.61)	
Upper middle income 3000 - 6000	1.42 (0.69 - 2.93)	
High income 6000+	2.12 (0.90 - 4.98)	
Residency/Location		
Rural & Tribal	Reference	
Urban informal	2.25 (0.97 - 5.22)	
Urban formal	1.22 (0.72 - 2.07)	
Total sample (n)	3220	
Prob > chi2	0.000*	
Linktest (_hatsq)		0.519

* Significant at the 0.05 level
Note: Employment Status is omitted due to collinearity
Note: Confidence Interval in parenthesis
Source: Own calculations based on data from NIDS (2013): Unweighted

4.5 Hypertension

4.5.1 Hypertension Prevalence across Demographic Variables

Table 4.6.1 presents the prevalence of hypertension among South African adults across various demographic variables. The general trend sees hypertension prevalence increase with age. Young adults aged 15 – 24 have a prevalence of 1.55%, which increases to nearly 5% among adults aged 25 - 34 (4.50%). From this point prevalence in the remaining groups increases dramatically to 14.47% in the prime adult 35 - 44 bracket to 40.82% in the elderly 60+ age group. Interestingly, close to half of adults over 60 years are diagnosed with hypertension.

The prevalence of hypertension among males is 8.34%. This figure more than doubles among females to reach close to 18.00% (17.62%). With regard to race, Whites have the highest prevalence of hypertension (20.73%). This is followed closely by the Coloured (19.32%), Asian/Indian (16.77%), and lastly African groups (11.93%).

In terms of marital status, widowed adults have the highest prevalence of hypertension with more than a third of its members diagnosed (36.99%). Adults who are divorced/separated also have a relatively high prevalence of 24.95%. Additionally, a quarter of married adults have hypertension (20.14%), while only 5.19% of never married adults are diagnosed with the disease. Interestingly, adults who were married, but have since lost their partners through death or divorce have the highest prevalence.

Table 4.6.1: Prevalence of Hypertension across Demographic Variables among South African Adults in 2008

Determinants		Hypertension Diagnosed (Row %)
Age Bracket		
	15 - 24	1.55% (1.13 - 2.13)
	25 - 34	4.50% (3.47 - 5.80)
	35 - 44	14.47% (12.35 - 16.89)
	45 - 59	28.19% (25.77 - 30.74)
	60+	40.82% (37.50 - 44.23)
	Total sample (n)	15506
Sex		
	Male	8.34% (7.33 - 9.47)
	Female	17.62% (16.46 - 18.85)
	Total sample (n)	15519
Race		
	African	11.93% (11.18 - 12.73)
	Coloured	19.32% (16.40 - 22.62)
	Asian/Indian	16.77% (10.75 - 25.22)
	White	20.73% (16.80 - 25.31)
	Total sample (n)	15519
Marital Status		
	Married	20.14% (18.43 - 21.97)
	Living with partner	15.01% (11.91 - 18.76)
	Widow/Widower	36.99% (33.15 - 41.00)
	Divorced/Separated	24.95% (18.25 - 33.12)
	Never married	5.19% (4.58 - 5.87)
	Total sample (n)	15472

Note: Confidence Interval in parenthesis
Source: Own calculations based on data from NIDS (2013): Weighted

4.5.2 Hypertension Prevalence across Socio-economic Variables

Table 4.6.2 presents the prevalence of hypertension among South African adults across various socio-economic variables. In relation to education, more than a quarter of adults with less than secondary schooling are diagnosed with hypertension (no schooling, 27.69% &

primary schooling, 22.42%). Interestingly, those with matric as their highest qualification have the lowest prevalence of the disease (7.37%).

In terms of employment, not economically active adults have the highest prevalence (16.34%). Employed adults have a slightly lower prevalence of close to 13.00% (12.96%), while the prevalence among unemployed individuals is slightly under 10% (9.76%). Occupations at either end of the scale have the highest prevalence. Unskilled and skilled professionals have a prevalence of 17.88% and 10.50% respectively. Skilled administrative and semi-skilled adults have a prevalence of 9.02% and 7.91% respectively. Adults in the low to middle income bracket have the highest prevalence of hypertension (12.92% & 11.34% respectively). Adults in the high income bracket also have a relatively high prevalence (10.56%), while the lowest prevalence is observed in the upper middle income bracket (8.31%). In relation to place of residence, individuals living in both formal and informal urban areas have the highest prevalence of hypertension (14.58% & 16.35% respectively). Those in rural and tribal areas have the lowest prevalence of 11.53%.

Table 4.6.2: Prevalence of Hypertension across Socio-economic Variables among South African Adults in 2008

Determinants		Hypertension Diagnosed (Row %)
Education Bracket		
	No schooling	27.69% (24.95 - 30.60)
	Primary (Gr. 0 - 7)	22.42% (20.49 - 24.47)
	Secondary (Gr. 8 - 11)	9.48% (8.36 - 10.72)
	Matric	7.37% (5.89 - 9.17)
	Tertiary	11.36% (8.59 - 14.89)
	Other	15.75% (10.28 - 23.37)
	Total sample (n)	15467
Employment Status		
	Unemployed	9.76% (8.19 - 11.59)
	Not Economically Active	16.34% (15.00 - 17.78)
	Employed	12.96% (11.72 - 14.30)
	Total sample (n)	15384
Primary Occupation		
	Unskilled	17.88% (14.45 - 21.92)
	Semi-Skilled	7.91% (5.96 - 10.42)
	Skilled Administrative	9.02% (6.36 - 12.64)
	Skilled Professional	10.50% (7.51 - 14.50)
	Total sample (n)	3749

Income Bracket (ZAR)	
Low income 0 - 1000	12.92% (10.36 - 15.99)
Middle income 1000 - 3000	11.34% (8.85 - 14.44)
Upper middle income 3000 - 6000	8.31% (5.51 - 12.34)
High income 6000+	10.56% (6.74 - 16.19)
Total sample (n)	3304
Residency/Location	
Rural & Tribal	11.53% (10.67 - 12.46)
Urban informal	16.35% (13.22 - 20.05)
Urban formal	14.58% (13.34 - 15.92)
Total sample (n)	15519

Note: Confidence Interval in parenthesis
Source: Own calculations based on data from NIDS (2013): Weighted

4.5.3 Hypertension Bivariate Binary Logistic Regression across Demographic Variables

Table 4.7.1 presents the bivariate binary logistic regression of hypertension across demographic variables among South African adults in 2008. Compared to young adults aged 15 - 24, the odds of having hypertension increases significantly with every increase in age group. This increase ranges from odds of 3.23 among adults aged 25 - 34, to odds of 41.90 among the elderly 60+. Interestingly, there is a drastic increase in odds among the older and elderly age groups (OR: 25.00+).

When compared to males, females have close to two and a half times the odds of being diagnosed with hypertension (OR: 2.31). Compared to African adults, every other race group has greater odds of having the disease. This is highest among White and Coloured adults (OR: 1.78 & 1.63 respectively).

Compared to married adults, divorced/separated and widowed individuals have greater odds of having hypertension (OR: 1.12 & 2.03 respectively). In contrast, adults who are never married have the lower odds (OR: 0.22).

Table 4.7.1: Bivariate Binary Logistic Regression of Hypertension across Demographic Variables among South African Adults in 2008

	Chronic Disease
	Hypertension Odds Ratio
Determinants	
Age Bracket	
15 - 24	Reference
25 - 34	3.23 (2.46 - 4.24)*
35 - 44	9.41 (7.36 - 12.04)*
45 - 59	25.69 (20.36 - 32.41)*
60+	41.90 (33.11 - 53.02)*
Total sample (n)	15506
Prob > chi2	0.000**
Sex	
Male	Reference
Female	2.31 (2.09 - 2.54)*
Total sample (n)	15519
Prob > chi2	0.000**
Race	
African	Reference
Coloured	1.63 (1.46 - 1.83)*
Asian_Indian	1.29 (0.91 - 1.83)
White	1.78 (1.51 - 2.09)*
Total sample (n)	15519
Prob > chi2	0.000**
Marital Status	
Married	Reference
Living with partner	0.58 (0.49 - 0.68)*
Widow/Widower	2.03 (1.79 - 2.31)*
Divorced/Separated	1.12 (0.90 - 1.41)
Never married	0.22 (0.19 - 0.24)*
Total sample (n)	15472
Prob > chi2	0.000**

* Significant at the 0.05
** Significant at the 0.20
Note: Confidence Interval in parenthesis
Source: Own calculations based on data from NIDS (2013): Unweighted

4.5.4 Hypertension Bivariate Binary Logistic Regression across Socio-economic Variables

Table 4.7.2 presents the bivariate binary logistic regression of hypertension across socio-economic variables among South African adults in 2008. In terms of education compared to those with no schooling, all other education brackets have significantly lower odds of being diagnosed with hypertension. Adults with primary education have odds of 0.69, while adults with a matric have the lowest odds (OR: 0.20).

With regard to employment, both employed and not economically adults have greater odds of hypertension compared to unemployed adults (OR: 1.49 & 2.03 respectively). Adults in all other occupation groups have lower odds of hypertension than those who are unskilled. Skilled professionals have odds of 0.83, while both skilled administrative and semi skilled adults have odds of 0.60. In terms of income, compared to those earning in the low income bracket, only adults with high incomes have greater odds of hypertension (OR: 1.17). On the other hand, adults with upper middle income earnings have the lowest odds (OR: 0.76). Both adults living in informal and formal urban areas have higher odds of hypertension than rural and tribal dwellers (OR: 1.25 & 1.32 respectively).

Table 4.7.2: Bivariate Binary Logistic Regression of Hypertension across Socio-economic Variables among South African Adults in 2008

	Chronic Disease
	Hypertension Odds Ratio
Determinants	
Education Bracket	
No schooling	Reference
Primary (Gr. 0 - 7)	0.69 (0.62 - 0.78)*
Secondary (Gr. 8 - 11)	0.24 (0.21 - 0.27)*
Matric	0.20 (0.17 - 0.24)*
Tertiary	0.34 (0.28 - 0.42)*
Other	0.62 (0.44 - 0.88)*
Total sample (n)	15467
Prob > chi2	0.000**
Employment Status	
Unemployed	Reference
Not economically active	2.03 (1.78 - 2.33)*
Employed	1.49 (1.29 - 1.71)*
Total sample (n)	15384
Prob > chi2	0.000**

Primary Occupation	
Unskilled	Reference
Semi-Skilled	0.60 (0.46 - 0.77)*
Skilled Administrative	0.60 (0.45 - 0.80)*
Skilled Professional	0.83 (0.64 - 1.08)
Total sample (n)	3749
Prob > chi2	0.001**
Income Bracket (ZAR)	
Low income 0 - 1000	Reference
Middle income 1000 - 3000	0.85 (0.67 - 1.09)
Upper middle income 3000 - 6000	0.76 (0.55 - 1.04)
High income 6000+	1.17 (0.85 - 1.61)
Total sample (n)	3304
Prob > chi2	0.083**
Residency/Location	
Rural & Tribal	Reference
Urban informal	1.25 (1.04 - 1.49)*
Urban formal	1.32 (1.21 - 1.45)*
Total sample (n)	15519
Prob > chi2	0.000**

* Significant at the 0.05 level
* *Significant at the 0.20 level
Note: Confidence Interval in parenthesis
Source: Own calculations based on data from NIDS (2013): Unweighted

4.5.5 Hypertension Multivariate Binary Logistic Regression - Model 1 - Demographic Variables

Table 4.8.1 presents Model 1 of the multivariate binary logistic regression of hypertension across demographic variables among South African adults in 2008. After controlling for other variables, adults in every age bracket display significantly higher odds of being diagnosed with hypertension. This ranges from 2.95 among adults aged 25 – 34, to a considerably higher 36.35 among the elderly. Females have more than twice the odds of having hypertension than males (OR: 2.27). Coloured adults have the highest odds, while Whites and Asian/Indians have odds close to 1.00 (OR: 1.50, 1.03 & 1.05 respectively). Adults in all marital groups have lower odds of having hypertension except for those living with a partner (OR: 1.10).

Table 4.8.1: Model 1 - Multivariate Binary Logistic Regression of Hypertension across Demographic Variables among South African Adults in 2008

	Chronic Disease	
	Hypertension Odds Ratio	
Determinants		
Age Bracket		
Young adult 15 - 24	Reference	
Middle adult 25 - 34	2.95 (2.23 - 3.89)*	
Prime adult 35 - 44	8.02 (6.18 - 10.39)*	
Older adult 45 - 59	21.82 (16.96 - 28.08)*	
Elderly 60+	36.35 (27.98 - 47.24)*	
Sex		
Male	Reference	
Female	2.27 (2.03 - 2.53)*	
Race		
African	Reference	
Coloured	1.50 (1.32 - 1.70)*	
Asian_Indian	1.05 (0.71 - 1.55)	
White	1.03 (0.86 - 1.23)	
Marital Status		
Married	Reference	
Living with partner	1.10 (0.92 - 1.31)	
Widow/Widower	0.96 (0.83 - 1.10)	
Divorced/Separated	0.86 (0.68 - 1.10)	
Never married	0.83 (0.72 - 0.94)*	
Total sample (n)	15459	
Prob > chi2	0.000*	
Linktest (_hatsq)		0.167

* Significant at the 0.05 level
Note: Confidence Interval in parenthesis
Source: Own calculations based on data from NIDS (2013): Unweighted

4.5.6 Hypertension Multivariate Binary Logistic Regression - Model 2 - Socio-economic Variables

Table 4.8.2 presents Model 2 of the multivariate binary logistic regression of hypertension across socio-economic variables among South African adults in 2008. After controlling for other variables all education groups besides those with a primary education (OR: 1.20) have lower odds of hypertension. Specifically, individuals with a matric or tertiary qualification have the lowest odds (OR: 0.29 & 0.37 respectively). Only skilled professionals have higher odds, while semi-skilled adults have significantly lower odds (OR: 1.02 & 0.62 respectively). Adults in all income brackets have higher odds of hypertension. This ranges from odds of 1.02 among middle income earners, to a significantly higher 2.01 among high income earners. Both formal and informal urban dwellers have significantly higher odds of the disease (OR: 1.41 & 1.69).

Table 4.8.2: Model 2 - Multivariate Binary Logistic Regression of Hypertension across Socio-economic Variables among South African Adults in 2008

	Chronic Disease
	Hypertension Odds Ratio
Determinants	
Education Bracket	
No schooling	Reference
Primary (Gr. 0 - 7)	1.20 (0.83 - 1.74)
Secondary (Gr. 8 - 11)	0.53 (0.36 - 0.79)*
Matric	0.29 (0.18 - 0.48)*
Tertiary	0.37 (0.22 - 0.64)*
Other	0.60 (0.28 - 1.28)
Primary Occupation	
Unskilled	Reference
Semi-Skilled	0.62 (0.47 - 0.82)*
Skilled Administrative	0.89 (0.63 - 1.27)
Skilled Professional	1.02 (0.68 - 1.53)
Income Bracket (ZAR)	
Low income 0 - 1000	Reference
Middle income 1000 - 3000	1.02 (0.79 - 1.32)
Upper middle income 3000 - 6000	1.19 (0.82 - 1.73)
High income 6000+	2.01 (1.29 - 3.14)*

Residency/Location		
Rural & Tribal	Reference	
Urban informal	1.69 (1.10 - 2.57)*	
Urban formal	1.41 (1.10 - 1.81)*	
Total sample (n)	3240	
Prob > chi2	0.000*	
Linktest (_hatsq)		0.998

* Significant at the 0.05 level
Note: Employment Status is omitted due to collinearity
Note: Confidence Interval in parenthesis
Source: Own calculations based on data from NIDS (2013): Unweighted

4.5.7 Hypertension Multivariate Binary Logistic Regression - Model 3 - Demographic & Socio-economic Variables

Table 4.8.3 presents Model 3 of the multivariate binary logistic regression of hypertension across both demographic and socio-economic variables among South African adults in 2008. After controlling for other variables, the odds of having hypertension increases significantly with age. Odds range from 2.47 among adults aged 25 – 34, to close to 15.00 among older and elderly adults (OR: 13.12 & 13.68 respectively). Females have significantly higher odds than males (OR: 1.97). Coloureds are the only racial group to have significantly higher odds (OR: 1.32). On the other hand, Asian/Indians have roughly half the odds of having the disease (OR: 0.63). In terms of marital status, only adults living with a partner or divorced/separated have higher odds, while never married adults have the lowest odds (OR: 1.19, 1.01 & 0.75 respectively).

In terms of education, only adults with a matric have lower odds of hypertension (OR: 0.89). Adults with primary education have the highest odds (OR: 1.51). Skilled professionals have the lowest odds of hypertension, while skilled administrative adults are the only occupation group with higher odds (OR: 0.82 & 1.04 respectively). With regard to income, both middle and high income earners have higher odds of the disease (OR: 1.03 & 1.30 respectively). In contrast, upper middle income earners have lower odds (OR: 0.96). Both formal and informal urban dwellers have higher odds of hypertension (OR: 1.14 & 1.80 respectively).

Table 4.8.3: Model 3 - Multivariate Binary Logistic Regression of Hypertension across Demographic & Socioeconomic Variables among South African Adults in 2008

	Chronic Disease
	Hypertension Odds Ratio
Determinants	
Age Bracket	
15 - 24	Reference
25 - 34	2.47 (1.15 - 5.30)*
35 - 44	5.19 (2.45 - 10.99)*
45 - 59	13.12 (6.17 - 27.93)*
60+	13.68 (5.58 - 33.52)*
Sex	
Male	Reference
Female	1.98 (1.52 - 2.57)*
Race	
African	Reference
Coloured	1.32 (1.01 - 1.72)*
Asian_Indian	0.63 (0.19 - 2.11)
White	1.06 (0.69 - 1.63)
Marital Status	
Married	Reference
Living with partner	1.19 (0.83 - 1.71)
Widow/Widower	0.97 (0.64 - 1.48)
Divorced/Separated	1.01 (0.64 - 1.59)
Never married	0.75 (0.55 - 1.02)
Education Bracket	
No schooling	Reference
Primary (Gr. 0 - 7)	1.51 (1.02 - 2.24)*
Secondary (Gr. 8 - 11)	1.05 (0.68 - 1.62)
Matric	0.89 (0.51 - 1.54)
Tertiary	1.14 (0.63 - 2.09)
Other	1.38 (0.62 - 3.08)
Primary Occupation	
Unskilled	Reference
Semi-Skilled	0.95 (0.69 - 1.30)
Skilled Administrative	1.04 (0.71 - 1.51)
Skilled Professional	0.82 (0.53 - 1.28)

Income Bracket (ZAR)		
Low income 0 - 1000	Reference	
Middle income 1000 - 3000	1.03 (0.78 - 1.37)	
Upper middle income 3000 - 6000	0.96 (0.64 - 1.44)	
High income 6000+	1.30 (0.80 - 2.14)	
Residency/Location		
Rural & Tribal	Reference	
Urban informal	1.80 (1.15 - 2.81)*	
Urban formal	1.14 (0.87 - 1.47)	
Total sample (n)	3229	
Prob > chi2	0.000*	
Linktest (_hatsq)		0.494

* Significant at the 0.05 level
Note: Employment Status is omitted due to collinearity
Note: Confidence Interval in parenthesis
Source: Own calculations based on data from NIDS (2013): Unweighted

4.6 Cardiovascular Disease

4.6.1 Cardiovascular Disease Prevalence across Demographic Variables

Table 4.9.1 presents the prevalence of cardiovascular disease among South African adults across various demographic variables in 2008. The prevalence of cardiovascular disease increases with age. Young adults aged 15 - 24 have a modest prevalence of 1.26%. This figure increases gradually among adults aged 25 - 34 to those over 60 years, from 1.62% to 8.86% respectively. Females have a higher prevalence than males (3.69% & 2.22% respectively).

In terms of race, Whites and Asian/Indians have the highest prevalence of cardiovascular disease (6.49% & 5.65% respectively). In contrast, Coloured and African adults have the lowest prevalence of the disease (3.05% & 2.52% respectively). In relation to marital status, the highest prevalence of cardiovascular disease is found among widowed adults (8.86%). Divorced/separated and married individuals have a slightly lower prevalence close to 5.00% (4.95% & 4.24% respectively). The lowest prevalence of the disease is found among adults living with a partner and who have never married (1.71% & 1.64% respectively).

Table 4.9.1: Prevalence of Cardiovascular Disease across Demographic Variables among South African Adults in 2008

	Determinants	CVD Diagnosed (Row %)
Age Bracket		
	15 - 24	1.26% (0.80 - 1.96)
	25 - 34	1.62% (1.07 - 2.44)
	35 - 44	2.17% (1.54 - 3.07)
	45 - 59	5.29% (4.23 - 6.59)
	60+	8.86% (6.72 - 11.61)
	Total sample (n)	15458
Sex		
	Male	2.22% (1.64 - 2.99)
	Female	3.69% (3.15 - 4.32)
	Total sample (n)	15471
Race		
	African	2.52% (2.16 - 2.92)
	Coloured	3.05% (2.10 - 4.42)
	Asian/Indian	5.65% (3.10 - 10.09)
	White	6.49% (4.19 - 9.91)
	Total sample (n)	15471
Marital Status		
	Married	4.24% (3.34 - 5.37)
	Living with partner	1.71% (1.10 - 2.65)
	Widow/Widower	8.86% (6.53 - 11.92)
	Divorced/Separated	4.95% (2.92 - 8.28)
	Never married	1.64% (1.26 - 2.13)
	Total sample (n)	15425

Note: Confidence Interval in parenthesis
Source: Own calculations based on data from NIDS (2013): Weighted

4.6.2 Cardiovascular Disease Prevalence across Socio-economic Variables

Table 4.9.2 presents the prevalence of cardiovascular disease among South African adults across various socio-economic variables. In relation to education, adults with less than secondary schooling have the highest prevalence of cardiovascular disease (no schooling, 4.14% & primary schooling, 4.80%). Among the remainder of the education groups prevalence is more uniform around 2%, with the matric group having the lowest prevalence (2.09%).

In terms of employment, not economically active adults have the highest prevalence of cardiovascular disease (4.14%). In contrast, unemployed adults have the lowest prevalence of 2.06%. With regard to occupation, unskilled and skilled professional adults have the highest cardiovascular disease prevalence (2.84% & 1.96% respectively). Semi-skilled and skilled administrative adults have a slightly lower prevalence (1.82% & 1.64% respectively). Adults in both low and high income brackets have the highest prevalence of cardiovascular disease (2.98% & 2.55% respectively). In contrast, individuals in the upper middle income range have the lowest prevalence of only 0.51%. In terms of place of residence, adults living in both informal and formal urban areas have the highest prevalence of cardiovascular disease (3.05% & 3.98% respectively). Those in rural and tribal areas have the lowest prevalence (1.86%).

Table 4.9.2: Prevalence of Cardiovascular Disease across Socio-economic Variables among South African Adults in 2008

Determinants		CVD Diagnosed (Row %)
Education Bracket		
	No schooling	4.14% (3.19 - 5.36)
	Primary (Gr. 0 - 7)	4.80% (3.86 - 5.97)
	Secondary (Gr. 8 - 11)	2.43% (1.87 - 3.16)
	Matric	2.09% (1.37 - 3.17)
	Tertiary	2.88% (1.47 - 5.56)
	Other	2.86% (1.05 - 7.53)
	Total sample (n)	15419
Employment Status		
	Unemployed	2.06% (1.49 - 2.84)
	Not economically active	4.14% (3.35 - 5.10)
	Employed	2.56% (2.01 - 3.25)
	Total sample (n)	15337
Primary Occupation		
	Unskilled	2.84% (1.60 - 5.00)
	Semi-Skilled	1.82% (0.77 - 4.22)
	Skilled Administrative	1.64% (0.67 - 3.94)
	Skilled Professional	1.96% (1.02 - 3.68)
	Total sample (n)	3737

Income Bracket (ZAR)		
	Low income 0 - 1000	2.98% (1.79 - 4.94)
	Middle income 1000 - 3000	2.33% (1.12 - 4.81)
	Upper middle income 3000 - 6000	0.51% (0.17 - 1.53)
	High income 6000+	2.55% (1.21 - 5.29)
	Total sample (n)	3292
Residency/Location		
	Rural & Tribal	1.86% (1.53 - 2.25)
	Urban informal	3.05% (1.99 - 4.65)
	Urban formal	3.98% (3.27 - 4.83)
	Total sample (n)	15471

Note: Confidence Interval in parenthesis
Source: Own calculations based on data from NIDS (2013): Weighted

4.6.3 Cardiovascular Disease Bivariate Binary Logistic Regression across Demographic Variables

Table 4.10.1 presents the bivariate binary logistic regression of cardiovascular disease across demographic variables among South African adults in 2008. Compared to young adults aged 15 - 24, every sequential age bracket has higher odds of being diagnosed with cardiovascular disease. This ranges from 1.50 among those aged 25 - 34, to odds of 8.93 among the elderly.

Compared to males, females have roughly twice the odds of being diagnosed with cardiovascular disease (OR: 1.70). In terms of race, all other races have significantly higher odds of having cardiovascular disease compared to African adults. Thereafter, Coloureds, Whites and Asian/Indians have odds of 1.52, 2.29 and 3.15 respectively. In relation to marital status, compared to those married, divorced/separated and widowed adults have significantly higher odds of cardiovascular disease (OR: 1.51 & 1.64 respectively). In contrast, adults living with a partner and never married have significantly lower odds (OR: 0.54 & 0.34 respectively).

Table 4.10.1: Bivariate Binary Logistic Regression of Cardiovascular Disease across Demographic Variables among South African Adults in 2008

Determinants	Chronic Disease: CVD Odds Ratio
Age Bracket	
15 - 24	Reference
25 - 34	1.50 (0.98 - 2.31)
35 - 44	2.60 (1.76 - 3.84)*
45 - 59	6.37 (4.56 - 8.90)*
60+	8.93 (6.38 - 12.49)*
Total sample (n)	15458
Prob > chi2	0.000**
Sex	
Male	Reference
Female	1.70 (1.40 - 2.08)*
Total sample (n)	15471
Prob > chi2	0.000**
Race	
African	Reference
Coloured	1.52 (1.19 - 1.93)*
Asian_Indian	3.15 (1.92 - 5.17)*
White	2.29 (1.70 - 3.08)*
Total sample (n)	15471
Prob > chi2	0.000**
Marital Status	
Married	Reference
Living with partner	0.54 (0.38 - 0.78)*
Widow/Widower	1.64 (1.28 - 2.10)*
Divorced/Separated	1.51 (1.01 - 2.28)*
Never married	0.34 (0.28 - 0.43)*
Total sample (n)	15425
Prob > chi2	0.000**

* Significant at the 0.05 level
** Significant at the 0.20 level
Note: Confidence Interval in parenthesis
Source: Own calculations based on data from NIDS (2013): Unweighted

4.6.4 Cardiovascular Disease Bivariate Binary Logistic Regression across Socio-economic Variables

Table 4.10.2 presents the bivariate logistic regression of cardiovascular disease across socio-economic variables among South African adults in 2008. Compared to those with no schooling, only adults with a primary education have higher odds of cardiovascular disease (OR: 1.07). In contrast, adults with a matric have the lowest odds of having the disease (OR: 0.39).

Compared to unemployed adults, both employed and not economically active individuals have higher odds of cardiovascular disease (OR: 1.12 & 1.88 respectively). In terms of occupation, compared to unskilled individuals, adults in all other occupation groups have lower odds of having cardiovascular disease. Skilled professionals have odds of 0.86, while skilled administrative adults have the lowest odds (OR: 0.46).

In terms of income, compared to adults earning in the low income bracket, only high income earners have higher odds of cardiovascular disease (OR: 1.16). Upper middle income earners in contrast have the lowest odds of the disease (OR: 0.25). Compared to rural and tribal dwellers, adults living in both informal and formal areas have significantly higher odds of cardiovascular disease (OR: 1.63 & 2.01 respectively).

Table 4.10.2: Bivariate Binary Logistic Regression of Cardiovascular Disease across Socio-economic Variables among South African Adults in 2008

	Chronic Disease
	CVD
	Odds Ratio
Determinants	
Education Bracket	
No schooling	Reference
Primary (Gr. 0 - 7)	1.07 (0.83 - 1.38)
Secondary (Gr. 8 - 11)	0.51 (0.39 - 0.67)*
Matric	0.39 (0.27 - 0.57)*
Tertiary	0.42 (0.26 - 0.66)*
Other	1.00 (0.50 - 2.01)
Total sample (n)	15419
Prob > chi2	0.000**

Employment Status	
Unemployed	Reference
Not economically active	1.88 (1.42 - 2.48)*
Employed	1.12 (0.84 (1.51)
Total sample (n)	15337
Prob > chi2	0.000**
Primary Occupation	
Unskilled	Reference
Semi-Skilled	0.54 (0.29 - 0.99)*
Skilled Administrative	0.46 (0.22 - 0.96)*
Skilled Professional	0.86 (0.47 - 1.58)
Total sample (n)	3737
Prob > chi2	0.074**
Income Bracket (ZAR)	
Low income 0 - 1000	Reference
Middle income 1000 - 3000	0.51 (0.28 - 0.92)*
Upper middle income 3000 - 6000	0.25 (0.09 - 0.71)*
High income 6000+	1.16 (0.60 - 2.23)
Total sample (n)	3292
Prob > chi2	0.003**
Residency/Location	
Rural & Tribal	Reference
Urban informal	1.63 (1.12 - 2.35)*
Urban formal	2.01 (1.66 - 2.44)*
Total sample (n)	15471
Prob > chi2	0.000**

* Significant at the 0.05 level
** Significant at the 0.20 level
Note: Confidence Interval in parenthesis
Source: Own calculations based on data from NIDS (2013): Unweighted

4.6.5 Cardiovascular Disease Multivariate Binary Logistic Regression - Model 1 - Demographic Variables

Table 4.11.1 presents Model 1 of the multivariate binary logistic regression of cardiovascular disease across demographic variables among South African adults in 2008. After controlling for other variables, adults in all age brackets display higher odds of having cardiovascular disease. This ranges from odds of 1.43 among adults aged 25 - 34 and escalates significantly to 7.45 among the elderly. Females have slightly more than one and a half times the odds of having cardiovascular disease (OR: 1.53). Adults in all racial groups present significantly higher odds of having cardiovascular disease compared to African adults. Thereafter, among

Coloureds, Whites and Asian/Indians, odds increase from 1.39, 1.54, 2.85 respectively. Widowed and divorced/separated adults have the highest odds of the disease (OR: 1.07 & 1.28 respectively). In contrast, adults living with a partner and never married have lower odds (OR: 0.92 & 0.93).

Table 4.11.1: Model 1 - Multivariate Binary Logistic Regression of Cardiovascular Disease across Demographic Variables among South African Adults in 2008

	Chronic Disease
	CVD **Odds Ratio**
Determinants	
Age Bracket	
15 - 24	Reference
25 - 34	1.43 (0.93 - 2.22)
35 - 44	2.29 (1.50 - 3.50)*
45 - 59	5.42 (3.68 - 7.98)*
60+	7.45 (4.97 - 11.16)*
Sex	
Male	Reference
Female	1.53 (1.24 - 1.88)*
Race	
African	Reference
Coloured	1.39 (1.09 - 1.77)*
Asian_Indian	2.85 (1.71 - 4.75)*
White	1.54 (1.13 - 2.11)*
Marital Status	
Married	Reference
Living with partner	0.92 (0.63 - 1.35)
Widow/Widower	1.07 (0.81 - 1.40)
Divorced/Separated	1.28 (0.84 - 1.94)
Never married	0.93 (0.71 - 1.23)
Total sample (n)	15412
Prob > chi2	0.000*
Linktest (_hatsq)	0.760

* Significant at the 0.05 level
Note: Confidence Interval in parenthesis
Source: Own calculations based on data from NIDS (2013): Unweighted

4.6.6 Cardiovascular Disease Multivariate Binary Logistic Regression - Model 2 - Socio-economic Variables

Table 4.11.2 presents Model 2 of the multivariate binary logistic regression of cardiovascular disease across socio-economic variables among South African adults in 2008. After controlling for other variables, adults in all educational groups except for those with primary education (OR: 1.02), display lower odds of being diagnosed with cardiovascular disease. Individuals with a matric or higher education have the lowest odds (OR: 0.45 & 0.32 respectively).

Both middle and upper middle income earners have significantly lower odds of cardiovascular disease (OR: 0.50 & 0.23 respectively). Only high income earners have greater odds (OR: 1.71). Both formal and informal urban dwellers have roughly two and a half times the odds of being diagnosed with the disease (OR: 2.33 & 2.41 respectively).

Table 4.11.2: Model 2 - Multivariate Binary Logistic Regression of Cardiovascular Disease across Socio-economic Variables among South African Adults in 2008

	Chronic Disease
	CVD **Odds Ratio**
Determinants	
Education Bracket	
No schooling	Reference
Primary (Gr. 0 - 7)	1.02 (0.42 - 2.48)
Secondary (Gr. 8 - 11)	0.75 (0.30 - 1.86)
Matric	0.45 (0.15 - 1.35)
Tertiary	0.32 (0.09 - 1.12)
Other	0.82 (0.16 - 4.25)
Income Bracket (ZAR)	
Low income 0 - 1000	Reference
Middle income 1000 - 3000	0.50 (0.27 - 0.93)*
Upper middle income 3000 - 6000	0.23 (0.07 - 0.78)*
High income 6000+	1.71 (0.69 - 4.19)

Residency/Location		
Rural & Tribal	Reference	
Urban informal	2.41 (0.92 - 6.27)	
Urban formal	2.33 (1.25 - 4.34)*	
Total sample (n)	3278	
Prob > chi2	0.000*	
Linktest (_hatsq)		0.109

* Significant at the 0.05 level
Note: Employment Status is omitted due to collinearity
Note: Occupation is omitted as it over specified the model
Note: Confidence Interval in parenthesis
Source: Own calculations based on data from NIDS (2013): Unweighted

4.6.7 Cardiovascular Disease Multivariate Binary Logistic Regression - Model 3 - Demographic & Socio-economic Variables

Table 4.11.3 presents Model 3 of the multivariate binary logistic regression of cardiovascular disease across both demographic and socio-economic variables among South African adults in 2008. After controlling for other variables, the odds of having cardiovascular disease is lower in every age group. Adults aged 25 - 34 and 35 - 44 have the lowest odds (OR: 0.30 & 0.28 respectively). Females have close to two and a half times the odds of males (OR: 2.43). Both Asian/Indians and Whites have higher odds (OR: 1.15 & 1.20 respectively). Adults in all marital groups besides those divorced/separated (OR: 1.40) have lower odds of the disease. Never married adults have the lowest odds (OR: 0.39). Adults with a primary education have the highest odds, while those with a tertiary or matric education have the lowest odds (OR: 1.10, 0.35 & 0.55 respectively). Only high income earners have higher odds of cardiovascular disease (OR: 1.46). In contrast, both middle and upper middle income earners have lower odds (OR: 0.55 & 0.22 respectively). Both formal and informal urban dwellers have higher odds of cardiovascular disease (OR: 1.96 & 2.20 respectively).

Table 4.11.3: Model 3 - Multivariate Binary Logistic Regression of Cardiovascular Disease across Demographic & Socioeconomic Variables among South African Adults in 2008

	Chronic Disease
	CVD Odds Ratio
Determinants	
Age Bracket	
15 - 24	Reference
25 - 34	0.30 (0.19 - 0.78)*
35 - 44	0.28 (0.11 - 0.73)*
45 - 59	0.66 (0.27 - 1.65)
60+	0.78 (0.18 - 3.37)
Sex	
Male	Reference
Female	2.43 (1.37 - 4.30)*
Race	
African	Reference
Coloured	0.87 (0.46 - 1.64)
Asian_Indian	1.15 (0.14 - 9.33)
White	1.20 (0.48 - 3.03)
Marital Status	
Married	Reference
Living with partner	0.85 (0.37 - 1.96)
Widow/Widower	0.78 (0.30 - 2.02)
Divorced/Separated	1.40 (0.57 - 3.40)
Never married	0.39 (0.18 - 0.84)*
Education Bracket	
No schooling	Reference
Primary (Gr. 0 - 7)	1.10 (0.44 - 2.71)
Secondary (Gr. 8 - 11)	0.89 (0.34 - 2.35)
Matric	0.55 (0.16 - 1.86)
Tertiary	0.35 (0.09 - 1.39)
Other	1.05 (0.19 - 5.88)
Income Bracket (ZAR)	
Low income 0 - 1000	Reference
Middle income 1000 - 3000	0.55 (0.29 - 1.04)
Upper middle income 3000 - 6000	0.25 (0.07 - 0.89)*
High income 6000+	1.46 (0.51 - 4.17)

Residency/Location		
Rural & Tribal	Reference	
Urban informal	2.20 (0.83 - 5.82)	
Urban formal	1.96 (1.03 - 3.73)*	
Total sample (n)	3217	
Prob > chi2	0.000*	
Linktest (_hatsq)		0.055

* Significant at the 0.05 level
Note: Employment Status is omitted due to collinearity
Note: Occupation is omitted as it over specifies the model
Note: Confidence Interval in parenthesis
Source: Own calculations based on data from NIDS (2013): Unweighted

4.7 Summary

This chapter presented a detailed description of the research results. Of the three chronic diseases focused on in this study, hypertension was noted to be most prevalent among South African adults. This was followed by diabetes and lastly cardiovascular disease. Chronic disease prevalence and risk was noted to vary across different demographic and socio-economic variables. The prevalence of all chronic diseases increased with age. Other demographic groups that displayed the highest disease prevalence and risk included females, Whites and Asian/Indians as well as adults who were widowed, divorced or married. Additionally, young adults, males, and African and never married adults generally displayed the lowest prevalence of chronic diseases. In terms of socio-economic indicators, adults with less than a primary education displayed the highest prevalence of chronic diseases. Additionally, not economically active adults, skilled professional and unskilled adults, low and high income earners, as well as formal and informal urban dwellers reported the highest prevalence and risk. In contrast, adults with a matric or tertiary education, unemployed individuals, skilled administrative and semi-skilled adults, upper middle income earners as well as rural and tribal dwellers generally displayed the lowest prevalence of chronic diseases.

Chapter 5 - Discussion, Recommendations & Conclusion

5.1 Introduction

Chronic diseases are by far the leading cause of global mortality (WHO, 2011). Already high rates of these diseases are projected to increase further in all parts of the world, more especially in developing regions (Yach et al., 2004). Ironically, the high frequency at which these diseases occur has increasingly become a neglected health matter (WHO, 2005). Around the world, as well as in South Africa, diabetes, hypertension and cardiovascular disease prove most common (Steyn, Fourie & Temple 2006). In turn, the treatment and management of these diseases exert the most pressure on diagnosed individuals as well as on health care facilities (Norman et al., 2007). Determining which demographic and socio-economic groups are most affect by chronic diseases may aid in developing well-targeted and effective treatment programmes. Additionally, uncovering which groups are at higher risk for such diseases may aid in promoting preventive programmes, which may 'cure' as opposed to treat the problem. Consequently, this study aimed to uncover the demographic and socio-economic determinants of chronic diseases in South Africa.

5.2 Chronic Diseases in South Africa

The prevalence of diabetes among South African adults was fractionally over 3.50% (3.51%). This is consistent with the average prevalence of the African continent (4.03%) (International Diabetes Federation, 2012). Furthermore, diabetes prevalence in South Africa is in line with the global prevalence which is documented to be between 4% - 6% (King, Aubert & Herman, 1998, Shaw, Sicree & Zimmet, 2010). Interestingly, prevalence in South Africa, and the African continent at large, is lower than other regions such as North America and the Caribbean (10.05%), South and Central America (9.02%), Europe (6.07%), and South-East Asia (8.07%) (International Diabetes Federation, 2012). The lower diabetes prevalence in South Africa provides a good starting point from which to manage the disease. Health education programmes and health facilities should reduce diabetes risk factors sooner rather than later. This proactive approach may be effective in preventing the disease from reaching more epidemic proportions predicted for developing nations in the future (Yach et al., 2004).

The prevalence of hypertension among South African adults was the highest across all three chronic diseases (13.59%). However, this figure is lower than the global average (20% - 40%) (Pereira et al., 2009, WHO, 2014). Due to hypertension being the most prevalent chronic disease in the country, its role in promoting cardiovascular disease, as well as the high cost of treatment, increased resources should be utilized in curbing the prevalence of this disease (Johannesson & Le Lorier, 1996; Arredondo & Zũńiga, 2006). As with diabetes, the lower prevalence of hypertension in South Africa compared to the rest of the world provides a good starting point from which to manage the disease.

Cardiovascular disease had the lowest prevalence of all chronic diseases in this study (3.05%). This disease is often cited as a leading cause of mortality in developed countries and this trend is predicted to soon follow in developing regions (Ezzati et al., 2005, WHO, 2013). In a developing country like South Africa, there is a need for well-targeted programmes designed to effectively reduce ever increasing rates of the disease.

In this study the prevalence of diabetes, hypertension and cardiovascular disease is generally lower than global averages. This may potentially stem from effective health programmes increasing the awareness of such diseases, and in turn promoting health conscious behaviour which may lower disease prevalence. Additionally, the set of lower disease prevalence may occur through low rates of screening and testing. This could potentially under-represent the true proportion of South African adults living with chronic diseases. On the other hand, the lower prevalence of chronic diseases found in South Africa may in fact stem from the countries slow progression through the epidemiological transition. Although particular demographic and socio-economic groups within South Africa may be further along such a transition, the country as whole may still be within the initial phases. Therefore it is vital to maintain, and in time reduce disease prevalence as opposed to allowing rates to escalate as illustrated in the ETT.

5.3 Demographic Determinants

The study found that the prevalence of diabetes, hypertension and cardiovascular disease increased with age. Adults aged 15 – 24 years reported the lowest prevalence for all three chronic diseases, while those aged over 60 years consistently reported the highest prevalence. These findings may not fully mirror the literature from developed regions which see the working age group having the highest chronic disease prevalence (Dalstra et al., 2005). Similarly, in developing countries such as Bangladesh, working aged adults display the highest rates of chronic disease (Rahman & Islam, 2008). Through employment, this group may be exposed to more stressful lifestyles. This may potentially increase disease prevalence. In contrast, studies in other developing countries such as Vietnam and China see a direct relationship between age and disease prevalence (Van Minh et al., 2005; Huang et al., 2011). In turn, the oldest members of the population exhibit the highest prevalence. These findings resemble the patterns found in this study. Additionally, population ageing and the proportion of older people in South Africa is expected to increase in the future (Joubert & Bradshaw, 2005). Consequently, the impact of chronic diseases may be amplified in time to come. The relationship between age and disease prevalence may in part resemble patterns found in phases 3 and 4 of the epidemiological transition. In these phases degenerative diseases are treated more effectively and life expectancy increases substantially (Omran, 1971). Consequently, older cohorts in the population are affected the most by chronic diseases. The increase in life expectancy depicted in phases 3 and 4 of the ETT may sit in opposition to trends observed in South Africa. Subsequently, some South African literature sees life expectancy in the country progressively decreasing, while other studies find population ageing to be significantly underway (Dorrington et al., 2002; Puoane et al., 2008). This may highlight a possible disconnect between theory and practice and in turn reveal limitations in the application of the ETT to the South African chronic disease context.

Age proves a strong predictor of chronic disease even after controlling a host of demographic and socio-economic variables. The risk of diabetes and hypertension increased by odds of 6 - 13 among adults aged over 60 years compared to adults aged 15 - 24. Interestingly, all adults aged over 25 years had lower odds of cardiovascular disease than individuals aged 15 - 24. Consequently, age may be a strong predicator of diabetes and hypertension prevalence, but not so for cardiovascular disease. Chronic disease prevention programmes should be targeted at the youth to establish positive health behaviour at earlier ages. Positive health choices entrenched at earlier ages may potentially reduce disease rates later in life.

Females consistently reported a higher prevalence of chronic diseases than males. The prevalence of diabetes and cardiovascular disease differed only by a few percentage points across both sexes. However, female hypertension prevalence was more than double that of males. Consequently, more generic health care programmes may be used to target diabetes and cardiovascular disease while hypertension may call for sex specific initiatives. In the respective multivariate regression models, females had roughly the same odds of having diabetes as males. In contrast, females exhibited significantly higher odds of being diagnosed with hypertension and cardiovascular disease compared to males. The higher prevalence and risk patterns of females is similar to findings from both developed and developing nations such as the United Kingdom, Spain and Brazil (Connolly et al., 2000; Larrañaga et al., 2005; Costa et al., 2007).

In South Africa, life expectancy at birth is lower among males than females (51.7 and 61.4 years respectively) (Statistics South Africa, 2013). Subsequently, the demographic profile of the South African population revealed a greater portion of females than males. This uneven sex distribution should be acknowledged, and its effects on the results of this study should be noted. A greater proportion of females may be living with the chronic diseases, while a greater proportion of males with the diseases may have not reached older age groups. Additionally, health facility attendance of both sexes should be taken into account. Studies indicate that females attend health care facilities more frequently than males (Kirzinger et al., 2012). Females may then have a greater chance of being diagnosed with particular chronic diseases. This may potentially lead to an under-represented prevalence among males. On this note, health programmes should have a broad enough appeal to attract males. Consequently, future health programmes and initiatives should find ways of targeting this group.

African adults reported the lowest prevalence for all three chronic diseases. This trend could be a manifestation of the generally 'traditional' lifestyle of this group (Bourne, Lambert & Steyn, 2008). Due to the large proportion of African adults in South Africa, traditional lifestyles may not be significantly offset by high rates of urbanization reported in the country (Levitt et al., 2011). Socio-cultural stigma attached to traditional lifestyles, practices and diets should be examined and reduced. In turn, health care programmes highlighting the health benefits of traditional lifestyles (increases in physical activity and higher consumption of fresh produce) should be promoted. In the United States, findings reveal that African and White Americans have the highest and lowest prevalence of chronic diseases respectively (Cornoni-Huntley et al., 1989; Ong et al., 2007; Burt et al., 1995 & Klag et al., 1997). Similarly, in Brazil, non-Whites were found to have a higher prevalence than Whites (Costa et al., 2007). The findings in this study sit in stark contrast to those from other parts of the world.

Asian/Indians had the highest prevalence of diabetes, while Whites displayed the highest rates of both hypertension and cardiovascular disease. These findings reflect common racial patterns of chronic disease observed in South African literature (Puoane et al., 2008). Interestingly, South African Asian/Indians may have the highest prevalence of diabetes as they are documented to be more insulin resistant than other race groups (Bajaj & Banerji, 2004). Compared to African adults, Asian/Indians were the only race group to have higher odds of diabetes in the respective multivariate regression model. The potential genetic predisposition of the Asian/Indian group to diabetes challenges previous literature which sees race having no significant impact on genetic composition (Bhopal & Donaldson, 1998; Schwartz, 2001). Importantly, health programmes may be effective through changing modifiable risk factors. However, genetic predisposition may be substantially more difficult, if not impossible to counteract. Consequently, this could call for specialised focus on predisposed groups and intensified health initiatives aimed at modifiable risk factors.

Compared to African adults, Coloured adults had lower odds of diabetes and cardiovascular disease in the respective multivariate models. However, in the hypertension multivariate regression model, the odds in this group was significantly higher than African adults. Consequently, the Coloured race group could be at higher risk for hypertension specifically. Health programmes based in predominantly 'Coloured' areas should primarily focus on the prevention and treatment of this chronic disease. Additionally, further examination of socio-cultural aspects of the Coloured race group is needed to pin-point key hypertension risk factors.

The lower prevalence of chronic diseases among the African race group may resemble patterns found in the first two phases of the epidemiological transition. In these phases chronic disease prevalence is low, thus mirroring patterns displayed by the African group. In contrast, the higher prevalence of chronic diseases exhibited by Coloureds, Asian/Indians and specifically Whites, may in part resemble the latter two phases of the transition. In these phases, chronic diseases start to readily emerge, and become a leading cause of mortality (Omran, 1971).

Adults who had never been married reported the lowest prevalence of all chronic diseases. In contrast, the highest prevalence was consistently found among adults who were widowed, divorce/separated or married. Subsequently, the emotional and physical impact of the death of a spouse may elevate prevalence levels among the widowed. Furthermore, events leading to a divorce may promote emotional and physical stress. Studies in developed nations like Russia and the United Kingdom uncover that marriage has a protective impact of health. In contrast, being a widow/widower, divorced/separated or having never married increased poor health (Malyutina et al., 2004; Gardner & Oswald, 2004; Murphy, Grundy & Kalogirou, 2007). Similarly, findings from China reveal poorer health among never married, widowed and divorced women when compared to those married (Wang, 2005). The findings from this study may in part sit in opposition as adults who have never been married have the lowest prevalence and risk of chronic diseases, while widowed adults and in some cases married adults display a relatively higher prevalence.

In the respective multivariate models, widowed adults reported higher odds of diabetes compared to married adults. Similarly, divorcees had higher odds for hypertension and cardiovascular disease. Health care programmes should therefore be designed to promote physical as well as mental and emotional health. This holistic approach to health may span a wider range of disease risk factors and subsequently be effective in promoting good health. Counseling programmes aimed at widowed, divorced as well as married and unmarried adults should be put in place to facilitate better health.

5.4 Socio-economic Determinants

Adults with less than primary schooling reported the highest prevalence across all chronic diseases. On the other hand, individuals with a matric generally had the lowest prevalence. This trend may reflect the general consensus which sees increased education promoting better health (Low et al., 2005). Similarly, studies in developed nations such as France, Denmark, Spain, Great Britain and Canada reveal a lower prevalence of chronic diseases among higher educated adults (Dalstra et al., 2005; Rabi et al., 2006). Similar results were found in studies conducted in developing nations such as Nigeria and Mexico (Anyanwu et al., 2010; Sánchez-Barriga, 2012).

Within the respective multivariate regression models, the odds of hypertension and cardiovascular disease were higher among adults with a primary education than adults with no schooling. Similarly, adults with secondary education had the highest odds of diabetes. Thereafter, along with health education programmes based at the school level (specifically starting at lower grades), the proportion of school 'drop-outs' needs to be reduced. This may promote better health throughout an individual's life. Consequently, higher educated individuals are documented to have increased health awareness (Deaton, 2002).

In terms of employment, the prevalence of diabetes, hypertension and cardiovascular disease was highest among not economically active adults (not actively seeking employment), and lowest among those adults who are unemployed (unsuccessfully seeking employment). The low prevalence of unemployed adults sits in opposition to traditional schools of thought which sees unemployment promoting poor health through negative behaviour (poor diet, excess alcohol & tobacco consumption), loss of income and a deterioration in physical and mental well-being (Jacobson, LaLonde & Sullivan, 1993; Rozanski et al., 1999). In this study unemployed individuals may exhibit the lowest prevalence of chronic diseases as they may be the least screened group. In contrast, employed adults may have higher screening rates due to greater access to health facilities including company health facilities and services. High prevalence among not economically active adults may stem from the inclusion of individuals who have been bordered off work due to ill-health. Additionally, the high prevalence displayed in the not economically active group may result from the inclusion of pensioners in this group. As age is positively associated with disease prevalence, pensioners may inflate disease prevalence among the not economically active. Moreover, studies in the United States revealed that adults aged over 65 years had a significantly higher number of health facility visits per 1000 population over an eight year period (Bernstein et al., 2003). The higher frequency of health facility visits may lead to increased screening of chronic diseases, and an increased diagnosis rate. Mobile health care services may provide greater support to all employment status groups. Adults who are unable to work due to poor health, older persons and pensioners, and employed and unemployed individuals may benefit from localized health services.

Unskilled and skilled professionals reported the highest prevalence across all chronic diseases. Interestingly, occupations focused on both menial labour and high levels of responsibility displayed the highest prevalence. In contrast, semi-skilled and skilled administrative adults had the lowest prevalence of chronic diseases. Studies in the United States saw increased chronic disease prevalence, specifically diabetes, among unskilled 'blue-collar' workers compared to 'white-collar' occupations (Maty et al., 2005). In contrast, studies in developing nations such as Japan highlight increased chronic disease prevalence among high status occupations (executives) compared to manual laborers (Shimamoto et al., 1989). Labour orientated occupations may provide a source of physical activity and in turn promote better health. Consequently, the findings from this study reflect patterns from both developed and developing nations. The duality of the South African population may then be seen more clearly. Effective health care programmes aimed at both higher and lower strata of society is needed. Furthermore, these programmes should be specific to the each group, as they may both have differing risk factors.

Although occupation in first phase of the epidemiological transition is primarily menial, as reflected by unskilled occupations in this study, prevalence of chronic disease during this period is low (Omran, 1971). As a result, the high prevalence of chronic diseases found among unskilled adults may illustrate possible gaps within the theory. However, the high prevalence of chronic diseases among skilled professionals may reflect the third and fourth phases of the epidemiological transition, where employment opportunities are wide and diverse and chronic disease prevalence high (Omran, 1971).

The study found that compared to unskilled adults, skilled administrative adults was the only group to have higher odds across both diabetes and hypertension. These findings may not fully reflect literature from other developing nation like Japan where prevalence of chronic diseases are higher among professional employees. Moreover, skilled professionals only display higher odds in terms of diabetes. This could be a result of the large time commitments, stressful work environments and in turn irregular eating patterns potentially displayed by this group. Public and private sectors should promote well-structured working days with well planned eating hours. This could potentially stabilize blood sugar levels throughout the day. Additionally, work canteens with daily fresh produce on offer may facilitate healthier eating habits.

The influence of number of hours worked, as well as whether occupations were regular 'day jobs', or shift work could have a strong influence in disease prevalence. However, this goes beyond the scope of this study, but should be considered for future research in this area.

The prevalence of diabetes and cardiovascular disease is highest in both low and high income groups. Moreover, adults in middle and upper middle income groups exhibit the lowest prevalence of these diseases. Consequently, earning too little, or too much may increase the risk of being diagnosed with particular chronic diseases. Moderate earnings in contrast, may act as a shield against poor health. In modern society income is a fundamental mechanism through which goods and services may be accessed (Rueda et al., 2011). Moreover, earnings too low may increase stress levels, hinder healthy food consumption and access to medical care as well as restrict higher standards of living and potentially higher quality living spaces.

Incomes which are too high may promote unhealthy diets, make transportation (public and personal) more accessible, and in turn decrease physical activity (Kennedy et al., 1998). The results found in this study are in contrast to findings from developed regions like Canada. In more developed regions diabetes and cardiovascular disease prevalence was directly related to income level (Lee et al., 2009). Adults in lower income brackets may fall into phases 1 and 2 of the epidemiological transition. In these phases income is generally low, but so too is chronic disease prevalence. This may illustrate a disjuncture from theory to practice. In contrast, in later phases of the transition, income and disease prevalence increases. These higher incomes and rates of disease may in part reflect the findings of this study. Subsequently, many phases of the epidemiological transition may be seen across the income spectrum in South Africa.

It was found that adults living in informal and formal urban areas have the highest prevalence of chronic diseases. Moreover, even after controlling for a host of variables, compared to rural and tribal dwellers adults in both urban locations' still displayed higher odds of all chronic diseases. These results may be consistent with phases 2 and 3 of the epidemiological transition. In these phases, rapid urbanization is underway leading to the formation of large cities and slums. The prevalence of chronic diseases begins to rise through poor diet, decreased physical activity and stressful living condition through over-crowding (Omran, 1971). A higher concentration of environmental pollutants and toxins (which may include noise pollution), easier access to unhealthy high-fat and sugar content foods, as well as stressful living environments in urban locations may promote the development of particular chronic diseases. On the other hand, individuals in urban areas may have better access to health care services and health promotion information (Haan, Kaplan & Camacho, 1987; Robert, 1998). Subsequently, there may be strong arguments for both high and low rates of chronic disease in urban locations. The results from this study may in part sit in contrast to findings from Canada and the United States. In these developed regions, chronic disease prevalence was lower in more urban settings than rural areas (Rabi et al., 2006; Roux et al., 2001). However, the high rates of chronic diseases in informal and formal urban areas reflect previous South African literature ((Alberts et al., 2005; Groenewald et al., 2008; Levitt et al., 2011).

Rural and tribal dwellers were found to have the lowest prevalence of all three chronic diseases. This is consistent with findings from other developing nations such as India and Pakistan (Ramachandran et al., 2008; Snehalatha & Ramachandran, 2009; Shera, Jawad & Maqsood, 2007). This could possible stem from more traditional lifestyles associated with these locations. This may include subsistence farming, consumption of natural produce, increased physical activity and labour as well as less stressful living conditions. These conditions may reflect phases 1 and potentially phase 2 of the epidemiological transition. In these phases society is still traditionally agrarian, physical activity is essential for survival, and chronic disease prevalence very low (Omran, 1971).

As the main research question from the NIDS questionnaire asked whether individuals have been told by a health-care practitioner if they have a particular disease or not, the bias relating to residency should be acknowledged. Consequently, those residing in rural and tribal areas may have less access to health care facilities and consequently, may have not been told they have a particular disease. The low prevalence reported by those in rural and tribal areas should be met with some reservation as this figure could potentially be higher than is reported.

5.5 Recommendations

In this study, prevalence was used to determine the level of chronic disease. This measurement only provides a static description of disease trends. A true reflection of the determinants of chronic disease is therefore not entirely possible. In future studies conducted in this particular area of research, prevalence as well as incidence of chronic diseases would be interesting to note. The use of panel data in tracking the changes in demographic and socio-economic variables would result in a far more precise understanding of particular relationships. This may reveal more robust determinants of chronic diseases. Thereafter, the far reach and broad scope of the NIDS should be noted as the changes in disease prevalence and incidence can be assessed using later waves (Waves 2 & 3). For larger scale projects the panel data would then become essential in the appropriate context.

Furthermore, as discussed earlier the relationship between income and health is ‘mutually determined’ (Deaton, 2002). This relationship lends itself to a similar premise of the 'social causation' and 'social selection' hypothesis' associated with employment status. To clarify the direction of this relationship, a longitudinal study would be more effective. In turn the direction of the relationship between socio-economic indicators and health may be better assessed.

Understanding health care facility attendance may provide better insight into under-represented prevalence rates among certain groups. Similarly, uncovering death registries may give a more accurate depiction of the impact of chronic diseases as opposed to a deflated representation. Deaths due to chronic diseases may add another dimension to the research and provide a more accurate understanding of the impact of chronic diseases.

Limitations in the classification of chronic diseases in this study should be acknowledged. 'High blood sugar' proves a broad term from which to extract a positive diagnosis of diabetes. Two major types of diabetes are generally used for classification (Type1 - minimal insulin production & Type 2 - insulin resistant) (International Diabetes Federation, 2014). Due to the scope of this study, no differentiation is made between the two. Similarly, hypertension prevalence is generally classified as either systolic (blood pressure while the heart pumps blood) or diastolic (blood pressure while the heart is at rest between beats) (Gillespie & Hurvitz, 2013). However, the broad term of 'having high blood pressure' was used to classify hypertensive adults. Subsequently, there may possibly be different risk factors for each of these classifications. In turn the determinants of specific types of diabetes and hypertension may differ. Additionally, cardiovascular disease commonly includes stroke in its classification. However, the impact of stroke is not considered in this study. This may have potentially deflated cardiovascular disease prevalence. Therefore, in future studies stroke should be included in the classification of cardiovascular disease.

A note to policy makers: In the modern South African society modifiable demographic factors such as marital status are primarily in the control of individuals themselves. However, socio-economic differences and inequalities are a manifestation of the country's previous political regime. Consequently, the effects of previous political policy and social systems are still noticed close to two decades later. Evidently it is said that disparities in health are often a result of socio-economic inequalities (Link & Phelan, 1995). Therefore, before levelling health disparities, policy interventions should primarily focus on levelling social inequalities in what is documented to be one of the most unequal countries in the world (Narayan & Mahajan, 2013). Social equality may in turn have a positive impact on health.

5.6 Conclusion

Hypertension, diabetes and cardiovascular disease are the most prevalent chronic diseases in South Africa. An array of demographic and socio-economic factors have been shown to be associated with high rates and high risk of these diseases. In terms of demographic factors, increases in age, being female, belonging to the White, Asian/Indian or Coloured racial groups, and being widowed, divorced or married are associated with increases in chronic disease prevalence and risk. On the other hand, the socio-economic determinants may include lower educational attainment, being economically inactive, working in unskilled or skilled professional occupations, earning in extremity, as well as residing in formal and informal urban areas. Many of these disease determinants reflect those found in other parts of the world. However, some determinants prove to unique in South Africa. In a country with a history of political and social injustice, a contemporary society identified through its world renowned social inequality and a future in which the burden of disease is predicted to intensify, identifying the determinants of chronic diseases may only be a small step forward, but an important one nonetheless.

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