SOCIOECONOMIC INEQUALITIES IN HEALTH: CHRONIC DISEASE PREVALENCE, HEALTH CARE UTILIZATION, HEALTH EXPENDITURE AND LIFE COURSE PERSPECTIVE IN BOTSWANA

BY

MPHO KEETILE

(200101315)

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DOCTORAL COMMITTEE:

PROFESSOR KANNAN NAVANEETHAM (Ph.D)
PROFESSOR GOBOPAMANG LETAMO (Ph.D)
DR SERAI DANIEL RAKGOASI (Ph.D).

Approval Page

This thesis has been inspected and approved as meeting the requirements for the fulfilment of Doctor of Philosophy in Population Studies.

Supervisor

Professor Kannan Navaneetham, (Ph.D).

………………………………………….. Date: ………………………

Co-supervisor

Professor Gobopamang Letamo, (Ph.D).

………………………………………. Date: ……………………….

Co-supervisor

Dr. Serai Daniel Rakgoasi (Ph.D)

………………………………………… Date: ………………………..

Internal Examinar…………………….. Date: …...............................

External Examiner…………………… Date ………………………..

Dean, School of Graduate Studies …………………………………………………….

Date………………………………………

Delaration of Authorship

I certify that the thesis entitled “Socioeconomic Inequalities in Health: Chronic Disease Prevalence, Health Care Utilization, Health Expenditure and Life Course Perspective in Botswana” submitted for the degree of Doctor of Philosophy is the result of my own work and that reference made to the work of others is properly acknowledged.

Name: Mpho Keetile

Department of Population Studies

Faculty of Social Sciences

School of Graduate Studies

University of Botswana

Signature………………………………..

Date…………………………………….

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Abstract

The debate on socioeconomic inequalities in health is currently dominating the research and policy agenda in many countries. In Botswana, empirical evidence on the socioeconomic inequalities linked to prevalence of NCDs, health care utilization, health expenditure and life course factors is extremely deficient and largely unknown. The main objective of this study was to explore and stir debate on socioeconomic inequalities in health in the face of the emerging burden of NCDs. Data used in this study was derived from the large sample survey on Chronic Non-Communicable Diseases in Botswana: A study on Prevalence, Health Care Utilization, Health Expenditure and Life Course (NCDs study, 2016).

The NCDs study adopted a representative cross-sectional descriptive study design. Using a multi-stage probability sampling design, the survey was carried in selected urban and rural areas of Botswana, among males and females aged 15 years and over. The total sample was 1178. Evidence in this thesis indicates an increase in the prevalence of NCDs and associated risk factors. The most prevalent NCD in the study population was hypertension.

Socioeconomic inequalities in health were measured by using the odd ratios and concentration index (CI). Overall, the study showed mixed findings on the association between socioeconomic status (SES) and health. The study noted that poor people were more likely to be exposed to NCD risk factors than the non-poor. For instance, they were found to have significantly higher odds of smoking, poor physical activity, and poor fruit and vegetable consumption. The poor were also found to be more likely to report multiple NCD risk factors than the non-poor. Meanwhile alcohol consumption was found to be high among the non-poor. Overweight/obesity did not show any variation by wealth status suggesting that both the poor and non-poor were overweight/obese. Though NCD risk factors are greater among the poor, the likelihood of reported morbidity for diabetes and hypertension was high among the non-poor.

Educational and wealth status inequalities have been observed to exist for health care utilization outcomes. People with low education and wealth status were found to be less likely to have needed health care in the last one year, less likely to have gotten health care when they needed it, and to have sought health care for NCDs than for other disease conditions.

As for the type of health facility utilized, less educated and poor people were found more likely to have visited public health facilities when they felt sick or needed to consult anyone about their health. The study established that wealth status was significantly associated with out-of-pocket health expenditure. This was evidenced by the non-poor more likely to report out-of-pocket expenditure for health care and medical insurance coverage than the poor.

The findings of this study confirmed the notion that childhood SES influence adult health. It was noted that people who had poor childhood SES status were more likely to report smoking, alcohol consumption and poor fruit and vegetable consumption but were less likely to be overweight/obese. People with poor childhood SES were also found to be more likely to report hypertension, diabetes, single and multiple NCD conditions.

Decomposition of inequalities analysis was done for hypertension and NCD risk factors. Overall, CI estimates were positive for poor physical activity, alcohol consumption and overweight/obesity indicating that these three NCD risk factors were more concentrated among the non-poor. Meanwhile negative CI estimates were observed for daily smoking and poor fruit and vegetable consumption. This suggests that the two risk factors were more concentrated among the poor.

Decomposition of the concentration index revealed that wealth status itself was the leading contributor to socioeconomic inequality for four risk factors; daily smoking, poor FV consumption, overweight/obesity and poor physical activity. Education on the other hand, was the leading contributor to socioeconomic inequality for alcohol consumption. CI

estimates for hypertension in the study population and population 50+ years were positive. Thus, the dominant factors to this inequality were education and wealth status, respectively.

Mixed findings on the relationship between SES and various health outcomes shown in this study indicate the need for further research into understanding and explaining of such inequalities. This is because eliminating socioeconomic differences in health requires new knowledge about the determinants of disease. These inequalities might be reduced by improving educational opportunities, wealth distribution, health-related behavior, or access to health care.

Key words: Socioeconomic Inequalities, chronic disease prevalence, health care utilization, health expenditure, life course perspective, Botswana

List of Abbreviations

AIDS:	Acquired Immuno Deficiency Virus
AOR:	Adjusted Odds Ratios
BP:	Blood Pressure
CC:	Concentration Curves
CHE:	Catastrophic Health Expenditure
CI:	Confidence Interval
CI:	Concentration Indices
CNCDs:	Chronic Non-Communicable Diseases
COPD:	Chronic Obstructive Pulmonary Disease
CSDH:	Commission on Social Determinants of Health
CVD:	Cardio Vascular Disease
EA:	Enumerations Area
ET:	Epidemiological Transition
GDP:	Gross Domestic Product
HDL:	High Density Lipoprotein
HICs:	High Income Countries
HIV:	Human Immunodeficiency Virus
HH:	Household
IHSP:	Integrated Health Service Plan
ISCED:	International Standard Classification of Education
LCA:	Life Course Approach
LIC:	Low Income Countries
LMICs:	Low- and Middle-Income Countries (LMICs)
MIC:	Middle Income Countries

MoFDP: Ministry of Finance and Development Planning

MoH: Ministry of Health

MoHW: Ministry of Health and Wellness

NCDs: Non-Communicable Diseases

NGOs: Non-Governmental Organizations

NHP: National Health Policy

NHS: National Health Service

OOP: Out-of-Pocket Expenditure

OR: Odds Ratios

PCA: Principal Component Analysis

PEPFAR: President's Emergency Plan for AIDS Relief

PSU: Primary Sampling Unit

SAGE: Study on Global Aging and Adult Health

SDGs: Sustainable Development Goals

SES: Socioeconomic Status

SEP Socio-Economic Position

SSA: Sub Saharan Africa

THE: Total Health Expenditure

UN: United Nations

UOR: Unadjusted Odds Ratios

WHO: World Health Organization

WHO HASPAF: World Health Organization Health System Performance Assessment Framework

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CHAPTER 1: INTRODUCTION

1.1 Background

Socioeconomic inequalities in health inquiry date as far back as the 19th century even though disparities in health across individuals and social groups and societies have always been part of human history (Antonovsky 1967; Illsley and Baker 1991; Mackenbach and Kunst 1997: Robert and House 2000; Mendez, Cooper, Wilks, *et al.* 2003; Kim and Nam, 2017). Research on socioeconomic inequalities in health gained momentum after the 1980s among sociologists, demographers and public health practitioners (Townsend and Davidson 1982; Adler and Ostrove 1999; Wagstaff, 2002; Marmot, 2005). This research was largely stimulated by a moral indignation that followed the publication of the famous "*The Black Report"* in the United Kingdom which had concluded that inequalities in health had widened even though Britain had introduced universal access to health care.

The Black Report had been commissioned by labour administration in August 1980 and was published by the United Kingdom Department of Health and Social Security (The Black Report, 1981). The Report showed in great detail the extent to which ill-health and death are unequally distributed among the population of Britain. It further suggested that these inequalities were broadening rather than decreasing. Moreover, the report had concluded that inequalities in health were not mainly attributable to failings in the National Health Service (NHS). Instead, the report concluded that these inequalities were attributed to many other social and economic factors influencing health such as; income, education, housing, diet, employment, and conditions of work (Gray, 1982).

By the 1990s, research on socioeconomic status (SES) and health had increased substantially (Adler and Strove, 1999). The main focus of this research was to examine the nature of the relationship between SES and health (Feinstein 1993; Adler and Strove, 1999). This research emphasised that SES is important to health not only for people in poverty, but at all levels of SES. The research also asserted that the more advantaged individuals are, the better their health (Townsend and Davidson, 1990; Adler and Strove, 1999; Marmot and Shipley, 1996). In the most recent era, studies are increasingly exploring the mechanisms by which SES exerts an influence on health (Cutler, Lleras-Muney and Vogl, 2011; Arpey, Gaglioti and Rosenbaum, 2017). The key focus of contemporary research has been to span the methodological debate on understanding pathways through which SES influence health.

Despite ample empirical evidence of socioeconomic differences in health since the mid-19th century, concern about the problem of measurement of health inequalities did not appear until 1991. Wagstaff, Paci and van Doorslaer (1991) cautioned that the conclusions reached by different authors about trends in health inequalities may vary depending on the type of measure used. Wagstaff, et al. (1991) also proposed the measures that they considered most appropriate to evaluate trends and cross-country differences in health inequalities. Subsequently, Kunst and Mackenbach (1997) published a review of measures that can be used to examine the magnitude of socioeconomic inequalities in health. In their overview of the methods, they incorporated several measures not proposed by the former authors, and noted that the measurement of health inequalities depends on the objective to be pursued.

In 2004, Regidor reviewed measures of inequalities and categorised them into four broad categories: measures of inequality in health in the strict sense, and three measures of socioeconomic inequality in health: being measures of association, measures of potential impact, and measures based on the ranking of the socioeconomic variable. Regidor’s (2004) review was distinct from the previous reviews by Wagstaff *et al.* (1991) and Kunst and Mackenbach (1997). It incorporated the distinction among measures that reflect inequality in the distribution of a health variable and measures that quantify differences in health among various values of a socioeconomic variable. Much of recent work on health inequalities uses the approach suggested by Kunst and Mackenback (1997) to understand the influence on SES variables on health outcomes. This seems to be the most plausible approach for our understanding of SES and health.

Kawachi and Kennedy (2002) examined a number of indicators of health, such as mortality rates (with respect to which the United States performed badly in comparison with all the other rich countries). They presented arguments to show that one's relative position in society is more important than absolute wealth or income. The view that one’s relative position in society is vital, has contributed much to the debate of socioeconomic inequalities in health. Navarro (2004) on the other hand maintained that research that uses income, consumption, and status as the primary categories of research practice have limitations. Navarro (2004) therefore, suggested that it is essential to use categories of analysis that focus on class relations as well as race and gender relations to study their impact on the health and well-being of populations.

On the basis of the above arguments, it is plausible to derive that understanding the association between SES and health warrants a multifaceted approach which does not focus on one or two socioeconomic variables, but on a variety of socioeconomic measures depending on the context. What is used as a definite measure of class or socioeconomic status in one context may not necessarily be applicable as a measure of SES in another context.

The relationship between SES and health is now widely studied using a variety of health indicators and socioeconomic variables (Smith, 2007; Cutler, Lleras-Muney, and Vogl, 2011). For instance, it was observed that among older adults in Britain and the United States, a move from the top education level to the bottom level is associated with an increase in the likelihood of reporting fair or poor health. Similarly, among the Mexican elderly this pattern was also observed, with the least educated reporting poor health than the most educated

(Smith 2007). As for mortality, it was observed in the United States and some six European countries (Austria, Belgium, Britain, Finland, Norway, Switzerland) that the increase in mortality risk was associated with income, occupation, race, and education (Cutler *et al.* 2011). A variety of socioeconomic variables—including income, education, occupation, race, and ethnicity, among others have been noted to exhibit similar associations with health. Thus, many researchers have come to agree that “a broader underlying dimension of social stratification or social ordering is the potent factor” (Adler and Ostrove, 1999). This implies that the various SES variables primarily serve as pointers of this underlying dimension.

Evidence suggesting how the mechanisms linking health to the dimensions of SES diverge and coincide has gained avid interest in many countries (Reidpath and Allotey, 2007). This has made the goal of reducing socioeconomic inequalities in health to become a central goal in the context of health policies and development programmes to achieve equality in health in many low- and middle-income countries (LMICs).This has been spurred by the Commission on Social Determinants of Health (CSDH) in 2005 which underscored the goal of reducing health inequalities. The Commission was set up in the spirit of social justice, to marshal the evidence on what can be done to promote health equity, and to foster a global movement to achieve it (World Health Organization (WHO, 2005a). Although empirical evidence on SES and health remains limited in LMICs (Vellakal, 2013), indications are that health inequality research is gaining momentum in many LMICs.

The available evidence on SES and health in LMICs is at best mixed. Whereas in some contexts there is evidence of the positive SES—health gradient, in other contexts the inverse holds. In India for example, an analysis using National Sample Survey Organization (2004) data found that prevalence of type 2 diabetes was highest among high-income groups based on self-reported statistics (Corsi and Subrammanian, 2012). Interestingly, in some other evidence for the SES—health gradient, Navarro (2004) identified socioeconomic disadvantage as a major reason why Africans, Carribeans, Pakistanis and Bangladeshis have higher rates of poor health and chronic illness than the whites.

Whereas Navarro's (2004) findings may be true in their context, Gupta, Deedwania, Sharma *et al.* (2012) on the other hand, found that low educational, occupational and SES Asian Indians have greater prevalence of central obesity, low High-Density Lipoprotein (HDL) cholesterol, hypertriglyceridemia, smoking or tobacco use and low physical activity and clustering of 3 or more major cardiovascular risk factors. Furthermore, Sommer, Griebler, Griebler, *et al.* (2015) found that having low SES and/or living in LMICs increases the risk of Cardio Vascular Disease (CVD), lung and gastric cancer, type 2 diabetes, and Chronic Obstructive Pulmonary Disease (COPD). Additionally, Sommer *et al.* (2015) noted a clear trend towards an association between low SES and increased risk of obesity in a systematic review of socioeconomic inequalities in non-communicable diseases and their risk factors in LMICs. Evidence of studies on socioeconomic disparities and NCD risk factors (tobacco use, alcohol use) for NCDs is still lacking in LMICs.

It is crucial to point out that socioeconomic inequalities in health are best explained within the notions of social justice[1]. Social justice affects the health of individuals and their risk of death. Evidence from across the world shows that life expectancy and good health continues to increase in some parts of the World and decline in other parts (Wagstaff, 2000; Shibuya, 2005; Marmot, 2005). A child born in one context may have a life expectancy of 80 years, while a child born in another context may be expected to live for just 45 years only. Within and between countries there are dramatic socioeconomic differences in health that are closely associated with notable degrees of social disadvantage.

[1]Social justice is a concept of fair and just relations between the individual and society. This is measured by the explicit and tacit terms for the distribution of wealth, opportunities for personal activity and *social* privileges

From a social justice and equitable development point of view, these differences are not only undesirable but also unjust. They arise because of the circumstances in which people grow, live, work, and age, and the systems put in place to deal with illness (WHO, 2008a). Congruently, circumstances in which people live and die are, in turn, shaped by social and economic factors. The success and advancement of any society, rich or poor, can be judged by the quality of its population's health. This is done by looking at how fairly health is distributed across the social spectrum, and the degree of protection provided from disadvantage as a result of ill-health (WHO, 2008b).

It is against this background that this study aims to re-direct attention to the vitally important socioeconomic factors that influence health in Botswana. This is catalysed by the fact that improvements in overall population health have been compromised by social and economic disparities, and the double burden of NCDs and communicable diseases, especially HIV/AIDS.

1.2 Problem Statement

Botswana has been experiencing declines in both mortality and fertility levels since the 1980's. This demographic change has resulted from socio-economic change. Its occurrence underlies much of subsequent social change that the country is undergoing and provides a necessary condition for the rise in NCDs levels (WHO, 2008c). There has been notable decline in the total fertility rate (TFR) from 6.6 in 1981 to just 2.8 in 2011 (Statistics Botswana, 2013). Life expectancy has also increased from 48.3 in 2001 to 66.8 years in 2016 (World Bank, 2001; World Bank 2016). This is because of the introduction of antiretroviral treatment in 2002. The demographic and socioeconomic change that Botswana has experienced has set necessary conditions for both nutritional and epidemiological transition that the country is currently undergoing.

According to 2011 Population Census, about 65 per cent of the population of Botswana was living in urban areas (Statistic Botswana, 2013). This is premised to predispose a significant share of population to lifestyle changes and prospects of NCDs. Moreover, urbanisation and industrialisation are poised to contribute to increased prevalence of nutrition related NCDs. Other than urbanization, the increased prevalence of NCDs has also been attributed to increasing longevity and lifestyle changes resulting from modernization (WHO, 2008b).

There are prospects of an increase in aged population due to rapidly declining fertility, improvements in survival and increasing life expectancy after the introduction of antiretroviral treatment. All these are necessary conditions for NCDs. Botswana is also faced with the double burden of communicable diseases (especially HIV/AIDs) and NCDs. This dual burden comes at a point when government health expenditure is high. The government provides the majority (75%) of health expenditure (Cali and Avila, 2016). This is not sustainable for the government considering that long-term economic growth prospects are less optimistic than in the past.

Even though there is little evidence of major rigorous scholarly work which has pursued the NCDs research in the country, NCDs and NCD risk factors are becoming a serious epidemiological challenge in Botswana. This is partly due to an ongoing health transition and increasing urbanization. Part of the reason for this neglect of scholarly work, which constitutes part of the rationale for the present work, has been the continued assumption that since primary health care is universal in Botswana; there are no socioeconomic differentials in health in the context of rising NCD epidemiology.

This study deviates from previous NCDs research in the country which has only considered surveillance of three NCDs (hypertension, diabetes and stroke) and their risk factors. The current study considers a wide range of NCDs and their risk factors as classified by the WHO ICD-10 classification codes[2] (http://apps.who.int/classifications/icd10/browse/2016/en). Furthermore, the study holistically looks at NCDs epidemiology and introduces other health outcomes such as health care utilization, expenditure, and life course perspective.

Although the association between SES and health is contextual and disease specific, little is known about this link in LMICs. This work therefore introduces the debate on SES and health into the intellectual questions raised by empirical research on SES and health into the context of Botswana. This is done with the belief that examination of SES and health in the context of the little empirical evidence on NCDs research promises improved insights into SES and health in LMICs, particularly in SSA. It is imperative to note that there are some views to the effect that socioeconomic inequalities in health should not exist or should be at minimum in the context of universal primary health care. Such views, however, do not provide sufficient evidence and comprehensive understanding of why inequalities should not exist or should be at minimum in the context of universal primary health care such as the one for Botswana. Consequently, the current study comes at an opportune time for the following reasons:

[2] **ICD-10** is the 10th revision of the International Statistical **Classification** of Diseases and Related Health Problems (**ICD**), a medical **classification** list by the World Health Organization (WHO)

First, the study provides a ground-breaking platform for scholarly research and debate on SES and health in the context of universal primary health care and the emerging burden of NCDs.

Secondly, although SES and health is a generally widely discussed topic there is currently limited amount of methodological work focusing on SES and health in LMICs hence this study provides a base for methodological work on SES and health in Botswana.

Thirdly, there is insufficient empirical evidence on the association between SES and health leading to uncertain interpretation and policy relevance of SES and health in SSA. There is need to assess the influence of SES on health outcomes such as health care utilization and expenditure in order to come up with policy relevant measures in the context of emerging NCD burden.

Finally, while adults from all SES levels generally encounter a decline in health as they age, research shows that childhood SES status has influence on adult health. This remains largely unexplored in Botswana and the study provides ground breaking evidence on the influence of childhood SES on adult health.

1.3 Main Objective of the Study

The main objective of this study was to explore the influence of SES on the following health outcomes; prevalence of NCDs and their risk factors; health care utilization, health expenditure and the life course. This study sought to establish whether there is evidence of SES—health gradient in Botswana and what policy relevant measures should be initiated to reduce health inequalities.

1.4 Specific Objectives

1. To examine the prevalence, patterns and determinants of NCD risk factors.

2. To investigate the prevalence, patterns and determinants of NCDs.

3. To explore patterns and determinants of health care utilization and expenditure.

4. To explore the association between SES (current and childhood) and health.

5. To measure and decompose factors explaining inequalities in health.

1.5 Research Questions

The main research questions identified to explore the influence of SES on health in this study are as follows:

a) How does SES influence NCDs risk factors in Botswana?

   In order to establish the magnitude of NCDs risk factors, the question on patterns of NCDs was addressed while determinants of NCDs risk factors helped to examine and explain how SES influence risk factors for NCDs in the study population.

b) How does SES and behavioral factors influence NCDs prevalence?

   This research question establishes the prevalence and patterns of NCDs, and examines determinants of NCDs. This question investigates the extent to which socioeconomic and behavioural factors influence NCDs.

c) How does SES influence health care utilization and health expenditure?

   This explains health care utilization and health expenditure patterns in the study population. Further, the questions examine the socioeconomic and any other determinants of health care utilization.

d) How does childhood SES influence prevalence of NCD risk factors, NCDs, health care utilization and expenditure?

   In order to understand the influence of childhood SES on adult health, the study explored socioeconomic and behavioural factors linked to adult health. This is done with the understanding that childhood SES predisposes individuals to poor health in later life.

e) What are the key factors explaining inequalities in health?

   This part measures, decomposes and analyses factors that explain the observed inequalities in health.

1.6 Botswana's Health Care System: An Overview

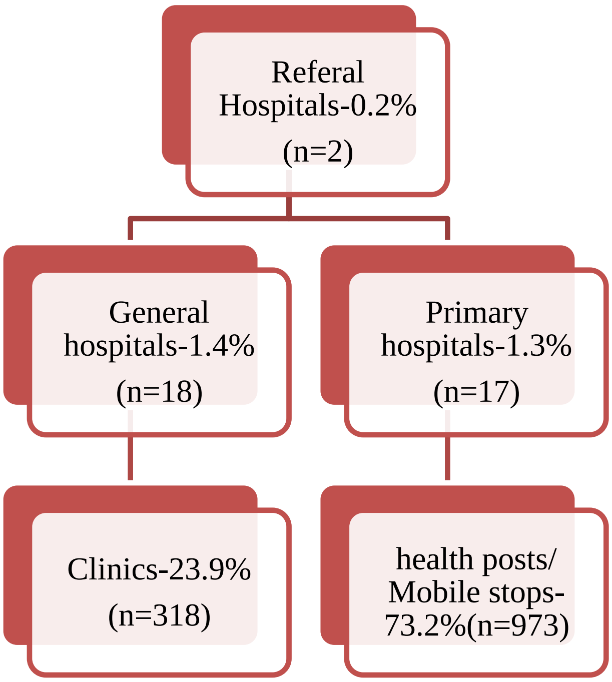
Botswana's health care system is among the best in the region and is well-organized such that health facilities are readily and easily accessible to the general population. This has been observed by Seitio-Kgogwe, Gauld, Hill, *et al.* (2014) using the World Health Organization Health System Performance Assessment Framework (WHO HSPAF). Seitio-Kgogwe et al. (2014) found that the health system is highly decentralised and overall physical access to health services is high (95% of rural population have access). Furthermore, Botswana is among the few countries in Sub Saharan Africa (SSA) which runs a universal primary health care system where health care is accessible to all for free.

The Ministry of Health and Wellness (MoHW) is responsible for formulation of policies, guidelines, regulations norms and standards for health services. The government is a key contributor to health expenditure and contributes 15% of total expenditure on health (about 75% of total health expenditure) (Ministry of Health, 2010).

There are several ways in which the population can access health services. There are for instance public, private for-profit, private non-profit and traditional medicine practice settings

(Ministry of Health, 2008). The public sector dominates the health system, operating an estimated 98% of the health facilities (Ministry of Health and Wellness, 2011). The Government of Botswana has increased the number of health facilities across the country over the years with the intention to meet the needs of increasing population and the demands it puts on the health care system.

Figure 1.1: Public Health service delivery system in Botswana, 2016



Source: Statistics Botswana, 2016

Public Health services are decentralized to the district level and delivered through a hierarchical network of health facilities, ranging from referral hospitals (0.2%) to general hospitals (1.4%) primary hospitals (1.3%), and finally to clinics (23.9%) and health posts (73.2%). These are operated by the government through the Ministry of Health and Wellness (MoHW), faith-based organizations and mining companies (Ministry of Health and Wellness, 2008).

In addition to the network of health facilities, there are over 800 mobile stops to populations in remote areas or those outside the 8 km radius of a health facility (Ministry of Health and

Wellness, 2014). All public hospitals and selected clinics, including those with a maternity wing, operate 24 hours. Other clinics and health post are open 8 hours, with on-call services for emergencies.[3]

The public health services in Botswana are generally regulated by a Public Health Act 2002 (Chapter 63:01). For both the public and private sector, professionals are accredited by professional councils in accordance with the Medical, Dental and Pharmacy Act and the Nurses and Midwives Act (Ministry of Health and Wellness, 2011). In addition to the professional accreditation, the MoHW is also responsible for the registration of private facilities through recognized standards.

It has been estimated that over 95% of the total population (89% of the rural population) live within an eight kilometres radius of a health facility (Ministry of Health and Wellness, 2014). This is relatively better compared to the neighbouring South Africa where 90% of South Africans live within 9 km of the nearest public health facility (Zoe, Cally and Murray *et al.* 2013). The public sector is the predominant provider of health care services in Botswana, with more than 80% of the people receiving care from public facilities and programmes (Ministry of Health and Wellness, 2011).

Anecdotal evidence shows that many people use the services of traditional health practitioners. The country has drafted a Bill for the regulation of traditional medical practice, which currently operates informally. Despite relatively better access to health care, health service underutilization and inefficiency in service utilization have been reported (Ministry of Health and Wellness, 2011). Health care underutilization may be associated with the population's health-seeking behaviour, quality of health care and an ineffective referral system, among other things.

[3] Ibid (2014)

The flow of clients along the hierarchy of the health facilities, particularly from the lower facilities to referral hospitals, is through a referral system. In the formal private sector there are about 167 private practitioners and two private hospitals (Ministry of Health and Wellness, 2014). There are also Non-Governmental Organizations (NGOs) providing mostly HIV/AIDS related services such as counselling and testing. Although NCDs are integrated into the primary health care services, there are only two specialised clinics for chronic diseases such as diabetes and cardiac diseases in referral hospitals (Nyangabgwe and Princess Marina) where people can access and utilize specialised health care.

Table 1.1: Distribution of physicians, nurses and hospital beds in selected years in Botswana Health Districts.

	Physician Density*			**Nurse Density***			**Hospital Bed Density***		
District	**2006**	**2009**	**2013**	**2006**	**2009**	**2013**	**2006**	**2009**	**2013**
Bobirwa	0.9	1.0	1.4	18.4	20.4	17.6	16.7	16.1	20.2
Boteti	1.7	3.3	3.3	26.3	39.2	27.2	29.1	27.7	32.1
Chobe	3.5	4.2	4.3	60.0	43.0	37.9	20.9	19.6	20.8
Francistown	8.6	17.6	16.5	46.1	15.7	46.3	59.7	58.8	66.8
Gaborone	10.5	6.8	8.1	52.4	44.7	67.4	31.5	29.2	31.7
Gantsi	1.9	1.5	2.0	18.3	38.3	51.0	30.8	31.4	32.5
Goodhope	0.8	1.4	2.0	16.8	22.5	21.7	12.0	12.2	14.3
Jwaneng	7.8	9.0	10.5	94.3	69.2	55.0	55.2	52.9	60.3
Kgalagadi	2.4	3.0	3.0	17.1	29.9	44.2	21.2	21.7	25.4
Kgalagadi North	1.1	3.7	4.7	56.2	50.3	55.4	36.4	33.9	36.1
Kgatleng	1.0	2.9	2.6	18.4	28.3	32.2	20.1	18.9	20.5
Kweneng East	1.2	1.6	1.9	21.4	21.3	23.3	11.1	17.3	17.3
Kweneng West	1.1	1.7	2.6	15.2	20.8	19.3	14.3	14.3	16.4
Lobatse	4.9	7.8	10.8	94.9	134.8	116.0	88.9	102.3	141.8
Mabutsane	0.9	3.3	3.5	18.2	30.2	32.3	9.6	16.3	16.9
Mahalapye	1.4	2.2	2.4	21.9	31.6	25.9	13.8	21.9	27.4
Masunga	1.2	2.4	2.7	23.8	29.9	36.7	16.3	16.6	18.4
Ngamiland	1.5	2.7	3.1	24.4	32.7	41.3	24.2	24.4	26.5
Okavango	1.0	1.3	1.9	19.0	23.2	31.0	11.7	13.0	14.9
Selibe Phikwe	2.0	1.7	2.9	30.9	15.4	51.0	45.1	17.5	23.9
Serowe/Palapye	1.1	1.9	1.7	12.1	28.4	16.5	5.9	18.2	20.9
South East	2.4	3.0	2.6	35.7	27.5	31.1	23.1	21.5	20.8
Southern	0.7	1.4	2.2	14.2	18.8	28.6	16.0	15.0	17.9
Tutume	0.6	1.6	1.9	9.5	15.3	16.9	9.8	9.8	11.1
National Mean	2.5	3.6	4.1	31.9	34.6	38.6	26.0	26.3	30.6
National Median	1.5	2.6	2.7	21.7	29.2	32.3	20.5	19.3	20.9

Source: Farahani, Price, El-Halabi *et al.* 2016

Note: *Densities were calculated for every 10 000 people in the district that year. Data sources: 2006 and 2009 from the Statistics Botswana, 2013 data derived from a study by Farahani, Price, El-Halabi *et al.* 2016.

Table 1.1 above shows the distribution of physicians, nurses and hospital beds in selected years in Botswana Health Districts. Results indicate that median doctor density had increased to 2.7, up from 1.5 in 2006. About twenty districts had less than four doctors per 10, 000 populations on average, with the remaining health districts (Farahani, Price, El-Halabi *et al.* 2016) having doctor densities ranging between 7.2 and 13.6 doctor densities (El-Halabi *et al.* 2016). The table shows that most health districts have experienced modest increases in doctor densities over the years, with a few notable exceptions, including Gaborone. Nurse density also showed similar patterns to doctor densities.

The median nurses' densities across the districts in 2013 was 32.3 nurses per 10 000 population up from 21.7 in 2007. The low doctor and nurses' densities across the country pose a serious challenge to health service care delivery due to human resource shortage in the context of an increasing burden of NCDs. There is need for the government to revise health care delivery and increase the doctor and nurse densities across the country to match the increasing burden of NCD morbidity in the population. This is because Botswana like many countries in SSA has the lowest doctor and nurse to population density in the world (WHO, 2006).

In terms of health expenditure, government covers a high proportion. Over 75% of health expenditure is covered by the government by providing health services for free in public health facilities (Ministry of Health, 2010). The private sector mainly provides services to insured clients. However, the uninsured do access private sector service through out-of-pocket payment. The private health sector is mostly associated with the high-income group while the traditional medicine sector is linked with both the low- and high-income groups. In the public health sector, nominal or no fees are charged for service utilization (Ministry of Health and Wellness, 2011).

In the context of providing services as a package, the lowest coverage of high-impact interventions is not less than 80% (Ministry of Health and Wellness, 2014). A nominal fee of about US$ 0.70 is charged for health services in the public sector, while sexual reproductive health services and antiretroviral therapy services are free. It should be noted however, that no one can be denied health services based on his or her inability to pay as per the health policy in Botswana.

1.7 Health Profile: NCDs in Botswana

The disease profile in Botswana is changing at an alarming rate. Most deaths and disabilities in the foreseeable future are likely to be accounted for by the ominous epidemics of NCDs such as heart disease, stroke, cancer and other chronic diseases and risk factors. Children, adults and the elderly are all vulnerable to the risk factors that contribute to NCDs. These result from unhealthy diets, low physical activity, exposure to tobacco smoke or the effects of the harmful use of alcohol (WHO, 2015). The key drivers of NCDs are aging, rapid unplanned urbanisation, and the globalisation of unhealthy lifestyles. Globalization of unhealthy lifestyles like unhealthy diets, for instance, may show up in individuals as raised blood pressure, increased blood glucose, elevated blood lipids, and obesity (WHO, 2015).

Before the 1980s, common diseases in Botswana were infectious diseases and those associated with unsanitary conditions, poverty and inadequate hygiene (WHO, 2008a). The increase of NCDs in Botswana, as in many LMICs can be attributed to urbanization and the changing lifestyles as well as the improved standard of living. These include improved road infrastructure and increased volume of traffic, as well as high levels of food and alcohol consumption (WHO, 2014). Since the 1980s new patterns of conditions associated with affluent lifestyles such as hypertension, diabetes and cardiovascular diseases emerged. The magnitude of such diseases was overshadowed by the re-emergence of infectious diseases such as tuberculosis and HIV/AIDS (WHO, 2011a). There has been an increase in the prevalence of NCDs and their risk factors in the past few decades. Common risk factors for NCDs in Botswana include tobacco use, unhealthy diet, poor physical activity and excessive use of alcohol.

The STEPs survey report of 2007, noted high prevalence rates of NCDs risk factors such as smoking (19.7%), unhealthy diet (96.6%), poor physical activity (34.7%), alcohol consumption (54.1%) and overweight (38.6%) (Ministry of Health, 2008). During the second STEPs survey in 2014, the proportions of population who smoke (18%) consume alcohol (26%) unhealthy diet (94.8%) and overweight (30.6%) had decreased (Ministry of Health and Wellness, 2014). The decrease in the prevalence of risk factors for NCDs during the inter-survey time could be attributed to the rigorous and robust campaigns for healthy lifestyles by MoHW (Ministry of Health and Wellness, 2011).

Although evidence suggests that prevalence of NCD risk factors has declined during the inter-survey period, prevalence of hypertension has increased from 33.3% in 2007 to 35.2% in 2014 (Ministry of Health, 2008 and Ministry of Health and Wellness, 2014). Moreover, the proportion of individuals who were diagnosed with diabetes increased marginally during the inter survey period from 2.3% in 2007 to 2.7% in 2014 (Ministry of Health, 2008 and Ministry of Health and Wellness, 2014).

Surveys of indigenous populations in a number of African countries indicated that hypertension rates are on the rise, as is the prevalence of diabetes. In a large percentage of affected individuals both conditions are being left untreated. In Seychelles, hypertension affects 40% of the population; in South Africa – 30.4%; in Mauritius – 28.4%. Diabetes affects from 4 to 25% of the population in these three countries (Guwatudde, Nankya-Mutyoba, *et al.* 2015).

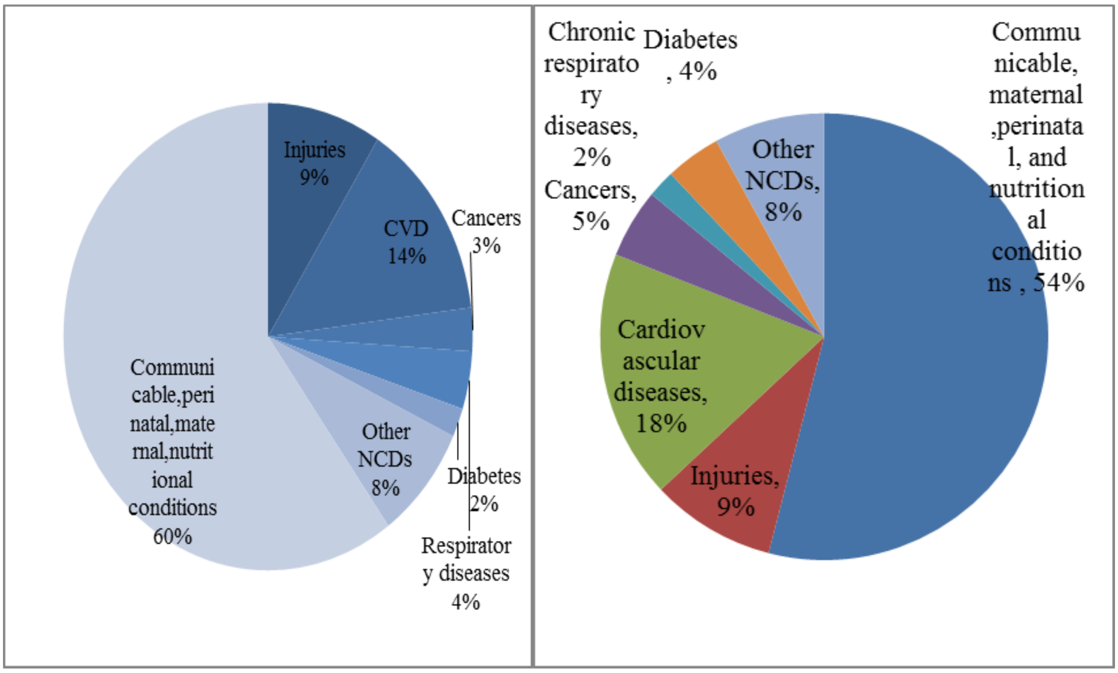
In 2009, it was estimated that 67% of the Botswana population aged 50 years and above had hypertension while 12.3% had diabetes[4]. The prevalence rates for musculoskeletal diseases were not different from those of hypertension, suggesting that the two groups could be

[4] http://www.aho.afro.who.int/profiles_information/index.php/Botswana:Analytical_summary_-_Non-communicable_diseases_and_conditions

associated with advancing age[5]. Injuries related to road traffic accidents have also been on the rise, commonly occurring during festive seasons and public holidays.

Figure 1.2 below indicates that communicable, perinatal, maternal and nutritional conditions caused about two thirds (60%) of total mortality in the population in 2011 while in 2014 they caused 54%. This shows that proportional mortality due to NCDs increased from 40% in 2011 to 46% in 2014 (indicating a 6% increase). This is quite indicative considering that just over a decade ago a higher proportion of mortality in Botswana was attributed to communicable diseases, especially HIV/AIDS.

Figure 1.2: Proportional Mortality (% total death for all ages) in Botswana, 2011 and 2014



Source; Computed from the Health Statistics report and WHO Country profiles 2011 and 2014.

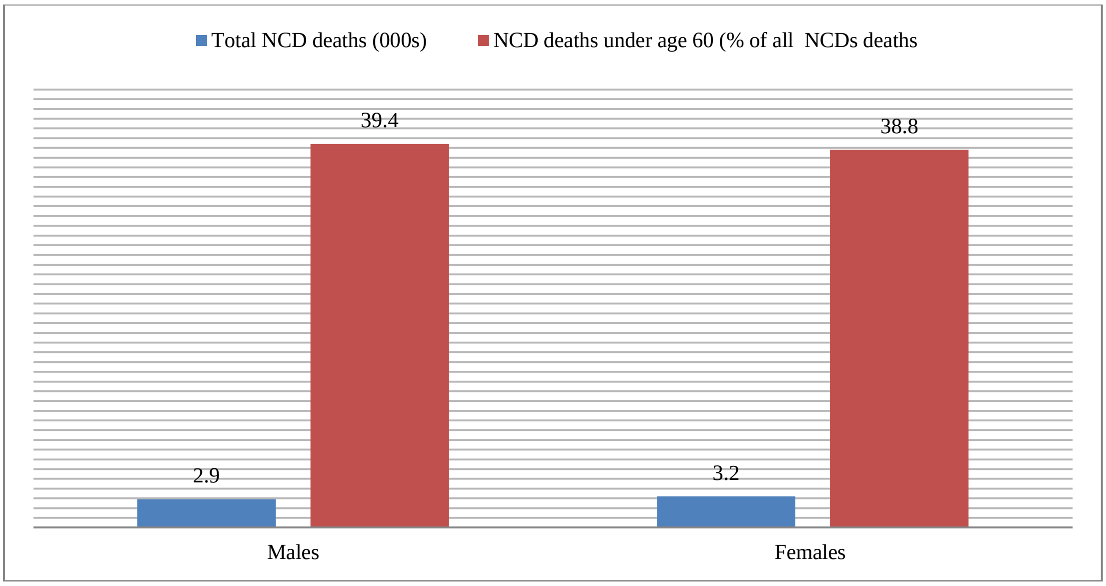
According to Statistics Botswana (2011) the major causes of mortality for the general population were: pneumonia (6.5%), septicaemia (4.1%), human immune-deficiency virus (3.3%), retrovirus infections (3.3%), stroke (3.2%), and tuberculosis of the lungs (3.1%). HIV/AIDS caused only 3.3% of deaths, almost the same proportion as deaths caused by

[5]Ibid 2009

stroke (3.2%). Since the establishment of the Botswana National Cancer Registry in 1999, 2000 cases (56.7% women and 43.3% men) of malignant cancers were registered between 1986 and 2004 (WHO, 2011).

Cancer of the cervix is one of the main gynaecological causes of hospitalization in Botswana, accounting for more than 25% of all cancers and just less than 50% of all female cancers in 2005 (WHO, 2014a). The increasing cases of cancer have been associated with HIV/AIDS (Chabner, Efsthathiou and Dryden-Peterson, 2013). This increase in cancers is related to immune suppression and the so-called Second Wave of AIDS has become increasingly evident.

Figure 1. 3: Total NCD deaths and NCD deaths under age 60 years in Botswana, 2008

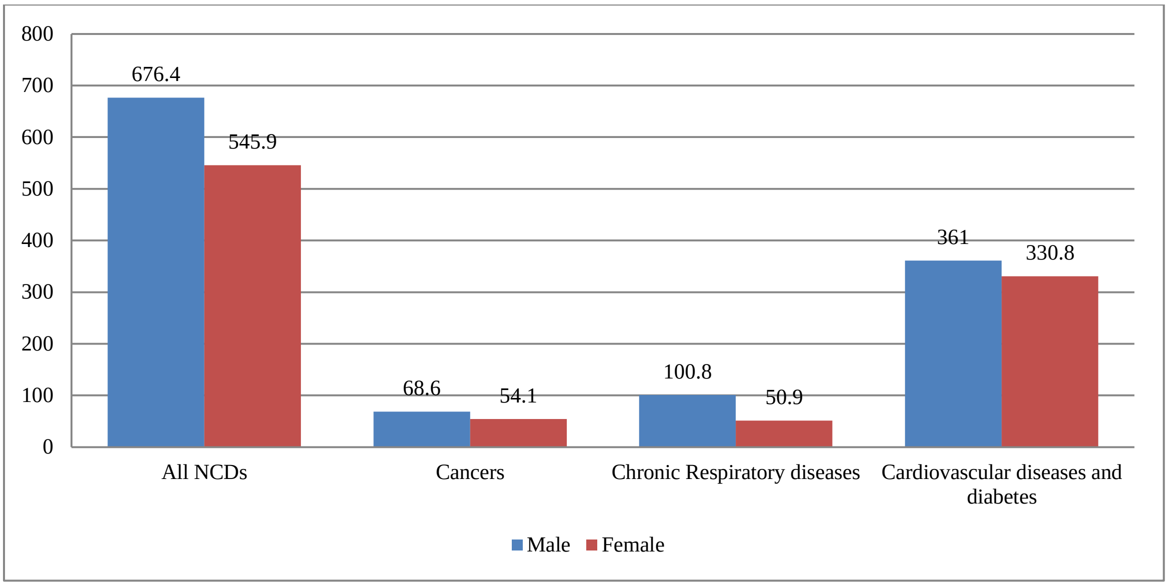


Source: Computed from World Health Organization-Country profiles, 2011

Figure 1.3 shows the total NCD deaths and NCD deaths for the population under 60 years in Botswana in 2008.The figure shows that a slightly high proportion of women (3.2) than men (2.9) died due to NCDs in the general population while for ages under 60 years deaths due to NCDs were slightly high among men (39.4) than women (38.8). Figure 1.4 shows the age standardized death rates (per 100 000 population) in Botswana in 2008.Results show that there was a high proportion of mortality (for all NCDs) among males (676.4) than females

(545.9). For cancers, chronic respiratory diseases and cardiovascular diseases estimates indicate that mortality was also slightly high among males than females.

Figure 1.4: Age standardized NCDs death rate per 100 000, Botswana 2008.



Source: Computed from World Health Organization-Country profiles, 2011

According to the WHO (2014a), Botswana's health system is still lacking in response to NCDs. The assessment shows that Botswana has an operational NCD unit/department within the MoHW and has a national, population-based cancer registry. However, the country does not have: an operational multisectoral national policy, strategy or action plan that integrates several NCDs and shared risk factors; an operational policy to reduce physical inactivity and/or promote physical activity, reduce unhealthy diet and/or promote healthy diets.

There are no evidence-based national guidelines/protocols/standards for the management of major NCDs through a primary care approach (WHO, 2014a). It is therefore reasonable to assert that Botswana needs to develop a robust NCD surveillance and monitoring system for NCDs.

1.8 Conceptual Clarifications

1.8.1 Socio-Economic Inequality

Various research and policy debates exist surrounding what socioeconomic inequality as measured by varying SES is. A more consensual definition of socio-economic inequality is often derived from social and economic stratification and ranking of individuals in terms of the amount of valued goods such as material resources, knowledge, prestige and power. According to Stronks (1997) the position of the individual in the stratification is indicated by the term social class or socio-economic status of that particular individual.

Studies in developed countries often use education, income, and occupational levels as indicators of SES (Susser, Watso, and Hopper, 1985; Liberatos, Link and Kelsey, 1988; Arcaya, Arcaya and Subramanian, 2015). However, wealth index has been used as a common measure of SES in many LMICs. This is mainly so because education and income levels have proved not to be so good measures of SES in the context of many LMICs mainly due to low education levels and income under/over-reporting.

Socioeconomic inequality is a derivative term (derived from socioeconomic status). It is used in this study to generally refer to socioeconomic differences in the health outcomes among individuals. According to Arcaya, Arcaya and Subramanian, (2015) any measurable aspect of health that varies across individuals (individual inequality) or according to socially relevant groups (group inequality) can be deemed a health inequality.

According to McKay (2002) inequality is typically thought of as differences between individuals within a population, normally a country, and it can also be considered for smaller or larger populations (for instance, within local communities or at a global level). Individual inequality implies that individuals within groups do not have the same opportunities. For some health measures (e.g. annual NCD morbidity rates) inequalities at the individual level are not very meaningful. Morbidity over one year is a dichotomous variable. Individuals are either healthy or sick at the end of the year. The proportion of the population that is sick (the period morbidity rate) comprises all the information on the level and distribution across individuals. Since there is a one-to-one correspondence between the proportion sick and the distribution of the population in the categories sick and healthy, the proportion healthy may be entirely informative of level and distribution. Although we may know the distribution of the population in the categories sick and healthy, there is likely to be variations in morbidity rates across subgroups of the population. In order to mitigate for this limitation measuring social group differences is thus an important adjunct to measuring the population morbidity (McKay, 2002).

Group inequalities are considered to be the differences across subgroups of the population, which may be based on biological, social, economic or geographical characteristics (WHO, 1999). The major concern is that individuals should not be disadvantaged on the basis of their socio-economic groups. McKay (2002) postulates that group inequalities are often considered between groups of people, including global inequality between countries, between regions or communities within a country, and inequality between groups of individuals or households classified according to various criteria (for example gender, SES). The latter is usually referred to as horizontal inequality. This study focuses on group inequalities because of the comparability of the SES variables across individuals in the study population.

There is need to clarify the difference between health inequality and health inequity in this study because there has been some conceptual misunderstanding about the differences between the two. According to Whitehead (1992) health inequity differs from health inequality in that *health inequity* is usually defined as a specific type of health inequality that denotes unjust differences in health. In other words, inequity refers to unfair, avoidable differences arising from poor governance, corruption or cultural exclusion while inequality simply refers to the uneven distribution of health or health resources as a result of genetic or other factors or the lack of resources. Given this definition, it is reasonable to say that health inequities are logical differences in health that could be avoided by using realistic means.

1.8.2 Health Care Utilization

RAND (2010) explains health care access as “the ease with which an individual can obtain needed medical services”. Utilization, on the other hand, is the actual use of health services, which has also been referred to as *realized access* (Andersen, 1995). Other studies conceptualize utilization of health services as a cognitive function of three factors: (a) perceived and evaluated need (such as perception of a problem or an existing health condition); (b) predisposing factors (i.e. age, gender, socioeconomic status, health beliefs); and (c) enabling factors (i.e., insurance, poverty status, actual access to medical care, and other individual, family, and community resources) (Gelberg, Andersen and Leake 2000; Small 2011). For purposes of this study, the operationalization of health care utilization implies access to and utilization of health services taking into cognizance the three factors stipulated above.

1.8.3 Health Expenditure

One of the key impediments of health care utilization is health expenditure. According to the WHO (2011b) people accessing health services may cause households to have no choice but to pay a large proportion of household effective earnings, then pushing households into financial hardship or even poverty (Xu, Evans, Kawabata, *et al.* 2011). This large payment has been termed catastrophic health expenditure (CHE). CHE essentially describes all kinds of health expenditures that pose a threat to the financial capacity of a household in order to maintain its subsistence needs (Zhou and Gao, 2011). The WHO (2014a) suggested that CHE occurs if out of -pocket payments (OOP) are at or exceed 40 % of income remaining after household subsistence needs have been met in any year. CHE could occur to both the rich and the poor hence it becomes an important aspect in understanding health expenditure from the socioeconomic perspective. However, in this study only out-of-pocket health expenditure is explored because the household income data was poor and inconclusive.

1.9 Organisation of the Study

This study is divided into 10 chapters. Among them, there are five core chapters which serve to address the key research questions of the study. The first chapter which is the current one introduces the background and context of the study and positions it within the broad field of health inequalities. Chapter 2 is on the review of literature and major theoretical perspectives from which researchers have tried to understand the problem of socioeconomic inequalities in health. Chapter 3 describes the setting, sampling design and analytical techniques of the study. Further, it validates the quality of data used for the study.

Chapter 4 presents results on the characteristics of the study population. Chapter 5 presents results on the patterns and determinants of NCDs risk factors. It seeks to mainly establish the influence of SES variables on NCDs risk factors prevalence. In Chapter 6, results concerning patterns and socioeconomic determinants of NCDs are presented. Chapter 7 presents results on health care utilization and expenditure. The main concentration of the results is to highlight the relationship between SES and utilization of health care services in the study population. The association between SES and health expenditure is also explored further. Chapter 8 presents results of the life course perspective. It mainly focuses on the influence of childhood and current SES on adult health.

Chapter 9 presents measurement of inequalities and results on the decomposition analysis of socioeconomic inequality in health. Chapter 10 discusses the key findings of the study, and concludes with some reflections about the future directions of research in the area of socioeconomic inequalities and health in the context of changing research priorities and epidemiological landscape. It also provides policy recommendations.

CHAPTER 2: LITERATURE REVIEW: THEORETICAL PERSPECTIVES ON SOCIOECONOMIC INEQUALITY IN HEALTH

2.1 The Current State of Knowledge on Socioeconomic Inequalities in Health

This chapter reviews major theoretical views from which scholars have worked to appreciate socio-economic inequalities in health. The review focuses attention on two interrelated states of scholarly work on socioeconomic inequalities in health and NCDs.

First, it is necessary to state that there is relatively not sufficient volume of work done in this area in Botswana and Sub Saharan Africa in general. Secondly, much of research in this area lacks theoretical sophistication that matches the issue in question. As Smith (2013) aptly indicates, there is an evident concern, raised among both researchers and policymakers, regarding the limited range of theories that contribute to explaining the origins and implications of socioeconomic inequalities in health.

Much of the extant work done in this area has been done within the rubrics of the mainstream theoretical views. These views were too simplistic to address social and economic realities of Africa, and more specifically, Botswana which is faced with the double burden of communicable and non-communicable diseases.

One of the major developments in population health research sciences in the past decade is the popularization of the concept of health inequalities. Issues central to the concept socioeconomic inequalities in health have been articulated in various research themes and programme approaches. Although inequalities in health began to draw the attention of most public health experts in the 19th century in developed countries, socioeconomic inequalities in health and wellbeing across individuals, social groups and societies have always been part of human history (Mackenbach and Kunst1997; Robert and House 2000).

Pioneering work on inequalities in health was conducted by public health professionals (Mackenbach and Kunst, 1997). Later in the 1980s most of research on inequalities in health was conducted mainly by sociologists, demographers, economists as well as public health practitioners. A considerable portion of this research was motivated by the Black Report, which had concluded that inequalities in health had widened even though Britain had introduced universal access to healthcare (Townsend and Davidson, 1982; Gwatkin, Guillot and Heuveline, 1999). Following the Black Report, there has been a flurry scholarly work on health inequalities covering a variety of health outcomes.

2.2 Gaps in socioeconomic inequalities in health research

Biomedical and epidemiological studies confirm that recently NCDs in LMICs can no longer be overlooked (Ebrahim and Smeeth 2005; Horton, 2007). Considering that issues around NCDs have been taking ground in developing countries over the past two or more decades, it would be logical to expect that socioeconomic inequalities associated with these diseases would dominate research and policy strategies in Africa. One possible explanation offered for the shortage of research on health inequalities in general is that traditionally public health challenge in Africa has been the scourge of infectious diseases. These infectious diseases are otherwise called communicable diseases such as Tuberculosis, Malaria, HIV/AIDS, Pneumonia and Diarrhoea.

Although health surveillance has been conducted for centuries, its application to NCDs is very recent and remained the concern of developed world until 1990s (Lopez, Mathers, Ezzatti, *et al.* 2006). However, it later became obvious that the greatest impact of NCDs will increasingly be in developing countries hence in 2000 WHO came with STEPs surveillance survey of NCD risk factors. The epidemiologic and demographic research for developed countries centred around NCDs while for developing countries it was mainly on infectious diseases. Lack of interest in NCDs in developing countries as a subject of serious inquiry is one of the major weaknesses of epidemiologic and demographic research in developing countries, especially in Africa.

Another explanation for the lag in attention to NCDs in developing countries relates mainly to understanding socio-economic inequalities underlying these diseases. Previous research ascribed NCDs to affluence and wealth. However several studies have documented that lower socioeconomic status is associated with poorer health and that the magnitude of inequalities can be more pronounced in some countries than others (Mackenbach, Stirbu, Roskam, et al. 2008; Hosseinpoor, Parker, Tursand'Espaignet, *et al.* 2012).

Data derived from the 2002-2004 World Health Survey across LMICs showed that persons with lower wealth or education levels had higher prevalence of angina, arthritis, asthma, depression and comorbidity, but lower prevalence of diabetes than people with higher wealth or education levels (Hoseinpoor, Bergen, Mendis, *et al.* 2012). Simultaneously, wealth and education inequalities were greater in low income countries (LIC) than middle income countries (MIC) (Hoseinpoor, Bergen, Mendis *et al.* 2012).

According to Sommer, Griebler, Mahlknecht *et al.* (2015) socioeconomic inequalities in relation to NCDs and their risk factors exist, but the available evidence is sparse and limited to only some NCDs in predominately high income countries (HIC). A number of research gaps that require future investigation have arisen as a consequence of this. Given the wealth of information available in the developed world, it is also clear that there is a considerable research gap between developing and developed countries (Mendez, Cooper, Wilks, *et al.* 2003).

Research findings from developed settings are not necessarily relevant to other contexts hence local knowledge is imperative. It is worth noting that even though most reviews set out to include data from LMICs, they end up with a strong imbalance in favour of studies from HICs. The lack of studies in LMICs points out the need for more research among these study populations in order to be able to assess socioeconomic inequalities within as well as among LMICs and HICs.

As discussed in Chapter 1, generally NCDs are unequally distributed within populations and often disproportionally affect the socioeconomically disadvantaged. For example, a study by Liu, Ma, Yin *et al.* (2011) among 52 countries found a trend for increased angina in poorer populations, although associations with individual- or societal-level socioeconomic markers were not analysed. Moreover, reviews of literature from different regions of the world indicate elevated NCDs-related mortality and morbidity in less-affluent neighbourhoods (Lee and Carrington, 2007).

Few multinational studies of LMICs have examined the role of socioeconomic inequality in NCDs, and most of these studies are from South East Asia, Latin America and very few are from Sub Saharan Africa (SSA). The assumption that NCDs are diseases of affluence could be blamed for serving to de-emphasise the need to pursue vigorous studies on socioeconomic inequalities for NCDs.

Another factor that has been associated with the neglect of NCDs in SSA is that studies in SSA have provided only a highly fragmented overview of the situation. Furthermore, prevention and treatment initiatives for NCDs in low-resource settings are hindered by a lack of attention to social and economic situations**.** In addition, only few people with NCDs seek medical services, and limited research has been conducted to determine the burden of household incomes due to NCDs.It is also crucial to highlight that none of the Millennium Development Goals had made reference to NCDs. Because of this oversight, governments and the international community previously paid little attention to major issues in transforming the post-transition morbidity profiles of African societies (Miszkurka, Haddad, Langlois, *et al.* 2012). Meanwhile, these morbidity profiles can be measured at the population level through the World Health Surveys, from which the dynamics of NCDs can be examined.

Also noteworthy is that the recently introduced Sustainable Development Goals (SDGs), especially SDG 3 emphasises the need to ensure healthy lives and promote well-being for all at all ages. This SDG, however, does not acknowledge the country-specific assessments to identify the most urgent priorities: such as infectious diseases, malnutrition and/or a rapid rise in NCDs and obesity.

Overall, the mixed findings about socioeconomic inequalities in health substantiate the need for disaggregated research to delineate the impact of individual NCDs on various socioeconomic groups. High quality epidemiological evidence is a cornerstone of effective policy development, deployment and monitoring. The present study seeks to unravel socioeconomic inequalities in health, looking at NCD prevalence levels, health care utilization, health expenditure and the life course view. An investigation of socioeconomic inequality is needed to formulate sustainable and effective approaches to prevent and manage NCDs among the socioeconomically disadvantaged.

2.3 Socio-economic inequalities theories

Theories underlying socioeconomic inequalities matter. The effective identification of causes of any problem is crucial to the elaboration of appropriate measures to address the problem. As a result this part discusses theoretical contributions to our understanding of socioeconomic inequalities in health. The first part discusses theories derived from the Black Report and their contribution to understanding socioeconomic inequalities in health. This is premised on the fact that much of the debate and theories about socioeconomic inequalities in health gained momentum after the Black Report. The second part of this section looks at the theories of social justice within which much of debates about socioeconomic inequalities are located. From the tenets of various theories discussed in this section the conceptual framework for this thesis was derived.

From the literature reviewed population sciences do not appear to offer any strong coherent body of theoretical understanding of socioeconomic inequalities in health. Socioeconomic inequalities in health in Africa have not been fully explored, but recently epidemiological evidence has started to generate interest on health inequalities among both scholars and policy makers. However, wherever health inequalities are encountered within the African context, they are perceived within notions of economic status of individuals, and individual's ability to purchase and utilise health care (Macassa, Anne-Sofie, Nadar, *et al.* 2014). For few decades this attitude has guided thinking, policy and programs in population health especially in Sub Saharan Africa.

The assumption has been that the experiences of more developed countries are diametrically opposed to those of less developed countries (Mosley and Chen 1984) mainly due to the economic disparities between the two (Whitehead, 2000). Work that connoted health transition viewed African societies as inherently lagging behind in terms of health and development (Macassa, Hiswåls, Ahmadi *et al.* 2014). Within this theoretical framework, patterns of socioeconomic inequalities in health in the African context have been under researched. Not much in-depth explanation has been given on the nature of socioeconomic inequalities in health in clearly defined notions and efforts to theoretically ground our understanding of these inequalities in Africa.

2.3.1 Theories from the Black Report

Much of the recent work on theories of socio economic inequalities in health are premised on the notions of the Black report. The Black Report identified four key theories for understanding how health inequalities arise (Mackenbach, Stirbu, Roskam *et al.* 2008). These theories were: artefact; selection theory (including natural and social selection); structural factors; and behaviours (including culture). The period after the Black report saw continued elaborations of these underlying theories. The theories opined in the Black Report elucidated mainly on why health inequalities arise but lacked to succinctly use basic epidemiological reasoning relating to association, causality and confounding. The subsequent paragraphs seek to evaluate major theoretical weaknesses associated with theories identified by the Black Report.

2.3.1.2 The Artefact Theory

The artefact theory is premised on the idea that the relationship between indicators of social status and health outcomes is merely a statistical artefact relating to the way in which social status has been classified over time (Black, Morris, Smith *et al.* 1980; Whitehead, 1988). Although the theory is essential in our understanding of causality between socioeconomic factors and health outcomes, it is gravely undermined by the universal demonstration of inequalities in health outcomes (Beckfield and Krieger, 2009). It is inadequate even in a case where different statistical measures of social status are used such as income, area deprivation, education, social class and occupational group (McCartney, Collins and Mackenzie, 2013). The major weakness of this theory that makes it very problematic to sustain is that such outcomes are unrelated to social status.

2.3.1.3 The Health Selection Theory

This theory opines that poor health causes social selection (a social slide) which leads to the observed association between ill health and low social status (McCartney, Collins and Mackenzie, 2013). The theory is very much hinged on the notion of reverse causation. Although the theory has been used in understanding health inequalities, it has mainly been tested using longitudinal studies, and such longitudinal studies demonstrated that a large majority of the concentration of ill-health in lower socio-economic groups is explained by pre-morbid social status rather than any subsequent social slide (Smith, Hart, Watt, *et al.* 1998; Power and Matthews 1997; Brimblecombe, Dorling and Shaw, 2000). In essence, the theory fails to account for health inequalities.

An alternate theory has been framed to reinvigorate selection hypothesis more (Gottfredson, 2004) and this theory implies the role of intelligence in health. However, the main limitation of this theory is that it views intelligence as the fundamental cause of health inequality. This is so because there have been secular measures of intelligence witnessed in various populations (Flyn, 1987) and that the difference in intelligence between populations has varied overtime (Tuddenham, 1948).

2.3.1.4 Cultural and Behavioural Theories

Cultural and behavioural theories suggest that differences in the prevalence of behaviours such as smoking, alcohol consumption, diet and physical activity between groups or differences in dominant cultures between groups are vital causes of health inequalities (McCartney, Collins and Mackenzie, 2013). Meanwhile, for health behaviours to be the cause of health inequalities, socioeconomic variables are effect modifiers in that relationship.

However, focussing merely on behaviours as fundamental theory of inequalities in health has some problems (Smith, Hart, Watt, *et al.* 1998). First, when populations in different socioeconomic groups, but with similar or equal exposure to behavioural risk factors, are compared a health outcome (e.g. morbidity) may remain higher in lower SES group (Hart, Gruer and Watt, 2011).

Second, a mere focus on behavioural variables ignores how and why individuals in particular socioeconomic groups adopt unhealthy behaviours (Nettle, 2009). If behavioural thesis is to provide a valid fundamental explanation, it should be able to explain, without reference to the prevalent circumstances of lower socioeconomic groups, how persistently damaging, but precisely different, health behaviours have risen among these groups, over a long period (McCartney, Collins and Mackenzie, 2013).

2.3.1.5 Structural Theory

The premise underlying this theory is that differences in socioeconomic circumstances of social groups (as well as differences in income, wealth, power, and access) at all stages of the life trajectory, causes differences in health outcomes (Krieger, 2001). This theory has provided quite substantially, the dominant frame for analysis of health inequalities in the UK (Black, Morris, Smith *et al.* 1980).

Supporting this view is the evidence that health inequalities have reduced in periods when structural inequalities have diminished, and have risen when such inequalities have increased (Krieger, Rehkopf, Chen *et al.* 2008; Thomas and Williams, 2008). Based on the hypotheses proposed by Black, Morris, Smith, *et al.* (1980) health inequalities have been and continue to be best explained from a structural view. Other theories such as behavioural and culture; selection and artefact can only provide some insights on mechanisms through which inequalities are generated. However, they lack in terms of providing adequate explanation for the principal causes of inequalities. This is not to mean that structural theory does not have limitations but it is relatively more plausible than other theories suggested by Black *et al.* (1980).

2.3.2 Theories of Social Justice

Socio economic status based inequalities, as measured by the ownership of assets, access to a variety of services and benefits, and in the basic provisions of life and health, is increasingly growing. The common and popular notion that the rich get richer and the poor get poorer appears to be largely based on fact, at national, regional and global context. There are marked inequalities at both micro level (individual and community level) and macro level (global level-inter country) and these inequalities seem to be widening overtime. The fundamental question is whether these facts about growing socioeconomic inequalities suggest a regression in social justice. The answer to this question can be provided possibly from a proper understanding of theories of social justice. The subsequent paragraphs make a presentation of the theories of social justice and seek to locate socioeconomic inequalities in health within the broad notions of theories of social justice.

Social justice as a concept owes its origins to philosophical discourse (de Vita, 2014) although it is often used in both our everyday language and social sciences, frequently without being clearly defined. It is a concept born of the struggles surrounding the industrial revolution and the advent of socialist (and later, in some parts of the world, social democratic and Christian democratic) views on the organization of society (Economic and Social Affairs Department, 2006).

The origins of theories of social justice can be traced back to the early 1970s through the path-breaking works by Rawls and Nozick (1971). The original view of Rawls when formulating theory of social justice was that a perfect society should be a society where all members are treated with equality and fairness. He argued that justice like love is virtue which every member of the society should enjoy.

Moreover, other initial proponents of social justice envisaged total equality in the society. In the modern society social justice, the overall increase in inequality is seen as unjust, unacceptable and disturbing. The underlying argument is that poverty reduction and overall improvements in the standard of living of all people are attainable goals that would bring the world closer to social justice (Economic and Social Affairs Department, 2006).

Some proponents of social justice—though significantly envisage total socioeconomic equality (Economic and Social Affairs Department, 2006). There is an established link between economic justice and social justice. Within the context of the present theoretical review, economic justice is considered an element of social justice. Subsequent paragraphs seek to disentangle several theories which are the derivatives of the broad social justice theory.

The following are some of the theories of social justice;

2.3.2.1 Utilitarianism

Initial proponents of utilitarianism considered practicability and utility to be the measure of virtue and justice. Mill (1801; 1969) suggests that the value of justice is inherent in how many individuals derive pleasure from it, which is how far it is useful or full of utility in favour of common interest. According to Mill (1801; 1969) utility ought to be the measure of good, right, morality, progress and justice. Bentham stressed that “justice must be demonstrated, and the welfare of the needy and the oppressed be protected”.

Thus, according to these thinkers, whatever is useless, painful, evil and unjust, must be reformed or changed in the interest of the greatest number of individuals (Jatava, 1998). In other words, according to this school of social justice, all questions of distributions are to be resolved by reference to consequences. Although this theory is on social justice its origins are rooted from political sciences discourse.

2.3.2.2 Marxism

According to the Marxist's perspective social justice is connected with the idea of liberating society from exploiting class, and social justice thrives in communist society, in which all traces of social and economic distinction disappear (Rosenthal and Yudin, 1967). According to this view the economic structure plays significant role in establishing and maintaining the social justice. The assumption is that there has always been a continuous struggle between the 'haves' and 'have not's throughout the ages and that the 'have not's' are exploited by the have class (Walzer, 1983).

According to the Marxist view, any form of inequality and social classes must be abolished in order to attain social justice. Laski (1948) eulogized the socialism of Karl Marx. For him it was essentially a humanist approach but he added an idea of freedom to economic equality. His view was that "equality involves up to the margin of sufficiency and identity of responsibility to primary needs and this is what is meant by justice" (Laski, 1948). The significance of freedom is that it encourages people to do what equality requires from them. The Marxian notion of communism or justice has been modified from time to time, place to place and situation to situation, though the crux has been the same – human welfare. Nevertheless, there is little evidence on the explicit application of this view to health inequality research.

2.3.2.3 Rawls' Theory

Rawl's theory is one of the most recent common views on inequalities. According to Rawls (1971), inequalities in the allocation of goods are permissible if and only if they work to the benefit of the least well-off members of society. He opines that each person is to have an equal right to the most extensive system of basic liberties compatible with a similar system of liberty for all. Social and economic inequalities are to be arranged so that they are both the greatest benefits to the least-advantaged, and attached to the offices and positions open to all under conditions of fair equalities of opportunities (Rawls, 1971). This theory largely explains inequalities as far as they can benefit the disadvantaged members of the society. The theory and its applicability to health inequalities remain inherently lacking although it's implied in most of the health inequality research.

2.3.2.4 Libertarianism

The theory of libertarianism derives from those who reject the notion of social justice altogether, and argue instead for a return to the traditional understanding of justice as respect for law and established rights. Their argument begins from different philosophical starting points but contain three central claims (Hayek, 1976; Nozick, 1974). First, the notion of social justice assumes that there is some agency responsible for the distribution of benefits in society, whereas in fact, this distribution arises through uncoordinated activity of many agents, non-aiming at overall results. Second, the quest for social justice involves replacing the market economy with a stultifying bureaucracy which tries to exercise complete control over the flow of resources to individuals. Third, this quest also involves fundamental interference with personal freedom, in so far as people must be prevented from doing as they please with the resources they are allocated if the preferred distributive pattern is to be maintained. This theory also has limited application to health inequalities, although it provides the basis for understanding social justice in general.

2.4 Emerging Conclusion on Theories

Good health is one of the most valuable things in life hence it is unfair that certain groups within society, do not enjoy an equal share of good health compared to other sections of the society. According to Schuyt (1987) this perceived injustice is even more emphatic if differences in health correspond with the distribution of other goods. This is the case with inequalities in health between socio-economic groups which are the focus of this study. Socioeconomic inequalities in health can be well understood within the notions of theories of social justice and theories from the Black Report. Even at this, theories from the Black Report present a relatively more coherent understanding of health inequalities.

Much of what has been written on justice and health has been confined to issues of allocation of health care, although social inequalities in health persist even when health care resources are more equitably distributed and to other health outcomes (Marchand, Wikler, and Landesman, 1998). Other scholars such as Rawl (1973) and Arrow argued (1973) that health inequalities can be considered as an issue of distributive justice. In the wake of Rawl's work scholars have increasingly sought to turn away from theories of welfarism (Dworkin 1981; Arneson1989; Cohen 1989) which is the notion that justice (morality as a whole) consists in the distribution of well-being and that what matters is individuals' welfare.

This view is relevant because health is more easily assimilated to the notion of welfare or outcomes than it is to the notion of means of resources hence it would be difficult to posit that a particular distribution of health outcome in a given society is just or unjust (Marchand, Wikler, and Landesman, 1998). Some theories discussed above argue that although it is morally objectionable that people of different socioeconomic position have different health outcomes and health statuses this intuition may not necessarily extend to other inequalities (Marchand, Wikler, and Landesman, 1998). Arguing in support of social justice Dworkin

(1981), for instance, propounds that justice consists in people having the same amount of resources with which to purchase health insurance (or other determinants of health).

It is noteworthy that in health inequalities research and public health generally, the number of theoretical contributions elucidating our understanding of socioeconomic inequalities in health is incommensurate to the ever increasing number of empirical studies. Most of empirical studies on health inequalities are informed by social theories (Social Theory and Health, 2015). This is so because much of the pioneering work that attempted to pay some attention to socioeconomic inequality in health was applied research with little concerns for the theoretical issues.

This situation was made possible by the excessive policy and media interest following the Black Report from the 1980s. During this period, discussion on the issue was re-ignited by the partial suppression by the Conservative Government of the report on inequalities in health (Black, 1980). Consequently, many scholars in European countries quickly documented similar kinds of disparities between the health status of groups defined by a variety of socio-economic categorisations. By 1987, the European Region of the World Health Organisation (WHO) had adopted the reduction of 25% in health inequalities as the first target of its 'Health for All' by the Year 2000 programme (Carr-Hill and Charlmers-Dixon, 2005).

Ordinarily, existing assumptions and common sense underlying the understanding of socioeconomic inequalities in health should have generated a flurry of serious scholarly work. Although NCDs have been associated with affluence, there has been lack of robust theoretical underpinnings to attest to this association. Where theoretical frameworks have been applied to study health inequalities, this has mostly been with the purpose of trying to understand, or help analyse, pre-existing data sets or findings.

There was not much effort to inform decisions about how we study, and try to tackle, such inequalities or to develop theoretical approaches that are specifically intended to help us better understand health inequalities as a phenomenon (Social Theory and Health 2015). Empirical studies in many countries show that people who are worst off as far as their socio-economic position is concerned are also worst off when it comes to health. The review of 'inequality' theories was to ground this attestation.

An obvious conclusion drawn from this review is that there is no single unified theoretical framework that is specifically suited for understanding socio-economic inequalities in health and certainly not for the African region. Theories reviewed in this chapter have approached inequalities from different standpoints with different degrees of analytical depth.

Theoretical preferences of mainstream demography theories lack important issues about health inequalities. Further emerging theoretical approaches mainly rooted in sociological, epidemiological and other intellectual fields pay superficial and tangential attention to socioeconomic inequalities in health especially in LMICs. It remains a challenge on how to stimulate heightened interest on health inequalities in Africa and how to find fitting theoretical approaches for investigating critical questions about socioeconomic inequalities and health. The conceptual model used in this study borrows extensively from notions of theories from the Black Report and theories of social justice.

2.5 Conceptual Model

The explanation of socio-economic inequalities in health is still largely unknown in Botswana (as it is in other LMICs). Based on existing (international) literature, this section provides an overview of the explanations that have been put forward with regard to socio-economic inequalities in health. On the basis of this overview as well as empirical data relating to the socio-economic distribution of specific health outcomes, a conceptual model was formulated to explain the influence of socioeconomic status on selected health outcomes. The model aimed to interrogate the relationships between socio-economic status (SES), and selected health outcomes.

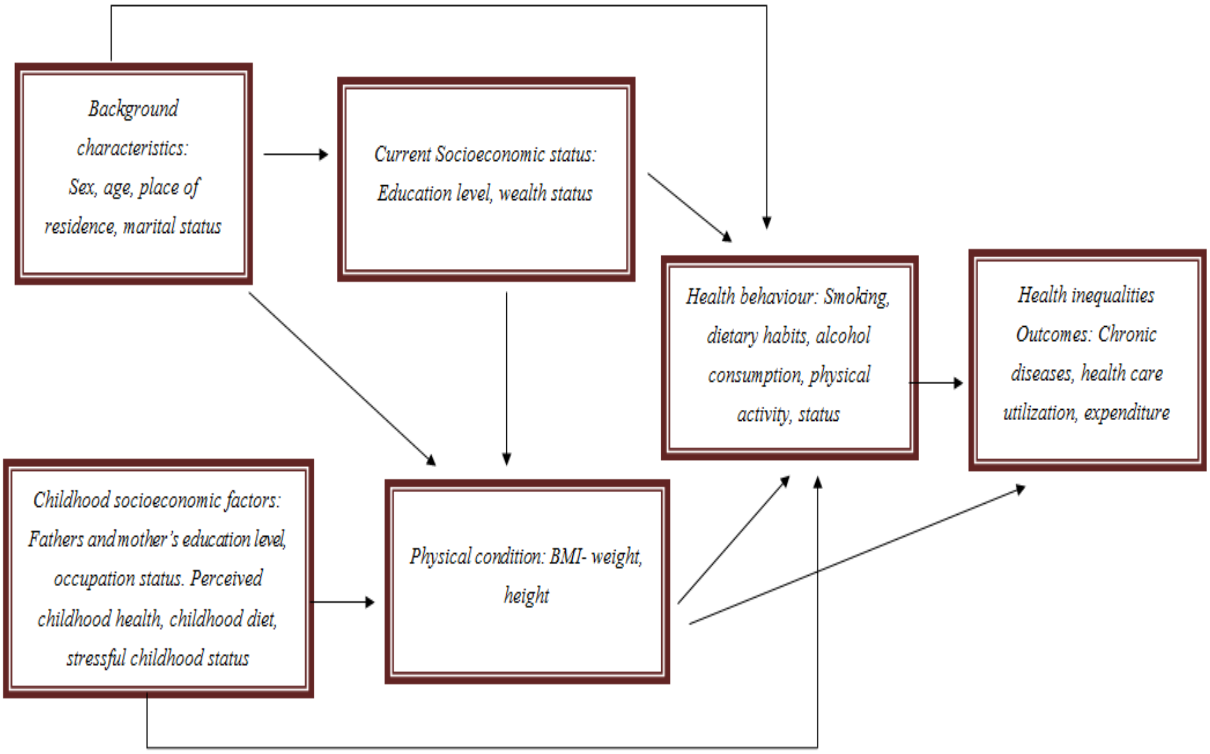
The theory of social justice also provides some background of socio-economic inequalities in health (For instance, Power,, Fogelman and Fox, 1986; Mackenbach and van del' Maas 1987; Carr-Hill 1987). This was considered during the development of the conceptual model. The decision to develop a new model was prompted by the wish to be able to derive specific hypotheses on the basis of this model which could then be tested using the data collected during the *"Chronic Non Communicable Diseases in Botswana: Prevalence, health expenditure, health care utilization and life course Study"*.

This required a specification of the relationship between explanatory factors and mechanisms that went further than the scope of the above-mentioned models. It is so because it attempts to integrate the existing explanations and the derived model has the potential to contribute to the discussion on the background of socioeconomic inequalities in health. However, in view of the general validity, it should be borne in mind that the model reflects a number of choices that were made. These choices concern both the health indicators and the explanatory variables which were considered. The model was restricted to the explanation of differences in selected health outcome variables.

The model focuses on NCDs such as hypertension, diabetes, asthma, etc. Other aspects of health, such as health expenditure, health care utilization, and the influence of childhood SES on health were also included in the model. In addition, the model is concerned with the explanation of inequalities in health in adulthood. Factors and mechanisms that occurred in previous stages in life (such as childhood SES) are involved in the explanation of these differences. Although the study pays attention to most of explanatory mechanisms discussed in the existing literature, within these mechanisms it focuses on specific aspects. For instance only those factors of which it is known that they are differentially distributed across socio-economic groups have been included in the conceptual framework.

Socio-economic inequalities in health have been observed over a long period. Despite this, a largely uncharted question is the question on the processes explaining the generation of these inequalities. Furthermore, the social processes underlying exposure to risk factors and mechanisms by which exposures lead to disease are still not well understood. However, as socioeconomic health differences in adult life are probably partly explained by processes in earlier life, some authors have stressed the importance of studying health inequalities and their determinants over the life course (see Davey-Smith, Blane and Bartley, 1994; Vagaro and Illsley 1995).The conceptual model (figure 2.1) used in this study considers the influence of SES (childhood and current adulthood SES) on health of individuals.

Figure 2.1: A graphical representation of mechanisms and factors hypothesised to be involved in the explanation of socioeconomic inequalities in health in Botswana.



The conceptual model for this study (figure 2.1) considers mechanisms and factors through which health exposures may lead to adverse health outcomes. Three main processes are emphasised in this model;

The first process presents the contribution of background characteristics to health risk behaviours which in turn contribute to inequalities in health. The central question underlying this process is: are people with certain socioeconomic characteristics more or less likely to have certain health behaviours which in turn influence health inequality outcomes than people of certain socioeconomic characteristics? Essential to this question is whether individual's health is produced independently of their socioeconomic characteristics or vice versa. In this process background characteristics are proximately linked to current physical conditions and health outcomes.

The second process concerns the contribution of current socioeconomic status to socioeconomic inequalities in health. Are people who are currently in lower socioeconomic groups less/more likely than people in high socioeconomic groups to experience adverse health behaviours and are they also likely/more likely to be exposed to inequalities in health?

The third process concerns the contribution of childhood factors (childhood SES) on current health behaviours because current health problems partly have their roots in childhood. If so, this might be a causal mechanism; poor childhood socio economic circumstances may cause health problems in later life.

Questions underlying this process are: Are individuals who had poor childhood SES more or less likely to experience inequalities in health than individuals who had high childhood SES?; Are individuals who had poor childhood SES more or less likely to have poor physical conditions and therefore experience inequalities in health or vice versa?; Are individuals who had poor childhood SES more or less likely to have health risk behaviours than those who had high childhood SES and experience inequalities in health or vice versa?

The conceptual model described above was examined empirically. Each of these processes was discussed separately using data from *"Chronic Non Communicable Diseases in Botswana: Prevalence, health expenditure, health care utilization and life course Study"*.

In this study, data on childhood socioeconomic conditions, adult socioeconomic status, personal characteristics/factors, and adult health related behaviour, are available to investigate the mechanisms whereby childhood socioeconomic conditions and selection on health play a role in explaining health inequalities in adult life.

2.6 Socioeconomic Status and Health

This section briefly discusses the interrelationship between health and SES. Over the years research evidence has shown that health is a socially and economically patterned phenomenon and that disadvantaged social groups tend to suffer a disproportionate burden of ill health, high mortality, greater incidence and severity (Feinstein 1993; Adler and Ostrove 1999; Chopra, 2005; Marmot, 2005). This has also be shown by recent epidemiological evidence thatsocial patterning of health is a consistent finding, with the picture being similar within and across populations, in many settings, across different times, in multiple studies, for varied outcomes, and using multiple measures of social conditions (Ruger and Kim 2005).

Review of literature for this work has shown that the reasons for the significant connection between SES and health are many, multifarious, and intertwined. An individual’s position within a social hierarchy is linked to the probability of health-damaging exposures or enhancing behaviors, understanding of health promotion messages, health-enhancing resources, stress, and other material and psychosocial factors that may affect health (Silva and Stanton, 1996). Recently, there has been a considerable upsurge in the interest of population scientists in understanding the social determinants of health and there have been calls for a greater focus on the social determinants of health in population health research (WHO, 2014a).

Most of the studies on the social determinants of health need measures of SES to quantify and understand health inequalities (see Kawachi, Subramanian and Almeida-Filho, 2002 for instance). These studies use measures of SES to assess the effects of policies and interventions on different social groups, and develop and evaluate programmes designed to reduce inequalities. According Kawachi *et al.* (2002) measures of SES are vital for most studies, not just those focusing on social determinants of health. Since SES is a key determinant of most health outcomes and is also related to many of the exposures in epidemiological studies, it was assumed to be a confounder in the relationships with health outcomes variables in this study.

CHAPTER 3: DATA AND METHODS

3.1 Introduction

This chapter provides the general approach and methods used in this study, as well as the design, implementation, conceptual framework, analytical strategy and measurement techniques employed. Further, this chapter provides an overview of the dataset used in this study –The Chronic Non Communicable Diseases in Botswana: A study on Prevalence, Health Care Utilization and Health Expenditure-2016 (The NCD Study). The survey information, objectives, sampling methods, and key variables are described. Finally, statistical analyses employed in the study are presented.

3.2 Dataset

The NCDs study was particularly designed to address key research questions of this study hence it was used for the larger part of analysis. The NCD study dataset contains information on most NCDs and risk factors that was not included in the WHO STEPs survey. Many other key indicators of health such as health care utilization, health expenditure and the life course information were included in the study questionnaire. Moreover, unlike previous surveys on NCDs, the NCDs study collected information on the proxy socioeconomic indicators (assets) from which the wealth index was created using the principal component analysis method.

The wealth index has become an important indicator for understanding the relationship between SES and health in LMICs. Self-reported data on several NCDs as classified by the WHO classification code of diseases (ICD-10) and their associated risk factors was collected. The collection of data on self-reported morbidity for NCDs would serve as baseline for comparison between clinical and self-reported prevalence of NCDs in Botswana.The NCDs data is recent and therefore provides an opportunity for the timely understanding of the etiology of NCDs in Botswana.

3.3 Survey Information

The NCDs study adopted a cross-sectional multistage survey design. The survey was carried out in selected urban and rural areas of Botswana, among males and females aged 15 years and over[6]. The sampling frame such as list of districts, localities and enumeration areas (EAs) together with their households was derived based on the 2011 Botswana Population and Housing Census.

The survey used a multi-stage probability sampling technique, where first the population was stratified into cities and towns, urban villages and rural settlements. A listing of all 26 census districts in each stratum was made at the initial stage, and from these districts a total of all 4845 EAs were listed for rural and urban localities. At the second stage, localities in urban and rural districts were randomly selected. A third and fourth stage comprised a random selection of EAs and Households in that order. Lastly, individuals aged 15 years and over were selected for interview from the list of households with persons 15 years and over.

3.4 Sampling[7]

Using the multistage probability sampling, census districts for Botswana were divided into rural and urban clusters at the first step. Urban districts were further divided into cities, towns and urban villages; while rural clusters were randomly selected (thus rural settlements in lands area, cattle posts, freehold farms, mixture of lands and cattle posts, and camp or other locality

[7]For detailed methodology for the study on 'Chronic Non-communicable Diseases in Botswana; A study on chronic disease prevalence, Health care Utilization, Health Expenditure and the Life course'' refer to the appendix 1

where type of locality is not stated were excluded from the sample). From cities and towns 3 were randomly selected, from the urban village's strata 15 urban villages were randomly selected, while for rural areas strata 15 rural villages were randomly selected. Enumeration areas were selected using probability proportional to size sampling method for the different strata and localities. For each selected EA, 20 households were selected using systematic sampling method. This followed guidelines used in most Demographic Health Surveys where 20-25 households (HHS) were selected from the primary sampling units (PSUs).

The Kish grid was used to select the eligible respondents from the selected households. Thus, once a household is selected, the interviewer created a listing (sampling frame) of all the persons in the household who were eligible for the interview. This listing includes the name of the person, their gender, their relationship to the head of the household and their age. Once the listing was done, each eligible member was assigned a unique number. Then using a randomized response technique a particular member was chosen for the interview. From an estimated initial sample size of 1280, only 1178 respondents successfully completed the individual questionnaire yielding a response rate of 92 per cent.

3.5 Survey Instruments

A population based survey comprising of quantitative data collection approaches was used. The survey instruments for the NCD study were based on several resources. These were mainly borrowed from the WHO Study on Global Ageing and Adult Health (SAGE), and WHO STEPS Survey. These were then reviewed and subsequently adopted by the research team. The review took into account the recommendations by the World Health Organization on undertaking population-based surveys.

3.6 Data Collection Procedures and Management

Scientific procedures for data collection and management are important for data quality and therefore its utilization. This is particularly relevant where scientific research undertaking has an expectation to inform policy direction. The quality and utility of the NCDs study data was dependent on the manuals, control forms and questionnaires used in the survey. The NCDs study as a consequence opted to use validated instruments and manuals that were informed by past research and United Nations bodies such as WHO.

3.7 Measurement of Variables

This sub section presents on how variables in this study were measured and coded.

3.7.1 Socio-Demographic Variables

Table 3.1 below shows demographic characteristics which were used and coded as follows in the study;

Table 3.1: Description of sociodemographic variables

Variable	**Variable description**
Sex	Re-coded into Male=1, Female=0
Age	Age was a continuous variable and was re-coded into a categorical variable as follows; ≤24=1, 25-34=2, 35-44=3, 45-54=4, 55-64=5 & 65+ years=6)
Residence	This variable denoted the place of residence for respondents and was coded as; Cities and towns=1, Urban villages=2 & Rural villages=3
Marital status	This variable had several categories which were re-coded as follows; Never married (never married and living together categories were combined) = 1, currently married=2 & ever married (combined divorced, widowed & separated) =3
Education level	The following question was used to measure education level of the respondent; what is the highest level of education you have completed? This was a categorical variable with several categories, which were later collapsed and recoded to have primary or less=1 (non-formal and primary), secondary (junior and senior) =2 and tertiary & over=3. This question on education level was also asked for life course questions where respondents were asked about the education level of their father at the time of

	their birth and the same codes were maintained.
Work status	The following question was used to conceptualize work status of the respondent; which of the following best describes your main work status in the past 12 months? Several broad job categories were coded as follows; public sector (government employee) =employee) =1, private sector (non-government employee) =employee) =2, self-employed=3, Not employed=4, Homemaker/student=5, and retired or other (retired, non-paid family helper, house-helper, house worker) =6.
Wealth status	A wealth index (WI) was constructed as a proxy to a measure of wealth status. WI is a composite measure of, typically, indicators of ownership of consumer durables, housing characteristics, and access to public services. Information on a range of durable assets was collected during the survey (e. g. car, refrigerator, television,), housing characteristics (e. g. material of dwelling floor and roof, main cooking fuel), access to basic services (e. g. electricity supply, source of drinking water, sanitation facilities) and ownership of livestock (e.g. cattle, goats, sheep, horses, chickens). Further to collection of information on durable assets, information on land and livestock ownership was collected. Principal component analysis method was used to create the wealth index.

3.7.2 Behavioural Variables

The five common risk factors for NCDs which have been used in this study are: tobacco smoking, alcohol consumption; poor physical activity, poor fruit and vegetable consumption and overweight/obesity.Moreover clustering of NCD risk factors was considered. These characteristics have been constructed as follows:

Tobacco Smoking-According to WHO (2014), tobacco use increases the risk of cardiovascular disease, cancer, chronic respiratory disease, diabetes and premature death. The survey question asked respondent ‘Do you currently smoke any tobacco products such as cigarettes, cigars or pipes?, ‘do you use snuff, chewed tobacco? This variable was coded such that yes=1 and no=0.

Alcohol Consumption-Alcohol consumption is associated with a risk of developing non-communicable diseases, mental and behavioural disorders, including alcohol dependence, as well as unintentional and intentional injuries, including those due to road traffic accidents and violence (WHO, 2014). The survey question asked respondents, 'Have you ever consumed alcohol in the past 30 days?" The resultant variable was yes=1 and no=0.

Poor Physical Activity-Previous studies have shown that lack of physical activity is associated with various NCDs such as cardiovascular diseases, cancer and chronic respiratory diseases. Four key features of the quality of physical activity (e.g. activity type, intensity, frequency, duration) are usually considered when choosing one for a research study. For this study the following two questions asking respondents about intensity of physical activity were used.

i) Activity at work: Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate like [examples] for at least 10 minutes continuously?
ii) Does your work involve moderate-intensity activity that causes small increases in breathing or heart rate such as brisk walking for at least 10 minutes continuously?

Different types of responses (yes and no) to the two levels of physical activities have been grouped together and given a value based on the intensity of the activity. For example, individuals who responded 'yes' to both questions were grouped together and those who responded 'no' were also grouped. The resultant variable was coded such that those who responded 'yes'=1 (physically active) and those who said 'no' were coded=0 (or poor physical activity).

Poor Fruit and Vegetable Consumption-Insufficient or non-consumption of fruits and vegetables is known to expose individuals to various diseases such as cardiovascular diseases, some type of cancer, and diabetes. The following survey questions were used to measure poor consumption of fruits and vegetables;

i). 'How many servings of fruits do you eat on one of those days (on a typical day)?

ii) 'How many servings of vegetables do you eat on one of those days (on a typical day)'.?

These two questions were follow-up to the questions which asked the respondents- In a typical week on how many days do you eat fruit/vegetables. The resultant variable was coded such that those who reported to have taken 5 or more weekly servings of either fruit or vegetables or combination of these two were given a code, sufficient intake=0 and those who reported to have taken less than 5 weekly servings were given a code insufficient intake=1.This was done based on the general recommendation by the WHO panel on diet, nutrition and chronic disease prevention that considers poor fruit/vegetables intake as having less than 5 servings of fruits and vegetables in a week.[8]

Overweight/Obesity-Body Mass Index (BMI) was categorized into four groups as per WHO recommendations: underweight (BMI < 18.5 kg/m2), normal weight (18.5 ≤ BMI <25 kg/m2), overweight (25≤BMI<30 kg/m2) and obese (BMI ≥30 kg/m2). Overweight and obese were used to create a binary outcome variable which is coded as: being overweight or obese (BMI≥25) =1; not overweight or obese =0 (BMI<25).

Multiple NCD Risk Factors-A composite variable was created to assess the existence of clustering of NCD risk factors among study participants. The variable was created from the five NCDs risk factors (tobacco use, alcohol consumption, poor physical activity, poor fruit and vegetable consumption, and overweight/obesity. It was coded such that if an individual reported that there was no existence of NCD risk factor a code of 0 was given, if there was

[8] World Health Organization, Food and Agriculture Organization. Diet, nutrition and the prevention of chronic diseases. WHO, Geneva, Switzerland; 2003. (Report of a Joint WHO/FAO Expert Consultation).

only one risk factor the code was 1= single NCD risk factor and 2 if there were more than one NCD risk factors (multiple risk factors).

3.7.3 Measurement of NCDs Variables

Arthritis -The survey asked the question “have you ever been diagnosed with arthritis? The final variable was coded such that, yes=1 and no=0.

Stroke-The survey asked the question, “Have you ever been told by the health professional that you had a stroke?” The answer to this question was binary in nature and was coded as yes=1 while no=0.

Angina -Angina is pain or discomfort in the chest that occurs when the heart does not receive sufficient oxygenated blood. The survey asked the question “Have you ever been diagnosed with Angina or angina pectoris (a type of heart disease).The resultant variable was yes=1, and no=0.

Diabetes-Diabetes is a metabolic disease in which the person has high blood sugar. The survey asked the question, “Have you been diagnosed with diabetes (high blood sugar)?” The final variable was coded such that yes=1, and no=0.

Chronic Lung Disease-Chronic lung disease refers to conditions where air flows to the lungs is limited and breathing is difficult. The survey asked the question, “Have you been diagnosed with chronic lung disease (emphysema, bronchitis, COPD)?”The variable was coded such that yes=1 and no=0.

Asthma-It is a respiratory disorder that is characterized by sudden narrowing of the airways, which results in wheezing and shortness of breath. The survey asked the question, “Have been diagnosed with asthma (an allergic respiratory disease)?”The resultant variable was yes=1 and no=0.

Hypertension-This is a common disorder in which blood pressure is maintained above normal levels. The prevalence of hypertension was reported. The survey asked the question, "Have you ever even been diagnosed with hypertension (high blood pressure)?". The final variable was coded such that yes=1 and no=0.

Other Chronic Conditions-An attempt was made to estimate the prevalence of other non-communicable diseases such as eye-vision problem, nerves problem, skin problem and depression. The survey asked questions to all the respondents, "During the past 12 months have you been told by a doctor or other health workers that you have/had or suffered from the following problems/conditions?". These were (a) eye vision (like cataract, retinopathy) (b) nerves problem (c) skin problem (d) depression (loneliness, suicidal attempt, no close friends etc.). These variables were only used for univariate analysis to assess prevalence levels of these conditions. Due to few cases in the sample multivariate analyses were not possible.

Multiple NCD Conditions-A composite variable was created to assess the clustering of NCD conditions among individuals in the study. The variable was created from NCD conditions reported in the study population and was coded such that if there was no existence of an NCD a code of 0 was given, if there was any one NCD condition the code was 1= single NCD condition and 2 if there were more than one NCD conditions (multiple NCD conditions).

3.7.4 Measurement of Health Care Utilization

In this study health care service utilization is measured to include the use of health facilities and related services by a group of individuals who need such services. Four health care service utilization indicators were used to assess health care utilization using Andersen's conceptual framework of healthcare utilization (Andersen, 1995). The following variables/questions were recoded and used to understand health care utilization patterns among respondents;

- Health care needed -derived from the question, 'When was the last time that you needed health care? This question referred to both inpatient and outpatient care. The question was recoded such that individuals who needed health care in the past 12 or less months were given a code=1 and those who needed health care more than a year ago or never needed health care were given a code=0.
- Health care received-derived from the question, 'The last time you needed health care, did you get health care'? Possible responses were yes=1 and no=0.
- What was the last (most recent) health care facility you visited in the last 12 months? Possible options were private health facility (private doctor's office/ private clinic/private hospital) =1, public health facility (public clinic or health facility/public hospital) =2 and other-health facilities (charity or church run clinic/charity or church run hospital/Traditional healer/Pharmacy or dispensary/others) =3.
- What was the main reason you needed care, even if you did not get care? ', The following were given as reasons why respondents needed care;, Chronic pain in your joints/arthritis (joints, back, neck)=1, Diabetes or related complications=2, Problems with your heart including unexplained pain in chest (angina)=3, Problems with your breathing (asthma)=4, High blood pressure/hypertension=5, Stroke/sudden paralysis of one side of body=6, Cancer=7, Nutritional deficiencies=8, Chronic lung disease=9,

Communicable disease=10 and =Other (specify). All NCDs were grouped and given a code, NCDs=1 and other disease conditions=0.

The variable health care needed denotes health seeking behaviour which is commonly thought of as the way in which people behave in relation to their health (Abera, Ncayiyana, and Levin, 2017) while health care received can be thought of as the utilization of health-care services, which is an endpoint of the process of seeking care (Ward, Mertens and Thomas, et al. 1997).

3.7.5 Health Expenditure Variables

Health expenditure refers to the direct and indirect costs associated with health of individuals. The following questions were used to assess inequalities in health expenditure;

(i) 'Thinking about your last [hospital] stay, how much did you or members of your family/household pay out of pocket for; health care providers fees, medicines, tests, transport, and others [specify]?. The final variable was re-coded such that a binary outcome was derived whereby all people who paid some amount for health care were given a code=1, while those who did not pay anything were given=0.

(ii) Out-of-pocket expenditure is very low in Botswana hence the question on medical insurance coverage was also used to assess the level of medical insurance coverage in the population. The question used for this variable was 'Are all your household members covered under any medical insurance'? Yes=1 and no=0.

3.7.6 Life Course Variables

Life course influence on NCDs was conceptualised to include; childhood social and economic exposures and their risks in later life (table 3.1). The resultant variable was a childhood SES index derived from childhood social and economic exposures below. An index was created to come up with three categories for childhood SES; low childhood SES=1, middle=2 and high=3.

Table 3.2: Life course variables

Life course variables	**Survey question**
Father's Education Level	What was the education level of your father when you were born? The variable was recoded such that low education=1 (includes no education, informal education & primary) & high education level=0 (includes secondary & tertiary or high)
Mother's Education Level	What was the education level of your mother when you were born? The variable was recoded such that low education=1 (includes no education, informal education & primary) & high education level=0 (includes secondary & tertiary or high)
Father's Occupation	State activity status and occupation of your father during your childhood. The variable was recoded; public sector=1,private sector=2, self-employed=3, unemployed=4 (student, retired, homemaker)
Mother's Occupation	State activity status and occupation of your mother during your childhood. The variable was recoded; public sector (government)=1,private sector (non-government)=2, self-employed=3, unemployed=4 (student, retired, homemaker)
Stressful Childhood	Have your life been stressful. Yes=1, no=0
Childhood Diet	Kind of food taken during childhood? Vegetarian=1, non-vegetarian=0
Perceived Childhood Health	How did you feel of your health? Below average=1,avarage=2 & above average=3
Childhood Major Ailment	Do you remember any major ailment you suffered? Yes=1 & no=2
Childhood SES	This was a resultant variable derived from the combination of material (socioeconomic) and psychosocial conditions in childhood e.g. parental

	education, parental occupation, perceived childhood health, and childhood diet. The positive childhood socioeconomic experiences were grouped together and negative ones were also grouped together and finally an index was created to come up with three categories for childhood socioeconomic status; low =1, middle =2 and high=3 childhood SES.

3.8 Methods of Statistical Analysis

Generally, data analysis in this study was carried out at four levels, namely; univariate, bivariate, multivariate and decomposition analysis. Data analysis was done using the Statistical Package for Social Sciences version 25, Microsoft excel 2010 and ADePT 6.0 program. The ADePT version 6 program was used to measure the health inequality and to do decomposition analysis of health inequalities in chapter 9.

3.8.1 Descriptive Analyses

Univariate analysis consists of an examination of frequency and percentage distributions of the independent/background and outcome/dependent variable. For the bivariate analyses, the association between each response variable and a set of predictor variables were examined. Hypothesis about the association between dependent variables with predictor variables were tested. The existence of associations between dependent and independent variables was tested by comparing the significance level that was calculated for each pair of factors. Percentages were presented together with the confidence intervals.

3.8.2 Multivariate Analysis

In this study the standard regression co-efficient (from binomial and multinomial logistic regression models) was used to measure socioeconomic differences for various health outcomes. The regression co-efficient shows the increase (or decrease) in the magnitude of the dependent variable (health outcome variables) for each unit increase in the socioeconomic variable (Clayton and Hills, 1993).

In calculating this statistic, both the dependent variables representing the health outcome and the independent variables representing the socioeconomic characteristics of the study population are either in an ordinal or nominal scale. The odds of a health event signify the frequency of an event divided by its counterpart. The odds ratios were calculated using logistic regression models after the logit transformation of the dependent variable (Clayton and Hills, 1993).

The regression coefficients were derived from the multivariate logistic regression models which evaluated the effect of a selected group of independent variables (socioeconomic characteristics) on a number of dependent variables (health outcomes), while controlling for other potential confounders (background variables). Several models were run to explore the influence of SES on health outcome variables.

Logistic regression results were presented as either Crude Odds Ratios (COR) for crude models (unadjusted with other covariates) and adjusted odds ratios (AOR) for adjusted models together with their 95% confidence intervals. Odds ratios were used to compare the relative odds of the occurrence of the outcome of interest (e.g. NCD conditions), given exposure to the variable of interest (e.g. socioeconomic and behavioural factors). The odds ratios were used to determine whether a particular exposure (e.g. smoking, alcohol consumption, etc.) is a risk factor for a particular outcome (NCDs), and to compare the magnitude of various risk factors for that outcome.

The 95% confidence interval (CI) was used to estimate the precision of the OR in this study. A large CI indicates a low level of precision of the OR, whereas a small CI indicates a higher precision of the OR. In practice, the 95% CI is often used as a proxy for the presence of statistical significance if it does not overlap the null value (e.g. OR=1) (see Szumilas, 2010). Complex samples module in SPSS was used since the NCD study was a cross sectional survey which used a multistage sampling design. Conclusions drawn from the data can only be inferred to the study population and not to national level.

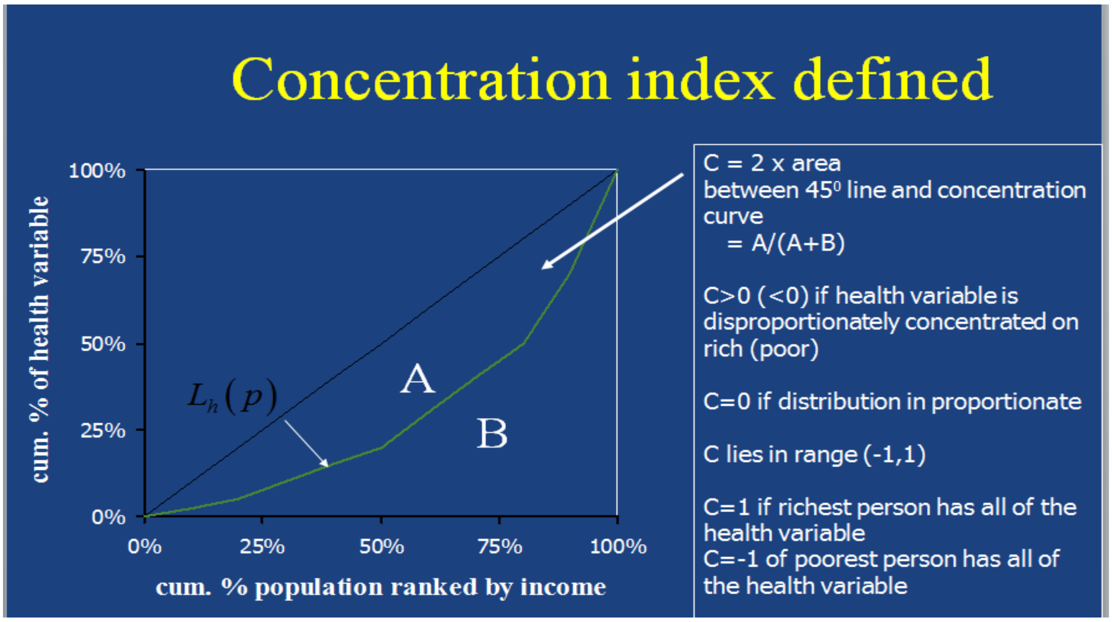
3.9 Measurement of Socioeconomic Inequality

3.9.1 Concentration Curve

Analysis of socioeconomic inequalities in health was done using ADePT software (version 6). Measurement of socioeconomic inequalities was done using concentration curves and concentration indices (CI). Concentration curves (see example: figure 3.1 below) have been used to plot the cumulative share of the health sector variable against the cumulative share of the living standard variable, in this case wealth status/index.

In calculating the cumulative percentages, the socioeconomic variable was ranked from lowest to highest quintile. If any health outcome variable is equally distributed, the curve will be running from the bottom left hand corner to the top right-hand corner (a 45° line). This is known as the line of equality. Contrarily, if any health outcome is low among the poor, the concentration curve will lie below the line of equality (O'Donnell, van Doorslaer, Wagstaff *et al.* 2008; Wagstaff, Bilge, Sajaia *et al.* 2011) (see figure 3.1 below for illustration).

Figure 3.1: An example of a concentration curve



Source: Cabases 1987

3.9.2 Concentration Index

This measure of inequality proposed by Wagstaff, Paci, and van Doorslaer (1991) was used (in chapter 9) in this study to assess the concentration of inequalities for a particular health outcome in the study population. The value of the health variable assigned to each individual was taken to be a function of the socioeconomic category to which the individual belongs. The interpretation of this index is based on what is called the "concentration curve" where the x-axis represents the cumulative proportion of individuals by SES level and ending with those whose level is highest, while the y-axis represents the cumulative total proportion of the health variable for these individuals.

The value of the concentration index ranges between -1 to +1. In a case where the concentration curve coincides with the diagonal, all individuals have the same level of health, as denoted by the health variable. If the curve is under the diagonal, this means that a particular health outcome is concentrated in persons of higher SES, while if the curve is above the diagonal, it means that health outcome is concentrated in those with a lower SES.

The farther the curve is from the diagonal, the greater the degree of inequality; the first case being regarded as health inequality in favour of individuals with high SES and the measure has a positive value, while the second case is known as health inequality in favour of individuals of lower SES and the value of the measure is negative (Regidor, 2004). Furthermore, if all health outcomes are concentrated in the person with the highest SES, the index will have a value of +1, and if all health outcomes are concentrated in the individuals with the lowest SES, the index will have a value of -1.

The index is defined as twice the area between the concentration curve and the line of equality (the 45° line). The index is 0 if there is no socioeconomic related inequality. If the outcome is positive (e.g. hypertension prevalence), that means the health variable is more concentrated among the non-poor and the concentration curve will lie below the line of equality. In contrast, a negative value means the health variable is more concentrated among the poor and the concentration curve will lie above the line of equality (O'Donnell, van Doorslaer, Wagstaff, *et al.* 2008; Wagstaff, Bilge, Sajaia, *et al.* 2011).

For a discrete living standards variable, the index is defined as;

1. $$C= \frac{2}{\mathrm{n}\mu h}\sum_{i-1}^{n} hiRi - 1 - \frac{1}{n}$$

Where: h_i is the health sector variable, μ_h is its mean, and $R_i=i/\mathrm{n}$ is the fractional rank of individual *i* in the living standards distribution, with *i*= 1 for the poorest and *i*= n for the richest (O'Donnell, van Doorslaer, Wagstaff *et al.* 2008). The index summarizes information through the imposition of value judgments about the weight given to inequality at different points in the living standard distribution. The concentration index depends only on the relationship between health variable and the rank of the living standard variable ($h_i r_i$) and not on variation of living standard variable itself (Wagstaff, Bilge, Sajaia, et al. 2011). The value judgments implicit in the index are seen when the index is written as:

2. $C = 1 - \frac{2}{n\mu}\sum_{i-1}^{n} hi(1 - Ri)$

The quantity hi/n_{μ} is the ith person's share of a specified health outcome. This is then weighted in the summation by twice the complement of the person's fractional rank, that is, 2 (1–R*i*). So the poorest person has the share of a specified health outcome weighted by a number close to two. The weights decline in a stepwise fashion, reaching a number close to 0 for the richest person. The extended concentration index is then 1 minus the sum of these weighted health shares.

3. $C(v) = 1 - \frac{v}{n\mu}\sum_{i-1}^{n} hi(1 - Ri)^{(v-1)}$

Where: *v* is the inequality-aversion parameter (the weight attached to the i_{th} person's health share), $hi/n\mu$, is now equal to $v(1–Ri)_{(v-1)}$, rather than by 2 (1–R*i*).When *v*= 1 everyone's health is weighted equally. As *v* is raised above 1, the weight attached to the health of a very poor person rises, and the weight attached to the health of a person above the 55th percentile decreases. Achievement Index (AI) was used to reflect average level of a specified health variable e.g. NCD morbidity and the inequality in health between the poor and the better off. The index is defined as a weighted average of a specified health variable in the sample with higher weights attached to the poor than to better off. The index is given as:

4. $1(v) = \frac{1}{n}\sum_{i-1}^{n} \mathrm{h}i\mathrm{v}(1 - \mathrm{R}i)^{(v-1)}$

This index can be shown to be equal to:

$1(v) = \mu[1 - C(v)]$

When h is a measure of good health, high values of I*(v)* are considered good and C *(v)*> 0 (good health is higher among the non-poor). If a specified health variable declines monotonically with living standard, the greater is the degree of inequality aversion, and the greater is the wedge between the mean (μ) and the value of the index I (v) (O'Donnell, van Doorslaer, Wagstaff et al. 2008; Wagstaff, Bilge, Sajaia et al. 2011). Indirect method of standardization was used to reflect differences across socioeconomic groups while controlling other determinants of a specified health variable. The standardizing variables are those correlated with the living standard measure and that of the health outcomes from existing empirical literature. Such standardization provides a way to remove components of inequalities from socioeconomic related inequalities and describe the distribution of the health outcomes by socioeconomic status conditional on other demographic, socio-economic factors (Wagstaff, Bilge, Sajaia et al. 2011)

5. $$y = \propto + \sum_j BjXij + \sum_k ykZkj + \varepsilon i$$

Where: yi is the health variable for the i_{th} individual; and α, β and y are parameter vectors, x_j are confounding variables used to standardize, and z_k are non-confounding variables for which we do not want to standardize but do want to control for in order to estimate partial correlations with the confounding variables.$\alpha,\beta j$ and yk parameter estimates of individual values of the confounding variables (x_{ji}), and sample means of the non-confounding variables (z_k) are then used to obtain the predicted values of the health indicator γ_i.

Estimates of indirectly standardized health outcomes are then computed by the difference between actual and predicted outcomes plus the overall sample mean (O'Donnell, van

Doorslaer, Wagstaff *et al.* 2008; Wagstaff, Bilge, Sajaia *et al.* 2011). Socioeconomic related inequalities were decomposed into the contributions of individual factors to wealth- related health inequality, in which each contribution is the product of the sensitivity of health with respect to that factor and the degree of wealth-related inequality in that factor.

6. $\text{Yi} = \propto \sum k\beta kXki + \epsilon i$

Where: Y_i= 1 for the specified health variable, X_ka set of exogenous determinants of that health variable and β_k coefficient determinant X_k, and $€_I$ is random error term.

CHAPTER 4: CHARACTERISTICS OF THE STUDY POPULATION

4.1 Introduction

This chapter provides descriptive characteristics of the study population. It covers sample description, household characteristics, and behavioural characteristics, distribution of NCD risk factors and NCDs in the study population. Results in this chapter are presented as descriptive statistics showing patterns and trends of NCDs and risk factors.

4.2 Sample Characteristics

4.2.1 Socio Economic Characteristics

Table 4.1 presents results on the sample description for the NCDs study.The results show that a total of 1,178 respondents of the ages of 15 years and above were successfully interviewed. The sample constituted a high proportion of females (69.1%) than males (30.9%).This suggests an over-representation of females relative to males in the sample. It is important to note that the over representation of females was not by study design as eligible participants were randomly selected using the Kish sampling method[9].

The sample age distribution suggests a relatively young study population, with over half (59%) of the sample being less than 39 years of age, and almost three quarters (73.5%) being less than fifty years of age. Over two thirds (69%) of the sample was female. As age increases, the sample sex distribution becomes more skewed in favour of females, from just fewer than 6 in every ten among those in the 20-24 years age group, to over 7 and 8 out of every ten among respondents over 40 years of age.

[9] Most demographic and health surveys in Botswana, have found similar observation where there is a slight overrepresentation of females (e.g. BAIS, BFHS, Population and Housing Census).

Table 4.1: Socio-economic characteristics of the respondents

Variable	%	N
Sex		
Male	30.9	364
Female	69.1	813
Total		**1177**
Age in years		
<24	26.4	270
25– 34	29.5	302
35 – 44	19.2	196
45– 54	12.7	130
55 – 64	7.3	75
65+ years	4.9	50
Total	100	**1023**
Locality Type		
Cities/Towns	30.2	355
Urban Villages	45.4	534
Rural Settlements	24.5	288
Total	**100.0**	**1177**
Marital Status		
Never Married	73.8	864
Currently married	17	199
Formerly married	9.2	108
Total	**100.0**	**1171**
Highest Level of Education Attained		
Primary or Less	35.5	410
Junior Secondary	27.2	314
Senior Secondary	17.3	200
Tertiary & Over	19.9	230
Total	**100.0**	**1154**
Work Status in past 12 months		
Public Sector	10.5	122
Private Sector	15.7	182
Self Employed	11.2	130
Not Employed	37.5	436
Homemaker-Student	18.8	218
Retired-Other	6.4	74
Total	**100.0**	**1162**
Wealth status		
Lowest	19.9	234
Second	20.1	237
Middle	19.9	235
Fourth	20.1	237
Highest	19.9	235
Total	**100.0**	**1178**

More than two fifths (45.4%) of the population resided in urban villages; just under a third (30.2%) resided in cities and towns while a quarter (24.5%) resided in rural areas and settlements. Almost three quarters (73.8%) of respondents were never married; over a third (35.5%) had primary education or less; over a quarter (27.2%) had junior secondary education while just under a fifth had senior secondary education (17.3%) and tertiary education and over (19.9%). Close to two fifth (37.5%) of respondents were not employed; while over a quarter were employed in either the public (10.5%) or private sector (15.7%).

Just over one in every ten (11.2%) were self-employed, while close to a fifth (18.8%) were either home makers or students; while only 6.4 per cent were retired from work. Considering wealth status, the study population was evenly distributed across the quintiles ranging between 19.9% and 20.1% (Lowest, middle and highest= 19.9%, while second and fourth=20.1%).

4.3 Behavioural Characteristics of the Study Population

WHO (2008a) has prioritized the following four behavioural risk factors for NCDs: tobacco use, harmful use of alcohol, unhealthy diet and physical inactivity. Thus most of the NCDs are preceded by unhealthy behaviours (behavioural risk factors), followed by the emergence of metabolic risk factors such as overweight and obesity. Metabolic risk factors are biochemical processes involved in the body's normal functioning (WHO, 2012).

It should be noted that these four behavioural risk factors lead to four key metabolic/physiologic changes (raised blood pressure, overweight and obesity, raised blood glucose and raised cholesterol). Risk factors are often classified as modifiable or non-modifiable. Modifiable risk factors are those that can be reduced or controlled by intervention in order to reduce the probability of contracting diseases (WHO, 2012).

A non-modifiable risk factor cannot be reduced or controlled by intervention, such as age, sex, race/ethnicity and family history (Center for Disease Control and Prevention, 2013). Subsequent paragraphs present results on the prevalence of the risk factors for NCDs.

Table 4.3 presents results on behavioural characteristics of the study sample. Prevalence of alcohol consumption was estimated at 17% in the sampled population. This is a decline from the 2014 (WHO STEPs Survey) prevalence rate of 26.4%. The marked decline in alcohol consumption during the inter-survey period is in-line with the WHO (2014a) target to reduce alcohol consumption by at least more than 10% within the national context. This is a step in the right direction because alcohol consumption is not only a health issue, but it is also associated with a number of other social issues such as traffic accidents, binge drinking, violence, crime, domestic violence, child abuse, and suicide.

Current alcohol consumption levels are still high and are going against efforts to curb the problem of alcohol through the adoption of the Global Strategy to Reduce Harmful Use of Alcohol. Even though it was hoped that this policy would strengthen measures to reduce harmful alcohol consumption in countries around the world evidence indicate otherwise. The government of Botswana has to effectively review existing policy options to reduce the harmful use of alcohol. Although Botswana has set itself apart in recent years by heeding to some of the approaches included in WHO 'best buys' there is much that needs to be done in terms of behavioural change programs. There is need to strengthen several alcohol consumption reduction interventions adopted by the government.

The observed reductions in alcohol consumption in this study may be attributed to several government initiatives and efforts. For instance, in 2008, an alcohol levy of 30% was introduced aimed at increasing the cost of and reducing demand for alcoholic beverages and the levy has gradually increased over the years and today stands at 55%, making it among the most aggressive in the region (Ministry of Health and Wellness, 2017). Furthermore the government has created a special fund known as the Levy on Alcoholic Beverages Fund with the main aim to promote projects and activities designed to combat alcohol abuse and minimise the effects of alcohol abuse. The Trade act and liquor act have also been created to regulate the sale of alcohol in the country which includes licensing and hours of operation.

The National Alcohol Policy for Botswana was adopted in 2010, to address issues of production, retailing, distribution, marketing and consumption of alcohol in the country and called for "a multisectoral, multipronged approach to dealing with the harmful and negative impact of alcohol." (Ministry of Health and Wellness, 2017). Other pieces of legislation aimed at alcohol consumption adopted by the government include; Traditional beer regulation 2011; and Road Traffic (Limit of Alcohol) Regulations of 2013. Further to these policies, the alcohol industry is not allowed to sponsor sports activities and alcohol advertising not allowed on government media; alcohol sachets have been banned and the names of convicted drunk drivers are routinely published in newspapers. Other national policy documents that speak to reducing harmful use of alcohol are the National Youth Policy 1996 (revised 2010) and the National Strategy on Good Social Values 2009 (Ministry of Health Wellness, 2017).

Although efforts have been put in place in terms of the preceding policy options, there is still need for more focussed implementation and behavioural change strategies. As such individual interventions such as screening for harmful drinking and treatment of alcohol dependence may also be effective, although they are more costly to implement than population-based measures. Meanwhile there is need to dispel certain sociocultural issues relating to alcohol consumption in order to further reduce alcohol consumption levels.

This will be done with the understanding that alcohol remains closely tied to cultural and social activities. Consequently there is need for more detailed evaluation of impact of interventions, and lack of population based data remains a huge challenge. Moreover, there is need for development of legislation on alcohol marketing and better evaluation of impact of interventions against alcohol abuse.

Table 4.3: Behavioural characteristics of the study population

Variable	**%**	**N**
Smoking?		
Yes	11.5	136
No	88.5	1042
Total		**1178**
Alcohol consumption		
Yes	17.3	204
No	82.7	974
Total		**1178**
Poor physical activity		
Yes	48.9	576
No	51.1	602
Total		**1147**
Fruit and vegetable intake?		
Poor fruit/vegetable intake	82.5	1045
Sufficient intake	17.5	133
Total		**1178**
Overweight/Obesity		
Yes	41.4	462
No	58.6	654
Total		**1116**
Multiple risk factors		
No risk factor	28.0	330
Single risk factor	41.9	494
Multiple risk factors	30.1	354
Total		**1178**

Tobacco smoking in the study population was estimated at 11.5%. Since this figure represents active smokers and not passive (second smokers) it is a misrepresentation of the effects of tobacco smoking in the general population. Evidence suggests that about 10% of the deaths due to tobacco consumption derive from second-hand smoking (WHO, 2014b). This is very indicative, considering that an estimated 6 million people die annually from tobacco use, and of this total, over 600 000 deaths are due to exposure to second-hand smoke (WHO, 2014b). Botswana has relevant laws and regulations relating to tobacco, which warn people about the dangers of tobacco use; enforce bans on tobacco advertising, promotion and sponsorship; and raising tobacco taxes. The main law on the control of tobacco consumption is the Control of Smoking Act (1992). Although this acts prohibits people who smoke tobacco to smoke in public places, spaces, and private places there has been minimal enforcements to protect non-smokers from exposure to tobacco.

Generally efforts to reduce the effects of current tobacco use in persons aged 15+ years by 30% as envisaged by WHO Global Target for Reduction of Tobacco Smoking (2014) are underway in Botswana. Substantial progress has been made in global tobacco control in recent years, in both the increase in the number of countries protecting their population and the number of people worldwide protected by effective tobacco-control measures (WHO, 2014b). According to the same report (WHO, 2014b), in 2013, 95 countries had implemented at least one of the four tobacco control "best-buy" interventions (very cost-effective interventions), at the highest level of achievement, and two countries had all four "best-buys" in place at the highest level and majority of this countries were found in LMICs. Botswana is still yet to expand activities to implement "best-buy" demand-reduction measures at the highest level of achievement, where they have not been yet implemented; reinforcing and sustaining existing programmes to incorporate a full range of measures; and, ultimately, implementing the full WHO Framework Convention on Tobacco Control.

Prevalence of poor physical activity was also high in the study population with 48.9% of respondents indicating that they do not do any moderate to rigorous-intensity sports, physical fitness or recreational activities that cause increases in breathing. Currently Botswana has undergone rapid sociocultural developments and urbanization which has led to the replacement of an economy based on manual labor (agriculture), to one dominated by industry and mechanized manufacturing. This has resulted to changes in habitual and occupational physical activity from high energy expenditures (e.g. active transport or walking, manual labor activities especially in agriculture) to sedentary behaviors (such as motorized transport, office work). Consequently, this has led to transition to lower levels of physical activity in Botswana which has ultimately resulted in the increase in preventable NCDs and overweight/obesity.

The need for efforts to curtail high physical inactivity levels in the population derive from the fact that according to the WHO (2014a) insufficient physical activity contributes to 3.2 million deaths and 69.3 million Disability Adjusted Life Years (DALYs) each year. It also suggests that adults who are insufficiently physically active have a higher risk of all-cause mortality compared with those who do at least 150 minutes of moderate-intensity physical activity per week, or equivalent, as recommended by WHO. Since regular physical activity reduces the risks of chronic conditions such as ischaemic heart disease, stroke, diabetes, and breast and colon cancer the government of Botswana has to set up physical activity targets, which incorporates multi-sectoral collaboration between transport, urban planning, recreation, and sports and education departments, to create safe environments that are conducive to physical activity for all age groups. There is need to create a culture that imbibes physical activity in the population.

Poor fruit and vegetable consumption was estimated at 82.5% in the study population. This was calculated based on the general recommendation by the WHO panel on diet, nutrition and chronic disease prevention that considers poor fruit/vegetables intake as having less than 5 servings of fruits and vegetables in a week. This high prevalence rate of poor fruit and vegetable consumption is not coincidental because globally it has been estimated that over 75% of the population does not take sufficient fruits and vegetables (Msambichaka, Eze, Ramadhani et al. 2018). A daily intake of sufficient fruits and vegetables is recommended by WHO (2008a) for protection against almost all major NCDs because fruits and vegetables have vitamins which singly or collectively protects the body against both NCDs and communicable diseases. This study, unlike the Botswana 2014 STEPS survey does not only provide information on the magnitude of poor fruit and vegetable consumption in the population, but allows for better characterization of fruit and vegetable consumption and assesses susceptibility factors to poor fruit and vegetable consumption.

Botswana like many other countries in SSA does not have food based dietary guidelines on how much fruits and vegetables can be consumed. This is notable because people can only act in favor of good health if they are aware, are convinced and know how to act based on the information provided to them. Traditionally, people in Botswana are non-vegetarian. Since poor fruit and vegetable consumption is associated with mortality and morbidity worldwide, fruits and vegetables as part of the daily diet could help prevent major NCDs and mortality. Moreover, eating a variety of vegetables and fruits clearly ensures an adequate intake of most micronutrients, dietary fibres and a host of essential non-nutrient substances.

Prevalence of overweight/obesity was estimated at 41.4% in the study population. Prevalence rate for overweight/obesity has increased between 2008 (Botswana STEPs survey) and 2016, from 29.9% to 41.4%, respectively. This is an 11.5% increase over a period of 9 years. Increasing prevalence of overweight/obesity in the population increases the likelihood of NCDs such as diabetes, hypertension, coronary heart disease, stroke and certain types of cancer. Similarly, it has been observed that worldwide, the prevalence of obesity has almost doubled since 1980 (WHO, 2014a; Monteiro, Moura, Conde *et al*. 2004; Zienczuk and

Egeland, 2012; Canter and Caballero 2012). In 2016, more than 1.9 billion adults, 18 years and older, were overweight (Canter and Caballero 2012). Of these over 650 million were obese (ibid, 2012).

Prevalence of overweight/obesity in the Botswana connotes changing nutrition patterns and effects of urbanization and changing lifestyles the population is experiencing. Furthermore, there are various socio-cultural dynamics responsible for excess weight gain and these different dynamics drive differences in food consumption with more and more people inclined towards sugar and fast foods. In Botswana, acculturation, through complex sociocultural pathways, has been observed to affect weight gain among both men and women and has had an even greater impact on the physical activity levels of women (Sober, 2001). For example, Letamo (2011) and Shaibu, Holsten, Stettler et al. (2012) opines that in Botswana cultural values consider large body size as a sign of wealth, healthfulness, or prosperity. This is consistent with findings by BeLue, Francis, Rollins, *et al.* (2009) that in SSA being overweight/obese could be perceived as being rich in males or sexually attractive in females.

Meanwhile, being overweight/obesity among Black South Africans is associated with attractiveness, physical wellbeing, happiness, respect, dignity; affluence (Phaswana-Mafuya, Peltzer, Chirinda *et al.* 2013). This emphasizes the need for taking into account socio-cultural issues in NCD health promotion interventions. There is need to address contextual factors such as the weak physical activity education, lack of conducive infrastructure, and lack of access to facilities that prevent people from engaging in physical activity when designing healthy lifestyle programmes to ensure their effectiveness in order to reduce the continued increase in prevalence of overweight/obesity.

Prevalence of multiple risk factors for NCDs was fairly high in the sampled population; with about 30% in the population reporting multiple risk factors for NCDs. Evidence of clustering of risk factors for NCDs in the population is important to identify populations with a higher risk for the development of NCDs. Previous research on NCDs has shown evidence of NCD risk factors clustering (Bobo & Husten 2000; Grant, Hasin, Chou *et al.* 2004; Nunes, Gonçalves, Vieira, *et al.* 2016) in countries experiencing demographic, nutrition and epidemiologic transitions like Botswana. For instance, Bobo and Husten (2000) opined that since alcohol and tobacco are often used together, people who smoke are much more likely to drink, and people who drink are much more likely to smoke.

It has also been observed that dependence on alcohol and tobacco is correlated: In the US for instance people who are dependent on alcohol are three times more likely than those in the general population to be smokers, and people who are dependent on tobacco are four times more likely than the general population to be dependent on alcohol (Grant, Hasin and Chou, 2004). A recent study by Nunes, Gonçalves, Vieira *et al.* (2016) in Brazil found that the clustering of two, three, four, and five risk factors were found in 22.2%, 49.3%, 21.7% and 3.1% of the population, respectively.

4.4 Prevalence of NCDs in the Study Population

In 2011 United Nations (UN) political declaration reaffirmed that reducing the global burden of NCDs is an overriding priority and a necessary condition for sustainable development (United Nations, 2011). It was estimated in 2012 that globally NCDs account for the 68% per cent (38 million) of the all deaths (56 million). Of all the deaths due to NCDs it was estimated that almost three quarters of deaths (28 million), occur in LMICs (WHO, 2014). It had been projected that the deaths from infectious diseases would decline and the NCD deaths would increase in the future (Mathers and Loncar, 2006). Botswana as a country is experiencing an increase in the burden of NCDs, which is mainly attributable to life style changes and rapid urbanization.

The NCD survey collected a range of information on NCDs to estimate prevalence of NCDs in Botswana and their intervention for treatment. Unlike the 2007 STEPS survey which only collected data on the two most common NCDs in Botswana; hypertension, and diabetes for the NCDs study, data collection was extended to other NCDs classified by WHO (ICD-10) as chronic conditions through self-reporting. Although limitations of using self-reports such as underreporting or poor reporting have been emphasised, in the case of Botswana self-reporting has been used in previous studies and robust conclusions drawn because Botswana has comparatively high level of adult literacy (90%) (Ministry of Education and Skills Development, 2015). Burdens of multi-morbidities are also presented, that is occurrence of more than one chronic conditions. Moreover, descriptive analysis of preventive health measures such as screening of cervical and breast cancer have been done in this section.

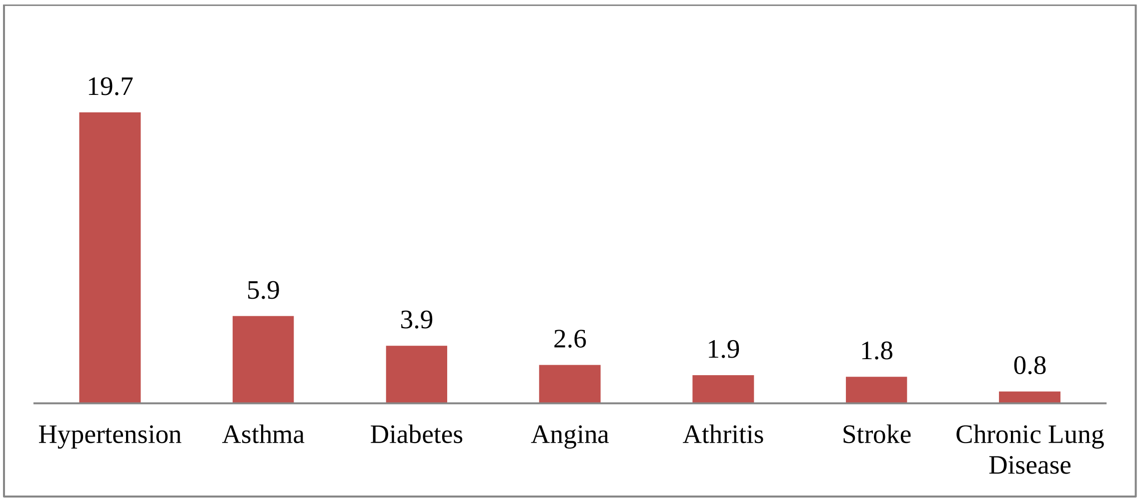
4.4.1 Single NCD conditions

Figure 4.1 below shows the prevalence of NCDs in the study population according to the highest order of prevalence; Prevalence rate for hypertension (19.7%) was found to be higher than for all NCDs in 2016. Hypertension is one of the most important risk factors of cardiovascular diseases as well as other chronic diseases and therefore increase in its prevalence causes significant burden to families.

The increase in prevalence of hypertension over the years in Botswana converges with the global increase of hypertension in the adult population. According to the Global Burden of Disease-2015 analysis, the estimated rate of annual deaths associated with systolic blood pressure (SBP) of at least 110–115 mm Hg between 1990 and 2015 has increased from 135.6

to 145.2 per 100 000 persons (Forouzanfar , Liu, Roth , *et al.* 2017). For Botswana there are several factors, influencing the observed increase in prevalence of hypertension. First, the major risk factors considered to be associated with hypertension such as daily smoking, alcohol consumption, poor fruit and vegetable consumption, lack of physical activity and overweight/obesity are also on the increase. Secondly, stressful events associated with demanding jobs, unemployment and aging may be associated with increasing levels of hypertension in Botswana (Keetile, Letamo and Navaneetham, 2015).

Figure 4. 1: Percentage distribution of self-reported prevalence of NCDs in the study population, 2016.



Source: Computed from NCD survey data, 2016

It was noted that 5.9% of the population reported having been diagnosed with asthma. This is consistent with the systematic analysis of asthma prevalence by Adeloye, Chan, Rudan *et al.* (2013) who concluded that there has been an increasing prevalence of asthma in Africa over the past two decades. On the other hand, the WHO (2011a) report indicated that about 300 million people have asthma globally, and current trends suggest that an additional 100 million people may be living with asthma by 2025. Just like with other chronic diseases in Botswana, the fast rate of urbanization and industrialization can be linked to the increase in the burden of asthma and other allergic diseases. Environmental factors such as exposure to various allergens, irritants, industrial pollutants, and particulate matter (such as from road traffic) are implicated in Botswana (Ministry of Health and Wellness, 2011). Poverty is possibly one of the indirect causes of asthma probably through increased exposure to environmental and psychosocial risk factors. The findings of this study necessitate the government to come with effective interventions to curb increase in asthma prevalence.

The common type of diabetes in Botswana is type 2 diabetes mellitus (Ministry of Health, 2008). It was found that in the sampled population prevalence of diabetes was 3.9% in 2016. This indicates an increase of diabetes by two times since the 2007 STEPs survey (Ministry of Health, 2008). This increase follows the global trend of the increase in prevalence rate for diabetes. Projections have shown that the number of people with diabetes will increase to 300 million by 2025 and 366 million by 2030 from 171 million in 2000 globally (Animaw and Seyoum, 2017) and that much of these numerical increments will occur in developing countries (Campbell, 2009) such as Botswana.

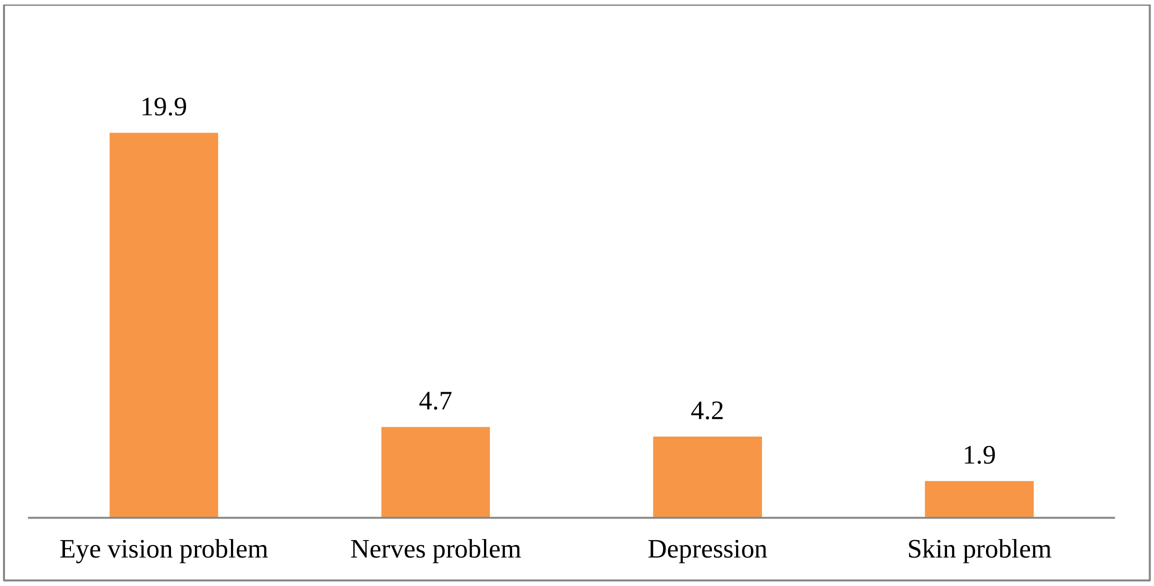
Although studies around the world have reported relatively higher level in the prevalence of diabetes mellitus than Botswana, the concern for increasing prevalence signals the need for urgent action. Countries which are experiencing health transition like Botswana such as Guatemala (8.4%), Korea (15.3 %) and Kenya (4.5%) have higher prevalence rates (Animaw and Seyoum, 2017). Although diabetes prevalence rates in Botswana are lower than for most countries undergoing demographic transition, there is need for focussed intervention efforts to lower current prevalence rates. There is need to focus attention on reducing the consumption of calorie-dense foods, sedentary lifestyle, and tobacco consumption. There is need for more focus and consideration of other factors that have been observed to exacerbate diabetes mellitus such as aging, family history of diabetes and use of antiretroviral medications.

4.4.2 Other NCD Conditions

The WHO classifies NCD conditions more than what has been discussed above, and in this study an attempt has been made to estimate the prevalence of other-NCDs. Unlike previous studies in the country, this study collected data on many other NCD conditions as classified by WHO. This was undertaken in order to establish their magnitude and provide baseline evidence for their existence in the population.

Other-NCDs include conditions such as eye-vision problem, nerves problem, skin problem and depression. The respondents were asked the question, "During the past 12 months have you been told by a doctor or other health workers that you have/had or suffered from the following problems/conditions?". These were (a) eye vision (like cataract, retinopathy) (b) nerves problem (c) skin problem (d) depression (loneliness, suicidal attempt, no close friends etc.).

Figure 4. 2: Self-reported prevalence of other-NCD conditions, NCD study 2016



Source: Computed from NCD survey data, 2016

Figure 4.2 shows self-reported prevalence of other selected NCDs. Results indicate that prevalence of eye vision problem was at 19.9% (n=235), nerves problem (4.7%, n=55), skin problem (1.9%, n=22) and depression (4.2%,n=50). Many of the non-communicable diseases coexist leading to major health problems. To understand the multi-morbidity in the context of Botswana, the number of health conditions among respondents were analysed by background characteristics. It was observed that about one fifth (19.1%, n=235) of the population in the NCD study had at least single NCD condition while 5.5% reported that they had two or more NCD conditions.

The screening for the early detection of cervical and breast malignancy is useful to diagnosis at early stage of the disease and if diagnosed early, it may result in a complete cure or improved long term survival. Overall 62% (n=269) of women in the sample reported that they had done pap smear test prior to the NCD survey. It was observed that compared to cervical cancer screening little proportion of women did breast screening. Only 6% of women reported that they did breast cancer screening in the previous year.

It was observed that conditions such as angina (2.6%), arthritis (1.9%), stroke (1.8%) and chronic lung disease (0.8%) were prevalent in the population. Although the proportion of population susceptible to these conditions was relatively low, existence of these conditions calls for immediate prevention actions. Conditions such as eye vision problem (19.9%), Nerves problem (4.7%), skin problem (1.9%) and depression (4.8%) were also prevalent in the population. These finding is quite indicative because it generally shows that NCDs are more prevalent in the population much more than they had earlier been perceived. It may also mean that these NCDs coexist leading to major health problems.

4.5 Summary of Key Results

The key modifiable behavioural risk factors like smoking, poor fruit and vegetable consumption, poor physical activity, and alcohol consumption, which in turn lead to overweight/obesity, raised blood pressure, and other-NCDs, were observed to be high in the sampled population. Of these behavioural risk factors the most prevalent was poor fruit and vegetable consumption while the least prevalent was smoking. The high prevalence levels of these health-damaging behaviours disproportionately predispose the population to NCDs.

It was found that hypertension was the most prevalent NCD condition, with one-in-five people reporting to have been diagnosed with high blood pressure. The least prevalent condition was chronic lung disease. Meanwhile other NCDs such as asthma, diabetes, angina, stroke, arthritis, eye/vision problem, nerves problem, depression and skin problem were also found to be prevalent in the sampled population. The observed patterns of NCDs and their risk factors in Botswana can be blamed on the rapid and unplanned urbanisation and modernization resulting in socioeconomic and behavioural changes in people.

Findings from this chapter suggest important policy implications for policy makers to improve participation rates and to further reduce the prevalence rates of NCDs. Moreover, these findings provide important information that can be used to improve screening and care through medical evaluation to detect and manage NCDs. In order to improve screening participation rates for NCDs a primary health care intervention such as an organized program of screening needs to be strengthened. This can be done by monitoring how public health policies impact on participation rates over time, by expanding the scope of free NCD examinations.

CHAPTER 5: LEVELS, PATTERNS AND CORRELATES OF RISK FACTORS FOR NCDS

5.1 Introduction

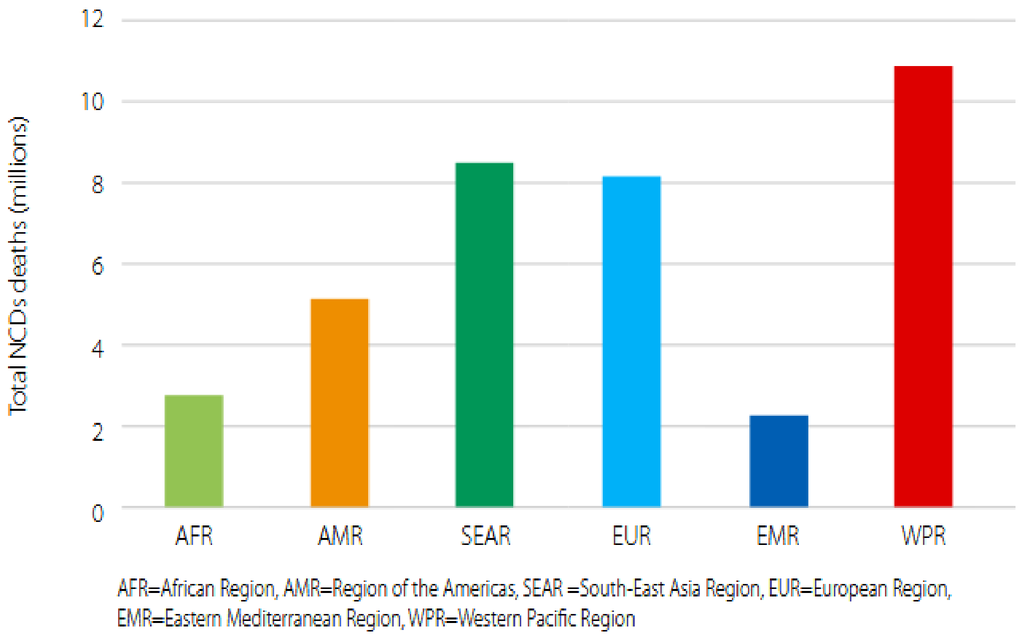
Majority of countries are experiencing an increase in risk factors for NCDs, which prevails in all age groups, among poor and rich people and also men and women (Beaglehole, Bonita, Horton *et al.* 2011). Available evidence reveal that NCDs are the leading cause of death globally, and are responsible for over 38 million (68%) of the world's 56 million deaths (WHO, 2014a). More than 40% (16 million) were premature deaths under age 70 years. Meanwhile, almost three quarters of all NCD deaths (28 million) and the majority of premature deaths (82%), occur in LMICs (WHO, 2014a).

Most NCDs share common risk factors, which are often categorised as behavioural or biological (Hoy, Rao, Nhung *et al.* 2013). Tobacco use, excessive alcohol consumption, an unhealthy diet and physical inactivity have been noted as key behavioural risk factors which contribute to the development of NCDs (Hunter and Reddy, 2013). These behavioral risk factors lead further to metabolic or physiological changes including overweight/obesity and raised blood pressure.

Figure 5.1 below shows that total deaths due to NCDs were relatively low in the Africa region, compared to other regions in 2014. However; the largest increase is expected in the African region where communicable diseases are still the leading cause of mortality in most countries (WHO, 2013). On the other hand the annual number of deaths due to infectious disease is projected to decline, while the total annual number of NCD deaths is projected to increase to 52 million by 2030 (WHO,2013).

The global leading causes of NCD deaths include: cardiovascular diseases (17.5 million deaths or 46.2% of NCD deaths), cancers (8.2 million, or 21.7% of NCD deaths), respiratory diseases, including asthma and chronic obstructive pulmonary disease (4.0 million, or 10.7% of NCD deaths) and diabetes (1.5 million, or 4% of NCD deaths) (WHO, 2014). Thus, these four major NCDs were responsible for 82% of NCD deaths.

Figure 5.1: Total NCD deaths, by WHO region, Comparable estimates, 2012



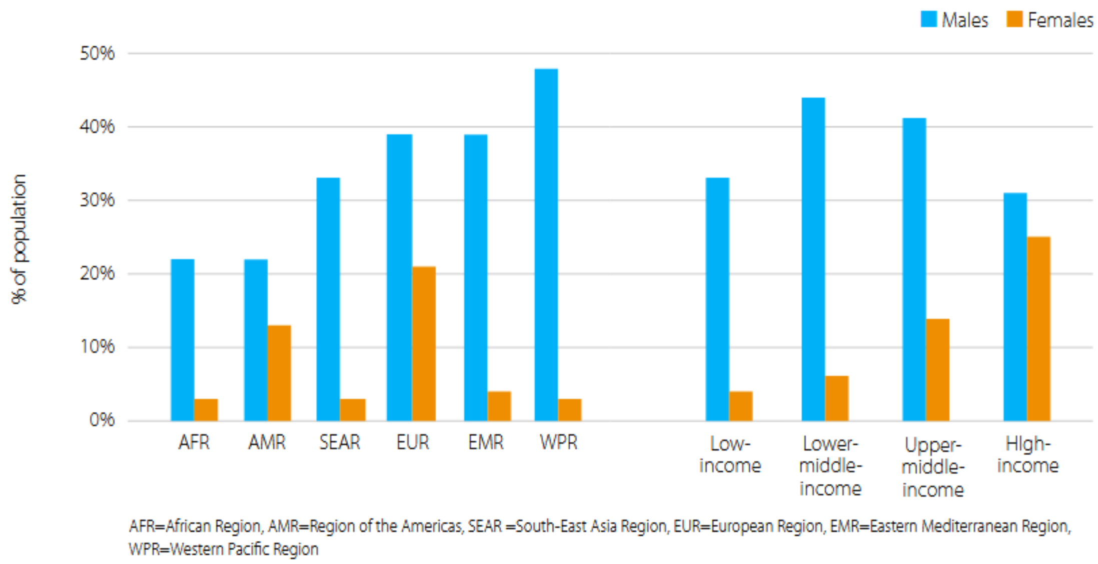
Source: World Health Organization, 2014a.

Generally there has been a global increase in risk factors for NCDs (WHO, 2014b). It has been noted that in 2012 there were some 1.1 billion smokers worldwide, with over 8 out of 10 tobacco smokers smoking daily (WHO, 2014b). Manufactured cigarettes, the most common form of smoked tobacco, are used by over 90% of current smokers. In addition, tobacco is smoked in cigars, pipes and other forms, particularly hookahs and bidis in Africa, Asia and the Middle East.

In some countries the consumption of smokeless tobacco is as high, or higher than smoked forms of tobacco (WHO, 2014b). Consequently, it has been noted that the direct consumption of tobacco and exposure to second-hand smoke are attributable to about 6 million deaths every year in the world and deaths are estimated to rise further to 7.5 million by 2020, accounting for 10% of all deaths in that year. It has also been suggested that roughly 71% of all lung cancer deaths, 42% of chronic respiratory diseases and 10% of cardiovascular diseases are caused by smoking (WHO, 2014b).

Figure 5.2 below shows the age-standardized prevalence of current tobacco smoking in persons aged 15 years and over, and the global prevalence of current tobacco smoking among adults was estimated at around 22%, with smoking rates varying widely across regions. The highest regional average rate for tobacco smoking was 30% (in the WHO European Region) while the lowest rate was 12% in the African Region, although it is projected to increase rapidly.

Figure 5.2: Age standardized prevalence of current tobacco smoking in persons aged 15 years and over, by WHO region and World Bank income group, comparable estimates, 2012



Source: World Health Organization, 2014b

Prevalence of smoking varies widely across Sub-Saharan Africa and even between similar country regions, but is always higher among men (Brathwaite, Addo, Smeeth, *et al.* 2015) than women (Brathwaite, Addo, Smeeth, *et al.* 2015). High smoking prevalence rates have particularly been observed to be high among countries in the eastern and southern regions of

Africa, mainly among men in Ethiopia (21.6%), Malawi (25.9%), Rwanda (20.9%), and Zambia (22.4%) (Brathwaite, Addo, Smeeth, *et al.* 2015).

Alcohol consumption is also largely attributable to premature mortality and disabilities worldwide. For example, according to WHO (2014b) there is an alarming increase in the global statistics of alcohol abuse with approximately 3.3 million deaths associated with alcohol abuse every year. It is suggested that alcohol abuse causes 5.1% of the global burden of disease. Consequently, more than half of the deaths due to alcohol consumption have resulted from NCDs – mostly cardiovascular diseases and diabetes (33.4%), cancers (12.5%) and gastrointestinal diseases, including liver cirrhosis (16.2%) (WHO, 2014a).

Cardiovascular diseases, cancers and gastrointestinal diseases (largely due to liver cirrhosis) are reported to be responsible for more than one third (37.7%) of this burden (WHO, 2014a). Given that the population is growing worldwide and that alcohol consumption is predicted to increase, the alcohol-attributable disease burden as well as the social and economic burden may increase further unless effective prevention policies and measures based on the best practices are implemented worldwide.

Several studies have also identified overweight/obesity as a key risk factor for several NCDs (WHO, 2014b; Nishida, Borghi, Branca *et al.* 2015; Agyemang, Boatemaa, Frempong et al. 2015). The worldwide prevalence of obesity nearly doubled between 1980 (6.4%) and 2014 (12.9%) (Nishida, Borghi, Branca *et al.* 2015). In 2014 prevalence of overweight/obesity, was 39% (38% of men and 40% of women) among adults aged 18 years and older (WHO, 2014b). This figure translates to more than half a billion adults worldwide classified as overweight or obese.

Considering regional variations in prevalence of overweight/obesity, the WHO (2014a) has reported that the prevalence of overweight/obesity is highest in the Americas (61%

overweight or obese in both sexes, and 27% obese) and lowest in the South-East Asia Region (22% overweight in both sexes, and 5% obese). For European and Eastern Mediterranean over 50% of women were reported to be overweight. In all three regions roughly half of overweight women are obese (25% in the European region, 24% in the Eastern Mediterranean, 30% in the Americas). It was also found that overweight/obesity rates are increasing in the Africa region, with Southern African region being the most affected (Agyemang, Boatamaa, Frempong *et al.* 2015). The rate of overweight/obesity was found to be higher among women than among men and in urban areas compared to rural areas while SES, age, parity, marital status, physical inactivity, body weight perceptions, and increased energy were noted to be powerful predictors of overweight/obesity in sub-Saharan Africa.

The WHO has long raised concern for low fruit and vegetable consumption (WHO, 2003). In 2012 it was reported that globally there were over 1.7 million deaths due to poor fruit and vegetable intake. 2.8% of these deaths were attributable to low fruit and vegetable (fruit and vegetable) intake which accounted for 1% of total DALYs (WHO, 2014b). More recent evidence indicates that in 2013, an estimated 5.2 million deaths worldwide were attributable to inadequate fruit and vegetable consumption[10].

Similarly, it has been estimated that globally 14% of gastrointestinal cancer deaths, nearly 11% of ischaemic heart disease deaths and about 9% of stroke deaths are caused by low intake of fruit and vegetable (WHO, 2014b). Including fruits and vegetables as part of the daily diet is vital since it reduces the risk of some NCDs including cardiovascular diseases and certain types of cancer.

Available evidence suggests that when consumed as part of a healthy diet low in fat, sugars and salt/sodium, fruits and vegetables may also help to prevent weight gain and reduce the risk of obesity, an independent risk-factor for NCDs (Nishida, Borghi, Branca *et al.* 2015).

[10] http://www.who.int/elena/titles/fruit_vegetables_ncds/en/

Empirical evidence has shown that poor physical activity increases the risk of many adverse health conditions, including the world's major NCDs such as hypertension, type 2 diabetes, and breast and colon cancers, and shortens life expectancy (Lee, Shiroma, Lobelo *et al.* 2012). This is because much of the world's population is physically inactive, which presents a major public health problem. Meanwhile, it has been found that insufficient physical activity can increase the risk of all-cause mortality by 20–30% (WHO, 2014). Moreover, physical inactivity can cause about 30% of ischaemic heart disease burden, 27% of diabetes and around 21–25% breast and colon cancer burden (WHO 2009a). Given that physical inactivity has been identified as the fourth leading risk factor for global mortality (6% of deaths globally) there is need for evidence on physical activity levels in LMICs in the impending burden of NCDs (WHO, 2014b).

Most diseases are caused by multiple risk factors and multi causality indicates that a range of interventions can be applied for disease prevention (ed. Ezzatti, Lopez, Rodgers *et al.* 2004). People with multiple health behaviour risks have the highest risks for NCDs, disability and premature death (Prochaska, 2008). Furthermore, health risk behaviours discussed above such as smoking, alcohol abuse, physical inactivity and poor diet often co-occur (Prochaska, Norcross and DiClemente, 2010).

Consequently, the clustering of these risk factors often leads to multiple NCD conditions (Drieskens, Van Oyen, Demarest, *et al.* 2010). Meanwhile, research evidence on multiple behavioural risk factors categorises them using two major approaches in respect to analytical techniques: co-occurrence and clustering (McCartney, Collins, Mackenzie *et al.* 2013). However, there is little difference in terms of the meanings of the two terms hence they are often used interchangeably. They both mean the existence of more than one NCD risk factors in one individual (McCartney, Collins, Mackenzie *et al.* 2013).

Available literature shows that the prevalence of NCD risk factors vary across the world. For instance, it was found that approximately 7.5% in the Belgian study (Drieskens, Van Oyen, Demarest, *et al.* 2010), 17% of the sample in the USA (Fine, Philongene, Gramling *et al.* 2004), 20% of the Dutch respondents (Schuit, van Loon, Tijhuis *et al.* 2002), 55% in the Scottish study (Lawder, Harding, Stockton *et al.* 2010), and about 70% of the largely rural populations in five Asian countries (Ahmed, Hadi, Razzaque, *et al.* 2009) had three or more behavioral risk factors (Ahmed, Hadi, Razzaque, *et al.* 2009).

Prevalence of different behavioral combinations is presented by all possible co-occurring patterns of included behaviours in the above studies. Lawder, Harding, Stockton, *et al.* (2010) examined five risky behaviours and among them diet low in fruit and vegetables had the highest prevalence. Lawder, Harding, Stockton, *et al.* (2010) further noted that people had two and more co-occurring risk factors; the most common combinations were 'diet low in fruit and vegetables and physically inactivity', 'diet low in fruit and vegetables, physically inactive and high BMI', and 'diet low in fruit and vegetables, physically inactive, high BMI and smoking'. Similarly, these co-occurring patterns had been previously observed by Fine, Philongene, Gramling *et al.* (2004) and Schuit, van Loon, Tijhuis *et al.* (2002).

Socioeconomic and behavioral factors have been recognized as one of the main explanations for health inequalities (Smith, Bartley and Blane, 1990; Macintyre 1997). It has been observed that substantial part of educational differences in health is attributed to various health behaviours (Laaksonen, Talala, Martelin *et al.* 2008; Perlman and Bobak 2008). Thus, the adoption of risky health behaviours tends to shift from people of higher to lower socioeconomic strata.

This comes about as countries develop more with higher socioeconomic groups adopting early new behaviours and discarding them rather quickly upon learning of the related health consequences. Meanwhile, lower socioeconomic groups are more inclined to take up these behaviours later (See, Blakely, Hunt and Woodward, 2005 for instance).

More insight into socioeconomic inequalities in risk factors for NCDs is important not only for descriptive purposes, but also for providing an understanding into the factors likely to contribute to these inequalities. This chapter presents levels, patterns and correlates of NCD risk factors. This would contribute to understanding of the factors leading to prevalence of risk factors among different socioeconomic groups. This understanding will further provide an insight into the extent of the burden of risk factors for NCDs in Botswana and is crucial for effective advocacy and action. Subsequent analysis shows levels, patterns and correlates of smoking.

5.2 Levels, Patterns and Correlates of Smoking

5.2.1. Levels and Patterns of Smoking

It has been observed from results in table 5.1 below that overall smoking prevalence was estimated at 11.6% (18.4% among men and 8.5% among women). This is relatively low compared to prevalence rates in other Sub Saharan Africa countries. For example, smoking prevalence in countries such as South Africa (15%), Ethiopia (18.1%), Malawi (26%), Rwanda (21.8%) and Zambia (17.1%) are relatively higher (Brathwaite, Addo, Smeeth *et al.* 2015; Owolabi, Goon, Adeniyi *et al.* 2017). This comparatively low prevalence rate for smoking in Botswana can be attributed to rigorous campaigns (including tobacco advertising ban) against tobacco consumption.

The Government of Botswana (GoB) has long recognized and accepted the need to sensitize its population to the harmful effects of tobacco as early as the 1970s (Mbongwe, 2004). Since the first commemoration of the World No Tobacco Day in 1988, there has been an intensive anti-tobacco campaign in the country. Rigorous campaigns with other educational programmes aimed at different sectors of the population and the general public, have contributed to sensitizing the general public about tobacco products harmful effects on human health and fostered a positive political climate (WHO, 2011a).

Significant gender differential in smoking (18.4% in men and 8.5% in women) observed in the sample is consistent with findings from other studies in SSA, which found that smoking prevalence rates tend to be consistently higher among men than women (Owusu-Dabo, Lewis, McNeill *et al.* 2009; Msyamboza, Ngwira, Dzowela *et al.* 2011; John, Mamudu and Liber, 2012; Nuwaha and Musinguzi, 2013). While biomedical literature posits that the lower consumption of tobacco among women may be related to gender differences in motivations for smoking (Allen, Oncken and Hatsukami, 2014; Vogel, Hertsgaard, Dermody, *et al.* 2014; Allen, Scheuermann, Nollen *et al.* 2016), psychological literature suggests that gender differences in tobacco consumption are mainly due to different behaviour, having its roots in traditional sex roles (Yen, 2005; Göhlmann 2006). The latter seems to be relevant to Botswana context where general characteristics of traditional sex roles lead to social pressure against female smoking. Moreover, traditional sex role norms cause differences in personal characteristics leading to more or less acceptance of smoking among men than women.

It was found that prevalence of smoking was highest (18.7%) among older adults (55-64 years) than other age groups. Similar findings have also been observed in Indonesia, where smoking prevalence rates were highest among older adults than among adolescents and middle aged adults (Lim, Jasvindar, Cheong *et al.* 2016). Many older adults in Botswana may have begun to smoke at a time when it was more socially acceptable, considered glamorous and good for mood and less was known about the health risks of smoking. Ultimately, they may find it difficult to imagine living without smoking or it could be that they believe that they are already so irreversibly damaged by smoking that quitting would accomplish no purpose. Meanwhile, studies have shown that elderly smokers when compared to young smokers have higher risk of developing diseases related to smoking because they tend to be exposed longer and more intensely to tobacco (WHO, 2011a; Lugo, La Vecchia, Boccia *et al.* 2013; Edwards, Carter, Peace *et al.* 2013). The effects of smoking, combined with clustering of other risk factors such as poor physical activity, and overweight/obesity combined with effects of aging puts older adults at an increased risk of multiple NCDs.

Residential differences in smoking were observed in the population, with high prevalence rates noted in rural areas (17.7%). Similar findings have been observed in India (Neufeld, Peters, Rani *et al.* 2005; Chockalingam, Vedhachalam, Rangasamy *et al.* 2013) and Zambia (Brathwaite, Addo, Smeeth *et al.* 2015), with a significantly higher prevalence in rural compared to semi urban and urban areas. In the context of Botswana, high prevalence of smoking in rural areas can be linked with relatively low education levels and limited access to health promotion information. Moreover, rural residents have less access to disease prevention services, making rural populations extremely vulnerable to tobacco consumption.

Table 5.1: Prevalence of smoking by socioeconomic characteristics of the study population

Variable	**%**	**N**	**p-value**
Sex			0.000**
Male	18.4	364	
Female	8.5	813	
Age			0.001**
≤24	2.6	270	
25-34	8.9	302	
35-44	10.2	196	
45-54	11.5	130	
55-64	18.7	75	
65+	16.0	50	
Marital status			0.001**
Never-married	10.9	864	
Currently-married	9.0	199	
Formerly-married	22.2	108	
Education			0.000**
Primary or less	20.0	410	
Secondary	6.0	514	
Tertiary or higher	7.8	230	
Residence			0.001**
Cities and towns	7.9	355	
Urban villages	10.7	534	
Rural villages	17.7	288	
Work status			0.000**
Public sector	4.1	122	
Private sector	11.5	182	
self-employed	19.2	130	
Not employed	13.8	436	
Home-maker/student	4.6	218	
Retired/other	16.2	74	
Wealth status			0.000**
Lowest	23.9	234	
Second	12.7	237	
Middle	8.5	235	
Fourth	6.8	237	
Highest	6.0	235	
Overall	**11.6**	**1178**	

Notes: **Statistically significant at 5%.

Smoking tobacco also appears to be driven by socio-economic factors, such as wealth and education. Other than sex, age and residence, this study found that prevalence of smoking was associated with poor wealth status (23.9% among the poorest) and low education (20% in primary education level). A recent study in South Africa by Teare, Naicke, Albers *et al.* (2018) also found that smoking prevalence rates were highest among the poor. Similarly, Pampel (2008) using population-based data from 16 Demographic Health Surveys (DHS) found that tobacco use in SSA was more prevalent among low education populations. This suggests that higher SES seems to have a protective effect against tobacco smoking. Consequently individuals with higher education and wealth status are exposed to disease prevention services and sufficient access to health promotion information compared to the poor and less educated.

5.2.2 Correlates of Smoking Behaviour: Logistic Regression Analysis

Table 5.2 shows logistic regression results for the socioeconomic determinants of smoking in the study population. Results are presented in two models; Model I is an unadjusted model showing the association between each socioeconomic variable and NCD risk factors; smoking, alcohol consumption, poor fruit/vegetable, poor physical activity, and overweight/obesity, Model II is an adjusted model showing the association between socioeconomic variables and NCD risk factors in the study population controlling the covariates. Results for unadjusted model are presented as unadjusted odds ratios (UOR), while for the adjusted model as adjusted odds ratios (AOR).

In the logistic regression anaysis, both the crude and adjusted models show that females were less likely to be smokers than males although there is a decline in the odds ratios in the adjusted model (UOR=0.41, 95% C.I. =0.28-0.59 and AOR= 0.16, 95% C.I. =0.09-0.28, respectively). This indicates that even after controlling for age, marital status, work status, place of residence and wealth status, sex still remains a significant determinant of smoking. Gender differences in smoking may be due to a combination of physiological, behavioral and cultural factors (Rahman, Hann, Wilson, et al. 2015).

Of the three factors, cultural factors through traditional sex roles may offer a plausible explanation for the observed gender variations in smoking in the context of Botswana. Traditional gender roles have led to social pressure and non-tolerance of female smoking in Botswana. Social norms that influence who smokes and how, where, and when are deeply entrenched in the Tswana culture. As a result aspects of individual identity and alignment with femininity or masculinity (smoking as “feminine rebellion” or “masculine cool”) determine smoking behaviour of men and women. Women who smoke are seen as unfeminine while constructs of masculinity (such as ideals of risk-taking, neglect of self-health, and strength and toughness smoke) encourage smoking among men.

After adjusting for confounding variables (sex, residence, education, wealth status and work status), the odds of smoking was highest in ages 55-64 years (AOR=13.6, 95% C.I. = 3.88-47.8) than among respondents aged ≤24 years. This finding corroborates evidence from studies in Italy (Gallus and La Vecchia, 2004; Gallus, Pacifici, Colombo et al. 2005) Germany (John, Meyer, Hapke et al. 2003], Brazil (Jeremias, Chatkin, Chatkin et al. 2012), South Africa (Owolabi, Goon, Adeniyi et al. 2017) and Zambia (Brathwaite, Addo, Smeeth et al. 2015) which also found that the odds of smoking were highest among older adults, than adolescents and middle aged adults.

However, it should be noted that adult smoking observed in the data does not suggest that adults started smoking during adulthood. This population may have begun to smoke during their adolescence, at a time when it was more socially acceptable and glamorous to smoke and less was known about the health risks of smoking. Cumulative effects of smoking during late adulthood may predispose this adult population to tobacco-caused diseases (Lugo, La Vecchia, Boccia et al. 2013).

Significant association was observed between education, marital status, place of residence and smoking in the unadjusted models. However, the effect of these variables on smoking diminished with the introduction of control variables in the adjusted model. This indicates that the relationship between smoking and education, marital status and place of residence was spurious. On the other hand the odds of smoking were significantly higher among the poorest (AOR=2.85). Previous studies have also shown the existence of wealth-related inequalities in smoking in LMICs (Hosseinpoor, Parker, D'Espaignet, *et al.* 2012; Palipudi, Gupta, Sinha *et al.* 2012).

These studies indicated that in most LMICs the poorest men and women are more likely to smoke than the richest, which is similar to results of this study. While these studies (Hosseinpoor, Parker, D'Espaignet, *et al.* 2012; Palipudi, Gupta, Sinha *et al.* 2012) suggest that poorer people may consume tobacco to suppress their hunger, in Botswana consumption of tobacco (especially among men) may be associated with machismo and status.

Table 5.2: Odds ratios showing the influence of socioeconomic variables on smoking.

Variable	**Unadjusted Model**		**Adjusted Model**	
	COR	**C.I.**	**AOR**	**C.I.**
Sex				
Male	1.00		1.00	
Female	0.41**	(0.28-0.59)	0.16**	(0.09-0.28)
Age				
≤24	1.00		1.00	
25-34	3.68**	(1.57-8.61)	4.32**	(1.59-11.7)
35-44	4.26**	(1.76-10.3)	5.10**	(1.78-14.6)
45-54	4.90**	(1.94-12.3)	6.80**	(2.12-21.7)
55-64	8.62**	(3.33-22.2)	13.6**	(3.88-47.8)
65+	7.15**	(2.46-20.7)	5.32**	(1.30-21.6)
Marital status				
Never-married	0.42**	(0.25-0.706)	0.84	(0.33-2.12)
Currently-married	0.34**	(0.17-0.67)	0.55	(0.19-1.53
Formerly-married	1.00		1.00	
Education				
Primary or less	1.00		1.00	
Secondary	0.25**	(0.16-0.39)	0.62	(0.32-1.20
Tertiary or higher	0.34**	(0.19-0.58)	0.76	(0.32-1.77)
Residence				
Cities and towns	1.00		1.00	
Urban villages	1.39	(0.66-2.24)	1.39	(0.75-2.57)
Rural villages	2.51**	(1.53-4.10)	1.14	(0.54-2.42)
Work status				
Public sector	0.22**	(0.07-0.65)	0.30	(0.08-1.18)
Private sector	0.67	(0.31-1.45)	1.03	(0.35-3.04)
self-employed	1.23	(0.57-2.62)	1.53	(0.54-4.32)
Not employed	0.82	(0.42-1.62)	1.31	(0.50-3.41)
Home-maker/student	0.24	(0.10-0.60)	1.04	(0.29-3.69)
Retired/other	1.00		1.00	
Wealth status				
Lowest	4.96**	(2.67-9.21)	2.85**	(1.12-7.27)
Second	2.28**	(1.18-4.43)	1.37	(0.55-3.45)
Middle	1.46	(0.72-2.98)	1.09	(0.45-2.66)
Fourth	1.14	(0.54-2.39)	1.04	(0.44-2.47)
Highest	1.00		1.00	

Note: **Statistically significant at 5%, Figures in parenthesis show 95% confidence intervals. N=999

5.3 Levels, Patterns and Correlates of Alcohol Consumption

5.3.1 Levels and Patterns of Alcohol Consumption

Table 5.3 shows prevalence of alcohol consumption in the study population by socioeconomic characteristics. Results of this analysis show high prevalence rates of alcohol consumption – 17.3% (34.8% in men and 9.1% in women). Self-reported alcohol consumption prevalence in the data is lower than in South Africa, where self-reported current alcohol use was estimated at 33.1% (47.7% among males, 20.2% among females)(Vellios and van Walbeek, 2018). The gender difference in alcohol consumption is one of the most consistent and persistent findings across the world, with alcohol consumption observed to be more prevalent among men than women (Wilsnack and Obot, 2005).

Analysis in this data show similar pattern with alcohol consumption observed to be significantly higher among men than women. It should however be noted that comparatively, female alcohol consumption prevalence in Botswana is lower than in some countries in the region. For instance, in South Africa data from the 2016 Demographic and Health Survey has shown that 37% among women aged 15 years and over reported that they were current alcohol consumers (Statistics South Africa, 2016), while in Zambia 42% of adult women were reported to consume alcohol (Ferreira-Borges, Parry and Babor, 2017). Although self-reported alcohol consumption in the sampled population is relatively low, alcohol consumption is one of the most important risk factors for burden of disease and injury as it is causally linked to chronic and acute health problems, in particular to cancer, cardiovascular diseases, digestive tract conditions, accidents and violence. It is also a risk factor for communicable diseases, especially HIV/AIDs (Sinkamba, 2015).

Table 5.3: Prevalence of alcohol consumption by socioeconomic characteristics of the study population

Variable	%	N	P-value
Sex			0.002**
Male	34.8	364	
Female	9.1	813	
Age			0.003**
≤24	16.7	270	
25-34	22.8	302	
35-44	18.4	196	
45-54	9.3	130	
55-64	12.0	75	
65+	17.0	50	
Marital status			0.034**
Never-married	18.9	864	
Currently-married	12.1	199	
Formerly-married	13.0	108	
Education			0.000**
Primary or less	12.7	410	
Secondary	15.6	514	
Tertiary or higher	28.3	230	
Residence			0.060
Cities and towns	19.7	355	
Urban villages	18.0	534	
Rural villages	12.8	288	
Work status			0.000**
Public sector	23.0	122	
Private sector	30.8	182	
self-employed	18.5	130	
Not employed	13.3	436	
Home-maker/student	12.4	218	
Retired/other	12.2	74	
Wealth status			0.045**
Lowest	16.2	234	
Second	14.3	237	
Middle	14.0	235	
Fourth	18.6	237	
Highest	23.4	235	
Overall	**17.3**	**1178**	

Note: **Statistically significant at 5%.

It was also observed that alcohol consumption was more prevalent among respondents in urban villages (18%) and cities and towns (19.7%). Consistent with findings of this study, residential differences have been observed in alcohol consumption. For instance, in South Africa it has been observed that alcohol consumption was more prevalent in urbanizing areas and cities (Vellios and van Walbeek, 2018). In Botswana a number of social and cultural factors are related to alcohol use patterns and also characterize urban and rural settings. For instance, social relationships in cities and towns may influence drinking behaviours while community social capital in rural areas, defined as neighbourhood attachment, supportiveness, or participation, may be protective of alcohol consumption. In rural areas, traditional values which discourage alcohol consumption are emphasised. The family environment in particular, including disapproval and disregard for alcohol consumption is more entrenched in rural areas.

Consistent with the finding of this study which showed that prevalence of alcohol consumption was high among individuals with tertiary or higher education (28.3%), a study by Assari and Lankarani (2016) among older Americans also found that alcohol consumption was more prevalent among higher education individuals. Similarly, in South Africa, it was observed that alcohol consumption was more prevalent among high than low education groups (Bhana, Rathod, Seloilwe *et al.* 2017). It was also found that alcohol consumption prevalence was highest among the richest (23.4%).

Similar findings were observed in Australia (Giskes, Avendano, Brug *et al.* 2010); in the United States (Mulia and Karriker-Jaffe, 2012) and in South Africa (Probst, Parry, Wittchen *et al.* 2018) that current alcohol consumption was highest among the high SES individuals. Batswana of higher SES certainly have greater economic resources, and can likely afford to buy alcohol when they want to drink. Moreover, they also are more likely to participate in activities that may involve drinking such as dining out at restaurants, going on vacation or socializing with co-workers.

5.3.2 Correlates of Alcohol Consumption: Logistic Regression Analysis

Table 5.4 shows the association between socioeconomic characteristics and alcohol consumption. In model I, results of the crude odds ratios showed that all variables were not significantly associated with alcohol consumption except for sex and work status. However, after introduction of control variables in the second model, sex, age, work status and wealth status were significantly associated with alcohol consumption. For instance, it was found that females were less likely (AOR=0.48, 95% C.I. = 0.25-0.81) to report alcohol consumption than males after controlling for other socioeconomic variables.

There is ample research evidence explaining gender differences in alcohol consumption elsewhere in Africa, and attention to the ways that such gender differences both cut across and are influenced by cultural differences, has greatly increased in recent decades (Fillmore, Hartka, Johnstone *et al.* 1991; Van Gundy, Schieman, Kelley *et al.* 2005; Popova, Rehm, Patra *et al.* 2007). Such evidence, unanimously show that the odds of alcohol consumption are significantly high among men than women.

In Botswana, gender differences in alcohol consumption are driven by traditional gender roles and gender-role attitudes (Sinkamba, 2015). These traditional gender roles and gender-role attitudes concerning the division of labour have provided women with a cultural protection against alcohol consumption. However, modernization and cultural diffusion has led to the "breakdown" of this protection consequently leading to alcohol use among women, although relatively less than for men. On the other hand men continue to view drinking as an ascribed right associated with their gender while women continue to see it as a privilege earned by demonstrated competence. Furthermore, for men alcohol consumption may symbolize their superiority to women in status and authority, while for women it maybe an effort to counteract this superiority.

It was noted that after adjusting for sex, residence, work status and wealth status, age was a significant correlate of alcohol consumption. It was observed that individuals in ages 25-34 and 45-54 years were 56% (AOR=0.44, 95% C.I. = 0.20-0.99) and 77% (AOR=0.23, 95% C.I. = 0.06-0.88) respectively, less likely to consume alcohol than in persons in ages ≤24 years. In Botswana research evidence shows that there is a concern about increasing and irresponsible use of alcohol especially among the young adults (Matsapa 2013, Sinkamba, 2015).

Other studies within adults have also identified greater alcohol use in younger age brackets adults (Galduróz and Caetano 2004; WHO 2010; Moura and Malta, 2011) corroborating the current study. Consequently greater alcohol use among young adults aged ≤24 years in this study may be explained by the birth cohort effect. Since the society has proven to be more tolerant towards alcohol consumption this cohort perceives it to be socially acceptable to consume alcohol. Although alcohol advertising is not allowed in Botswana, mass media still plays a role in portraying alcohol as a factor for socialization, a way in which young people reach desired emotional states and can overcome shyness (Pinsky, 2009). Consuming alcohol is often seen as normal and necessary in celebration, and drunken scenes are considered fun and inoffensive.

Table 5.4: Odds ratios showing the influence of socioeconomic variables on alcohol consumption

Variable	Unadjusted Model		Adjusted model	
	COR	**C.I**	**AOR**	**C.I**
Sex				
Male	1.00		1.00	
Female	0.48**	(0.30-0.77)	0.45**	(0.25-0.81)
Age				
≤24	1.00		1.00	
25-34	0.61	(0.31-1.19)	0.44**	(0.20-0.99)
35-44	1.10	(0.48-2.55)	0.80	(0.27-2.35)
45-54	0.40	(0.14-1.08)	0.23**	(0.06-0.88)
55-64	0.70	(0.18-2.68)	0.64	(0.11-3.52)
65+	0.34	(0.10-1.16)	0.32	(0.05-1.88)
Marital status				
Never-married	1.48	(0.64-3.42)	0.56	(0.10-3.03)
Currently-married	1.57	(0.55-4.49)	0.68	(0.11-3.95)
Formerly-married	1.00		1.00	
Education				
Primary or less	1.00		1.00	
Secondary	1.09	(0.61-1.93)	0.57	(0.21-1.55)
Tertiary or higher	1.25	(0.67-2.30)	0.73	(0.23-2.27)
Residence				
Cities and towns	1.00		1.00	
Urban villages	1.17	(0.68-2.02)	1.64	(0.85-3.16)
Rural villages	0.59	(0.32-1.10)	0.59	(0.23-1.51)
Work status				
Public sector	2.44	(0.82-7.26)	2.60	(0.69-9.78)
Private sector	3.60**	(1.29-10.0)	3.80**	(1.08-13.4)
self-employed	3.25**	(1.01-10.4)	2.66	(0.67-10.5)
Not employed	1.57	(0.60-4.12)	1.34	(0.41-4.33)
Home-maker/student	3.30**	(1.05-10.3)	3.70**	(1.88-15.4)
Retired/other	1.00		1.00	
Wealth status				
Lowest	0.69	(0.35-1.35)	0.92	(0.30-2.82)
Second	0.92	(0.44-1.93)	1.59	(0.56-4.50
Middle	0.77	(0.37-1.57)	0.76	(0.30-2.82)
Fourth	1.27	(0.61-2.62)	2.27**	(1.53-5.40)
Highest	1.00		1.00	

Note:**Statistically significant at 5% level, Figures in parenthesis show 95% confidence intervals. N=992

It was found that the odds of reporting alcohol consumption slightly increased in the adjusted model where private sector employees (AOR= 3.80, 95% C.I. = 1.08-13.4) and homemakers/students (AOR=3.70, 95% C.I. = 1.88-15.4) were found to be more than 3 times more likely to report alcohol consumption than retired individuals. Congruent with the current study findings, previous studies have also shown high alcohol consumption levels among students in Botswana (Matsapa, 2013; Sinkamba, 2015). High alcohol consumption is a major contributor to deaths or injuries in young people, and potentiates severity of NCDs in later life (Cunningham, Maio, Hill *et al.* 2002). The earlier the age a person starts drinking, the more likely they are likely to suffer the cumulative effects of alcohol consumption.

Although the crude model for the multivariate analysis between alcohol consumption and wealth status did not show any significant association between alcohol consumption and wealth status, in the adjusted model rich individuals were two times (AOR=2.27, 95% C.I.= 1.53-5.40) more likely to report alcohol consumption. This shows that the observed association between alcohol consumption and wealth status is mediated for by other socioeconomic variables. Different interpretations of the role of alcohol in the relationship between SES and health have been brought forward in literature. Unlike findings from this study, most studies have typically found that the odds of alcohol consumption are high among people of low SES (Ruhm, 1995; Mullahy and Sindelar, 1996; Roche, Kostadinov, Fischer *et al.* 2015).

However, this relationship is often complex with other factors such as education levels, wealth status and gender likely to influence the relationship between SES and alcohol consumption. For the case of Botswana, non-poor include the middle class who have high education and income levels. This group comprises the middle to the top cadre of government and private sector employees. Similarly, findings from previous studies elsewhere have also shown that a higher prevalence of light to moderate drinking is found in higher socioeconomic groups (Cummins, Sharper, Walker *et al.* 1981; Jacobsen, 1989; Knupfer, 1989; Hulshof, Louik, Kok *et al.* 1991; Knibbe and Swinkels, 1992; Bennett, Jarvis, Rowland *et al.* 1996; Marmot, 1997). However, due to the high odds of alcohol consumption among people of high SES, a higher prevalence of excessive drinking might also be expected. Meanwhile, factors explaining differences in high odds alcohol consumption among individuals in the 4th quintile than in the highest quintile are unknown. However, it can only be postulated that area level differences (i.e., the effects of living in a certain neighbourhood, and locality) explains why individuals in the 4th quintile were more likely to consume alcohol than those in the highest quintile.

5.4 Levels, Patterns and Correlates of Poor Fruit/Vegetable Consumption

5.4.1 Levels and Patterns of Poor Fruit/Vegetable Consumption

Inadequate or low consumption of fruits and vegetables is known to expose individuals to various disease conditions. Poor fruit and vegetable consumption in this analysis was done based on the general recommendation by the WHO panel on diet, nutrition and chronic disease prevention that considers poor fruit/vegetables intake as having less than 5 servings of fruits and vegetables in a week.

It was found that poor fruit and vegetable consumption was disproportionately high (82.5%) in the sampled population (see table 5.5 below). Similarly, high poor fruit and fruit consumption has also been observed in South Africa (68.5%), Tanzania (82%), Benin (85%) and Mozambique (95%)(Fagbohoun, 2008; Padrão, Laszczyńska, Carla Silva-Matos, *et al.* 2011; Peltzer and Phaswana-Mafuya 2012; Msambichaka, Eze, Abdul *et al.* 2018). It has been found that most African countries do not have functional food based dietary guidelines but the few (including Botswana) which have such guidelines are not clear on how much fruit and vegetable should be consumed (Ministry of Health-Malawi, 2007; Naude 2013; Ministry of Health-Kenya, 2017). This is quite indicative because if people are to act in line with good dietary behaviour, they can do so if they are aware and convinced and know how to act.

There were no significant gender and residential variations observed in poor fruit and vegetable consumption indicating that both men and women, and residents of urban and rural areas are susceptible to poor fruit and vegetable consumption. Socioeconomic factors are vital in shaping fruit and vegetable intake patterns and education and wealth status as indicators of SES have been found to be associated with fruit and vegetable intake (Pechey, Jebb, Kelly *et al.* 2013). Similarly, it was found in this analysis that poor fruit and vegetable consumption and education and wealth status were significantly associated.

High prevalence levels of poor fruit and vegetable consumption were found to be among individuals with low education (87.7%) and poor SES (86.7%). Consistent with this finding, a body of research evidence has consistently shown that consumption of unhealthy diets, in particular, eating fewer fruits and vegetables, is strongly associated with poor SES and low education (Giskes, Avendaňo, Brug, *et al.* 2010; Appelhans, Milliron, Woolf, *et al.* 2012; Pechey, Jebb, Kelly *et al.* 2013).

Table 5.5: Prevalence of poor fruit/vegetable consumption by socioeconomic characteristics of the study population

Variable	%	N	P-value
Sex			0.275
Male	84.6	364	
Female	81.5	813	
Age			0.543
≤24	80.7	270	
25-34	84.7	302	
35-44	84.6	196	
45-54	80.5	130	
55-64	84.2	75	
65+	70.0	50	
Marital status			0.055
Never-married	83.6	864	
Currently-married	82.0	199	
Formerly-married	69.6	108	
Education			0.009**
Primary or less	84.7	410	
Secondary	85.1	514	
Tertiary or higher	75.1	230	
Residence			0.101
Cities and towns	86.1	355	
Urban villages	81.4	534	
Rural villages	78.1	288	
Work status			0.074
Public sector	74.4	122	
Private sector	87.7	182	
self-employed	80.5	130	
Not employed	85.5	436	
Home-maker/student	79.1	218	
Retired/other	86.8	74	
Wealth status			0.097
Lowest	86.7	234	
Second	84.7	237	
Middle	85.4	235	
Fourth	83.3	237	
Highest	76.3	235	
Overall	**82.5**	**1178**	

Note:**Statistically significant at 5% level.

5.4.2 Correlates of Poor Fruit and Vegetable Consumption: Logistic Regression Analysis

Odds ratios for the association between poor fruit and vegetable consumption and socioeconomic variables in the study population are presented in table 5.6 below. After controlling for cofounders, women were 33% (AOR=0.67, 95% C.I. = 0.42-1.07) less likely to report poor fruit and vegetable consumption than men. This suggests that the effect of sex of respondent on poor fruit and vegetable consumption is mediated for by other socioeconomic variables and that when holding constant the effects of such variables, sex of respondent significantlyinfluence poor fruit and vegetable consumption.

Consistent with this finding Rasmussen, Krølner, Klepp, *et al.* (2006) reviewed fruit and vegetable intake in several countries and found that most studies (27 out of 49) showed gender differences in which women had a higher intake of fruits and/or vegetables than men. These studies have attributed this gender difference to a preference for fruits and vegetables among women. On the other hand, low fruits and vegetables consumption among men relates to the view that men do not like fruits and vegetables as much as women do (Bere, Brug and Klepp, 2007; Cooke and Wardle, 2005). In addition to preference, women tend to have a greater knowledge, and stronger intentions and self-efficacy compared to men.

Studies conducted in the western societies also report consistent associations between gender and specific foods, where meat (especially red meat), alcohol, and hearty portion sizes are associated with masculinity, while vegetables, fruit, fish and sour dairy products (e.g. yogurt, cottage cheese) are associated with femininity (Jensen and Holm, 1999; Sobal, 2005). In Botswana, observed differences in fruit and vegetable consumption could also be explained by gender specific food preferences, with men preferring meat while women favour vegetables.

It was observed that marriage status, age and work status were not significant determinants of poor fruit and vegetable consumption. For education, tertiary education level respondents were 67% (AOR=0.33, 95% C.I. = 0.15-0.72) less likely to report poor fruit and vegetable consumption. These results confirm the findings of previous studies (Satheannoppakao, Aekplakorn and Pradipasen, 2009; Bhupathiraju and Tucker, 2011) that demonstrate a relationship between educational attainment and intake of fruits and vegetables. Low intake of fruit and vegetable in the low education group corroborates the findings of some studies in South Africa (Peltzer, 2012; Perreira, 2014) and Zambia (Rakotoniaina, 2017).

In Botswana, observed educational level differences in fruits and vegetable consumption can be explained by the close relationship between nutritional knowledge and health considerations among the high education group on the one hand and food choices on the other. Moreover, educational difference in the intake of quality and quantity of fruit and vegetable may be closely linked to health inequalities in the study population, because low education individuals are also more likely to be poor.

The odds of poor fruit and vegetable consumption were 30% (AOR=1.30, 95% C.I. = 1.00-2.58) and 58% (AOR=1.58, 95% C.I. = 1.01-2.96) higher among residents of rural and urban villages than cities and towns. This indicates rural/urban differences in fruit and vegetable consumption. Studies confirming that poor fruits and vegetables intake is higher in rural than urban areas are available in other SSA countries. In countries such as Kenya, Burundi and Ethiopia, for example, consumption of fruits and vegetables was found to be high in urban areas than in rural areas (Ruel, Minot and Smith, 2005).

The diets of urban dwellers (cities and towns) are generally more diverse than for residents of rural areas (Ruel and Garret 2003; Smith 2004). This partly explains observed residential variations in poor fruit and vegetable consumption in this study. These variations may be due to a combination of factors including the availability and access to a wider variety of foods in urban markets, availability of storage facilities, changes in lifestyles and cultural patterns, and the need for convenience leading to the purchase of more processed food in cities and towns.

Table 5.6: Odds ratios showing the influence of socioeconomic variables on poor fruit and vegetable consumption in the study population.

Variable	Model 1-Crude Model COR C.I		Model II-adjusted model AOR C.I	
Sex				
Male	1.00			
Female	0.79	(0.53-1.19)	0.67**	(0.42-0.98)
Age				
≤24	1.00		1.00	
25-34	1.32	(0.79-2.19)	1.37	(0.72-2.60)
35-44	1.31	(0.73-2.37)	1.28	(0.60-2.76)
45-54	0.98	(0.51-1.88)	0.92	(0.39-2.17)
55-64	1.27	(0.50-3.26)	1.63	(0.42-6.35)
65+	0.55	(0.20-1.54)	0.41	(0.11-1.70)
Marital status				
Never-married	2.22**	(1.14-4.32)	1.86	(062-5.58)
Currently-married	1.98**	(1.00-4.28)	2.00	(0.66-6.02)
Formerly-married	1.00		1.00	
Education				
Primary or less	1.00		1.00	
Secondary	1.03	(0.64-1.67)	0.65	(0.32-1.31)
Tertiary or higher	0.54**	(0.33-0.90)	0.33**	(0.15-0.72)
Residence				
Cities and towns	1.00		1.00	
Urban villages	0.71	(0.46-1.09)	1.58**	(1.01-2.96)
Rural villages	0.57**	(0.34-0.97)	1.30**	(1.00-2.58)
Work status				
Public sector	0.44	(0.15-1.27)	0.59	(0.18-1.88)
Private sector	1.07	(0.37-3.14)	0.82	(0.26-2.57)
self-employed	0.62	(0.212-1.83)	0.48	(0.15-1.58)
Not employed	0.89	(0.32-2.44)	0.92	(0.31-2.72)
Home-maker/student	0.28	(0.57-0.20)	0.46	(0.15-1.41)
Retired/other	1.00		1.00	
Wealth status				
Lowest	2.03**	(1.01-4.16)	2.30**	(1.06-5.86)
Second	1.71**	(1.00-3.03)	1.91**	(1.01-4.01)
Middle	1.81**	(1.05-3.12)	1.74**	(1.02-3.36)
Fourth	1.55	(0.93-2.59	1.43	(0.81-2.55)
Highest	1.00		1.00	

Note:**Statistically significant at 5% level, Figures in parenthesis show 95% confidence intervals. N=999

There was significant association observed between wealth status and poor fruit and consumption. After adjusting for other socioeconomic factors there was a slight increase in the odds of poor fruit and vegetable consumption among individuals in the lowest SES group (AOR=2.30, 95% C.I.= 1.06-5.86) suggesting that the introduction of controls in the model made the association between wealth status and poor fruit and vegetable consumption more discernible and credible. It is known that consumption levels of fruits and vegetables are strongly associated with wealth status (Peltzer, 2012; Pechey, Jebb, Kelly *et al.* 2014; Pechey, Monsivias, Yin-lam *et al.* 2015). Meanwhile, population-level factors implicated in the association between wealth status and fruit and vegetable consumption include food environments, with those in lower SES groups having less physical access to healthier food outlets and greater exposure to unhealthy outlets (Cummins, Smith, Taylor *et al.* 2009; Monsivais, McLain, and Drewnowski, *et al.* 2010; Molaodi, Leyland, Ellaway *et al.* 2012). Energy-dense foods often provide cheaper sources of calories and are affordable to people of low SES.

In Botswana wealth status differences in fruit and vegetable consumption can be best explained by food preference and availability, with the poor more likely to prefer and have access to meat (especially red meat) and energy-dense foods while the non-poor have access to and prefer fruits and vegetables. The wealthy are likely to be more educated and therefore much aware of the health benefits of fruits and vegetables. Moreover, poor fruit and vegetable consumption in Botswana has historical connotations. The discovery of diamonds in the 1970s has led to a decline in the contribution of agriculture (mainly cattle farming) to the gross domestic product (GDP) of the country. Such a decline may have affected food consumption patterns leading to significant growth in retail supermarkets around the mid-1990s (Weatherspoon and Reardon, 2003). This growth of retail supermarkets coupled with urbanization has influenced food availability, accessibility and choice for consumers.

Consequently, rapid urbanization and globalization have led to changes in diet from the traditional cereals and wild fruits, berries and vegetables to modern genetically modified food.

One other thing that has spurred the change of diet from wild fruits and vegetables as part of diet in Botswana, other than modernisation is the emphasis on nature conservation, which has seen a shift to 'modern' perishable fruits and vegetables. These modern fruits and vegetables are relatively expensive to buy since they are mainly imported from neighbouring South Africa. As a result few households afford fruits and vegetables on a daily basis. At a macro level there is need for many new initiatives that may enhance fruit and vegetable production in Botswana, while at micro level households should be encouraged to produce fruits and vegetables and include them consistently as part of diet.

5.5 Levels, Patterns and Correlates of Poor Physical Activity

5.5.1 Levels and Patterns of Poor Physical Activity

Results in table 5.7 indicate that overall prevalence of poor physical activity in the study population was high, estimated at 48.9% (49.1 in females, 48.6% in males). Poor physical activity prevalence rate in the sampled population is slightly lower than in the neighbouring South Africa (60.5%) (Peltzer and Phaswana-Mafuya 2012). High poor physical activity levels observed in the study population may be explained by the fact that in the past few decades Batswana have been moving away from agriculture to urban areas focusing on manufacturing and services. Further to this, there has been increased use of motorised transport and growth in media technologies (e.g. television, internet) which encourage sedentary lifestyle.

Consistent with this finding, Souza, Fillenbaum, and Blay (2015) also found that in Brazil prevalence of poor physical activity was highest among people with primary or lower education and lowest SES. The high prevalence rates of poor physical activity observed in high education and SES individuals may be explained in part by the fact that highly educated and high SES persons have developed a range of skills and traits, including cognitive skills, problem solving, and diverse personality traits. These skills help educated and high SES people to adopt healthy behaviours such as physical activity than the less-educated and the poor (Pampel, Krueger and Denney, 2010; Braveman, Egerter and Barclay, 2011). Consequently adults with higher levels of education and SES are less likely to engage in risky behaviours, such as poor physical activity, and are more likely to have healthy behaviours related to diet and exercise.

Meanwhile it was found that there were no significant gender differences in poor physical activity. It was also seen that factors such as age, marital status, place of residence and work status did not have significant association with poor physical activity, suggesting that poor physical activity cuts across genders, marital statuses, place of residences and work types.

Table 5.7: Prevalence of poor physical activity by socioeconomic characteristics of the study population

Variable	%	N	P-value
Sex			0.886
Male	48.6	364	
Female	49.1	813	
Age			0.131
≤24	47.4	270	
25-34	45.7	302	
35-44	42.9	196	
45-54	53.8	130	
55-64	49.3	75	
65+	62.0	50	
Marital status			0.103
Never-married	47.2	864	
Currently-married	51.3	199	
Formerly-married	57.4	108	
Education			0.047**
Primary or less	52.7	410	
Secondary	44.6	514	
Tertiary or higher	49.1	230	
Residence			0.467
Cities and towns	47.9	355	
Urban villages	50.7	534	
Rural villages	46.5	288	
Work status			0.256
Public sector	54.1	122	
Private sector	42.9	182	
self-employed	43.1	130	
Not employed	50.7	436	
Home-maker/student	50.5	218	
Retired/other	50.0	74	
Wealth status			0.006**
Lowest	57.3	234	
second	43.5	237	
middle	42.1	235	
Fourth	51.5	237	
Highest	50.2	235	
Overall	**48.9**	**1178**	

Note: **Statistically significant at 5%.

5.5.2 Correlates of Poor Physical Activity: Regression Analysis

Table 5.8 below shows unadjusted and adjusted odds ratios of the relation of poor physical activity with socioeconomic factors in the study population. Gender differentials were observed for poor physical activity. For instance, the association between poor physical activity and sex remained intact even after controlling for other socioeconomic variables and females were observed to be two times more likely to report poor physical activity than males (AOR=2.55, 95% C.I.= 1.87-3.47).

Several reasons could inhibit women from being physically active in Botswana such as; lack of time due to demands such as child-rearing, household duties and paid work. Lack of motivation and health problems also lead to physical incapacity among women. Other reasons include lack of money and gender stereotypes that women should act as ‘queens’ and should only do domestic chores.

Edwards and Sackett (2016) conducted a study on why women are less physically active than men and found sex differences in psychosocial factors and influences on physical activity. Some of the correlates of poor physical activity which they argued influence poor physical activity among women includes; self-efficacy, perceived competency, outcome expectancies, attitudes, perceived barriers and risks, subjective norms, social support, motivation, enjoyment, decisional balance, and body image.

What has been gathered in the reviewed in literature and in this study is that, men and women demonstrate differing levels of physical activity and these differences put women at unique risks for serious health consequences (Kohl, Craig, Lambert *et al.* 2012; Kinsman, Norris, Kahn *et al.* 2015). Cultural factors can act as additional barriers to physical activity among Botswana women, such as the sceptical attitudes towards wearing tight-fitting clothing when participating in sport, as well as the view that taking part in leisure-time physical activity takes time away from household chores.

It was also observed that age and poor physical activity were not significantly associated. This contradicts findings from other studies which have shown significant link between poor physical activity and increasing age (Beijersbergen, Granacher, Vandervoort, *et al.* 2013; Bijlsma, Meskers, van den Eshof *et al.* 2013). Findings from this study are quite revealing, because it suggests that when holding constant the effects of other socioeconomic factors there are no age differences in poor physical activity implying that in Botswana poor physical activity cuts across different age groups.

This study also found that education level was not a significant determinant of poor physical activity contrary to findings from other studies (Beijersbergen, Granacher, Vandervoort *et al.* 2013; Bijlsma, Meskers, van den Eshof *et al.* 2013). For instance, a study by Shaw and Spokane (2008) using longitudinal data concluded that low-education was associated with reduced physical activity, whereas for highly educated individuals the reverse was true.

Furthermore, Droomers, Schrijvers, Polanczyk *et al.* (2001) long established that lower educated respondents experience statistically significant higher odds to decrease physical activity compared with respondents with higher vocational schooling or a university degree. Education does not come as a significant determinant of poor physical activity in this study due to the fact that during the past few decades Batswana of all education levels have been moving away from rural areas (away from active agrarian lifestyle) to urban areas which are hubs of sedentary lifestyles. Further to this there has been increased use of motorised transport and growth in media technologies (e.g. television, internet) which encourage sedentary lifestyle.

Again, this finding seems to underscore and reflect an underlying cultural orientation among Batswana that does not value physical activity. Batswana of all education levels seem to believe that formal physical activity is too demanding, not worthwhile, uncomfortable, dangerous, or just generally tedious. Even at a low education level age, an age which is crucial in forming long-term exercise habits, there is general lack of interest in physical activity (Malete, Mokgatlhe, Nnyepi, *et al.* 2017). Because of the lack of the culture endorsing physical activity, even those who have the education to engage in healthier, active lifestyles seem to be choosing not to do so.

Table 5.8: Odds ratios showing the influence of socioeconomic variables on poor physical activity in the study population.

Variable	**Model 1-Crude Model**		**Model II-adjusted model**	
	COR	**C.I**	**AOR**	**C.I**
Sex				
Male	1.00		1.00	
Female	2.41**	(1.86-3.13)	2.55**	(1.87-3.47)
Age				
≤24	1.00		1.00	
25-34	0.80	(0.56-1.14)	0.71	(0.46-1.11
35-44	0.67	(0.45-0.99)	0.55	(0.34-0.91)
45-54	0.73	(0.47-1.14)	0.54	(0.30-0.96)
55-64	1.21	(0.68-2.16)	0.97	(0.46-2.06)
65+	2.35**	(1.05-5.23)	2.11	(0.79-5.58)
Marital status				
Never-married	0.56**	(0.35-0.90)	1.12	(0.55-2.28)
Currently-married	0.74	(0.43-1.28)	1.55	(0.74-3.23)
Formerly-married	1.00		1.00	
Education				
Primary or less	1.00		1.00	
Secondary	0.74**	(0.55-0.98)	1.08	(0.73-1.62)
Tertiary or higher	0.66**	(0.47-0.94)	1.29	(0.78-2.14)
Residence				
Cities and towns	1.00		1	
Urban villages	0.97	(0.73-1.30)	0.74	(0.53-1.04)
Rural villages	1.05	(0.75-1.47)	0.61*	(0.40-0.94)
Work status				
Public sector	1.37	(0.78-2.39)	1.35	(0.67-2.71
Private sector	1.02	(0.56-1.87)	1.25	(0.65-2.40)
self-employed	0.90	(0.51-1.59)	1.20	(0.60-2.37)
Not employed	0.77	(0.42-1.39)	1.43	(0.78-2.61)
Home-maker/student	1.51	(0.90-2.55)	1.41	(0.72-2.75)
Retired/other	1.00		1.00	
Wealth status				
Lowest	1.92**	(1.29-2.85)	1.73**	(1.00-2.99)
Second	1.49**	(1.01-2.19)	1.62**	(1.00-2.67)
Middle	1.26**	(1.00-1.84)	1.38	(0.86-2.21)
Fourth	1.38	(0.95-2.02)	1.44**	(1.02-2.20)

Highest	1.00	1.00

Note: **Statistically significant at 5%, Figures in parenthesis show 95% confidence intervals. N=974

The odds of poor physical activity were found to be significantly low among individuals residing in rural areas (AOR=0.61, 95% C.I. = 0.40-0.94) than cities and towns. This finding corroborates studies from both HICs and LMICs which have shown that individuals living in urban centres would be less active than their rural counterparts (Albarwani, Al-Hashmi, *et al.* 2009; Al-AbrIsmailov and Leatherdale 2010; Chillon, Ortega, Ferrando *et al.* 2011). Urban-rural differences in poor physical activity in Botswana are reflective of the effects of urbanization. Research dealing with the impact of urbanization on physical inactivity suggests that urbanization leads to sedentary lifestyles (such as using motorised transport, TV viewing, computer use).

It was observed that after controlling for cofounders, wealth status was a significant determinant of poor physical activity. For instance the odds of poor physical activity were significant among individuals in different SES from lowest to fourth quintile than the richest. Incongruous with some previous studies in LMICs as it may be (Albarwani, Al-Hashmi, *et al.* 2009; Al-AbrIsmailov and Leatherdale 2010; Micklesfield, Pedro, Kahn *et al.* 2014) this finding indicates that Botswana has undergone a transition from an agrarian to industrial society due to urbanization subsequently leading to industrial modernity. Consequently this has led to poor physical activity among both the poor and the non-poor.

5.6 Levels, Patterns and Correlates of Overweight/Obesity

5.6.1 Levels and Patterns of Overweight/Obesity

Estimated prevalence of overweight/obesity in the sampled population was 41.3% (Table 5.9 below). This high prevalence is similar to the growing prevalence of overweight/obesity sweeping across Southern Africa, with national prevalence rates ranging between 30 and 60% among populations over the age of 15 years in most countries (WHO 2009a; Peltzer, Pengpid, Samuels, *et al.* 2014; Nnyepi, Gwisai, Lekgoa *et al.* 2015). High prevalence of overweight/obesity observed in Botswana may be attributed to dietary shift away from high-fibre, low-calorie diets rich in fruits and vegetables towards refined, energy-dense foods high in fat, calories, sweeteners and salt (Nnyepi, Gwisai, Lekgoa *et al.* 2015). It may also be attributed to low physical activity due to transition from agrarian to a sedentary industrial society (Malete, Mokgatlhe, Nnyepi *et al.* 2017).

The existence of socioeconomic inequalities in overweight/obesity prevalence is a well-established finding, and has been previously confirmed (Alaba and Choba, 2014). This study adds to those findings showing that socioeconomic inequalities in prevalence of overweight/obesity exist in Botswana. In particular, this analysis suggests that women than men (48.6% in women, 25.5% in men), individuals residing in rural areas (46.8%), public sector employee (55.2%) and those with lower education (45%) had high prevalence rates for overweight/obesity. Gender differences in prevalence of overweight/obesity have also been indicated by previous studies in Botswana (Letamo, 2011; Tapera, Marogwe, Tumoyagae et al. 2017). These studies consistently found that the highest prevalence rates for overweight/obesity were observed among women than men.

A paradoxical situation, in which low SES and high levels of overweight/obesity co-exist in rural settings, may be explained by reduced levels of physical activity in rural villages. This is also possibly because of the rapid spread of urban lifestyles (high consumption of processed food, reduced physical activity) into rural areas. From a public health perspective, this indicates that targeting rural areas before the prevalence of overweight/obesity increases further could have a significant impact on the future trends in the prevalence of overweight/obesity in the country.

Table 5.9: Prevalence of overweight/obesity by socioeconomic and behavioural characteristics of the study population

	Prevalence of overweight and obesity		
Variable	**%**	**N**	**P-value**
Sex			0.000**
Male	25.5	364	
Female	48.6	813	
Age			0.000**
≤24	21.8	270	
25-34	36.8	302	
35-44	53.0	196	
45-54	54.5	130	
55-64	61.8	75	
65+	43.8	50	
Marital status			0.000**
Never-married	35.5	864	
Currently-married	62.2	199	
Formerly-married	54.1	108	
Education			0.019**
Primary or less	45.4	410	
Secondary	36.7	514	
Tertiary or higher	44.6	230	
Residence			0.008**
Cities and towns	37.9	355	
Urban villages	41.0	534	
Rural villages	46.8	288	
Work status			0.000**
Public sector	52.2	122	
Private sector	36.8	182	
self-employed	55.0	130	
Not employed	45.8	436	
Home-maker/student	29.4	218	
Retired/other	40.3	74	
Wealth status			0.765
Lowest	38.8	234	
Second	43.2	237	
Middle	41.1	235	
Fourth	39.7	237	
Highest	44.1	235	
Alcohol consumption			0.445
No	33.3	766	
Yes	37.7	412	
Smoking			0.004**

Yes	29.7	136	
No	42.9	1042	
Poor physical activity			0.547
Yes	41.5	376	
No	39.6	771	
Poor fruit/vegetable consumption			0.832
No	41.9	133	
Yes	43.0	1045	
Overall	**41.3**	**1178**	

Note: **Statistically significant at 5%.

Among behavioural factors this study offers evidence that non-smoker (42.9%) showed high prevalence rates of overweight/obesity. Alcohol consumption, poor physical activity and poor fruit and vegetable consumption did not show any significant association with overweight/obesity. The association between smoking and overweight/obesity is complex and not wholly understood, and published studies have produced inconsistent results. While some studies have shown no significant association between smoking status and BMI (Zbikowski, Jack, McClureothers *et al.* 2011), some studies like the current study show that prevalence of smoking may be associated with lower BMI (Munafò, Tilling and Ben-Shlomo, 2009). However, prevalence of overweight/obesity among non-smokers corroborates the evidence that current smoking does not lead to overweight/obesity (Filozof, Fernandez-Pinilla and Fernandez-Cruz, 2004; Cois and Day, 2015). This is because it has been found that smoking leads to weight-loss through loss of appetite (Cois and Day, 2015).

The relationship between poor physical activity and body weight is completely understood. Consequently, high overweight/obesity levels among individuals with poor physical activity are an established finding in both LMICs and HICs. Data from this study corroborates with such findings. Poor physical activity and increased sedentary behaviour associated with rapid urbanization (Chan, Lim, Lim *et al.* 2017) as observed in Botswana may lead to an increasing prevalence of overweight/obesity due to decreases in energy expenditure. Contrary to some observational studies on the effect of alcohol intake on overweight/obesity which concluded that alcohol consumption predisposes individuals to overweight/obesity (Yeomans, 2010; Traversy and Chaput 2015) this data did not show any significant association between alcohol consumption and overweight/obesity.

5.6.2 Correlates of Overweight/Obesity: Regression Analysis

Table 5.10 below indicates adjusted odds ratios of the relation of overweight/obesity with socioeconomic and behavioural correlates. One unadjusted and two adjusted models were run. Model I assessed the association between overweight/obesity and each of the socioeconomic variables, Model II assessed the association between overweight/obesity adjusting for socioeconomic factors, while Model III assess the association between overweight/obesity adjusting for both socioeconomic and behavioural factors. It was observed that sex was a significant correlate of overweight/obesity when controlling for socioeconomic variables only and when controlling for both socioeconomic and behavioural factors.

Women were observed to be 2 times (AOR=2.74, 95% C.I. =1.92-3.90) more likely to be overweight/obese than men. Literature yields mounting evidence on the gender differential for overweight/obesity across and within countries (Kanter, 2012; Li, Gower, Shelton *et al.* 2017; Pinto, Griep, Rotenberg *et al.* 2018). While in some developed countries such as the US and the UK men have been observed to be more overweight than women (Luppino, de Wit, Bouvy *et al.* 2010), in developing countries women are noted to be overweight than men (Kanter and Cabballero, 2012). However, although gender differences for overweight/obesity vary greatly within and between countries, overall women are likely to be overweight/obese than men. Similarly in this data it was noted that gender disparities in overweight/obesity were exacerbated among women, like elsewhere in developing countries, especially in the Middle East and SSA (Kanter and Cabballero, 2012).

Gender differences in overweight/obesity observed between developed and developing countries with weight gain high among men in developed countries and high among women in developing countries indicate that gender disparities in excess weight gain are explained by myriad sociocultural dynamics. For instance, acculturation, through complex sociocultural pathways, affects weight gain among both men and women. Moreover, the nutrition transition taking place in many developing countries has also affected excess weight gain among both genders, but has had an even greater impact on the physical activity levels of women (Gerbens-Leenes, Nonhebel, Krol *et al.* 2010). Furthermore, in some countries, cultural values favour larger body size among women or men as a sign of fertility, healthfulness, or prosperity especially in SSA (Wansink, Cheney and Chan, 2003). Other studies suggest that contextual factors drive gender differences in food consumption, and women often report consuming healthier foods, yet may consume more sugar-laden foods, than men (Kant, Graubard, and Kumanyika, 2002).

Similarly, in Botswana gender differences in overweight/obesity can be explained by a wide array of sociocultural dynamics. Firstly, although women are more likely to report eating or wanting to eat "healthier" foods, they seem to prefer and consume more foods high in added sugars than men including energy-dense processed foods such as cookies, chocolate, and ice cream. Secondly, overweight among women may also be attributed to comparatively low levels of physical activity (Malete, Mokgatlhe, Nnyepi *et al.* 2017). Moreover, like in other African settings, being overweight/obese among Botswana women is considered as a sign of social status, fertility, good health and prosperity (Letamo, 2011).

The odds of being overweight/obese increased with age after controlling for socioeconomic and behavioural factors. This is quite indicative, and shows that age is a significant correlate of overweight/obesity independent of other covariates. It was found that odds of being overweight/obese increased with age and were highest among individuals aged 55-64 years (AOR=5.53, 95% C.I. = 2.62-11.6), but declined at ages 65+ years (AOR=2.88, 95% C.I. =

1.21-6.86). This finding corroborates data from large population studies (Flegal, Carrol, Kuczmarski, *et al.* 1998; Villareal, Apovian, Kushner *et al.* 2005; Sperrin, Marshall, Higgins *et al.* 2016) which shows that mean body weight and BMI gradually increases during most of adult life and reach peak values at 50–59 years of age in both men and women and after the age of 60 years, mean body weight and BMI tend to decrease.

Clinically it has been found that aging is associated with considerable body changes in body composition (Vazquez, Duval, Jacobs *et al.* 2007). It has been suggested that after 20–30 years of age, fat-free mass (FFM) progressively decreases, whereas fat mass increases (Manson, Willett, Stampfer, *et al.* 1995; Wormser, Kaptoge, Antonio *et al.* 2011). Aging is also associated with a redistribution of both body fat and FFM whereby there is a greater relative increase in intra-abdominal fat than in subcutaneous or total body fat, and there is a greater relative decrease in peripheral than in central FFM because of the loss of skeletal muscle (Beaufrere and Morio, 2000). This possibly explains the observed pattern noted in this data of having high odds of overweight/obesity among the elderly than the young population.

Education was also a found to be a significant factor associated with overweight/obesity in the study population after controlling for socioeconomic covariates. It was found that individuals who had secondary (AOR=1.70, 95% C.I. = 1.11-2.61) and tertiary or higher (AOR=1.99, 95% C.I. =1.16-3.38) education were more likely to be overweight/obese than individuals with primary or less education. This finding corroborates other studies which have shown that education may be associated with overweight/obesity via socioeconomic status, literacy and health behaviors (Chandola, Clarke, Morris *et al.* 2006; Cutler and Lleras-Muney 2006; Fletcher and Frisvold 2009). Furthermore, studies which have used education as a proxy for socioeconomic status in developing countries have shown that individuals with high educational attainment were more likely to be obese (Cohen, Rai, Rehkopf *et al.* 2013). The relationship between educational attainment and obesity also depends on the individual’s level of development, such that positive associations are more common in more educated groups (Fiscella and Kitzman, 2009).

There was no significant relationship observed between overweight/obesity and work status and wealth status in the general study population. This finding is incongruent with other studies previously done in LMICs which found that in most developing countries higher SES is associated with an increased risk of overweight/obesity (Sobal and Stunkard 1989; McLaren, 2007) while in developed countries, higher SES has been associated with decreased obesity risk, especially among women (Rtveladze, Marsh, Barquera, *et al.* 2014).

The observed pattern of no association between overweight/obesity, work and wealth status may suggest that in Botswana, there is no diet differences based on the wealth and work status of individuals. Moreover, Botswana has over the decades moved from lower human development index (HDI) to middle HDI, consequently leading to nutrition transition where both the poor and non-poor have access to diets with more fat, more meat, added sugars and bigger portion sizes, and lower physical activity.

Adjustment for known risk factors suggested that variations in smoking accounted for part of the socioeconomic variation in overweight/obesity. It was noted that the odds of overweight/obesity increased two times (AOR=2.16, 95% C.I. = 1.22-3.83) among smokers than non-smokers. This finding is consistent with other studies, which found that the odds of being obese were significantly associated with cigarette smoking. For instance, Chiolero *et al.* (2008) based on literature review observed that heavy smokers tend to have greater body weight than do light smokers or non-smokers, which likely reflect a clustering of other risky behaviours (e.g. low level of physical activity, poor diet, and smoking) that is conducive to weight gain (Dare, Mackay, Pell *et al.* 2015; Tuovenin,Saarni, Mannisto et al. 2016). In this dataset it was observed that smoking, among men clustered with poor fruit and vegetable and alcohol consumption.

Overweight/obesity was significantly associated with poor physical activity (AOR=1.46, 95% C.I. =1.03-3.24). A decline in physical activity leads to adiposity. This has been established in literature (Yeomans, 2010; Traversy and Chaput 2015; Chan, Lim, Lim *et al.* 2017). It has been shown that although there is genetic predisposition to overweight/obesity, overweight/obesity can also result from an energy imbalance between calories consumed and calories expended (Plaisance and Grandjean, 2006). This may be due to lack of physical activity ultimately leading to decreases in energy expenditure (perhaps creating a chronic energy imbalance), than to increases in energy intake, strongly implicating poor physical activity in the aetiology of overweight/obesity (Thomas and Williams, 2008).The relationship between overweight/obesity and poor physical activity can be bidirectional, whereby poor physical activity leads to overweight/obesity and also overweight/obesity may lead to further poor physical activity hence predisposing individuals to chronic diseases such as hypertension and diabetes (WHO, 2013).

Table 5.10: Odds ratios showing the influence of socioeconomic and behavioural variables on overweight/obesity in the study population.

Variable	Model I		Model II		Model III	
	COR	CI	AOR	C.I	AOR	CI
Sex						
Male	1.00		1.00		1.00	
Female	2.75**	(2.08-3.64)	3.01**	(2.12-4.26)	2.74**	(1.92-3.90)
Age						
≤24	1.00		1.00		1.00	
25-34	2.08**	(1.42-3.03)	1.77**	(1.12-2.77)	1.83**	(1.17-2.88)
35-44	4.02**	(2.67-6.08)	3.70**	(2.23-6.12)	3.87**	(2.34-6.42)
45-54	4.28**	(2.70-6.78)	3.04**	(1.66-5.55)	3.26**	(1.78-5.98)
55-64	5.78**	(3.26-10.2)	4.91**	(2.35-10.2)	5.53**	(2.62-11.6
65+	2.78**	(1.46-5.28)	2.74**	(1.15-6.50)	2.88**	(1.21-6.86)
Marital status						
Never-married	0.46**	(0.30-0.71)	0.68	(0.34-1.34)	0.66	(0.33-1.32)
Currently-married	1.39	(0.84-2.29)	1.34	(0.66-2.71)	1.28	(0.63-2.61)
Formerly-married	1.00			1.00	1.00	
Education						
Primary or less	1.00		1.00		1.00	
Secondary	0.69**	(0.53-0.91)	0.49**	(0.29-0.83)	1.70**	(1.11-2.61)
Tertiary or higher	0.96	(0.69-1.35)	0.87	(0.58-1.32)	1.99**	(1.16-3.38)
Residence						
Cities and towns	1.00		1.00		1.00	
Urban villages	1.13	(0.86-1.50)	1.06	(0.74-1.50)	1.07	(0.75-1.52)
Rural villages	1.44**	(1.04-1.99)	1.37	(0.88-2.12)	1.37	(0.88-2.12)
Work status						
Public sector	1.61	(0.89-2.93)	1.30	(0.64-2.65)	1.22	(0.59-2.50)
Private sector	0.86	(0.49-1.51)	1.20	(0.61-2.36)	1.19	(0.60-2.35)
self-employed	1.18	(0.65-2.13)	1.24	(0.61-2.51)	1.29	(0.63-2.62)
Not employed	1.25	(0.75-2.08)	1.30	(0.70-2.40)	1.30	(0.70-2.41)
Home-maker/student	0.61	(0.35-1.07)	0.96	(0.48-1.92)	0.96	(0.48-1.92)
Retired/other	1.00		1.00		1.00	
Wealth status						
Lowest	0.80	(0.55-1.17)	0.60	(0.34-1.05)	1.03	(0.64-1.68)
Second	0.96	(0.66-1.40)	0.67	(0.40-1.11)	1.12	(0.68-1.85)
Middle	0.88	(0.60-1.28)	0.73	(0.45-1.19)	1.20	(0.71-2.01)
Fourth	0.83	(0.57-1.21)	0.79	(0.50-1.23)	1.53	(0.87-2.69)
Highest	1.00		1.00		1.00	
Smoking			N.I			
Yes	0.56*	(0.37-0.83)			2.16**	(1.22-3.83)
No	1.00				1.00	
Poor physical activity			N.I			
Yes	1.08	(0.83-1.40)			1.46**	(1.03-3.24)

No	1.00		1.00
Poor fruit/vegetable consumption		N.I	
Yes	0.82 (0.55-1.22)		0.80 (0.28-2.24)
No	1.00		1.00
Alcohol consumption		N.I	
Yes	0.66* (0.47-0.91)		1.23 (0.53-2.83)
No	1.00		1.00

Model I: Crude model-; Model II: socioeconomic variables included; Model III: socioeconomic + behavioural variables included.**statistically significant at 5%.N=958.

5.7 Levels, Patterns and Correlates of Multiple NCD Risk Factors

It has been shown that multiple risk factors for NCDs have impact on health (WHO, 2005). The clustering of NCD risk factors, is associated with an increased risk of developing NCDs (Tassitano, Dumith, Chica *et al.* 2014; Nunes, Gonçalves, Vieira *et al.* 2016; Rodrigues, Padez, Ferreira *et al.* 2016) and potentiate the risk for NCDs in adulthood (Agrawal, Sangram, Patel *et al.* 2016). The investigation of the simultaneous presence of risk factors for NCDs is important because these risk factors are modifiable from changes in lifestyle. Moreover, this investigation helps to identify populations with a higher risk for the development of NCDs.

5.7.1 Levels and Patterns of Multiple Risk Factors

Table 5.11 shows the prevalence of multiple NCD risk factors in the study population by socioeconomic characteristics. It was found that the overall prevalence of multiple NCD risk factors in the study population was relatively higher (30.1%), than in other countries such as Bangladesh (6.5%) and Brazil (22.2%) (Nunes, Gonçalves, Vieira *et al.* 2016; Khalequzzaman, Chiang, Choudhury *et al.* 2017). Gender differential was observed in prevalence of multiple risk factors, with males (31.6%) bearing the highest burden of risk factors than females (29.4%). For age, as age increases the proportion of individuals who reported multiple NCD risk factors also increased. For instance, the proportion of individuals who reported multiple NCD risk factors was lowest in ages ≤24 years (13.3%) but highest between group 55-64 years (40%).

It was also observed that multiple NCD risk factors were mostly concentrated among the formerly married (44.4%), individuals with primary or less education (45.4%), residents of rural areas (51.7%), and among self-employed individuals (38.5%). For wealth status the clustering of multiple NCD risk factors was observed to be considerably high (56.8%) among individuals in the lowest quintile groups.

Table 5.11: Prevalence of multiple NCD risk factors by socioeconomic characteristics of the study population

	0		1		≥2	
Variable	**%**	**N**	**%**	**N**	**%**	**N**
Sex					*p-value=0.001*	
Male	34.1	364	34.3	364	31.6	364
Female	25.3	813	45.3	813	29.4	813
Age					*p-value=0.000*	
≤24	46.7	270	40.0	270	13.3	270
25-34	30.8	302	44.4	302	24.8	302
35-44	24	196	24.8	196	32.7	196
45-54	23.8	130	40.8	130	35.4	130
55-64	12.0	75	48.0	75	40.0	75
65+	16.0	50	50.0	50	34.0	50
Marital status					*p-value=0.000*	
Never-married	31.1	864	40.3	864	28.6	864
Currently-married	24.1	199	46.7	199	29.1	199
Formerly-married	10.2	108	45.4	108	44.4	108
Education					*p-value=0.000*	
Primary or less	17.6	410	37.1	410	45.4	410
Secondary	34.8	514	42.8	514	22.8	514
Tertiary or higher	32.6	230	50.9	230	16.5	230
Residence					*p-value=0.000*	
Cities and towns	43.4	355	42.0	355	14.6	355
Urban villages	25.5	534	45.9	534	28.7	534
Rural villages	13.9	288	34.4	288	51.7	288
Work status					*p-value=0.000*	
Public sector	31.1	122	47.5	122	21.3	122
Private sector	30.8	182	41.8	182	27.5	182
self-employed	20.8	130	40.8	130	38.5	130
Not employed	18.3	436	44.3	436	37.4	436
Home-maker/student	48.6	218	35.8	218	15.6	218
Retired/other	23.0	74	43.2	74	33.8	74
Wealth status					*p-value=0.000*	
Lowest	10.3	234	32.9	234	56.8	234
Second	18.6	237	41.8	237	21.7	237
Middle	29.8	235	48.5	235	21.7	235
Fourth	41.8	237	40.1	237	18.1	237
Highest	39.6	235	46.4	235	14.0	235
Overall	**28**	**1178**	**41.9**	**1178**	**30.1**	**1178**

5.7.2 Correlates of Multiple NCD Risk Factors: Regression Analysis

The multinomial logistic regression model was used to assess the correlates of NCD risk factors. This was applied conditional to the measurement level of modelling for the derived dependent variable (DDV). Under this modelling approach, the response variable was recoded to generate three categories: 0="No risk factor", 1="1 risk factor" and 2="2 and more risk factors". The DDV was modelled as a polychromous response variable, to estimate the probability of occurrence of the different categories. The model assessed the determinants for occurrence of the categories of NCDs, rather than the levels of occurrence of the NCDs. Therefore, the multinomial logit model (MLM) was a natural choice, taking the form;

$$p(\,Yi = k) = \frac{e^{\beta_{K\prime - x_i}}}{1 + \sum_{k=1}^{k-1} e^{\beta_{K\prime - x_i}}}$$

The index, *i* is a set of predictors {1, 2…} while k represents a set of categories for the response category, Y with the range belonging to the set {0, 1, 2} for the 3 categories of NCDs as classified. k = 0 was chosen as a suitable base category against which the other categories are compared. The exponential beta coefficients thus represent the change in the odds of the response variable being in a particular category versus the reference category, associated with a one-unit change of the corresponding predictor variable. The usual limitation that arises with MLM relying upon the independence of irrelevant alternatives did not affect this model since chances of existence of irrelevant alternatives were minimized by exhausting the choices for the predictor variables.

5.7.1. Multinomial Logistic Regression Results

In order to examine the determinants of multiple NCD risk factors, odds ratios were generated, by fitting a multinomial logit model with results presented in table 5.11 below. Two models were derived; one for determinants of 1 risk factor and the other for determinants of 2 or more risk factors. The category 0 '=0 risk factors' was used as the base or reference category. Evidence of NCDs risk factor clustering was found in the study population.

There was gender difference in the odds of having a single NCD risk factor, with women 9 times (AOR=9.53, 95% C.I. =2.53-35.7) more likely to report a single NCD condition than men. The single NCD risk factor found to be highest among women was overweight/obesity. This finding corroborates studies on clustering of behavioural risk factors for CNDs which have shown that in LMICs overweight/obesity is the most common single NCD risk factor among women (Khuwaja and Kadir, 2010; Rawal, Biswas, Khandker et al. 2017).

The presence of one risk factor (overweight/obesity) among women is likely to increase the chances of having other risk factors ultimately leading to a clustering phenomenon. Meanwhile, there was no significant association between sex and multiple risk factors suggesting that multiple NCD risk factors were uniformly distributed among both men and women.

For age, respondents aged ≥65 years were 3 times (AoR=3.03, 95 % C.I. =1.01-10.5) more likely to report multiple NCD risk factors. This finding corroborates evidence from Brazil and Bangladesh where it was found that clustering of NCD risk factors was fairly high among adults with a tendency of clustering towards older age groups (Zaman, Bhuiyan, Karim *et al.* 2015; Rodrigues, Padez, Ferreira, *et al.* 2016). Meanwhile the relationship between age and multiple risk factors is controversial. While some studies indicate that advancing age is accompanied by greater clustering of risk factors (Duncan, Schmidt, Polanczyk *et al.* 2004; Pereira, Barreto, Passos, *et al.* 2009), others find no such association (Schuit, van Loon, Tijhuis *et al.* 2004; Muniz, Schneider, Silva *et al.* 2012), while others observe an inverse association (Malta, Moura, Silva *et al.* 2010). This lack of consistency is due in part to some conditions such as poor physical activity and obesity, which are more frequent in older individuals.

For education, respondents with secondary (AOR=0.42, 95% C.I. =0.23-0.76) level were less likely to report a single NCD condition than those with primary or less condition, while for multiple risk factors no association was found with education. This suggests that multiple risk factors cut across different education groups in Botswana. This is contrary to evidence from elsewhere (Minh, Byass, Huong *et al.* 2005; Ahmed, Hadi, Razzaque *et al.* 2009) which has shown that increasing level of educational achievements is associated with greater probability of risk factors clustering due to the fact that with increasing education also comes affluence. In Botswana both the low and high education groups have greater access to tobacco, alcohol, diets high in fats, salt, and sugar. This partly explains why there are no educational differences observed in clustering of NCD risk factors.

Individuals residing in urban villages were less likely to report single NCD risk factor (AOR=0.50, 95% C.I. =0.30-0.85) and for multiple risk factors individuals residing in urban (AOR=0.19, 95% C.I. =0.30-0.85) and rural villages (AOR=0.55, 95% C.I. =0.33-0.93) were also less likely to report multiple risk factors than those residing in cities and towns. Similar findings were observed in Uganda where participants residing in urban areas were found to be more likely to have two or more risk factors than those in rural areas (Teo, Chow, Vaz, et al. 2009; Riha, Karabarinde, Ssenyomo *et al.* 2014). Other related studies also noted that urban residence is a primary determinant of risk factors for NCDs impacting on the health of the population (Riha, Karabarinde, Ssenyomo *et al.* 2014).

SES was a significant determinant of both single and multiple NCD risk factors. For instance, individuals in the lowest quintile were two times (AOR=2.10, 95% C.I. = 1.06-4.16) more likely to report single NCD risk factor compared to those in the highest quintile. Furthermore, individuals in the lowest quintile were 6 times (AOR=6.96, 95 % C.I. =3.16-15.3) more likely to report multiple NCD risk factors compared to those in the highest quintile. This finding is in concord with previous findings which have shown that the poor in LMICs bears the greatest risk of both single (Gupta, Deedwania, Sharma *et al.* 2012; Zaman, Patel, Jan, *et al.* 2012) and multiple NCD risk factors (Neufeld, Peters, Rani *et al.* 2012; Hosseinpoor, Parker, Tursan *et al.* 2012; Corsi, Subramanian, Lear, *et al*. 2014).

Table 5.12: Odds ratios showing the influence of socioeconomic factors on multiple NCD risk factors.

	Reference category is 0 risk factor			
Variable	**1 risk factor**		**≥2 risk factors**	
	AOR	**C.I**	**AOR**	**C.I**
Sex				
Male	1.00		1.00	
Female	9.53**	(2.53-35.7)	1.59	(0.35-7.25)
Age				
≤24	1.00		1.00	
25-34	0.56	(0.19-1.59)	0.35	(0.10-1.15)
35-44	0.64	(0.23-1.80)	0.81	(0.25-2.57)
45-54	0.59	(0.21-1.61)	1.08	(0.35-3.29)
55-64	1.59	(0.50-5.08)	1.19	(0.40-3.57)
65+	0.56	(0.19-1.78)	3.03**	(1.01-10.5)
Marital status				
Never-married	0.55	(0.21-1.40)	0.69	(0.25-1.92)
Currently-married	0.74	(0.28-1.91)	0.86	(0.30-2.47)
Formerly-married	1.00		1.00	
Education				
Primary or less	1.00		1.00	
Secondary	0.42**	(0.23-0.76)	0.86	(0.43-1.72)
Tertiary or higher	0.68	(0.44-1.05)	0.89	(0.51-1.57)
Residence				
Cities and towns	1.00		1.00	
Urban villages	0.50**	(0.30-0.85)	0.19**	(0.10-0.35)
Rural villages	0.87	(0.53-1.42)	0.55**	(0.33-0.93)
Work status				
Public sector	0.86	(0.37-1.97)	0.63	(0.23-1.71)
Private sector	1.13	(0.57-3.10)	1.57	(0.63-3.93)
self-employed	0.65	(0.30-1.41)	1.66	(0.63-4.32)

Not employed	1.32 (0.63-2.75)	1.42 (0.60-3.32)
Home-maker/student	1.30 (0.61-2.71)	0.68 (0.26-1.77)
Retired/other	1.00	1.00
Wealth status		
Lowest	2.10** (1.06-4.16)	6.96** (3.16-15.3)
second	1.31 (0.75-2.28)	2.76** (1.39-5.50)
middle	0.93 (0.56-1.53)	0.86 (0.43-1.70)
Fourth	0.66 (0.42-1.04)	0.90 (0.48-1.68)
Highest	1.00	1.00

Notes: **statistically significant at 5%.N=963

5.8 Summary of Key Findings

- Gender differences were observed for NCD risk factors. For instance, men were observed to smoke tobbacco, and report poor fruit and vegetable consumption, while women were observed to report poor physical activity and to be overweight/obese. Moreover, women were 9 times more likely to report single NCD risk factor than men, while no significant gender diferences were observed for poor physical activity and multiple risk factors.
- Residential differences were also noted for risk factors for NCDs. It was found that individuals who resided in urban and rural areas were more likely to report poor fruit and vegetable consumption.The odds of having single and multiple NCD risk factors were noted to be lowest in urban and rural villages than in cities and towns. No significant residential differences were observed for smoking, alcohol consumption and overweight/obesity.
- Education was also found to be a key correlate for NCD risk factors.It was found that respondents who had teriary or higher education were less likely to report poor fruit and vegetable, while individuals who had secondary and tertiary/higher education were more likely to be overweight/obese. Meanwhile, no siginficant education

differences were observed for smoking, alcohol consumption and reporting multiple NCD risk factors.

- Significant association was found between wealth status and NCD risk factors with positive link observed between poor SES and NCD risk factors. For example, individuals who had poor wealth status, were more likely to smoke tobbacco, report poor physical activity, poor fruit and vegetable and report multiple NCD risk factors. Quite conversely, the odds of alcohol consumption were high among respondents in the fourth quintile. Meanwhile, for overweight/obesity there were no significant wealth status differences found in the general study population and among women only, but among men only it was noted that men with low wealth status were less likely to be overweight/obese.

Overall, results in this chapter indicate evidence of socioeconomic differences in NCD risk factors. It was noted that the poor and women in particular, were more likely to be exposed to NCD risk factors than the non-poor and men. For instance, the poor were found to have significantly higher odds of smoking, poor physical activity, poor fruit and vegetable consumption and to report multiple NCD risk factors than the non-poor.

Alcohol consumption was noted to be highest among the rich, while no SES based differences were observed for overweight/obesity in the entire study population and women, but among men those with low SES were less likely to be overweight/obese. This finding suggests that in Botswana overweight/obesity affects both the poor and non-poor in the general population, but for men it affects non-poor men than poor men.

Coupled with rapid urbanisation, industrialisation and increased sedentary lifestyles, high prevalence levels of NCD risk factors among the low socioeconomic group may lead to the rapid emergence of NCDs such as hypertension, diabetes, stroke, heart disease and other cardiovascular diseases among the poor in the future. Subsequent chapter assesses levels, patterns and, socioeconomic and behavioural factors associated with NCDs.

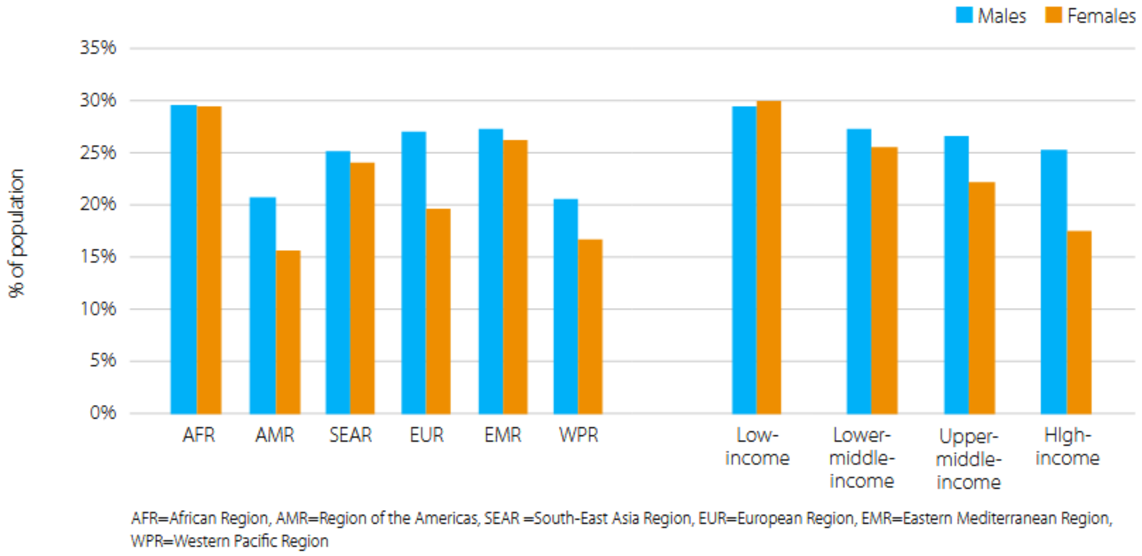
CHAPTER 6: LEVELS, PATTERNS AND, SOCIOECONOMIC AND BEHAVIOURAL FACTORS ASSOCIATED WITH NCDS

6.1 Introduction

In 2011 United Nations (UN) political declaration reaffirmed that reducing the global burden of NCDs is an overriding priority and a necessary condition for sustainable development (United Nations, 2011). It was estimated in 2012 that globally NCDs account for the 68% per cent (38 million) of all deaths (56 million). Of all the deaths due to NCDs it was estimated that almost three quarters of deaths (28 million), occur in LMICs (WHO, 2014). It had been projected that the deaths from infectious diseases would decline and the NCD deaths would increase in the future (Mathers and Loncar, 2006) even in the developing countries.

According to WHO (2014) hypertension is one of the leading risk factors for global mortality and is estimated to have caused 9.4 million deaths. It is a major cardiovascular risk factor and estimates indicate that global prevalence rates of hypertension are expected to increase, especially in LMICs. The global prevalence of raised blood pressure (defined as systolic and/or diastolic blood pressure ≥140/90 mmHg) in adults aged 18 years and over was around 22% in 2014 (WHO 2014). It has also been shown that across the WHO regions, the prevalence of hypertension was highest in Africa, at 30% for adults (see figure 6.1). In 2014, in all WHO regions men had slightly higher prevalence of raised blood pressure than women and that generally, the prevalence of raised blood pressure was higher in LMICs compared to HICs.

Figure 6.1: Age-standardized prevalence of raised blood pressure in adults aged 18 years and over (defined as systolic and/or diastolic blood pressure equal to or above 140/90 mm Hg), by WHO region and World Bank income group, comparable estimates, 2014.



Source: World Health Organization, 2014

Although HICs have begun to reduce hypertension through strong public health policies to reduce salt in processed food, improve the availability and affordability of fruits and vegetables, and create environments that promote physical activity not as much efforts has been done in LMICs. Meanwhile, the number of people with undetected and uncontrolled hypertension has increased worldwide and some studies in high-income countries report that about one fifth of people with hypertension are unaware of their condition, about one quarter do not receive treatment and only around half have their blood pressure under control (Yusuf, Islam, Chow *et al.* 2011; Mendis, Al Bashir, Dissanayake *et al.* 2012). This situation is much worse in LMICs, where it is estimated that only about half of those with hypertension are aware of their status, only a fraction receive treatment, and the majority do not have their blood pressure under control (WHO, 2014a). In general, awareness, treatment and control of hypertension are lower in people with lower levels of literacy and socioeconomic status.

Diabetes is also one NCD condition which is a well-recognized cause of premature death and disability, increasing the risk of cardiovascular disease, kidney failure, blindness and lower-limb amputation (WHO, 2014a). Diabetes was directly responsible for 1.5 million deaths in 2012 and 89 million DALYs. The global prevalence of diabetes was estimated to be 9% in 2014 (WHO, 2014b). In recent decades, the prevalence of diabetes has been increasing globally, and has been particularly accelerated in LMICs. Low-income countries showed the lowest prevalence and upper-middle-income countries showed the highest prevalence of diabetes for both sexes (WHO, 2014a). This rise is largely driven by modifiable risk factors such as poor physical activity, overweight and obesity. Besides population ageing due to glucose intolerance diabetes may be associated with socioeconomic factors.

It has been noted that of the 17.5 million deaths due to cardiovascular diseases in 2012, 7.4 million were due to heart attacks (ischaemic heart disease) and 6.7 million were due to strokes (WHO, 2014). In the last four decades, the rate of death from cardiovascular diseases has declined in HICs, due to reductions in cardiovascular risk factors and better management of cardiovascular disease (O'Flahert, Buchan, and Capewell, 2012), However, this death rate has been substantially higher in LMICs than in HICs (Yusuf, Rangarajan, Teo *et al.* 2014). Currently, over 80% of cardiovascular deaths occur in low- and middle-income countries. In 2012, heart disease and stroke were among the top three causes of years of life lost due to premature mortality globally (WHO 2014).

A range of factors has been identified under the framework of social determinants of health (WHO 2005). These factors are premised to influence prevalence of NCDs and generally include: the wider socioeconomic context; inequality; poverty; social exclusion; socioeconomic position; income; public policies; health services; employment; education; housing; transport; the built environment; health behaviours or lifestyles; social and community support networks and stress (Farrell, McAvoy, Wilde *et al.* 2008). Evidence from reviewed literature indicates that generally people who are less well off or who belong to socially excluded groups tend to be predisposed to NCDs (e.g. Yusuf, Islam, Chow *et al.* 2011; Mendis, Al Bashir, Dissanayake *et al.* 2012; WHO, 2014a). For example, people with low SES may have lower incomes, poorer education, fewer or more precarious employment opportunities and/or more dangerous working conditions or they may live in poorer housing or less healthy environments with access to poorer services or amenities than those who are better off, all of which are linked to susceptibility to NCDs.

In order to tackle inequalities in health, five of the Sustainable Development Goals (SDGs) set targets that relate to the reduction of health inequalities nationally and worldwide. The targets which are specifically aligned to target health inequalities are poverty reduction, health and wellbeing for all, equitable education, gender equality, and reduction of inequalities within and between countries (Niessen, Mohan, Akuoku, *et al.* 2018). The SDGs address existing global health inequalities through comprehensive, cross sector strategies and the United Nations (UN) explicitly recognises the broader socioeconomic determinants of health and wellbeing. Studies on the association between SES and NCDs in low-income and middle-income countries (LMICs) are relatively scarce and little systematic evidence exists to support the interaction between SES and health in high income countries (HICs).

Available evidence indicates that populations with low SES are much more likely to have a higher chronic disease burden than groups with high economic status (Wagstaff 2002; Suhrcke, Nugent, Stuckler *et al.* 2006; van Doorslaer, O'Donnell *et al.* 2007; van Doorslaer, O'Donnell, Rannan-Eliya, *et al.* 2006). From the available literature, it has been observed that the link between inequalities in social and economic endowments and health is complicated. Poor economic and educational outcomes for households inhibit good health, while low socioeconomic status leads to chronic ill health, and NCDs reduce income status of households.

Literatures reviewed in previous chapters have shown that NCDs account for most causes of early death and disability worldwide, that there is an increase in the clustering of NCD conditions with low SES in LMICs since 2000, which was previously seen in high-income settings. Research evidence from 283 studies tremendously supports association between low-income, low socioeconomic status, or low educational status and higher prevalence of NCDs (Niessen, Mohan, Akuoku, *et al.* 2018). In LMICs India has provided more evidence on the association between SES and NCDs but the relationship is in the opposite direction. For instance, using Indian data drawn from the National Sample Survey Office (NSSO) 2004 found that prevalence of NCDs was highest among higher-income groups based on self-reported morbidity (Mahal, Karan and Engelgau, 2010).

Additionally, positive association was observed between income and the prevalence of diseases at the national level in self-reported diabetes from the Indian National Family Health Survey-3 (Corsi and Subramanian, 2012). Another evidence from a study in Chennai city, India, which used biochemical measures for diagnosis, revealed the prevalence of diabetes and cardio-metabolic risk factors rapidly increased in low income groups over a ten year period, such that they 'caught up' to those of middle income groups (Vellakal, Subramanian, Millet *et al.* 2013). Furthermore, another study in India using more objective biochemical measures confirmed greater prevalence of cardiovascular diseases risk factors among the low SES groups in India (Gupta, Deedwania, Sharma *et al.* 2012).

The NCD survey collected a range of information on NCDs to estimate prevalence rates in Botswana. The NCD survey, extended data collection to other NCDs other than the ones collected through STEPs survey classified by WHO as chronic conditions. Having discussed the NCD risk factors in the previous chapter, this chapter analyse the levels, patterns and factors associated with NCDs in Botswana from the data collected during the NCD survey.

6.2 Prevalence, Patterns and Factors Associated with NCDs

6.2.1 Prevalence and Patterns of NCDs

This subsection presents prevalence rates and patterns of NCDs in the study. Consequently, results in this subsection are inconclusive since the patterns are indicative from bivariate analysis perspective since they are not controlled for other covariates. Table 6.1 shows prevalence of NCDs by socioeconomic and behavioural characteristics of the study population.

Stroke

Demographic, nutritional and epidemiological shifts resulting in changes in the distribution of cardiovascular risk factors have resulted in stroke becoming a major health problem in Botswana. Results indicate that prevalence of stroke in the study population was 1.8%. This prevalence estimate, may be an underestimation of the actual prevalence rate of stroke in the population because some participants may not yet been diagnosed at the time of the survey and patients who die quickly from stroke or those with mild stroke were not captured.

Stroke was slightly high among females (2.1%) than males (1.1%), and it was also more prevalent among individuals in ages 45-54 years (3.8%) than other age groups. Previous study in Botswana by Ministry of Health, (2008) has also shown similar findings, where the number of inpatients with stroke increased with age for both sexes. Meanwhile, females were observed to be the most affected by stroke. This finding however, contradicts evidence from other epidemiological studies, which indicates that globally stroke is more common among men, but women are more severely ill (Appelros,Stegmayr and Terent, 2009). The biological and social explanations for observed gender differences require further study. Furthermore, efforts to discuss observed age differences in stroke prevalence have been hampered by the paucity of data on gender-differences in age-specific stroke incidence. However, little available evidence suggests that the particular influence of oestrogen and testosterone on the endothelium and the vascular system, the role of risk factors unique to women such as the use of oral contraceptives, hormone replacement therapy and pregnancy, systemic delays in the recognition and insufficient treatment of conventional stroke risk factors in women have all been considered are probable explanations (Carandang, Seshadri, Beiser *et al.* 2006; Petrea, Beiser, Seshadri *et al.* 2009).

Considering marital status, stroke was more prevalent among formerly married (5.6%) respondents, than never (1.2%) and currently (2.5%) married groups. Some studies suggest that being divorced, widowed or separated confer a higher risk for stroke compared with other forms of marital status, such as being married, single (not divorced), or cohabitating (Dupre, Beck and Meadows, 2009). There is also evidence to suggest that marital loss has a greater impact on the health of women than men (Dupre, Beck and Meadows, 2009; Hughes and Waite, 2009) particularly cardiovascular health such as being predisposed to stroke (Zhang and Hayward, 2009). This possibly explains the observed pattern of gender difference in stroke prevalence being highest among women. The reasons for these differences are not entirely known; however, like in this study, studies have shown that divorced, separated and widowed women suffer greater economic losses and emotional distress than men (Smock, Manning, and Gupta, 1999; Zhang and Hayward, 2009; Hughes and Waite, 2009).

Stroke was also more prevalent among individuals with primary or less education (2.7%), individuals residing in urban villages (2.4%) and unemployed respondents (3%). Prevalence of stroke among individuals with low education level in part can be explained by general lack of knowledge about cardiovascular health. Lack of knowledge about cardiovascular health coupled with health risk behaviours (such as poor diet and poor physical activity) among individuals residing in urban villages may also be responsible for high prevalence rates in such areas.

Concomitant with observations made from this study, two studies from Brazil have shown that residing in semi urban and having low education level confer risks for stroke compared to residing in cities and towns and having higher education level (Cabral, Gonçalves, Longo et al. 2009; Fernandes and Bastos, 2013). On the other hand prevalence of stroke among the unemployed could possibly be explained by emotional distress associated with unemployment (Hughes and Waite, 2009).

It was also observed that stroke was more prevalent among individuals in the lowest quintile group (3%), than among other quintile groups. This finding corroborates evidence from previous studies which have noted higher rates of stroke among people of lower SES (Avendano, Kawachi, Van Lenthe *et al.* 2006; Heeley, Wei, Carter *et al.* 2011; Kerr, Slavin, Clark *et al.* 2011). These studies suggest that classic vascular risk factors such as smoking, poor physical activity, poor fruit and vegetable consumption, and poor diets partly explain the increased risk of stroke among lower socioeconomic groups.

Considering behavioural risk factors stroke was more prevalent among individuals with poor physical activity (2.2%), and poor fruit/vegetable consumers (1.8%). Poor physical activity and poor fruit and vegetable consumption have been identified as classic vascular risk factors for stroke (Kerr, Slavin, Clark *et al.* 2011). These risk factors have been opined to lead to prevalence of high blood pressure and cholesterol which ultimately lead to stroke incidence (Langagergaard, Palnum, Mehner *et al.* 2011; Owolabi, Arulogun, Melikam *et al.* 2015).

Angina

Angina remains relatively uncommon in SSA, despite an increasing prevalence of risk factors, but its incidence is rising (Churchill, 2013). Prevalence and incidence of angina in developing countries such as Botswana is fuelled by notable economic development, high rates of urbanisation and changes in life expectancy resulting from the impact of pre-transitional diseases. In the data used for this study, it was found that the prevalence rate for angina was 2.5% in the study population.

This prevalence rate is comparatively higher than in neighbouring countries (South Africa, Zimbabwe and Namibia) where prevalence rates for angina have been found to be below 2% (Steyn, Sliwa, Hawkens *et al.* 2005; Commerford and Ntsekhe 2008; Twagirumukiza, De Bacquer, Kips-Jan *et al.* 2011). Meanwhile, the increased prevalence of the major risk factors for angina such as high blood pressure (hypertension), smoking, drinking excessively, poor eating habits, obesity and lack of physical activity is assumed to increase incidence and prevalence of angina in the region (Churchill, 2013). With about 20% of the population in the study reporting to have been diagnosed with hypertension, 65% reporting poor physical activity and 41% being overweight/obese, prevalence of angina is likely to increase in the future.

Angina was more prevalent among females (3%) than males (1.6%). This finding is similar to what other studies found that over time and at different ages, independent of diagnostic and treatment practices, women have a slightly higher prevalence of angina than men across countries (Hemingway, Langenberg, Damant *et al.* 2008).

In this study, high prevalence rates of angina among women augurs with high prevalence rates of risk factors for angina among women, such as hypertension (24.8% in women vs 7.7% in men), poor physical activity (73.6% in women vs 53.6% in men) and overweight/obesity

(48.6% in women vs 25.5% in men). This partly explains why angina was more prevalent among women than men in the study population. Meanwhile, clinical studies suggest that angina in women is more commonly microvascular in origin than is the case in men (Pepine, Kerensky, Lambert *et al.* 2006).

Contrary to some findings in HICs where angina has been found to be associated with old age (Johnston, Mendis, and Mathers, 2009), in this study prevalence of angina was found to be highest among individuals in aged 25-34 years (4.3%) than among other age groups. In LMICs, there is insufficient evidence to corroborate this finding. Observed prevalence of angina among young people aged 25-34 years in Botswana may be explained by psychological distress due to unemployment, poverty and low socioeconomic status.

Incidentally, it was found that in this study angina was also more prevalent among unemployed people (4.6%) who are mainly youth. As a result, this offers a plausible explanation why angina is more prevalent among this group because anxiety and depression symptoms due to unemployment are prospectively associated with cardiac disorders such as angina (Grace, Abbey, Irvine *et al.* 2004; Celano and Huffman, 2011). Anxiety and depression are more common among the poor and unemployed people (Grace, Abbey, Irvine *et al.* 2004). It is also suggested that depression not only play a role in development of angina, but of anginal pain in particular (Arnold, Spertus, Ciechanowski *et al.* 2009).

For wealth status angina was more prevalent among individuals in the lowest quintile at 3%. There is ample evidence confirming this finding, which indicates that angina is positively correlated with low socioeconomic status (Phillips and Klein, 2010). Although much of this evidence is from industrialised countries (Addo, Ayerbe, Keerthi, *et al.* 2012; Tchicaya and Baumann, 2015) there is upsurge of similar evidence in developing countries (Alves, Cesar and Horta, 2010; Alam, Naqvi, and Aslam, 2016). Such evidence links poor physical activity, poor diet, and smoking with angina (American Heart Association, 2009; Churchill, 2013), behaviours which have also been found to be associated with low socioeconomic status in this study.

Empirical evidence has shown that behavioural risk factors driving prevalence of angina include poor physical activity, poor diet (including poor fruit and vegetable consumption) and smoking (Churchill, 2013). Similarly, in this data it was observed that angina was more prevalent among individuals who reported such behavioural factors. For instance, it was found that angina was more prevalent among smokers (2.2%), physically inactive (2.2%), poor fruit and vegetable consumers (2.6%) and alcohol consumers (1.8%).

Diabetes

Diabetes was found to be the third most prevalent NCD condition (after asthma and hypertension) in the study population and its prevalence was estimated at 3.8%. This prevalence rate is relatively higher than in some SSA countries but lower than the regional prevalence of 4.3% (Ojuka and Goyaram, 2014). Although there is variation in diabetes prevalence between countries, with prevalence ranging from a low of 0.6% in Benin to a high of 18.2% in Réunion (International Diabetes Federation, 2015) prevalence of diabetes in SSA, similar to trends being seen worldwide, is rapidly rising. However, it should be noted that the prevalence rate observed in this data may be an underestimation of the actual prevalence rate because of under-reporting. Under reporting can be attributed to a lack of access to health care facilities, poorly trained health care providers, and lack of screening.

In Botswana, diabetes carries a twofold burden because of the increased risk of infectious diseases such as HIV, TB, and pneumonia (Pastakia, Pekny, Manyara *et al.* 2017). This is because these infectious diseases have been found to be associated with increased cases of diabetes. HIV and the antiretroviral medications used to suppress its replication have been noted to be both associated with metabolic dysfunction and changes in insulin sensitivity, leading to metabolic syndrome and/or diabetes (Pastakia, Pekny, Manyara *et al.* 2017).

Diabetes was more prevalent among females (4.1%), than males (3.3%), while for age the proportion of individuals who had diabetes increased with age, and was highest in ages 55-64 years (13.3%), and ≥65 years (12%). This finding supports results from previous studies, which have shown that diabetes is more prevalent among women and also increases with age. For instance, Beckles and Thompson-Reid (2001) opined that a sex variation for diabetes is justified, especially for women because of the impact of gestational diabetes on both the mother and baby regarding the increased risk of developing type 2 diabetes in later life and the increasing prevalence among older women due to their greater life expectancy.

For this study, high prevalence of diabetes among women than men can be partly explained by high proportion of women than men who were overweight/obese (48.6% in women vs 25.5% in men) in the sample. This is because it has been shown that overweight/obesity is a strong predictor of diabetes (Grant, Hicks, Taylor *et al.* 2009). It has also been noted that the unprecedented aging of the world's population is a major contributor to the diabetes epidemic (Boyle, Thompson, Gregg *et al.* 2010; Narayan, Boyle, Geiss *et al.* 2011), and this probably explains high prevalence of diabetes in older adults in this study.

It is acknowledged that psychosocial, structural and behavioural factors such as marital status, place of residence, employment status and wealth status significantly influence diabetes prevalence (Grant, Hicks, Taylor *et al.* 2009; Pastakia, Pekny, Manyara *et al.* 2017). Similarly, in this study it was observed that diabetes prevalence was high among the formerly married (11.1%), individuals with primary or less education (6.1%), in urban villages (4.1%), public sector employees and individuals in the highest quintile (6.5%). Looking at psychological factors studies have shown that formerly married (divorced, widowed and separated) people usually suffer anxiety and depression leading to poor physical activity and poor diets which in turn leads to overweight/obesity ultimately resulting in diabetes (Boyle, Thompson, Gregg *et al.* 2010; Narayan,Boyle, Geiss *et al.* 2011). This offers plausible explanation for observed prevalence of diabetes among the formerly married in this study. Low education level and urban village residence may predispose individuals to diabetes through poor health behaviours and lack of knowledge and access to information on good health habits.

For work status, public sector employees in Botswana are mainly office workers who live sedentary lifestyle. Due to this sedentary lifestyle, they are likely to be physically inactive consequently leading to overweight/obesity which is a key risk factor for diabetes. Epidemiological evidence also suggests that sedentary behaviour (e.g., office work, television watching) are associated with increased risk of type 2 diabetes (Hu, Li, Colditz *et al.* 2003; Kulshreshtha, Vaccarino, Judd, *et al.* 2013). Moreover, sedentary behaviour has been associated with adiposity (Hu, Li, Colditz *et al.* 2003); adiposity-associated inflammation (Allison, Jensky, Marshall *et al.* 2012); and reduced lipoprotein lipase activity, clearance of triglycerides, clearance of an oral glucose load, and glucose-stimulated insulin secretion (Owen, Sparling, Healy *et al.* 2010). Thus sedentary behaviour partly explains diabetes prevalence among public sector employees in this study.

For behavioural factors, diabetes was more prevalent among smokers (4.2%), physical inactive (4.3%), and individuals who do not take sufficient fruits/vegetables (4.3%) and who consume alcohol (3.8%). This adds to previous findings from other studies which have shown that lifestyle factors such as smoking, physical inactivity and poor diets predisposes people to diabetes (Azevedo and Alla, 2008; Grant, Hicks, Taylor *et al.* 2009; Pastakia, Pekny, Manyara *et al.* 2017).

Chronic Lung disease

It was found that chronic lung disease was the least prevalent NCD condition in the study population, with an estimated prevalence rate of 0.8%. This prevalence rate is lower that the regional prevalence rate of 4.8% (Abdallah, Taktak, Chtourou *et al.* 2011; Al Zaabi, Asad, Abdou *et al.* 2011). It is also lower than in LMICs such as Tunisia (3.8%), Lebanon (5.6%), Saudi Arabia (2.4%) and United Arab Emirates (3.7%) (Abdallah, Taktak, Chtourou *et al.* 2011; Tageldin, Nafti, Khan *et al.* 2012; Ahmed, Robinson and Mortimer, 2017).

Low chronic lung disease prevalence rate in Botswana may be explained by relatively low prevalence of smoking in the population. This is because tobacco smoking is major risk factor of chronic lung disease. Other suggested risk factors, such as biomass fuels, pneumonia, older age, genetic factors, drug use and environmental pollutants have been observed to cause few cases of chronic lung disease (Cui, Carruthers, McIvor *et al.* 2010; Gingo, George, Kessinger *et al.* 2010). Some studies have suggested that HIV infection and highly active antiretroviral therapy (HAART) may contribute to the development of COPD in people with HIV infection

Chronic lung disease was more prevalent among males (1.4%) than females (0.5%). This finding corroborates evidence from other studies which have shown high prevalence of chronic lung disease among smokers. For instance, a recent study noted that in Saudi Arabia estimated chronic lung disease prevalence in the general population was 2.4% and 14.2% among smokers (Ahmed, Robinson and Mortimer, 2017). Meanwhile it has been found in this data that a high proportion among men than women reported to be smokers and this possibly explains the observed gender difference in chronic lung disease. Thus a high proportion among men than women is likely to be exposed to the risk of chronic lung disease than women.

It was also found that chronic lung disease was slightly higher among individuals with primary or less education (1.2%), residing in rural villages (1%) and retired employees (1.4%). This finding indicates the interplay of several socioeconomic risk factors for chronic lung disease in the study population. Other studies have also shown that chronic lung disease is more prevalent in adults, residents of rural areas and non-workers even after adjusting for smoking, occupational exposure and ethnicity (Feldman, McMullan and Abernathy, 2004; Uzaslan, Mahboub, Beji *et al.* 2011, Alam, Naqvi, and Aslam, 2016).

This study also found that prevalence of smoking was high among respondents with primary or less education. This was mostly in rural areas and among retired employees suggesting that smoking could be the cause of chronic lung disease among these socioeconomic groups. Poor socioeconomic status has been shown to be an independent risk factor for chronic lung disease and has a significant correlation with lung function even after adjustment for smoking, occupational exposure and ethnicity (Hegewald and Crapo; Sundeep and Peter, 2009). Similarly, this study shows that chronic lung infection was slightly more prevalent among people of low socioeconomic status (1.3%). Likewise, a study by Pallasaho, Lindström, Põlluste *et al.* (2004) in Finland, Sweden and Estonia interviewed 44,483 participants and reported a significant link between low socio-economic status and chronic lung disease.

For behavioral variables, chronic lung disease was more prevalent among smokers (0.8%) and those who reported poor physical activity (1.3%). The finding corroborates evidence from other studies that have shown that smoking and lack of physical activity are risk factors for chronic lung disease (Feldman, McMullan and Abernathy, 2004; Uzaslan, Mahboub, Beji, 2011, Alam, Naqvi, and Aslam, 2016). In SSA chronic lung disease prevalence in current smokers ranges from 9.4% to 56.9%, and the WHO reports that smoking alone causes about 42% of chronic lung diseases (WHO, 2015). This indicates the need for the government to enhance smoking cessation programs and anti-smoking campaigns in order to reduce increased prevalence of chronic lung disease in the population.

Table 6.1: Prevalence of NCDs by socioeconomic and behavioural characteristics of the study population

	Stroke (N=21)	**Angina (N=30)**	**Diabetes (N=45)**	**Chronic lung disease (N=9)**	**Asthma (N=68)**	**Hypertension(N=230)**
Variable	**%**	**%**	**%**	**%**	**%**	**%**
Sex						
Male	1.1	1.6	3.3	1.4	4.9	7.7*
Female	2.1	3.0	4.1	0.5	6.2	24.8
Age						
≤24	0.7	1.9	0.4	0.0	10.7	1.1
25-34	0.0	4.3	1.7	0.7	5.3	5.6
35-44	0.0	1.5	3.6	1.0	5.6	19.4
45-54	3.8	0.8	4.6	0.8	3.1	31.5
55-64	10.0	1.3	13.3	0.0	6.7	50.7
65+	1.4	2.0	12.0	0.0	2.0	62.0
Marital status						
Never-married	1.2	2.9	2.4	0.9	6.8	11.8
Currently-married	2.5	1.5	6.0	0.5	3.0	34.7
Formerly-married	5.6	1.9	11.1	0.0	1.9	54.6
Education						
Primary or less	2.7	2.2	6.1**	1.2	3.9	36.6**
Secondary	1.0	3.1	2.1	0.6	6.6	9.5
Tertiary or higher	0.9	1.7	3.5	0.0	7.4	11.7
Residence						
Cities and towns	0.8	0.8**	3.7	0.3	6.5	14.1**
Urban villages	2.4	3.6	4.1	0.9	5.6	21.3
Rural villages	1.7	2.8	3.5	1.0	5.2	22.9
Work status						
Public sector	1.6	2.5	5.7	0.0	4.1**	28.7**
Private sector	0.5	1.1	2.7	0.5	6.0	12.1
self-employed	0.8	0.8	5.4	0.8	6.2	20.0
Not employed	3.0	4.6	4.4	0.9	3.9	23.2
Home-maker/student	0.5	0.9	1.4	0.9	10.6	9.2
Retired/other	2.7	1.4	4.1	1.4	5.4	32.4
Wealth status						
Lowest	3.0	3.0	4.3	0.4	4.7	20.1
Second	1.7	3.0	3.8	1.3	4.6	21.9
Middle	1.3	2.1	2.6	0.9	6.0	20.0
Fourth	2.1	3.0	2.1	1.3	4.6	21.1
Highest	0.9	1.7	6.5	0.0	8.9	14.5
Smoking						
Yes	1.7	2.6	4.2**	0.8	6.1	19.5
No	2.2	2.2	0.7	0.7	2.9	19.9
Poor physical						

activity						
Yes	0.5**	2.7	3.2	1.3	6.9	16.0**
No	2.2	1.9	4.3	0.5	5.4	21.4
Poor fruit/vegetable consumption						
Yes	1.8	2.6	3.7	0.8	5.8	19.3
No	0.8	2.5	4.1	0.8	5.8	23.1
Alcohol consumption						
Yes	1.8	1.8	2.7	0.0	0.0	20.0
No	1.0	1.0	2.0	0.5	0.5	8.8
Overweight/obesity						
Yes	1.5	3.2	5.6**	1.1	5.6	28.8**
No	1.8	1.7	2.4	0.6	6.3	12.4
Multiple NCDs risk factors						
0 risk factor	1.8	2.7	3.3	0.6	6.1	11.2**
1 risk factor	1.6	2.4	4.5	0.4	6.5	23.1
2≥risk factors	2.0	2.5	3.4	1.4	4.5	22.3
Overall	1.8	2.5	3.8	0.8	5.8	19.5

Note: **Statistically significant at 5%.

Asthma

It was found that asthma (5.8%) was the second most prevalent NCD condition after hypertension. It has also been generally observed that in SSA, the prevalence of acute respiratory infections is one of the highest in the world (Ahmed, Robinson and Mortimer, 2017). Asthma and allergic sensitization are becoming more widespread in SSA, a trend supported by studies in Ghana, Kenya, Ethiopia and Rwanda (D'Amato, Holgate, Pawankar *et al.* 2015). This rising trend is mostly associated with sensitization to house dust mite, tobacco smoking, and living in urbanised area (Mabey, Gill, Whitty *et al.* 2013; Thomsen, 2015). In Botswana little is known about the causes of asthma. Consequently, further studies are needed to untangle causes of asthma.

Asthma was more prevalent among females (6.2%) than among males (4.9%). Clinical evidence supports this finding, and shows that increased asthma symptoms occur in women than in men (Fuseini and Newcomb, 2017). However, it has been shown that gender disparities in asthma prevalence occur through different stages of life. For example, as children, boys have an increased prevalence of asthma compared to girls (Centers for Disease Control and Prevention, 2011), and boys are also twice as likely as girls to be hospitalized for an asthma exacerbation (Kynyk, Mastronarde and McCallister, 2011). However, during adolescence there is a decline in asthma prevalence in males and an increase in females and adulthood, women have increased asthma prevalence compared to men (Moorman, Zahran, Truman *et al.* 2011). These shifts in asthma prevalence based on gender have been observed to coincide with changes in sex hormones and suggest that sex hormones modulate pathways associated with asthma pathogenesis (Fuseini and Newcomb, 2017).

Consistent with other studies (Moorman, Zahran, Truman *et al.* 2011; D'Amato, Holgate, Pawankar *et al.* 2015), this study found that prevalence of asthma declined with increasing age, with the highest prevalence observed in ages below 24 years (10.7%) and lowest prevalence in ages over 65 years (2%). However, other studies suggest that asthma is frequently underdiagnosed or misdiagnosed among the elderly (Global Initiative for Asthma, 2009; Gibson, McDonald, and Marks, 2010) due to atypical presentation, age-related reduction of dyspnea perception, and associated comorbidities (Tzortzaki, Proklou, and Siafakas, 2011).

Similar observations have been made in Botswana, where asthma and COPD have been suggested to overlap and converge in older people (Kiboneka, Levin, Mosalakatane, *et al*. 2016) ultimately leading to under-estimation of the other in the older population. Other socioeconomic covariates of asthma included; being never married individuals (6.8%), tertiary or higher education (7.4%), cities and towns (6.5%), and individuals in the highest quintile (8.9%). Other studies on smoking and asthma have provided contradicting conclusions. In several cross-sectional studies, the risk of asthma was not elevated in active smokers compared with never-smokers (Walraven, Nyan, van der Sande *et al.* 2001; Piipari, Jaakkola, Jaakkola *et al.* 2004; Ikeue, Nakagawa, Furuta, *et al.* 2010), whereas other studies detected an increased risk of asthma in smokers (Flodin and Jonsson, 2003; Arif, Delclos, Lee *et al.* 2003).

The few longitudinal studies published have also reported inconsistent results on current smoking and asthma. Meanwhile, this study found similar pattern with studies which have seen association between smoking asthma. Prevalence of asthma was slightly high among smokers (6.1%) than non-smokers (2.9%). It was also found that asthma was more prevalent among individuals with poor physical activity (6.9%) and overweight/obese (28.7%). Consistent with this finding, previous studies have noted poor physical activity and overweight/obesity to cause and exacerbate prevalence of asthma (Mosen, Schartz, Magid *et al.* 2008; Kim, Sutherland and Gelfand, 2014).

Hypertension

Hypertension (19.5%) was the most prevalent NCD condition in the study population. This finding reaffirms the notion that hypertension in sub-Sahara Africa (SSA) is a widespread problem, and in some communities, it has been reported to be as high as 38 % (Opie and Seedat, 2004; Steyn, Bradshaw, Norman *et al.* 2008; Ataklte, Erqou, Kaptoge *et al.* 2015). A four country (Tanzania, South Africa, Uganda and Nigeria) study by Guwatudde, Nankya-Mutyoba, Kalyesubula *et al.* (2015) found that overall prevalence rate for hypertension in the general population was as high as 25.9%. In Botswana the high prevalence of hypertension is accentuated by rapid changing lifestyles associated with modernization and urbanization (Keetile, Navaneetham and Letamo, 2015). Increasing urbanization with its associated lifestyle changes including unhealthy dietary habits, increased alcohol use, smoking and low physical activity drives hypertension levels in Botswana (Ministry of Health, 2008).

Gender differential in prevalence of hypertension is an established finding (Bradshaw, Norman *et al.* 2008; Ataklte, Erqou, Kaptoge *et al.* 2015). In general, women have often been found to be more hypertensive than men (Cappuccio, Micah, Emmett *et al.* 2004; Keetile, Letamo and Navaneetham, 2015; Ataklte, Erqou, Kaptoge *et al.* 2015). Similarly, it was found in this study that hypertension was significantly higher among females (24.8%) than males (7.7%). High prevalence of hypertension among women in this study is hypothesised to be influenced by poor physical activity and overweight/obesity which are also observed to be significantly high among women than men. These factors, have been noted to be key risk factors for hypertension (Gu, Reynolds, Wu *et al.* 2002; Bharucha and Kuruvilla, 2003; Everett and Zajacova, 2015).

As expected, prevalence of hypertension increased with age, from as little as 1.1% among individuals in ages below 24 years to 62% among individuals in ages above 65 years. This is in conformity with some other studies on the prevalence of hypertension that found that hypertension increases with age, and this is the case for both developed and developing countries (Mohan, Campbell and Chockalingam, 2005; World Health Organization, 2010; Prince, Ebrahim and Acosta, 2012). Keetile, Navaneetham and Letamo (2015) using the 2007 WHO STEPwise survey data found similar trend where prevalence of hypertension increased with age. Poor physical activity and the cumulative effects of other risk behaviours such as alcohol consumption, poor fruit and vegetable consumption and weight gain explain increased levels of hypertension in old ages observed in this data.

Other factors which were found to be significantly associated with hypertension are education, marital status, rural area residence and employment status. For instance, individuals with primary or less education (36.6%), formerly married individuals (54.6%), rural area residents (22.9%) and retired individuals (32.4%) had highest prevalence of hypertension. Similar findings were observed in Vietnam: where people with low level of education and were residing in rural areas were more often hypertensive than those with high educational level and resided in urban areas (Son, Quang, Viet *et al.* 2012).

It has also been found that in Tanzania, South Africa, Uganda and Nigeria, rural area residents and low education level participants were more hypertensive (Guwatudde, Nankya-Mutyoba, Kalyesubula *et al.* 2015). Meanwhile, prevalence of hypertension among formerly married (divorced, widowed or separated) may be explained by psychological stress, while among retired individuals aging may be a key factor for hypertension. Low wealth status has previously been identified as one of the important risk factors for hypertension by the different cross sectional studies (Hendriks, Wit, Roos *et al.* 2012; Pires, Sebastião, Langa *et al.* 2013; Helelo, Gelaw and Adane, 2014). However, in SSA there are mixed findings on the association between low socioeconomic status and hypertension.

Other studies found no association (Tuoyire and Ayetey, 2018), others found an inverse relationship (Fernald and Adler, 2008) while still others positive association (Leng, Jin, Li, *et al.* 2015). Findings from this study corroborate the latter, where hypertension was highest among the low wealth status group (21.9%). The positive association between SES and hypertension in most LMICs has been explained by the theory that the prevalence of modifiable risk factors for hypertension such as overweight/obesity, sedentariness, and excessive caloric, fat, alcohol and salt intake as well as increased psychological stress are common among the poor (Reddy, Naik and Prabhakaran, 2006; Ibrahim and Damasceno, 2012). This notion perfectly explains the finding of this study. In Botswana, the adoption of unhealthy lifestyles that hinges around increased meat intake, increased patronage of poor diets which are typically high in sodium and fat, increased alcohol consumption, overweight/obesity and physical inactivity are more common among the poor than the non-poor (Keetile, Navaneetham and Letamo, 2015).

Hypertension was found to be significantly more prevalent among alcohol consumers (20%) and overweight/obese (28.8%) individuals. Quite conversely, hypertension was not significantly associated with smoking, and physically inactivity in the study population. This finding shows that alcohol consumption and overweight/obesity are important covariates of hypertension in Botswana. This augurs with the literature on hypertension which have also identified alcohol consumption and overweight/obesity as one of the major determinants of hypertension (Vernooij, van der Graaf, Visseren *et al.* 2012; Maniecka-Bryla, Szymocha, Bryla *et al.* 2011; Commodore-Mensah, Samuel, Dennison-Himmelfarb *et al.* 2014).

6.2.2 Other NCD Conditions

In this study, data was collected for other-NCD conditions which are not common and have not received much attention in Botswana. Table 6.2 below shows prevalence of these NCDs by socioeconomic and behavioural characteristics of the study population. It was observed that eye/vision problem (19.9%) was the most prevalent other-NCD condition, followed by nerves problem (4.7%), Skin problem (4.2%) and lastly depression (1.9%).

Prevalence of eye/vision problem (22.8%), nerves problem (6%) and depression (4.6%) was high among females, while skin problem was more prevalent among males (1.8%). Cross-sectional population-based studies from the last two decades performed in Africa have also shown an increase in eye/vision problem, nerve conditions, skin problem and depression. This includes studies from Kenya (Mathenge, Kuper, Limburg *et al*. 2007a, 2013), Nigeria (Rabiu and Muhammed, 2008; Abdull, Sivasubramaniam, Murthy *et al.* 2009), Tanzania (Kikira

2007; Habiyakire Kabona, Courtright *et al*. 2010), Rwanda (Mathenge, Nkurikiye, Limburg *et al.* 2007b), Cameroon (Oye, Kuper, Dineen *et al.* 2006; Oye and Kuper 2007), Ghana (Guzek, Anyomi, Fiadoyor *et al*. 2005), Guinea (Moser, Martín-Baranera, Vega *et al*. 2002), Burundi (Kandeke, Mathenge, Giramahoro *et al*. 2012) and Ghana (Budenz, Bandi, Barton *et al*. 2012).

Prevalence of other-NCD conditions increased with age, until ages 55-64 years. Similar observations have been made in both HICs and LMICs where age has consistently been found to be a significant covariate of conditions such as eye/vision, nerves, and skin condition (Mbulaiteye, Reeves, Mulwanyi *et al.* 2003; Mathenge, Bastawrous, Peto, *et al.* 2013; Bastawrous, Burgess, Mahdi, *et al.* 2014). Meanwhile, eye vision problem (46.3%), nerves problem (11.1%) and depression (11.1%) were more prevalent among formerly married respondents. There is evidence to suggest that eye/vision problem, and nerves problems are linked to depression (Zhang, Bullard, Cotch *et al.* 2013), which may also be associated with loss of marital partner.

Table 6.2: Prevalence of Other-NCDs by socioeconomic and behavioural characteristics of the study population

	eye/vision problem (N=235)	Nerves problem(N=55)	Skin problem(N=22)	Depression(N= 50)
Variable	**%**	**%**	**%**	**%**
Sex				
Male	13.7**	1.6**	1.9	3.6
Female	22.8	6.0	1.8	4.6
Age				
≤24	13.3**	5.2	3.0	4.1
25-34	13.2	4.6	1.7	4.3
35-44	16.8	3.1	4.1	3.1
45-54	24.6	6.2	0.0	3.8
55-64	28.0	0.0	0.0	2.7
65+	40.0	8.0	0.0	8.0
Marital status				
Never-married	16.7**	4.1**	2.1	3.4**
Currently-married	19.6	3.5	1.5	4.0
Formerly-married	46.3	11.1	0.9	11.1
Education				
Primary or less	26.8**	4.4**	1.0	4.4**
Secondary	14.0	3.1	2.1	2.7
Tertiary or higher	19.1	7.8	3.0	7.0
Residence				
Cities and towns	18.9	5.1	2.3*	3.7
Urban villages	20.2	3.6	2.4	4.7
Rural villages	20.8	6.3	0.3	4.2
Work status				
Public sector	22.1**	4.1	2.5	5.7
Private sector	11.5	4.9	1.6	2.2
self-employed	16.9	3.1	0.8	1.5
Not employed	26.1	5.3	1.6	4.8
Home-maker/student	15.1	5.0	3.2	5.0
Retired/other	21.6	2.7	1.4	5.4
Wealth status				
Lowest	17.9	4.3**	0.4	4.7
Second	25.7	4.6	2.1	4.6
Middle	17.0	0.9	1.7	2.6
Fourth	20.3	5.9	2.5	3.4
Highest	18.7	7.7	2.6	6.0
Smoking				
Yes	19.8	5.0	1.9	4.3
No	21.3	2.2	1.5	3.7
Poor physical activity				
Yes	17.8	4.0	2.9	3.2
No	20.8	5.2	1.4	4.7

Poor fruit/vegetable consumption				
Yes	20.0	4.6	2.0	3.6**
No	19.0	5.0	0.8	9.1
Alcohol consumption				
Yes	16.4	8.2**	2.7	4.5
No	15.7	2.5	2.0	3.9
Overweight/obesity				
Yes	24.2**	5.8	1.5	6.7**
No	16.4	4.3	2.1	2.3
Multiple NCDs risk factors				
0 risk factor	17.0	5.2	2.7	2.7
1 risk factor	20.2	4.7	1.6	4.5
2≥risk factors	22.3	4.2	1.4	5.4
Overall	**19.9**	**4.7**	**4.2**	**1.9**

Note: **Statistically significant at 5%.

For education, mixed findings were observed. For instance, eye/vision problem (26.8%) was more prevalent among individuals with low education, while nerves (7.8%), skin problem (3%) and depression (7%) were more prevalent among individuals with tertiary or higher education. Eye/vision problem has often been associated with poor diet, especially with poor fruit and vegetable consumption among the poor (Olsen, Bruhel, Nielsen, *et al.* 2013).

This notion may explain why eye/vision problem was observed to be high among the poor. Studies have shown that poor diet leads to hypertension and diabetes which can ultimately damage the vessels supplying blood to the retina, and can lead to bleeding in the eye, blurred vision and complete loss of vision (Mendez, Cooper, Wilks *et al.* 2003; Busingye, Arabshahi, Subasinghe *et al.* 2014; Amegah and Näyhä, 2018). Individuals with both diabetes and high blood pressure are at an even greater risk of eye/vision problem and nerves problem (Hwang, Lee, Hwang *et al.* 2015).

Nerves (7.7%) and skin problem (2.6%) were more prevalent among individuals in the highest quintile than in the lowest quintile. This is contrary to what other previous studies have found that higher socioeconomic status, whether measured at the individual or the area-level, is associated with greater access to discretionary procedures, healthier behaviours, better nerves and skin health (Gittelsohn, Halpern and Sanchez, 1991; Siciliani and Verzulli, 2009; Jones-Rounds, Evans, Braubach *et al*. 2014). Meanwhile for behavioural factors it was observed that eye/vision problem (21.3%) was more prevalent among non-smokers, while nerves (5%), skin problem (1.9%) and depression (4.3%) were more prevalent among smokers. It was also found that skin problem (2.9%) was more prevalent among poor physically active individuals, while eye/vision problem (16.4%) was more prevalent among alcohol consumers. A high proportion of individuals with multiple NCD risk factors had eye/vision problem (22%) and depression (5.4%).

6.3 Correlates of NCDs: Logistic Regression Analysis

This sub-section presents multivariate analysis for some selected NCDs, Diabetes and hypertension. Other NCD conditions were left out of the regression models due to few cases in the sample.

6.3.1 Factors Associated with Diabetes and Hypertension: Logistic Regression Analysis

Three models were run to assess the relationship between hypertension, diabetes and socioeconomic and behavioural risk factors. Model I is the unadjusted model and presents results on the association between NCD condition (diabetes or hypertension) and socioeconomic factors, Model II presents results on the association between NCD condition and multiple risk factors adjusting for socioeconomic variables. Model III presents results on the association between NCD conditions, socioeconomic and behavioural factors.

From Table 6.3, it was found that there was no significant statistical association between diabetes and sex, education, residence, and work status. However, it was noted that the odds of having diabetes increased with age indicating a positive gradient with age, in all models.

For instance the odds of having hypertension were highest among individuals aged 45+ years than among individuals aged less than 24 years in the model adjusted for multiple risk factors (AOR=11.2, 95 % C.I. = 2.01-189.1) and model adjusted for behavioural variables (AOR=21.2, 95% C.I.= 2.01-199.1). However, due to the relatively small sample size for age distribution, the confidence intervals are too wide; hence little could be derived from this investigation.

It was observed that in all three models, wealth status had small but significant effects on diabetes. For instance, it was found that when controlling for multiple risk factors (AOR=0.10, 95 % C.I. =0.01-0.43) and other behavioral variables (AOR=0.12, 95% C.I. =0.01-0.61) individuals in the lowest quintiles were less likely to have diabetes compared to those in the highest quintile. Literature provides mixed conclusions on whether diabetes is a disease of low SES or high SES (Berkowitz, Karter, Lyles *et al.* 2014) or there is no relationship between them (Suwannaphant, Laohasiriwong, Puttanapong *et al.* 2017).

Findings from this data confirm that in Botswana diabetes is a disease of high SES. Low odds of diabetes among the poor in Botswana may be indicative of the effects of urbanization and modernization which influence type of diet, poor physical activity, and unhealthy behaviours possibly affecting the clustering of diabetes. It was also observed that there was no significant association between multi-risk factors and diabetes in this data. Furthermore, behavioural risk factors such as smoking, poor fruit and vegetable, poor physical activity, overweight and obesity were not associated with prevalence of diabetes.

Table 6.3: Odds ratios showing the influence of socioeconomic and behavioural factors on diabetes.

Variable			
Sex	**Model I**[†] **AOR C.I.**	**Model II**[††] **AOR C.I.**	**Model III**[†††] **AOR C.I.**
Male	1.00	1.00	1.00
Female	0.70 (0.29-1.72)	0.65 (0.17-1.64)	0.65 (0.17-1.64)
Age[@]			
≤24	1.00	1.00	1.00
25-34	5.70 (0.55-58.3)	3.70 (0.15-88.3)	4.70 (0.25-48.3)
35-44	15.4** (1.52-155.2)	10.3** (1.01-88.2)	13.3** (1.01-125.2)
45+	22.7** (2.07-249.2)	11.2** (2.01-189.1)	21.2** (2.01-199.1)
Marital status			
Never-married	0.70 (0.23-2.10)	0.45 (0.12-2.07)	0.65 (0.17-2.07)
Currently-married	0.33** (0.09-1.14)	0.19 (0.02-1.11)	0.29 (0.04-1.11)
Formerly-married	1.00	1.00	1.00
Education			
Primary or less	0.49 (0.07-3.37)	0.31 (0.01-3.21)	0.41 (0.03-3.31)
Secondary	0.37 (0.06-2.10)	0.23 (0.01-1.88)	0.33 (0.01-2.01)
Tertiary or higher	1.00	1.00	1.00
Residence			
Cities and towns	1.00	1.00	1.00
Urban villages	1.04 (0.41-2.64)	1.02 (0.38-2.59)	1.01 (0.37-2.58)
Rural villages	0.98 (0.31-3.04)	0.81 (0.13-2.89)	0.91 (0.23-2.99)
Work status			
Public sector	2.74 (0.47-15.9)	1.40 (0.22-12.2)	1.60 (0.32-13.2)
Private sector	3.19 (0.48-20.9)	2.11 (0.13-10.9)	3.11 (0.43-20.9)
self-employed	2.92 (0.48-17.6)	1.87 (0.21-12.8)	2.87 (0.41-16.8)
Not employed	2.57 (0.49-13.3)	1.51 (0.27-11.4)	2.51 (0.47-12.4)
Home-maker/student	2.55 (0.33-19.5)	1.41 (0.03-13.4)	2.41 (0.13-16.4)
Retired/other	1.00	1.00	1.00
Wealth status			
Lowest	0.14** (0.02-0.85)	0.10** (0.01-0.43)	0.12** (0.01-0.61)
Second	0.09** (0.01-0.59)	0.04** (0.00-0.36)	0.06** (0.00-0.45)
Middle	0.08** (0.01-0.56)	0.03** (0.01-0.43)	0.03** (0.01-0.43)
Fourth	0.04** (0.00-0.61)	0.02** (0.00-0.25)	0.01** (0.01-0.35)
Highest	1.00	1.00	1.00
Multiple NCDs risk factors			
0 risk factor		1.00	
1 risk factor		1.23 (0.01-6.43)	
2≥risk factors		1.33 (0.21-5.43)	
Smoking Yes			0.12 (0.01-1.43)
No			1.00
Poor fruit/vegetable consumption			

Yes			1.23 (0.98-2.43)
No			1.00
Alcohol consumption			
Yes			1.05 (0.68-2.43)
No			1.00
Overweight and obesity			
Yes			1.01 (0.78-2.34)
No			1.00

Notes: †Model I socioeconomic variables only included; ††Model II: socioeconomic + multiple risk factors included, †††Model III: socioeconomic and behavioural variables included. **statistically significant at 5% level. @=In cases where there were few cases for age group categories, the age groups were grouped especially from ages 45+ years. N=955

Results in table 6.4 indicate that females were more likely to report hypertension than their male counterparts in the unadjusted model, model adjusted for multiple risk factors and the model adjusted for behavioural variables. For instance, the odds of reporting hypertension were 3 times (AOR=3.64, 95% C.I. =2.03-7.04) higher among females than males in the crude model, and declined to 1.6 (AOR=1.61, 95% C.I. = 1.02-8.86) when controlling for multiple risk factors, and declined further slightly after introducing behavioural variables (AOR=1.60, 95% C.I. =1.03-8.89). This corroborates findings from previous study which found that in Botswana women are more likely to be hypertensive than men (Keetile, Navaneetham and Letamo, 2015).

Other studies in China, Ghana, and South Africa have also found that the burden of hypertension showed gender variations with females more likely to report hypertension than males (Wong, Wang, Leung *et al.* 2014; Sliwa, Ojji, Bachelier *et al.* 2014; Tuoyire and Ayetey, 2018). Sandberg and Ji (2012) observed that gender differences in hypertension, which exist in human populations, may be due to both biological and behavioral factors.

The biological factors include sex hormones, chromosomal differences, and other biological sex differences that are protective against hypertension in women (Sandberg and Ji 2012; Vitale, Mendelsohn, and Rosano 2009). These biological factors become evident during adolescence and persist through adulthood until women reach menopause, at which point gender differences in hypertension become correspondingly smaller or non-existent (Everett and Zajacova, 2015). Meanwhile observed high levels of hypertension among women in Botswana may also be associated with poor physical activity and high overweight/obesity levels associated with changing lifestyles.

As expected, the odds of reporting hypertension increased with age with highest odds of hypertension observed in ages 45 years and above, when adjusting for other socioeconomic and multiple risk factors (AOR=7.62, 95% C.I. =1.07-18.1) and for other socioeconomic and behavioural risk factors (AOR=9.64, 95% C.I. =3.09-19.2). This is consistent with previous studies which also found that hypertension increases with age in both developed and developing countries (World Health Organization, 2010; Prince, Ebrahim, Acosta *et al.* 2012)

While in the unadjusted model, results indicate no significant association between hypertension and wealth status, in the model adjusted for multiple risk factors (AOR=0.06, 95% C.I. = 0.00-0.82) and model adjusted for socioeconomic and behavioural factors (AOR=0.07, C.I. =0.00-0.82) individuals in the lowest quintile group were less likely to report hypertension compared to those in the highest quintile. However, the effects of wealth status on hypertension were small.

This supports evidence from studies from many developing nations which have suggested a positive association between high socioeconomic status and hypertension (Cois and Ehrlich, 2014; Razak and Subramanian, 2014). However, in many developed countries, an association between low socioeconomic status and hypertension has been also observed (Lam, 2011; Fan 2015). The observed small effect of wealth status on hypertension in this data may be explained by small variations for overweight/obesity among the poor and non-poor. On the other hand, the association between SES and hypertension in Botswana can be explained by the theory that suggests that economic prosperity and urbanization increase the prevalence of risk factors for hypertension such as overweight/obesity, a sedentary lifestyle and excessive salt intake (Busingye, Arabshahi, Subasinghe, *et al*. 2014).

Botswana has also experienced economic prosperity and rapid urbanization which have spurred prevalence of risk factors for hypertension such as obesity, sedentary lifestyle and excessive salt intake. This is contrary to high income countries where negative association between SES and hypertension can be explained by the reversal of the risk factors as development increases (Reddy, Naik and Prabhakaran, 2006). It is opined that as development increases, people with high wealth status become more conscious of the health risks and ultimately adopt healthy behaviours (Prince, Ebrahim, Acosta *et al*. 2012; Razak and Subramanian, 2014).

The evidence from reviewed literatures gave mixed results that show that the impact of socioeconomic status on hypertension is complicated and unclear. While in some studies findings show that low SES is associated with higher blood pressure (Grotto, Huerta and Sharabi, 2008), in other studies including this one, suggests that high SES is associated with hypertension (Busingye, Arabshahi, Subasinghe, *et al.* 2014).

Table 6.4: Odds ratios showing the influence of socioeconomic and behavioural factors on hypertension

Variable	Hypertension		
	Model I† **AOR C.I.**	**Model II††** **AOR C.I.**	**Model III** **AOR C.I.**
Sex Male	1.00	1.00	1.00
Female	3.64** (2.03-7.04)	1.61** (1.02-8.86)	1.60** (1.03-8.89)
Age@			
≤24	1.00	1.00	1.00
25-34	5.59** (1.51-20.7)	4.35 (0.22-8.67)	4.65 (0.32-9.67)
35-44	24.4** (6.81-87.8)	7.52** (3.65-15.2)	8.54** (4.65-16.2)
45+	37.0** (9.95-138.1)	7.62** (1.07-18.1)	9.64** (3.09-19.2)
Marital status			
Never-married	0.56 (0.27-1.13)	0.11 (0.01-1.75)	0.13 (0.01-1.77)
Currently-married	0.61 (0.29-1.26)	0.16** (0.03-1.80)	0.14** (0.03-1.80)
Formerly-married	1.00	1.00	1.00
Education			
Primary or less	0.62 (0.14-2.61)	0.13 (0.01-1.78)	0.14 (0.01-1.79)
Secondary	0.40 (0.10-1.58)	0.35 (0.08-3.37)	0.34 (0.07-3.36)
Tertiary or higher	1.00	1.00	1.00
Residence			
Cities and towns	1.00	1.00	1.00
Urban villages	0.84 (0.50-1.41)	0.79 (0.04-3.52)	0.89 (0.14-5.52)
Rural villages	0.63 (0.33-1.17)	0.51 (0.02-7.31)	0.53 (0.03-8.30)
Work status			
Public sector	1.05 (0.44-2.48)	1.70 (0.41-13.2)	2.71 (0.43-15.6)
Private sector	0.79 (0.31-1.96)	2.16 (0.41-17.8)	3.17 (0.46-19.9)
self-employed	0.57 (0.23-1.40)	2.81 (0.39-15.1)	2.89 (0.46-17.3)
Not employed	0.61 (0.28-1.31)	2.51 (0.43-12.2)	2.55 (0.49-13.1)
Home-maker/student	0.77 (0.29-2.00)	2.49 (0.26-18.5)	2.50 (0.27-18.7)
Retired/other	1.00	1.00	1.00
Wealth status			
Lowest	0.49 (0.12-1.93)	0.06** (0.00-0.82)	0.07** (0.00-0.82)
Second	0.45 (0.12-1.72)	0.07** (0.00-0.85)	0.06** (0.00-0.83)
Middle	0.34 (0.09-1.33)	0.17** (0.03-0.91)	0.16** (0.03-0.91)
Fourth	0.84 (0.21-3.43)	0.07** (0.00-0.85)	0.07** (0.00-0.85)
Highest	1.00	1.00	1.00
Multiple risk factors			
0 risk factor		1.00	
1 risk factor		1.67** (1.01-3.01)	
2 risk factors		1.54** (1.00-2.81)	
Smoking			
Yes			0.19 (0.01-2.43)
No			1.00
Poor physical activity			
Yes			2.77** (1.02-5.41)

No			1.00
Poor fruit/vegetable consumption			
Yes			2.26 (0.29-17.5)
No			1.00
Alcohol consumption			
Yes			0.147** (0.02-0.88)
No			1.00
Overweight and obesity			
Yes			3.07** (1.01-10.3)
No			1.00

Notes:†Model I: socioeconomic variables included; ††Model II: socioeconomic + behavioural characteristics included.*statistically significant at 5%.@=In cases where there were few cases for age group categories, the age groups were clustered especially from ages 45+ years. This was mainly because few cases in the sample yielded unstable and high coefficients. N=999.

It was found that when adjusting for socioeconomic variables, individuals who reported single (AOR=1.67, 95% C.I. = 1.01-3.01) and multiple (AOR=1.54, 95% C.I. =1.00-2.81) NCD risk factors were more likely to report hypertension than those who reported no risk factor. Likewise, previous empirical studies have clearly shown a close relationship between clustering of lifestyle health risk factors and hypertension (Gillman, Cook, Evans *et al.* 1995; Thadhani,, Camargo, Stampfer *et al.* 2002; Arokiasamy and Agrawal, 2010).

These studies have shown consistent association between either of the risk factor such as smoking, alcohol consumption, and overweight/ obesity (Gillman, Cook, Evans *et al.* 1995; Thadhani, Camargo, Stampfer *et al.* 2002; Abubakari and Bhopal 2008) and clustering of such risk factors and hypertension (Szymocha, and Bryla, 2011; Vernooij, van der Graaf and Visseren, 2012). The finding in this data emphasises the fact that NCD risk factors do not operate in isolation, but often coexist and interact to influence hypertension or any NCD condition. The clustering of NCD risk factors, such as alcohol consumption, smoking, poor physical activity, poor fruit/vegetable consumption and overweight/obesity have been observed to contribute to hypertension (Gupta, Deedwania, Sharma *et al.* 2012).

Among the behavioural risk factors, the odds of having hypertension were two times (AOR=2.77, 95% C.I. =1.02-5.41) higher among individuals who reported poor physical activity than individuals who were physically active. This is consistent with other studies. For example, in sub-Saharan Africa (Hendriks, Wit, Roos *et al.* 2012; Gebreselassie and Padyab 2014) poor physical activity was found to have a significant effect on the odds of reporting hypertension. This is quite indicative because it shows that even after controlling for socioeconomic and behavioural factors, the effect of poor physical activity on hypertension still maintains and therefore it has independent effect on hypertension. Poor physical activity was observed to have a significant association with being overweight/obese which is associated with an increased risk of hypertension.

The other risk factor, overweight/obese was also associated with high odds (AOR=2.77, 95% C.I. =1.02-5.41) of reporting hypertension, consistent with other studies (Abubakari and Bhopal, 2008; Szymocha, and Bryla, 2011; Jiang, Lu, Zing et *al.* 2016). Available research evidence identifies overweight/obesity as one of the major determinants of hypertension in different settings (Abubakari and Bhopal, 2008; Szymocha, and Bryla, 2011; Vernooij, van der Graaf and Visseren, 2012; Maniecka-Bryla, Commodore-Mensah, Samuel, *et al.* 2014). The relationship between overweight/obesity and hypertension is well established biologically as well (Jiang, Lu, Zing *et al.* 2016).

It has been found that the activation of the sympathetic nervous system (SNS), the amount of intra-abdominal and intra-vascular fat, sodium retention leading to increase in renal reabsorption, and the renin-angiotensin system, have important functions in the pathogenesis of obesity-related hypertension (Jiang, Lu, Zing *et al.* 2016). This explains why women are often hypertensive than men. It has been suggested that being overweight/obese predisposes women to high risks of hypertension more than men (Marie, Flemming, Robinson *et al.* 2014).

Quite conversely, it was found that individuals who reported to consume alcohol (AOR=0.147, 95% C.I. =0.02-0.88) were less likely to report hypertension compared to those who did not consume alcohol even after controlling for both socioeconomic and other behavioural factors (in model III). Although numerous studies have established a close relationship between alcohol consumption and hypertension the findings are mixed.

While other studies suggest that heavy alcohol consumption increases the risk of hypertension (MacMahon 1987; Witteman, Willett, Stampfer et al. 1990; Klatsky, Koplik, Gunderson et al. 2006), the effect of light to moderate alcohol consumption on the risk of hypertension remains controversial. Some studies suggest that light to moderate alcohol intake can decrease the risk of hypertension, while others suggest that the effect of light to moderate alcohol intake on the risk of hypertension may be harmful overtime (Gillman, Cook, Evans *et al.* 1995; Thadhani, Camargo, Stampfer *et al.* 2002). Meanwhile, for this study unlike other studies it was found that heavy drinking did not show any significant association with hypertension. This may suggest that other risk factors such as overweight/obesity as observed in this study are the key determinants of hypertension prevalence in Botswana, other than alcohol consumption

6.4 Factors Associated with Multimorbidity

Multimorbidty is an emerging problem in developing countries and requires holistic approach of health care system deliveries. This section presents the prevalence of multimorbidity derived from seven NCD conditions collected during the survey and the factors associated with it.

6.4.1 Prevalence of Multiple NCD Conditions

Table 6.5 shows bivariate associations between multiple NCD conditions and socioeconomic and behavioural characteristics of the study population. Results are presented as percentages together with significance levels (**) derived from chi square tests. Overall prevalence of single NCD condition was estimated at 24.2%, while prevalence of multiple NCDs conditions was at 5.4%. Similar observations of increased prevalence of multiple NCD conditions have been made in the region. For instance, a study by Phaswana-Mafuya, Peltzer, Chirinda *et al.* (2013) revealed that in South Africa about 50% of the sampled adults had one chronic NCD and that the most prevalent self-reported chronic NCDs were hypertension and arthritis. For this study, the most prevalent self-reported NCDs were hypertension and asthma. Phaswana-Mafuya, Peltzer, Chrinda *et al.* (2013) also found that the prevalence of multimorbidity (≥ 2 conditions) was 22.5%, which is comparable to that of the United States (about 26%) (Ward and Schiller, 2013) but much higher than the one estimated in this study. Other studies in low- and middle-income countries (Khanam, Streatfield, Kabir *et al.* 2011) have shown contrasting evidence.

A systematic review by Fortin, Stewart, Poitras *et al.* (2012) has also reported wide ranges in the prevalence of multimorbidity, especially in the older age groups. It should be noted that the differences observed in multimorbidity between Botswana and other LMICs may be due to sociodemographic differences. One other thing worth noting is that the chronic comorbidities highlighted in this study were self-reported, and therefore possibilities of information bias that might have contributed to underreporting of the prevalence cannot be overlooked, especially because individuals tend to underreport poor health.

The prevalence of multimorbidity was high among women (6.6%), formerly married (20.4 %), and increased with age, with about 18% of individuals aged 65 years and above reporting multimorbidity. Individuals with primary or less education (9.5%) had the highest multimorbidity prevalence, while for wealth status individuals in the lowest quintiles (6.4%) had the highest prevalence. Similarly, other studies also found that increasing age, being female; being separated or widowed, having low education, low wealth status, and residing in an urban area were associated with the presence of chronic conditions (Marengoni, Winblad, Karp *et al.* 2008; Hosseinpoor, Bergen, Kunst *et al.* 2012; Omoleke, 2013; Phaswana-Mafuya, Peltzer, Chirinda *et al.* 2013).

For behavioural risk factors, only alcohol consumption (6.4%) was significantly associated with multimorbidity, while 5.6 % among individuals who had multiple NCD risk factors reported multimorbidity. Some studies have shown similar findings where alcohol consumption and not other risk factors (smoking, overweight, poor physical activity and poor fruit and vegetable consumption) was associated with high prevalence of multimorbidity (Dhalwani Zaccardi, O'Donovan *et al.* 2017; Han, Moore, Sherman *et al.* 2018).

Table 6.5: Prevalence of multiple NCD conditions by socioeconomic and behavioural characteristics of the study population

	0 NCD condition (N=829)	1 NCD (N=285)	≥2 NCDs (N=63)
Variable	**%**	**%**	**%**
Sex			**≤0.001**
Male	81.9	15.7	2.5
Female	65.3	28.0	6.6
Age			**≤0.001**
≤24	85.6	13.7	0.7
25-34	83.8	14.9	1.3
35-44	71.9	24.5	3.6
45-54	60.8	32.3	6.9
55-64	42.7	38.7	18.7
65+	30.0	52.0	18.0
Marital status			**≤0.001**
Never-married	77.1	19.4	3.5
Currently-married	56.3	38.2	5.5
Formerly-married	42.6	37.0	20.4
Education			**≤0.001**
Primary or less	55.6	34.9	9.5
Secondary	79.4	18.3	2.3
Tertiary or higher	77.8	18.3	3.9
Residence			**≤0.001**
Cities and towns	77.2	19.4	3.4
Urban villages	68.4	24.9	6.7
Rural villages	66.0	28.8	5.2
Work status			**≤0.001**
Public sector	63.1	30.3	6.6
Private sector	78.6	19.8	1.6
self-employed	69.2	26.2	4.6
Not employed	67.7	24.5	7.8
Home-maker/student	77.5	20.6	1.8
Retired/other	59.5	31.1	9.5
Wealth status			**≤0.001**
Lowest	69.7	23.9	6.4
Second	68.4	26.6	5.1
Middle	71.5	23.0	5.5
Fourth	69.6	26.6	3.8
Highest	73.2	20.9	6.0
Smoking			**0.098**
Yes	70.3	24.0	5.7
No	71.3	25.7	2.9
Poor physical activity			**0.053**
Yes	73.4	22.6	4.0
No	69.3	24.8	6.0

Poor fruit/vegetable consumption			**0.234**
Yes	70.4	24.3	5.2
No	70.2	23.1	6.6
Alcohol consumption			**≤0.001**
Yes	70.0	23.6	6.4
No	79.9	18.6	1.5
Overweight/obesity			**0.871**
Yes	61.3	30.5	8.2
No	77.5	19.4	3.1
Multiple NCDs risk factors			**≤0.001**
0 risk factor	77.7	19.1	3.3
1 risk factor	67.4	26.1	6.5
≥2risk factors	68.1	26.3	5.6
Overall	**70.4**	**24.2**	**5.4**

Note; statistical significantce level is at 5%.

6.4.2 Factors Associated with Multimorbidity: Multinomial Logistic Regression Analysis

In order to examine factors associated with multimorbidity in the study population, four models were run using multinomial logistic regression analysis. Model I- presents results for the association between a single NCD condition, and multiple risk factors, using socioeconomic variables as covariates; Model II- presents results for the association between a single NCD condition, and behavioural risk factors, using socioeconomic variables as covariates- Model III presents results for the association between multiple NCD conditions, and multiple risk factors, using socioeconomic variables as covariates; Model IV- presents results for the association between multiple NCD conditions, and behavioural risk factors, using socioeconomic variables as covariates.

Tables 6.6a-b show the estimated odds ratios from the multinomial logistic regression model that gives the association between multiple NCD conditions with socioeconomic and behavioural factors in the study population. It was found that sex was a significant determinant of multimorbidity when using behavioural and socioeconomic factors as covariates, with women observed to be 3 times (AOR=3.34, 95% C.I. =1.22-21.3) more likely to report multimorbidity than men. Most previous studies have also shown an increased prevalence of multimorbidity among women (Uijen and van de Lisdonk, 2008; Marengoni, Angleman, Melis *et al*. 2011; Salisbury, Johnson, Purdy *et al.* 2011; Prados-Torres, Poblador-Plou, Calderón-Larrañaga *et al.* 2012), though not all studies find this (Fortin, Bravo, Hudon *et al.* 2005; Rizza, Kaplan, Senn *et al.* 2012). In Botswana gender differences in multimorbidity may be explained by high prevalence of risk factors such as poor physical activity and overweight/obesity among women and also because women have a longer life expectancy than men (Nkwe, Mukamaambo and Malema, 2017).

It was also observed that age was a significant determinant of having single and multiple NCD conditions in the study population. Young people aged below 24 years were less likely to report single (AOR=0.09, 95% C.I. = 0.03-0.24) and multiple NCD conditions (AOR=0.01, 95% C.I. =0.00-0.07) compared to elderly people aged 65 years and above. Research evidence in both developed and developing countries corroborates this finding. This evidence has also established that the prevalence of multimorbidity rises rapidly with increasing age (Marengoni, Angleman, Melis *et al.* 2011; Barnett, Mercer, Norbury *et al.* 2012; Afshar, Roderick, Kowal *et al.* 2015). Multimorbidity among the aged population can be explained by the cumulative effects of lifestyle behaviours accrued throughout life course (Loza, Jover, Rodriguez *et al.* 2009; Letamo, 2011)

Table 6.6a: Odds ratios for the influence of socioeconomic and behavioural factors on multiple NCD conditions from the Multinomial Logistic Regression Model.

Factors	Model I-Single NCD Condition/no NCD condition		Model II- Multiple NCD condition/no NCD condition	
	AOR	**C.I.**	**AOR**	**C.I.**
Sex				
Male	1.00		1.00	
Female	0.43**	(0.28-0.65)	1.99	(0.62-6.37)
Age				
≤24	0.07**	(0.03-0.24)	0.09**	(0.03-0.24)
25-34	0.10**	(0.04-0.27)	0.11**	(0.04-0.27)
35-44	0.20**	(0.09-0.49)	0.21**	(0.09-0.49)
45-54	0.25**	(0.12-0.62)	0.27**	(0.12-0.62)
55-64	0.44	(0.18-1.05)	0.43	(0.18-1.03)
65+	1.00		1.00	
Marital status				
Never-married	1.03	(0.50-2.15)	1.03	(0.50-2.15)
Currently-married	1.20	(0.57-2.53)	1.17	(0.56-2.48)
Formerly-married	1.00		1.00	
Education				
Primary or less	1.00		1.00	
Secondary	1.39	(0.77-2.51)	1.39	(0.77-2.50)
Tertiary or higher	1.10	(0.67-1.81)	1.09	(0.67-1.78)
Residence				
Cities and towns	1.00		1.00	
Urban villages	0.95	(0.58-1.56)	0.96	(0.58-1.57)
Rural villages	1.11	(0.72-1.72)	1.12	(0.72-1.72)
Work status				
Public sector	1.28	(0.58-2.83)	1.28	(0.58-1.57)
Private sector	1.08	(0.50-2.36)	1.09	(0.50-2.37)
self-employed	1.13	(0.51-2.50)	1.11	(0.50-2.45)
Not employed	0.80	(0.40-1.61)	0.80	(0.40-1.60)
Home-maker/student	1.19	(0.54-2.61)	1.17	(0.53-2.55)
Retired/other	1.00		1.00	
Wealth status				
Lowest	0.57	(0.30-1.10)	0.57	(0.29-1.09)
Second	0.71	(0.40-1.28)	0.71	(0.39-1.27)
Middle	0.71	(0.40-1.26)	0.70	(0.40-1.24)
Fourth	1.16	(0.70-1.90)	1.13	(0.69-1.86)
Highest	1.00		1.00	
Multiple NCDs risk factors				
0 risk factor	1.00		1.00	
1 risk factor	0.90	(0.57-1.43)	0.73	(0.41-1.28)
≥2risk factors	1.29	(0.59-2.82)	1.09	(0.67-1.77)
Smoking				

Yes		0.45	(0.16-1.28)
No		1.00	
Alcohol consumption			
Yes		1.38	(0.76-2.52)
No		1.00	
Poor fruit/vegetable consumption			
Yes		0.73	(0.28-1.86)
No		1.00	
Poor Physical activity			
Yes		1.15	(0.64-2.07)
No		1.00	
Overweight/obesity			
Yes		1.46**	(1.25-1.82)
No		1.00	

Notes: Reference category: 0 NCD condition. **statistically significant at 5% level. N=1177.

It was found that currently married persons were less likely to report multimorbidity compared to formerly married persons when controlling for individual and multiple risk factors (AOR=0.24, 95% C.I.=0.07-0.80 and AOR=0.23, 95% C.I.=0.06-0.76). This implies that formerly married viz, windowed, divorced and separated are more likely to suffer from multimorbidity in Botswana. Unlike currently married persons, divorced, widowed and separated individuals are more likely to suffer depression, which ultimately leads to hypertension which is often accompanied by diabetes (Barnett, Mercer, Norbury *et al.* 2012). This observation possibly explains why formerly married individuals are more likely to suffer multimorbidity in Botswana. Some studies in both developed and developing countries attest to this assertion (Afshar, Roderick, Kowal *et al.* 2015; Agur, McLean, Hunt, *et al.* 2016).

Wealth status was not significantly associated with single NCD morbidity but with multimorbidity, with individuals in the 2nd wealth quintile (AOR=0.20, 95% C.I. = 0.05-0.75) found to be less likely to report multimorbidity than those in the 5th quintile, when adjusting for multiple risk factors and socioeconomic covariates. The association between multimorbidity and low socioeconomic position has been found in literature. For instance, strong association between multimorbidity with socioeconomic deprivation has also been found in countries in Western Europe (Afshar, Roderick, Kowal *et al.* 2015), Asia (Pati, Swain, Hussein *et al.* 2015) and South America (De Carvalho , Roncalli, Cancela *et al.* 2017).

Table 6.6b: Odds ratios for the influence of socioeconomic and behavioural factors on multiple NCD conditions from the Multinomial Logistic Regression Model.

Factors	**Model III- Multiple NCD conditions/no NCD condition**		**Model IV-Multiple NCD conditions/no NCD condition**	
	AOR	**C.I.**	**AOR**	**C.I.**
Sex				
Male	1.00		1.00	
Female	0.49	(0.17-1.34)	3.34**	(1.22-21.3)
Age				
≤24	0.01**	(0.00-0.07)	0.01**	(0.00-0.07)
25-34	0.02**	(0.00-0.10)	0.02**	(0.00-0.12)
35-44	0.08**	(0.02-0.34)	0.09**	(0.02-0.37)
45-54	0.17**	(0.05-0.64)	0.19**	(0.05-0.70)
55-64	0.68	(0.21-2.18)	0.68	(0.21-2.18)
65+	1.00		1.00	
Marital status				
Never-married	0.76	(0.28-2.04)	0.72	(0.27-1.91)
Currently-married	0.24*	(0.07-0.80)	0.23**	(0.06-0.76)
Formerly-married	1.00		1.00	
Education				
Primary or less	1.00		1.00	
Secondary	0.73	(0.21-2.56)	0.82	(0.23-2.86)
Tertiary or higher	0.72	(0.23-2.25)	0.79	(0.25-2.48)
Residence				
Cities and towns	1.00		1.00	
Urban villages	1.09	(0.36-3.28)	1.14	(0.38-3.43)
Rural villages	1.46	(0.62-3.45)	1.50	(0.63-3.52)
Work status				
Public sector	0.89	(0.24-3.33)	0.91	(0.24-3.37)
Private sector	0.53	(0.10-2.70)	0.49	(0.09-2.48)
self-employed	0.86	(0.20-3.60)	0.80	(0.19-3.32)
Not employed	0.96	(0.31-2.99)	0.94	(0.30-2.92)
Home-maker/student	0.84	(0.18-3.93)	0.83	(0.18-3.87)
Retired/other	1.00		1.00	
Wealth status				
Lowest	0.32	(0.09-1.16)	0.31	(0.08-1.12)
Second	0.20**	(0.05-0.75)	0.19	(0.05-0.73)
Middle	0.33	(0.10-1.10)	0.32	(0.10-1.07)
Fourth	0.38	(0.11-1.22)	0.38	(0.12-1.20)

Highest	1.00		1.00	
Multiple NCDs risk factors				
0 risk factor	1.00		1.00	
1 risk factor	1.98	(0.60-6.50)	1.57	(0.43-5.70)
2≥risk factors	3.32	(0.61-17.9	2.22	(0.78-6.28)
Smoking				
Yes			0.05	(0.00-0.43)
No			1.00	
Alcohol consumption				
Yes			4.80**	(1.16-19.8)
No			1.00	
Poor fruit/Vegetable consumption				
Yes			0.41	(0.07-2.22)
No			1.00	
Poor Physical activity				
Yes			1.22	(0.32-4.63)
No			1.00	
Overweight/obesity				
Yes			0.44	(0.12-1.61)
No			1.00	

Notes: Reference category: 0 NCD condition. **statistically significant at 5%.N=1177

Single NCD morbidity was seen to be associated with overweight/obesity with individuals who were obese/overweight (AOR=1.46, 95% C.I. =1.25-1.82) more likely to report having a single NCD condition compared to those who were not. Previous studies indicate that overweight/obesity are strongly associated with major NCDs such as cardiovascular disease (CVD), cerebrovascular disease, type 2 diabetes mellitus (DM), atherogenic dyslipidaemia and certain types of cancer (World Health Organization, 2016b). Meanwhile, in this study the most prevalent single NCD which was found to be strongly associated with overweight and obesity is hypertension implying that hypertension could be that NCD condition associated with overweight/obesity in the population.

It was noted that alcohol consumers were 4 times (AOR=4.80, 95% C.I. = 1.16-19.8) more likely to report to have multiple NCD conditions than non-alcohol consumers. Consistent with this finding, there is a strong link between alcohol and NCDs in literature, particularly cardiovascular disease, liver disease, pancreatitis and diabetes (Parry, Patra and Remh, 2011) and the findings of this study support calls by WHO to implement evidence-based strategies to reduce harmful use of alcohol. In Thailand it was also noted that alcohol consumption of 4 or more glasses per occasion, even if the occasions were infrequent, was associated with elevated risk of multimorbidity (Wakabayashi, McKetin, Banwell, *et al.* 2015).

Recent evidence has also shown that alcohol consumption is strongly associated with an increasing prevalence of multimorbidity among adults (Han, Moore, Sherman *et al.* 2017; Piano, Mazzucco, Kang *et al.* 2017). These studies evidently show that alcohol consumption is a risk factor for several diseases, can exacerbate existing diseases particularly NCDs and can complicate the management of chronic diseases.

Given that consumption of alcohol was high (17.3%) in the sampled population and the previous finding that alcohol consumers in Botswana are generally hazardous drinkers (Keetile, Letamo and Navaneetham, 2015) it explains why alcohol consumers were more likely to have multimorbidity than non-alcohol consumers in this study. Quite conversely there was no significant association observed between single and multimorbidity and multiple NCD risk factors. Consequently, larger datasets are needed in order to fully assess and understand the association between multiple NCD risk factors and multimorbidity in Botswana.

6.5 Summary of key findings

- Gender differences were observed for prevalence of NCDs. For instance, it was found that prevalence of all NCD conditions (stroke, angina, diabetes, asthma and hypertension) was highest among women except for chronic lung disease and skin problem which were highest among men.
- Multimorbidity prevalence was also found to be highest among women.
- For multivariable models it was found that women were more likely to report hypertension than men, while for diabetes no significant variation was found for sex.
- Factors such as increasing age, low education level, low SES, urban and rural area residence were significantly associated with prevalence of most NCDs (stroke, angina, diabetes, asthma and hypertension) in bivariate models. Only asthma was observed to be highest among young ages than old ages.
- Multivariate analysis showed that increasing age and high wealth status were the only significant determinants of diabetes.
- It was also found that increasing age, high SES, currently married, poor physical activity, overweight/obese and reporting multiple NCD risk factors were significant determinants of hypertension.
- Multimorbidity prevalence was observed to be high; among women, increased with age, formerly married, low education, urban villagers and among retired individuals.
- Overweight/obese individuals were more likely to report single NCD condition.
- Individuals who reported to consume alcohol were 4 times more likely to report multimorbidity.

Overall, findings from this chapter have shown the existence and prevalence of several NCDs (hypertension, asthma, diabetes, stroke, chronic lung disease, angina, skin condition, vision problem, nerves problem and depression) and multi-morbidity in the study population.

Hypertension was found to be the most prevalent NCD condition among adults in Botswana with about one-in-five (19.9%) people reporting to have been diagnosed with hypertension.

It is imperative to note that this could be an underestimation of the actual prevalence, given that some people in the sampled population may have hypertension although they have not yet been diagnosed. Socioeconomic differences were observed for hypertension and diabetes. For instance, it was found that diabetes was significantly associated with increasing age and low wealth status while hypertension was significantly associated with increasing age, high SES, currently married, poor physical activity, overweight/obese and having multiple NCD risk factors.

This study provides initial evidence for the existence of socioeconomically determined health inequalities, which may have potentially important implications for understanding the deeper aetiology of common NCDs and for informing public policies. More research in this area is required to reveal the magnitude of other-NCDS–socioeconomic relation. The next chapter discusses socioeconomic inequalities in health care utilization and health expenditure in the context of emerging burden of NCDs.

CHAPTER 7: HEALTH CARE UTILIZATION AND HEALTH EXPENDITURE

The previous chapter assessed levels, patterns and, socioeconomic and behavioural factors associated with NCDs. Given that findings from the previous chapter have shown socioeconomic differences in NCDs prevalence, an understanding of socioeconomic inequalities in health care utilization and health expenditure is critical for achieving health equity in the context of the rapidly increasing burden of NCDs. This chapter presents and discusses results on levels, patterns and determinants of health care utilization and health expenditure in Botswana.

7.1 Introduction

Governments generally recognize the importance of access and utilization of health care services especially among the poor, who are usually faced with a heavier burden of diseases (Buxton and Kogan, 2003; Gwatkin, Rutstein, Johnson, *et al.* 2007). Despite this recognition, there are limited studies in the field of medical and social sciences which examine the effect of socioeconomic inequalities on healthcare utilization, especially in resource constrained settings faced by the dual burden of NCDs and communicable diseases. The poor typically lag behind the better off in terms of health outcomes and utilization of health services. As developing countries become increasingly advanced in the provision of public health systems, governments have simultaneously emphasized the importance of fairness in distribution of health care services (Azétsop and Ochieng, 2015).

Numerous studies have been carried out by medical and social scientists on socioeconomic disparities in health care utilization in both developing and developed countries. For instance, Celik and Hotchkiss (2000) assessed the impact of socio-economic factors on maternal healthcare utilization in Turkey, while Veugelers and Yip (2003) examined whether lower socioeconomic groups use more health services in Canada, and found that people with lower SES used comparatively more family physician and hospital services than the non-poor, while the use of specialist services was significantly higher in the high SES group. Other studies by Habicht and Knust (2005) and Hoeck, Francois, Geerts et al. (2011) also found socioeconomic differences in health care utilization in Estonia and Belgium. Both studies found that the poor and men were less likely to utilise health care services than the non-poor and women.

In developing countries little is known on the inequalities in health care utilization. However, there is evidence of studies on socioeconomic differences for other health outcomes in some developing countries. For instance, in Nigeria Onwujekwe and Uzochukwu (2005) examined socioeconomic and geographical inequalities in healthcare seeking, expenditure and method of paying for healthcare and found that the poor and rural area dwellers were the major sufferers of inequalities. In rural Burkina Faso, Nikiema, Haddad and Potvin (2008) evaluated the link between gender and access to healthcare and concluded that women suffer delays in or exclusion from healthcare than men.

It is often observed that the heavier burden of disease, illness, poor access to formal health care and resources are more common among the poor, in a phenomenon called "inverse care law" (Gwatkin, Johnson, Wagstaff, *et al.* 2000). The inverse care law states that;

> *"The availability of good medical care tends to vary inversely with the need for it in the population served. This ... operates more completely where medical care is most exposed to market forces, and less so where such exposure is reduced."* (Hart, 1971).

This law is best explained by Hart's view that the extent that health care becomes a commodity is the extent to which it becomes distributed just like champagne. That is rich people gets lots of it. Poor people don't get any of it (Hart, 1971). This view explains how the poor suffer health inequality compared to the non-poor and according to Dobson (1997), health inequality is the worst inequality of all. In the context of health care utilization, the poor have been found to be less likely to utilise health care services than the non-poor (Celik and Hotchkiss, 2000; Onwujekwe and Uzochukwu 2005; Habicht and Knust 2005).

Makinen, Waters, Rauch *et al.* (2000) found that richer groups were more likely to seek care, than poorer groups. Using data drawn from eight developing countries (Kyrgyzstan, Thailand, Zambia, Kazakhstan, Guatemala, Burkina Faso, Paraguay, and South Africa), they found that in seven of these countries, individuals in the richest quintile had higher percentages of seeking care than those in the poorest quintile. The poor were seen to be more likely to use hospitals when ill, because hospitals are provided by the public sector and therefore are cheap or free. Overall, it has been found that for both developed and developing countries utilization of health care services is pro-rich. Even at that, there is paucity of evidence on health care utilization in developing countries in the context of emerging burden of NCDs.

Most studies have used different approaches to determine the significance of socio-economic inequalities on healthcare utilization (Celik and Hotchkiss, 2000; Onwujekwe and Uzochukwu 2005; Habicht and Knust 2005), and the set of variables used as proxies for socio-economic factors vary from one study to the other. It is most probable that in Botswana utilization of health care services is segregated by wealth status and education.

Such information would be vital in ascertaining how changes in wealth (especially at the group level) as well as education potentially affect health care utilization patterns and behavior. Even though it is noted that SES is an essential factor in explaining health care utilization there is a lack of sufficient evidence about how variations in SES explain health care utilization in Botswana.

In order to understand socioeconomic differences in health care utilization and health expenditure in the context of emerging burden of NCDs, subsequent subsections present results on levels, patterns and determinants of health care utilization and health expenditure in Botswana.

7.2 Descriptive Analysis for Health Care Utilization

Table 7.1 gives health care utilization variables derived from the survey. It was found that 75.8% of respondents reported that they needed health care in the past 12 months prior to the survey. Of this proportion 97% reported that they got health care the last time they needed it. The larger percentage of people, who are able to access and utilize health care when they need it, is indicative that universal health coverage (UHC) is a real possibility for Botswana. The government of Botswana encourages the growth of private health insurance providers in order to achieve UHC (WHO, 2015). However, the greatest challenge to UHC remains in rural areas, where improved access has not necessarily translated to utilization of health services, especially among the poor. As Botswana's health system continues to move toward UHC, there is need to take additional steps to ensure equitable access to health services through partnerships with the private sector (African Health Organization, 2015).

A high proportion of the study participants reported that they have used public health facilities (87.4%) followed by private health facilities (11.4%) for health care, while a small proportion reported to use other facilities including traditional health facilities (1.2%). Public health facilities are the most commonly used in Botswana. These facilities, especially hospitals play a major role in delivering preventive, curative, diagnostic, and rehabilitative services (Statistics Botswana, 2012). Hospitals also act as referral centres from primary healthcare facilities meaning that they have a significant influence on the performance of the entire health system. On the other hand private facilities are accessed by insured clients or uninsured people who pay out-of-pocket to access healthcare services (Seitio-Kgogwe, Gauld, Hill, *et al.* 2014). Anecdotal evidence show that many people use the services of traditional health practitioners and the above proportion (1.2%) may be an underestimation of the actual proportion of people who use traditional health facilities. In fact, Makgala (2010) shows that Batswana from all walks of life (educated, uneducated, politicians, professionals, business people, farmers and even leaders of Pentecostal churches!) do make use of traditional medicine but often under the cover of darkness. Traditional medicine in Botswana is often stigmatised because it is associated with witchcraft, spirituality and psychotherapy (Togarasei, Mmolai and Kealotswe, 2016).

It was found that 67% in the study population reported to have gone for routine check-up for on-going chronic condition, new or both. Routine screening for non-communicable diseases within communities or indeed at clinical facilities is not a common practice in Africa (Jaffar, Amberbir, Kayuni, *et al.* 2013) and the high proportion of individuals who reported to have attended routine check-up in this study is indicative of the readiness of the health system to adopt preventive medicine to manage and control NCDs.

Research evidence indicates that effective implemented routine check-up for NCDs can prevent disability and death and improve the quality of life (Strong, Wald, Miller, *et al.* 2004; World Health Organization, 2012a). The poor prognosis for people with diseases that are diagnosed at an advanced stage can make early detection and intervention a worthwhile strategy hence the need to encourage even more routine screening for NCDs in Botswana.

Table 7.1: Dimensions of access and utilization of health care

Variable	%	N
Did you need health care in the past 12 months prior to the survey? Yes No **The last time you needed health care, did you get health care?**	 75.8 24.2	 477 153
Yes	97.3	464
No	2.7	13
What was the last (most recent) health care facility you visited in the last 12 months?		
Private Health Facility	11.4	54
Public Health Facility	87.4	416
Other facilities	1.2	6
Did you go for routine check-up for on-going chronic condition, new or both?(Routine check-up)		
Yes	67.1	320
No	32.9	156
Over the last 12 months did you receive any care not including an overnight stay in a hospital or long term care facility?(Out-patient care)		
Yes	90.5	780
No	9.5	82
What type of facility did you use for your overnight stay in your last most recent visit?(In-patient care)		
Public hospital	92.9	79
Private health facility	7.1	6
How did you get to the health facility for your overnight stay in your last most recent visit?		
Private vehicle	41.6	37
Public transport	14.6	13
Taxi/cab	6.7	6
Ambulance or emergency vehicle	24.7	22
Walked	12.4	7
What was the main reason you needed care, even if you did not get care?		
NCDs	16.7	80
Other disease conditions **Which reason best describes why you needed this visit?** Hypertension Other NCDs	83.3 15 65	397 12 78
Who paid for your hospitalization?		
Respondent	21.3	19
Spouse/partner	3.4	3
son/daughter	2.2	2
Other family member	3.4	3
Insurance scheme	2.2	2
Hospitalization was free	67.5	59
Overall, how satisfied were you with the care you received in your last hospital care?		
Very satisfied	49.4	44
Satisfied	31.5	28

Neither satisfied or dissatisfied	7.9	7
Dissatisfied	6.7	6
Very Dissatisfied	4.5	3
What was the last outcome or result of your last visit? Did your condition get better?		
Get much better	54.5	48
Get better	37.5	33
No change	8	5
Which was the last health care provider you visited?		
Medical Doctor	35.3	251
Nurse/midwife	61.5	437
Dentist	2.1	15
Physiotherapist/chiropractor	0.1	1
Pharmacist/druggist	1.0	7

It was also found that 90.5% among participants reported to have received care, not including an overnight stay in a hospital or long term health care facility in the past 12 months preceding the survey. Consistent with this finding, generally research evidence indicates high percentage of out-patient visit than in-patient visit. For instance, in the neighbouring South Africa studies consistently found that over 90% of the patients reported that the kind of care they receive often when they visit hospitals or long term health care facilities is outpatient-care (Phaswana-Mafunya, Davids, Senekal, *et al.* 2011; Ogunsanwo, 2012)

A significant majority of respondents (41.6%) indicated that they used private vehicle to get to the hospital (the rest used public transport (14.6%); taxi/cab (6.7%); ambulance or emergency vehicle (24.7%). This finding is quite indicative because the high percentage of people who use private vehicle to get to hospital indicates the state of pre-hospital care in Botswana. In Botswana, an ambulance is often used in cases of emergency, where the patient cannot walk and does not have a private transport to take them to the hospital.

Transporting a patient from their place of residence to a hospital is a critical element of pre-hospital care, since a lack of transportation is often the major barrier preventing patients from accessing health care (Samai and Sengeh, 1997; Joshipura, Shah and Patel, 2003; Waters, Hyder and Phillips, *et al.* 2004). A considerable proportion (12.4%) reported that they walked to a health facility. This corroborates evidence from other LMICs, especially in SSA which show that there are hundreds of thousands of people who cannot gain access to care using even the most basic means but they walk to health facilities (Buntman and Yeomans, 2002).

A large proportion of respondents reported that their hospitalization was free (67.5%), while others reported that it was paid for by themselves (21.3%), spouse/partner (3.4%), son/daughter (2.2%), other family member (3.4%), and insurance scheme (2.2%). This finding indicates low medical insurance coverage (2.2%) in the study population. Botswana's health system remains dominated by the public sector and low private health insurance expenditure (African Health Organization, 2015). Consequently, hospitalization in public health sector is free, unlike in the private sector where hospitalization is paid for by the patient.

Moreover, respondents were asked 'what was the main reason why they needed care, even if you did not get care?' and a significant majority reported that they sought health care for other diseases (83.3%) than NCDs (16.7%). One of the dimensions on health care utilization was on which reason best describes why respondents needed to visit hospital/health facility? The majority of respondents indicated that the main reason why they needed health care was for other-NCD conditions (85%) other than for hypertension (15%).

This observation is quite striking because hypertension was found to be the most prevalent NCD condition in the study population. It indicates that there is generally lack of awareness in the population about hypertension. Recent research evidence has shown that persons diagnosed with hypertension need to have their total cardiovascular risk assessed and those at high risk need to seek for and receive effective care (Campbell, Lackland, Lisheng *et al.* 2015; Cappuccio and Miller 2016).

Unlike in many other Sub-Saharan African countries where the main barrier to health care utilization is out-of-pocket payment for medical care and medication, in Botswana patients only pay nominal fees, which even if they cannot afford they still access health care for free.

Botswana's universal primary health care is a main step forward in ensuring that persons with NCD conditions have access to effective, affordable, and accessible care. There is need for more screening for hypertension in the population given that it is the most prevalent NCD condition and yet the proportion of people who seek health care for it is comparatively small.

There were generally a high proportion of respondents who were satisfied (89.3%) with the health care they received in their last hospital visit. The remaining 11.7% constituted those who were either satisfied/dissatisfied. Client satisfaction is one of the key indicators of the quality of care and the relatively high proportion of individuals who reported that they were generally satisfied with the service they received may not necessarily explain the quality of the health care received. Unlike this study, many studies have been concerned with measuring patients' expectations in diverse viewpoints going from the general expectations about health care accessibility and facilities to the more particular expectations related to health care providers' interpersonal and clinical skills (Kravitz, Cope, Bhrany, *et al.* 1994; Pérula de Torres and Jaramillo-Martin, 2007).

Most of the patients' expectations are mainly focused on the health care provider's ability to show interest, i.e., listening to patients' concerns, discussing problems or doubt which is reported to be the general nature of expectation (Schoenfelder, Klewer and Kugler, 2011; Bowling, Rowe and McKee, 2013). This in part explains the perceived satisfaction in the study population. However, it should be noted that the high satisfaction ratings reported in this study cannot be considered to point to the fact that patients have had a good experience in relation to the entire health care system. It may only mean that the participants were satisfied with the fact that the health care providers showed interest, listened to patient's and allowed them to report their health care needs.

7.3 Factors Associated With Health Care Utilization

Education and wealth status have been identified as important socioeconomic indicators by previous studies (Xiao-Xiao, Zhao-Bin, Xu-Jia *et al.* 2018; Quercioli, Nisticò, Troiano, *et al.* 2018). The same notion was used to select them as key socioeconomic variables for analysis in this part. For education, a group containing lowest education level (no education, primary and secondary education) and a group containing highest education level (Post-secondary education, tertiary and post tertiary education) of the International Standard Classification of Education (ISCED) were distinguished. For wealth status, a lowest wealth status group (1st and 2nd quintile) and a high wealth status group (3rd to 5th quintile) were compared.

In order to assess the influence of socioeconomic status on health care utilization, two models were run. The first model uses logistic regression analysis to compare the lower education with the higher education group, while in the second model lower SES group was compared with the higher SES group. For each health care utilization variable, I tested if an interaction effect was present between wealth status and education level in the study population.

This was done for each health care utilization variables by calculating the _2 log likelihood of a model with and without the interaction term. In order to address possible interaction between education and wealth several models were run, at first education was excluded while wealth status was included and then wealth status was excluded but education level variable included. Then both variables were included in the model. Standard errors remained stable when adjusting for both groups of variables. Results were presented as adjusted odds ratios, together with their 95% confidence intervals.

7.3.1 Educational Disparity in Health Care Utilization

Table 7.2 summarizes adjusted odd ratios (AORs) for health care utilization by education level in the study population. Four indicators were used to assess education inequalities in health care utilization using Andersen's conceptual framework of healthcare utilization:

i) Health care needed—derived from a question asking respondents whether they needed health care in the last 12 months prior to the survey.

ii) Health care received—derived from the question which sought to understand whether the respondent received health care the last time they needed it.

iii) Seeking health care for NCDs—derived and recoded from the question that sought to establish the main reason the respondent needed care, even if they did not get care.

iv) Type of facility used.

Three dependent variables namely; health care needed, health care received and seeking health care for NCDs were dichotomised to 0, 1 values (0 → no and 1 →yes). For type of facility, multinomial model was used, and the variable was coded such that public facility=1, private facility=2 and the reference category was other health facilities (includes, traditional healer, pharmacy or dispensary).

The variable health care needed denotes health seeking behaviour which is commonly thought of as the ways in which people behave in relation to their health (Abera, Ncayiyana, and Levin, 2017) while health care received can be thought of as the utilization of health-care services, which is an endpoint of the process of seeking care (Ward, Mertens and Thomas, 1997).

Educational inequalities have been observed to exist for different indicators of health care utilization in this study. For instance, inequalities were observed when respondents were asked about when was the last time they needed care. The odds were significantly low for low education group to have needed health care in the last one year (AOR=0.41, 95% C.I. =0.27-0.63) than high education group. It was also found that low education level group were less likely to report to have gotten health care when they needed it (AOR=0.62, 95% C.I. =0.54-0.69). This is suggestive of the health seeking behavior of the low education group compared to the high education group, that even when they may have been ill they were less likely to have needed and received health care. Previous evidence has shown that based on the education level of individuals it is possible that two equally healthy individuals report different levels of health and act on their disease condition based on their conceptions of good health and their health expectations are contingent on their knowledge of disease (van Kippersluis, O'Donnell, and van Doorslaer, 2011).

For example, one study in the US found an education advantage in consistent need and reception of health care, which suggests that the highly educated are more prompt to need and seek for health care than the uneducated (Lleras-Muney and Lichtenberg, 2002). Similarly education differences observed in this study can also be explained by differences in conceptions of health, the need for medical attention and knowledge about health seeking and ultimately utilization or health services among the less educated than the more educated.

Table 7.2: Odd ratios giving educational inequality on the selected indicators of health care utilization in Botswana.

			Type of facility†		
Education	**Health care needed** **AOR (95% CI)**	**Health care received** **AOR (95% CI)**	**Private/no care** **AOR (95% CI)**	**Public/no care** **AOR (95% CI)**	**Reason for seeking health care** **AOR (95% CI)**
Low	0.41** (0.27-0.63)	0.62 (0.54-0.69)**	0.21**(0.14-0.36)	1.70** (1.41-2.80)	0.56** (0.37-0.85)
High	1.00	1.00	1.00	1.00	1.00

Notes: Control variables used: sex, age, wealth status and residence. **statistically significant at $P<0.05$; †multinomial model used, N=476.Reference category=Other-health facilities.

It was found that less educated respondents were less likely to have sought health care for NCDs than for other disease conditions (AOR=0.56, 95% C.I. =0.37-0.85). This observation is expected, in the case of Botswana because people with low education levels are often poor and more susceptible to infectious diseases than NCDs. This explains why people with low education in this study were found to be less likely to seek health care for NCDs. This finding concurs with the evidence from other LMICs which have shown that traditionally infectious diseases have a higher prevalence among individuals with a lower SES and that communicable diseases are the main reason why people with a lower SES seek for medical help (Myer, Ehrlich and Susser, 2004; Abera, Ncayiyana, and Levin, 2017). However, while this is still largely the case, the increasing complexity of health problems has led to infectious diseases now also occurring amongst individuals with a high SES status. Similarly, chronic diseases, previously thought to be most prevalent among individuals of a higher SES status, are now also occurring among individuals of a lower SES.

Considering the type of facility utilized it was found that less educated people were more likely to report to have more often visited public health facilities (AOR=1.70, 95% C.I. =1.41-2.80) when they felt sick or needed to consult anyone about their health. Contrarily, low education level respondents were less likely to have sought for health care in private health facility (AOR=0.21, 95% C.I. 0.14-0.36). Choice of health care provider and type of health facility to visit when sick is often determined by affordability and geographical accessibility, with the latter being the key determinant (Blackwell, Iacus, King, *et al.* 2009). In Botswana public health facilities are accessed freely and have geographical accessibility and therefore affordable to low level education participants. Private health facilities are accessed through medical insurance or out-of-pocket payment for health care services which low education respondents may not afford. Moreover, private health facilities are often found in urban areas and are accessed by high education and SES individuals.

Similar observations have been made elsewhere. For instance, a study conducted in Kogi State, Nigeria showed that public facilities compared to private facilities were preferred on account of cost of accessing health services (Awoyemi, Obayelu and Opaluwa, 2011). Cost was suggested as a major factor for utilization of public rather than private facilities. Similarly in Botswana low education level individuals cannot access other-facilities and private health facilities due to high costs linked with these facilities.

7.3.2 Wealth Status Disparity in Health Care Utilization

Table 7.3 presents the AORs for health care utilization by wealth status in the study population. Four health care utilization indicators used to assess education inequalities in health care utilization were also used to assess wealth status inequalities. Wealth status disparities were observed when respondents were asked about when was the last time they needed health care. It was found that the poor were less likely to have needed health care in the last 12 months (AOR=0.58, 95% C.I. =0.39-0.86) and they were less likely to have received health care the last time they needed health care (AOR= 0.69, 95% C.I. =0.61-0.78) than the non-poor. Consistent with this finding previous studies have also indicated an association between wealth status and health seeking behaviour with the poor observed not to need and seek for medical care even when ill or sick compared to the non-poor (Ahmed, Adams, Chowdhury, *et al* 2000; Ghosh, Chakrabarti, Chakraborty, *et al.* 2013; Muriithi, 2013).

Moreover, the poor were less likely to have sought health care for NCDs (AOR=0.33, 95% C.I. 0.11-0.99). The on-going urbanization in Botswana, coupled with the growth of the economy, makes the relationship between SES and health status to be more complex. Chronic diseases, previously thought to be most prevalent among individuals of a higher SES, are now also occurring among individuals of a lower SES. However infectious diseases, especially HIV have a higher prevalence among individuals with a lower SES (Fox, 2010; WHO, 2014).

Table 7.3: Wealth status differences (poor vs non-poor) for health care utilization in Botswana.

			Type of facility†		
Wealth status	**Health care needed** **AOR (95% CI)**	**Health care received** **AOR (95% CI)**	**Private** **AOR (95% CI)**	**Public** **AOR (95% CI)**	**Seeking health care for NCDs** **AOR (95% CI)**
Poor	0.58**(0.39-0.86)	0.69**(0.61-0.78)	0.16** (0.09-0.26)	1.60** (1.27-2.27)	0.33** (0.11-0.99)
Non-poor	1.00	1.00	1.00	1.00	1.00

Notes: Control variables used: sex, age, wealth status and residence**statistically significant at 5%.
†multinomial model used; N=476. Reference category=Other-health facilities

Consistent with previous studies (Muriithi, 2013; Abera, Ncayiyana, and Levin, 2017) it was found that individuals with poor wealth status were more likely (AOR=1.60, C.I. =1.27-2.27) to report to have visited public health facilities when they felt sick or needed to consult anyone about their health. Conversely, poor wealth status respondents were less likely to have visited private facilities when sick (AOR=0.56, 95% C.I. 0.37-0.85). It has been found that disparities in the type of health facility visited by individuals depend on affordability and geographical proximity (Blackwell, Iacus, King, *et al.* 2009). This explains the observed differences between wealth status and type of facility used by people in this study. This is because public health facilities in Botswana are free, while private facilities are paid for. Consequently, the poor inevitably visit public health facilities than private health facilities when they are sick because of affordability and geographical proximity.

7.3.3 Determinants of Public Health and Private Health Services Utilization

Multinomial logistic regression was employed using 'other facilities' (includes, traditional healer, pharmacy or dispensary) as the reference category to identify predictor variables associated with public and private outpatient care utilization and the results are given in Table 7.4. It was found that sex has significant effects on the odds of using public health facility than other health facilities. Women were found to be 13 times more likely to use public health facilities (AOR=13.6, 95% C.I. = 1.23-22.4) and less likely to use private health facilities (AOR=0.07, 95% C.I. = 0.02-0.23) than other health facilities compared to men. Utilization of public health facilities than private health facilities among women can also be explained by affordability of public health facilities.

Furthermore, women's greater need approximated by their worse state of health (greater morbidity, worse perception of health, worse health-related quality of life, and greater degree of disability than men) and the different social construction of the disease (roles, attitudes, beliefs and behaviours of men and women when they are sick or worried about ill-health) can also explain observed gender differences in utilization of health facilities (Saeed, Xicang, Yawson, *et al.* 2015).

The odds of using public health facility instead of other facilities increased with age while the odds of using a private health facility instead of other facilities were lowest in ages above 50 years. Utilization of public health facilities instead of private and other facilities among the elderly may be explained by the fact that public health facilities are accessed freely. Moreover, in Botswana the elderly are given special care at health facilities. They are given priority and they are not allowed to queue at public health facilities. Corroborating this evidence, one study on health care utilization among the elderly in Botswana found that the elderly people usually use public clinics when they are not well, especially in rural areas (Clausen, Sandberg, Ingstad *et al.* 2000). It was also found that other-health facilities (including traditional doctors) are consulted by the elderly for more specific familiar or interpersonal problems related to tradition and beliefs rather than for typical health problems.

People residing in urban villages (AOR=5.66, 95% C.I. = 1.23-14.2) and rural areas (AOR=7.68, 95% C.I. =2.01-17.4) were 5 and 7 times, respectively, more likely to use public health facilities than individuals staying in cities and towns. On the other hand the odds of using private health facility instead of other facilities was lowest in rural areas (AOR=0.02, 95% C.I. =0.00-0.23) and urban villages (AOR=0.18, 95% C.I. =0.03-0.68). This finding suggests that utilization of different types of health facilities differ by residence and this is consistent with findings from an earlier study in Uganda which reported that rural residents were more likely to use public health facilities (Pariyo, Ekirapa-Kiracho, Okui, *et al.* 2009). Meanwhile, other studies have found inconsistent evidence about the influence of residence on the type of facility used.

Some studies highlighted that urban residents are more likely to use public facilities than rural counterparts (Pariyo, Ekirapa-Kiracho, Okui, *et al.* 2009; Awoke, Negin, Moller *et al.* 2017), whereas some others have shown that no significant association exists between residence (urban/rural) and type of health facility (Akazili, Garshong, Aikins *et al.* 2012; Saeed, Xicang, Yawson, *et al.* 2015). In the context of Botswana, private health facility coverage is greater in urban areas and there is less choice of private health service provision in villages.

Table 7.4: Odds ratios showing the influence of socioeconomic factors on outpatient public and private healthcare utilization, multinomial logistic regression model.

Variables	**Public Health Facility/other facilities**		**Private Health facility/other facilities**	
	AOR	**C.I.**	**AOR**	**C.I.**
Sex				
Male	1.00		1.00	
Female	13.6**	(1.23-22.4)	0.07**	(0.02-0.23)
Age				
≤24	1.00		1.00	
25-44	2.33	(1.01-5.23)	0.01	(0.00-1.01)
45-54	8.23**	(2.34-15.3)	0.07	(0.02-2.84)
55-64	9.00**	(2.72-19.3)	0.11**	(0.03-0.56)
65+	5.00**	(1.19-13.1)	0.20**	(0.04-0.73)
Residence				
Cities/towns	1.00		1.00	
Urban villages	5.66**	(1.23-14.2)	0.18**	(0.03-0.68)
Rural areas	7.68**	(2.01-17.4)	0.02**	(0.00-0.23)
Wealth status				
Poor	8.50**	(3.01-18.6)	0.11**	(0.03-0.56)
Non-poor	1.00		1.00	
Education Level				
Low	16.3**	(4.12-26.8)	0.07**	(0.02-0.43)
High	1.00		1.00	

Note: Reference category is 'other facilities', **statistically significant at 5%.N=630. For education, no education, primary and secondary= low and post-secondary, tertiary and post-tertiary education=high; for wealth status, quintile 1 & 2=poor and 3 to 5=non-poor.

For wealth status, the odds of using a public health facility instead of other facilities were highest among the poor (AOR=8.50, 95% C.I. =3.01-18.6) than the non-poor and for using private hospital instead of other facilities the odds were lowest among the poor (AOR=0.11, 95% C.I= 0.03-0.56) than the non-poor. Wealth status has been identified as an important enabling factor for health care utilization based on Andersen's conceptual framework of healthcare utilization (Andersen, 1995). Under this conceptual framework wealth status is suggested to be a strong predictor of both public and private outpatient care utilization and that SES of an individual is very key in determining whether they utilize public health facilities or private health facilities.The finding in this study corroborates the above claim, because it shows that the poor are more likely to utilize public health facilities which are usually offered for free and are geographically accessible to the poor.

Education was also identified as one of the significant predictors of utilization of health facilities in the study. The odds of using public health facility instead of other health facilities were significantly high among the low education group (AOR=16.3, 95% C.I. = 4.12-26.8) than the high education group while the odds of using private health facility than other health facilities were significantly lowest among the low education group (AOR=0.07, 95% C.I. = 0.02-0.43) than in the high education group.

Despite the availability of many service providers in Botswana, less educated (who are often poor), being financially constrained, normally have limited choice and often use public services which are offered free of charge. Similar findings have been observed in other countries such as Uganda (Kiwanuka,, Ekirapa, Peterson *et al.* 2008), Malawi (Machira & Palamuleni, 2017), and Zambia (Hagoma, Robberstad and Aakvik, 2017) that the less educated due to their poor SES are likely to use public health facilities, where there are no user fees.

Preference to use public health facilities over other facilities in Botswana is based on affordability rather than choice (WHO, 2017). It should be noted that although the poor rely on public health services for their care, most public health facilities are poorly suited for providing primary care. Public health services in Botswana tend to be episodic or disease-oriented, and continuity or coordination is limited.

People using hospital outpatient services, especially poor people in rural areas, travel farther and wait longer due to congestion (Seitio-Kgogwe, Gauld, Hill *et al.* 2014). In private health hospitals waiting time is shorter and usually queues are minimal. Differences in waiting time may be explained only in part by the fact that appointments are more likely to be made based on the work load of a physician and appointments can take as long as six months while in private health facilities due to the small patient-physician ratio appointments are done expeditiously.

The next section of this chapter looks at the health expenditure patterns and correlates in the study population.

7.4 Health Expenditure

Botswana's health system has initiated several reforms designed to eliminate access barriers to health services (Seitio-Kgokgwe, Gauld, Hill *et al.* 2014). The health system consists of public, private for-profit, private non-profit and traditional medicine practice. The public sector dominates the health system, operating 98% of the health facilities (African Health Organization, 2015). A large proportion of people with low SES constitute those who access health services from public health sector (WHO, 2015).

Although the government plays a larger role of ensuring universal access to health care through free public health sector services, people accessing health services from private health facilities usually pay out-of-pocket or through medical insurance for health services. Paying a large proportion of household income has been found to push households into financial hardship or even poverty (Berki 1986; Wagstaff and Van Doorslaer 2002; WHO, 2014). If not checked, out-of-pocket expenditure may result in "Catastrophic Health Expenditure" which is a general term used to describe all kinds of health expenditures that pose a threat to the financial capacity of a household in order to maintain its subsistence needs (Berki 1986; Wagstaff and Van Doorslaer 2002; Aizuddin, Zainuddin, Manaf *et al.* 2012).

Botswana's commitment to achieving universal health coverage has reduced the risk of catastrophic health expenditure in the population, while at the same time increasing government expenditure on health. The government provides the majority (57%) of health expenditure in Botswana while the balance is covered for through private health insurance (Cali and Avila, 2016). This is not sustainable for the government considering that long-term economic growth prospects are less optimistic than in the past. As a way forward, the government has recently developed a health financing strategy that will increase efficiency, ensure financial sustainability, and promote an effective mix of public and private mechanisms for health financing and service provision (Cali and Avila, 2016). Botswana has made concerted efforts to reduce public spending to GDP including government health expenditure. Consequently public expenditure on health has declined from 4.2 per cent of the GDP in 2009 to 3.1 per cent in 2013 (MoFDP, 2015).

Botswana's level of health spending per capita is above average compared to other similar countries in Southern Africa (Cali and Avila 2016). It has been noted that health care spending per person increased from BWP 348 in 1995 to BWP 1491 in 2013 and this has all along been driven by public spending. Botswana (5.4%) spends a comparatively less share of its GDP to health compared to Namibia (7.7%) and South Africa (8.9%).
Private health expenditure has been increasing rapidly since 2005 (ibid 2016) while OOP health expenditure in Botswana constituted 5.4% of total health expenditure in 2013, which is the lowest compared to other countries (Cali and Avila 2016). With this background, health expenditure analysis in this sub section focuses on assessing OOP expenditure patterns and factors associated with OOP expenditure in the study population.

Given the context of universal health coverage in Botswana out-of-pocket expenditure is hypothesized to be low. However, an assessment of out of-pocket expenditure patterns in the study population is essential to provide baseline evidence on health out-of-pocket expenditure in the context of universal health coverage system. Moreover, documenting patterns and determinants of out-of-pocket health expenditures in the context of universal health coverage can help strengthen public policies aimed at achieving equity in health.

7.4.1 Analysis of Health Expenditure

This section presents results for patterns of health expenditure. It focuses on out-of-pocket expenditure among respondents. Table 7.5 indicates that 44% of the study participants indicated that for their last visit to the hospital they paid some amount for health care provider fees. Of this proportion, it was found that a high percentage (31.5%), reported to have paid a nominal fee of BWP 1-99, while only 2.8% had paid more than BWP500. Although the highest proportion of participants in the sample indicated that they paid between BWP 1.00 and BWP 100.00 for poor households this amount may not be affordable.

It was found that for medicines, 25.2% indicated that they paid some amount (BWP1.00+), while for tests, 22 % indicated that they paid for tests and 26.2% reported that they had paid for transport costs. Meanwhile it was also found that overall 9.2% of participants reported to have paid out-of-pocket for in-patient care in the last 12 months, while 45.2% reported to have paid out-of-pocket for outpatient visits. Of those who paid for out-patient visits majority of them (19.6%) had paid more than BWP500. It was also observed that 63.1% of respondents had paid out-of-pocket overall for health care provider fees, medicines, tests, transport and other-things combined.

Overall this analysis indicates that in Botswana out-of-pocket expenditure for health care is nominal. Although out-of-pocket payment for health care is insignificant and affordable, for the very poor no price is affordable. Even nominal user fees can lead to massive exclusion of the poor from life-saving health services. However, government’s efforts to provide universal health coverage aimed at making health care accessible to all for free needs to be emphasised in the population (Ministry of Health and Wellness, 2011). Even at that, in order to access specialised and expedited care for NCDs the poor at times are required to use private health care which is not free, especially for secondary care. Universal health coverage provides greater equality, but also much larger overall health gains since it manages the most easily curable diseases and the prevention of easily avoided illnesses that are otherwise left out when the system relies on out-of-pocket payments (WHO, 2017).

Medical insurance coverage is relatively low in Botswana, with about 21.8% of study participants reporting that they were covered by some medical insurance. However, this proportion is slightly higher than the estimated national medical insurance coverage of 17% (Cali and Avila, 2016). People who are under medical insurance are covered by private insurance schemes (Health Policy Project, 2016). Although these schemes cover just up to 17% of the population, they have grown rapidly as a source of health expenditure.

The government recognizes the significance of private health insurance providers and is considering ways to expand coverage through the private sector, including compulsory enrolment of public employees in these schemes and contracting out (Health Financing Project, 2015). Both the public and private sector already heavily subsidize employees’ health insurance, so mandating enrolment for private companies is likely to face resistance. Meanwhile, the current system of tax-financed health services has been successful in pooling risk, contributing to reductions in catastrophic expenditure and promotion of equity in health (PEPFAR, 2015).

Table 7.5: Per cent distribution of health expenditure indicators in the study population, NCD study 2016.

Variable	%	N
Thinking about your last visit, how much did you or your household pay for health care provider fees?		
Free	56.6	81
1-99 BWP	31.5	45
100-499 BWP	9.1	13
500+ BWP	2.8	4
Thinking about your last visit, how much did you or your household pay for medicines?		
Free	74.8	98
1-99 BWP	7.6	10
100-499 BWP	13.7	18
500+ BWP	3.8	5
Thinking about your last visit, how much did you or your household pay for tests?		
Free	78	92
1-99 BWP	3.4	4
100-499 BWP	3.4	4
500+ BWP	15.3	18
Thinking about your last visit, how much did you or your household pay for transport?		
Free	26.2	43
1-99 BWP	57.3	94
100-499 BWP	13.4	22
500+ BWP	3.0	5
Thinking about your last visit, how much did you or your household pay for other things?		
Free	98.8	162
1-99 BWP	1.2	2
100-499 BWP	0.0	0
500+ BWP	0.0	0
Overall, what is total expenditure on health care during the last 12 months? (this includes expenditure for all the members in the household for all episodes) In patient care:		
Free	90.8	286
1-99 BWP	2.9	9
100-499 BWP	3.8	12
500+ BWP	2.5	8
Overall, what is total expenditure on health care during the last 12 months? (this includes expenditure for all the members in the household for all episodes) Out-patient care:		
Free	54.8	204
1-99 BWP	15.6	58

100-499 BWP	9.9	37
500+ BWP	19.6	73
Overall out-of-pocket expenditure		
Free	36.9	24
1-99 BWP	29.2	19
100-499 BWP	21.5	14
500+ BWP	12.3	8
Are all your household members covered under any medical insurance?		
Yes	21.8	127
No	78.2	455

7.4.2 Factors Associated with Health Expenditure

Multivariate logistic regression analysis was used to examine the factors associated with health expenditure (overall out-of-pocket expenditure). Overall OOP health expenditure was derived by summing expenditure incurred on health care provider fees, medicines, tests, transport and other-things. Adjusted odds ratios (AOR) and 95% confidence intervals (CI) were estimated for the model. In the logistic regressions, outcome variables were coded as '1' if respondent incurred OOP expenditure and '0' if they did not incur any OOP expenditure.

Gender differences were observed in health expenditure. For instance, it was found in table 7.6 that females were 8 times (AOR=8.31, 95% C.I. = 1.08-23.5) more likely to incur OOP than males. This finding corroborates findings from Ethiopia (Guda, Akadu, Tamiru et al. 2012) and India which found that women were 4 times and 5 times respectively more likely to pay OOP health expenditure than men. High odds of OOP expenditure for women may be explained in part by health seeking behaviour of women.

Generally, women in Botswana have been found to visit health facilities frequently than men (Seitio-Kgokgwe, Gauld, Hill *et al.* 2014). Consequently, they are likely to expend on health services than men. Usually, men do not use healthcare if their illness is not severe, whereas women may utilize healthcare services at the early stages of disease.

It was also found that age was a significant factor in OOP expenditure, and respondents aged 65+ years were 4 times (AOR=4.32, 95% C.I.= 1.64-9.72) more likely to spend out-of-pocket for health services than those in ages less than 24 years. In this study it was also found that the elderly sought for medical care more than young adolescents. As a result this may explain why they were more likely to expend on medical care.

The increased use of medical care may contribute to the elderly with chronic conditions having higher out-of-pocket medical expenses. In the United States in 2014, it was also found that out-of-pocket expenditures for elderly adults were higher compared with non-elderly adults (Soni, 2017). This is because longevity is strongly, positively correlated with OOP health care expenses (Banerjee, 2018). The longer a person lives, the more likely they are to pay higher OOP health care expenses. But what might not be obvious is the extent of the difference longevity makes in terms of these expenses.

Table 7.6: Adjusted odds ratios (AOR) showing the association between socioeconomic factors and out-of-pocket health expenditure among respondents.

Variable		**AOR** **C.I.**
Sex	Male	1.00
	Female	8.31** (1.08-23.5)
Age	24	1.00
	25-34	1.89 (0.34-10.5)
	35-44	2.02 (0.24-16.8)
	45-64	3.35 (0.29-19.9)
	65+	4.32** (1.64-9.72)
Education	Low	0.17 (0.02-1.11)
	High	1.00 (0.53-7.18)
Residence	Cities/towns	1.00
	Urban villages Rural	0.11** (0.01-0.95) 0.09** (0.01-0.89)
Wealth status	Poor Non-poor	0.14** 1.00

Notes;**Significant at 5%.N=65, for education, no education, primary and secondary= low and post-secondary, tertiary and post-tertiary education=high; for wealth status, quintile 1 & 2=poor and 3-5=Non-poor.

It was found that people in urban villages (AOR=0.11, 95% C.I. = 0.01-0.95) and rural villages (AOR=0.09, 95% C.I. = 0.01-0.89) were less likely to have spent out-of-pocket for medical care than those in cities and towns. This is consistent with previous findings which have shown that OOP health expenditures are more significantly associated with urban communities (Onwujekwe, Uzochukwu, Obikeze *et al.* 2010). Urban communities in Botswana may access private health care, which is accessed through out-of-pocket payment and medical insurance coverage. Meanwhile rural communities mainly use public health facilities which are normally free for their healthcare needs.

It was found that wealth status was significantly associated with out-of-pocket health expenditure; with the poor (AOR=0.14) less likely to report out-of-pocket expenditure for health care. This is consistent with what other previous studies found that socioeconomic status is the household characteristic most commonly associated with variation in out-of-pocket health expenditure. Studies in countries such as Kenya, Namibia, Nigeria, Albania, Bangladesh, and India found that poorer individuals and households had no or lower absolute out-of-pocket expenditures on health care than wealthier households (Chuma and Maina 2012; Karan, Selvaraj, and Mahal, 2014; Onwujekwe, Uzochukwu, Obikeze *et al.* 2014; Rahman, Hann, Wilson *et al.* 2015).

In Botswana the variation between wealth status and OOP expenditure may be explained by the fact that in Botswana the non-poor mostly access private health facilities where user fees are paid, while the poor often use public health facilities which are accessed freely. Private health facilities have relatively efficient and high quality services. However, due to the widespread utilization of public health facilities the non-poor can also access public health facilities if they do not want to pay out-of-pocket for health. Thus, both the non-poor and poor have an option of using public health facilities which are for free, but the non-poor prefer private health care for its quality and convenience (Basu, Andrews, Kishore *et al.* 2012).

7.4.6 Factors Associated with Medical Insurance Coverage

Table 7.7 gives the adjusted odds ratios derived from the logistic model on medical insurance coverage. Education level differences for medical insurance coverage were observed, with people who had primary or less education (AOR=0.33, 95% C.I. = 0.12-0.85) less likely to have any medical insurance coverage compared to those with tertiary or higher education. Most studies have also shown similar observations that insurance coverage is more pronounced in the high SES groups than low SES (Markowitz, Gold and Rice, 1991; Buchmueller 1996; Merzel 2000; African Health Organization, 2015) although low SES groups suffer ill-health. This may in the long run predispose poor people to further poverty in cases of chronic conditions due to extensive out-of-pocket expenditures.

This study also found that people in villages (AOR=0.53, 95% C.I. = 0.29-0.96 for urban villages and AOR=0.48, 95% C.I. for rural villages) were less likely to be covered under any medical insurance than residents of cities and towns. In Botswana, residential differences in medical insurance coverage may be due to the fact that urban residents have access to, can afford and use private health facilities where medical insurance is used, while in rural areas there are no or few private health facilities where people can use medical insurance. Quite often rural areas tend to have fewer insurance companies offering plans in the health insurance marketplaces. Even in rural areas where there is existence of insurance companies premium increases tend to be higher because there is less competition among insurers.

Table 7.7: Adjusted odds ratios showing the influence of socioeconomic factors on medical insurance coverage among study participants, NCD study, 2016.

Characteristics		AOR 95% CI
Sex	Male	1
	Female	1.59 (0.90-2.79)
Age	≤24	1.00
	25-34	0.58 (0.28-1.21)
	35 - 44	1.31 (0.60-2.83)
	45 - 54	2.01 (0.80-5.03)
	55 - 64	1.53 (0.43-5.38)
	65+	0.62 (0.06-5.67)
Education	Low	0.33** (0.12-0.85)
	High	1.00
Locality	Cities and towns	1
	Urban villages	0.53** (0.29-0.96)
	Rural	0.48** (0.21-0.91)
Wealth Status	Low	0.07** (0.02-0.27)
	High	1.00

Notes;**Significant at 5%, N=582; for education, no education, primary and secondary= low and post-secondary, tertiary and post-tertiary education=high; for wealth status, quintile 1 & 2=poor and 3-5=non-poor.

It was also observed that the poor (AOR=0.07, 95% C.I. = 0.02-0.27) were less likely to report to be covered by medical insurance than the non-poor. Medical insurance coverage is often associated with non-poor households which can afford insurance premiums while the poor are usually covered by public health medical care. The coverage of medical insurance in Botswana benefits the non-poor, creating inequality in the ability to purchase quality care. This is because the non-poor are covered under public health medical care but they can also purchase private health care, through medical insurance coverage.

Meanwhile the government recognizes the importance of health insurance and employers in both the public and private sectors are urged to instigate mandatory medical insurance enrolment for their employees (PEPFAR, 2015). There have been considerable efforts to extend coverage to rural areas. The current system of tax-financed health services has been successful in pooling risk, contributing to reductions in catastrophic expenditure and promotion of equity in health in Botswana (African Health Organization, 2015).

7.5 Summary of Key Findings

- Women were found to be more likely to use public health facilities and less likely to use private health facilities than other health facilities compared to men
- Educational and wealth status inequalities have been observed to exist for different indicators of health care utilization in this study. It was found that people with low education and poor wealth status were less likely to; have needed health care in the last one year, to report to have received health care when they needed it, and to have sought health care for NCDs than other disease conditions. However the poor and less educated people were more likely to report to have used public health facility than other-health facilities for their health care.
- It was also found that people residing in urban and rural villages were 5 and 7 times, respectively, more likely to use public health facilities than individuals staying in cities and towns.
- Gender differences were observed in health expenditure, with women 8 times more likely to report to have incurred out-of-pocket expenditure than men.
- The elderly (65+ years) were 4 times more likely to spend out-of-pocket for health services than individuals in ages less than 24 years.
- It was found that people in urban villages and rural villages were less likely to have spent out-of-pocket for medical care than those in cities and towns.
- It was found that wealth status was significantly associated with out-of-pocket health expenditure; with the poor less likely to report out-of-pocket expenditure for health care
- Medical insurance coverage is relatively low in Botswana, with about 21.8% of study participants reporting that they were covered by some medical insurance.

- Education and wealth status differences for medical insurance coverage were observed, with people who had low education and wealth status less likely to have any medical insurance coverage compared to those with high education and wealth status.
- It was also found that people in villages and urban villages were less likely to be covered under any medical insurance than residents of cities and towns.

Overall findings from this chapter have shown socioeconomic inequalities in utilization of health care services and health expenditure in the study population. For health care utilization it was found that women, the poor, the less educated and residents of rural and urban villages were less likely to have sought for health care, received health care when they needed it and needed health care for NCDs than other disease conditions. It was further found that they were more likely to use public health facilities than other health facilities.

It was found that women, the non-poor, and residents of cities and towns were more likely to report OOP expenditure. This indicates that government provision of universal health coverage contributes to reductions in catastrophic expenditure and promotion of equity in health in Botswana. Meanwhile, people who had low education, poor wealth status and resided in rural or urban villages were less likely to report any medical insurance coverage. Affordable medical insurance coverage should be extended to the poor and rural or urban villages in order to create equality in the ability to have choice in purchasing quality care. The next chapter looks at the influence of childhood SES position on health of individuals.

CHAPTER 8: LIFE COURSE PERSPECTIVE: CHILDHOOD SOCIOECONOMIC STATUS AND HEALTH

The previous chapter presented results on levels, patterns and determinants of health care utilization and health expenditure in Botswana. Some socioeconomic differences were noted for some health care utilization and health expenditure variables. In order to further understand socioeconomic inequalities in health this chapter focuses on the influence of childhood SES on adult health controlling for current SES. An understanding of the influence of childhood SES on adult health is critical for achieving health equity in the early stages of life and for designing effective childhood interventions.

8.1 Introduction

In recent years, life course perspective is an approach adopted by researchers to explain how socioeconomic factors at different levels (individual, family and community) during the life course operate through more proximate determinants to influence health. There is ample evidence showing correlation between childhood SES and adult health (Wadsworth 1997; Diaz-Roux 1998; Becker, Gary, Kevin *et al.* 2005; Kuate-Defo 2001; Vellakal, Subramanian, Millett *et al.* 2013).

These evidence suggest that childhood SES is a powerful predictor of adult health. For instance, Galobardes, Lynch and Davey-Smith (2008) reviewed 40 studies examining the link between childhood SES and adult mortality. They (Galobardes, Lynch and Davey-Smith Lynch and Davey-Smith 2008) concluded that individuals with lower SES during childhood were at an elevated risk of premature mortality, regardless of their socioeconomic circumstances during adulthood. Another review of 49 studies by Pollitt, Kaufmann, Rose *et al.* (2007) examined the evidence supporting a link between SES throughout the life course and adult cardiovascular outcomes. They found that poorer socioeconomic conditions during childhood place individuals at risk for adult cardiovascular disease and cardiovascular-related mortality, independent of adult SES. More convincing was the evidence that adult cardiovascular disease risk increases as the number of years throughout the life course (childhood included) spent in a low SES environment goes up.

The above literature yields mounting evidence of the effects of SES on health. The socioeconomic factors that may influence adult health include family-level variables such as education and employment, income and ownership of consumer durable goods, type of drinking water, sanitation and housing type (WHO 2000) ; as well as community-level covariates captured by the availability of health related services and relevant socioeconomic infrastructures. A number of studies (such as Bicego and Boerma 1993; Adair and Guilkey 1997; Alvarez-Dardet 2000; Armar-Klemesu, Ruel, Maxwell *et al.* 2000; Brown 2003**)** have supported the general evidence that SES is a stronger determinant of adult health in developed countries. The argument given is that socioeconomic position has been observed to influence individual's choices, skills and behaviour related to preventive care, nutrition and hygiene among others (Wagstaff, 2002).

Further, it has been shown empirically that individuals from high socioeconomic position are more likely to take advantage of modern technology and are more aware of nutritional and health related problems (Diaz-Roux 1998; Kuate-Defo 2001; Becker, Gary, Kevin *et al.* 2005), while in contrast those from poor socioeconomic position are less likely to take advantage of available health resources, are unable to generate resources for improved nutrition and health hence they are more prone to some NCDs (Vellakal, Subramanian, Millett *et al.* 2013). In Western European countries, in particular the United Kingdom, the consequences of social stratification for health has been the subject of research for several decades (Nunn, Johnson, Monro *et al.* 2007; Braveman and Gottlieb, 2014).

There is mounting research evidence showing that SES exposures during childhood are powerful predictors of adult health (Mare, 1982; Cohen, Janicki-Deverts, Chen *et al*. 2010). This research evidence shows that adult and childhood SES are correlated. For instance it has been shown that individuals with highly educated and relatively wealthy parents are more likely to have access to educational opportunities and to higher status, due to well-paying careers (Chen, 2004; Pollitt, Kaufman, Rose, *et al.* 2007; Galobardes, Lynch and Smith, 2004; Galobardes, Lynch and Smith, 2008). Consequently, this may suggest that childhood SES does not itself play a role in adult health, but merely acts as a marker of future adult SES, which in turn influences adult health (Cohen, Janicki-Deverts, Chen *et al*. 2010).

It has also been found that SES is correlated with NCD risk factors. Behavioural risk factors such as tobacco smoking, heavy alcohol consumption, physical inactivity, and unhealthy eating are socially patterned, with individuals of low SES generally experiencing a higher burden of risk factors (Stringhini, Sabia, Shipley *et al.* 2010; Stringhini, Sabia, Shipley *et al*. 2011).

Some further evidence indicate that unhealthy behaviours were more frequent in high socioeconomic groups at the beginning of the 20th century in developed countries, but the burden later shifted towards the disadvantaged socioeconomic groups (Stringhini and Bovet, 2017). This explains why NCDs have long been considered as "diseases of affluence" (Wilkinson, 1994). Meanwhile the question of whether NCD risk factors disproportionately affect poor individuals in the poorest countries has recently sparked an intense debate. This debate centres on policy issues, whether it means that substantial resources should be allocated to curbing NCD risk factors in countries with very low resources, in addition to on-going efforts to control infectious diseases and under nutrition.

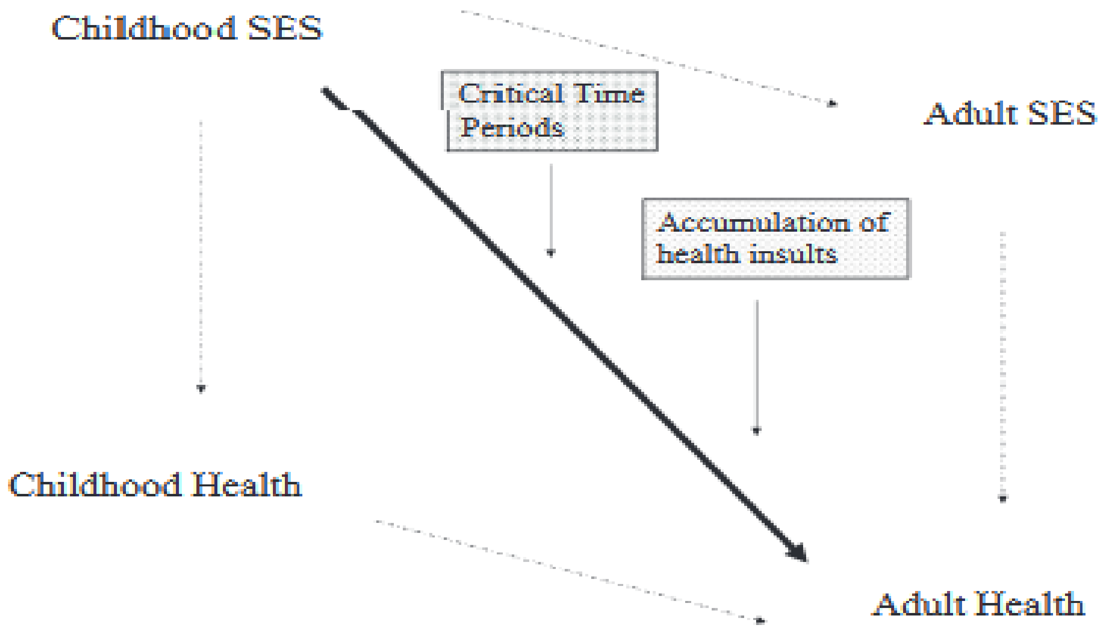
In LMICs there is scarce and inconsistent social patterning of NCD risk factors. According to Stringhini and Bovet (2017) the inconsistent findings on the social patterning of risk factors in

LMICs might relate to the small numbers of studies done in these countries, the limited quality of several of them, and a number of methodological issues (e.g. how to define socioeconomic status in these contexts). Furthermore, the social patterning of risk factors might differ between countries according to cultural norms and traditions, particularly in LMICs where the dominant lifestyles and diet might be driven to a lesser extent by global media and trade than in HICs (Subramanian, Corsi, Subramanyam *et al.* 2013; Stringhini and Bovet, 2013; Narayan and Ali, 2013; Jones-Smith, 2013).

The application of the life course approach (LCA) to epidemiology has helped epidemiologists and demographers to theoretically examine social gradients in population health. There is need to study lifelong changes in health, and this need has resulted in increasing emphasis on a life course approach in different fields of inquiry in recent years. The main aim of life course approach is to explore how socioeconomic and social risk factor trajectories, acting across the life course, influence health of individuals (Bharmal, Derose, Felician *et al.* 2015). The significance of childhood SES and adult characteristics was generally acknowledged to influence health and well-being in the first half of the twentieth century, but it was not until the 1990s that comprehensive life course epidemiology took feet (Niedzwiedzet, Katikireddi, Pell *et al.* 2012). The growing focus on life course determinants of health has implications for studies of long-term changes in epidemiology of non-communicable diseases.

It should be acknowledged that LCA presents great challenges for the continued development of testable theoretical models and effective study design and analysis. Although most studies have effectively used longitudinal data to study lifelong changes in health, robust conclusions have also been drawn from cross sectional data. In Botswana there is no evidence of research linking childhood SES and adult health and it is this gap which this chapter is intended to fill.

Figure 8.1: Pathways connecting the childhood, adulthood socioeconomic status and adult health



Source: Conroy, Sandel, and Barry Zuckerman, 2010.

Figure 8.1 above depicts the multiple interactions among childhood SES; how childhood health, physical and social environments experienced by the child during childhood have lasting effects on subsequent adult health. For example, children born with low birth weight, related to low maternal education (Berghella, 2007), wealth status (Lee, Ferguson, Corpuz *et al.* 1988) and health risk behaviours such as smoking (Lieberman, Gremy, Lang *et al.* 1994)—all of which are more prevalent in low SES households—is a risk factor for NCDs among adults.

This is because children from low SES face the possibility of poor development which ultimately predispose them to NCDs such as type 2 diabetes and hypertension (Conroy, Sandel and Zuckerman *et al.* 2010). Moreover, poor health behaviours disproportionately seen among low SES adults further exacerbate poor adulthood health. For instance, a person who is exposed to NCD risk factors such as smoking, alcohol consumption, poor physical activity, poor fruit and vegetable consumption and malnutrition during childhood and adolescence faces the greatest risk of developing NCDs later in life.

The analysis in this section is guided by framework in Figure 8.1 above. This study is not a pure ‘life course’ study in the sense that it does not follow the same individuals as they age as in the case of a longitudinal study. However, the cross sectional data used here often referred to as pseudo-life-course approach. Although not tracking the same individuals as they age, it allows for tracking the average socioeconomic patterns for group of individuals during childhood using self-reported health while controlling for possible confounders.

The cross sectional data such as the one used in this stduy has been used by previous studies to understand the influence of SES on health throughout life course using self-reports (Hertzman, Power, Matthews *et al.* 2001; James, Van Hoewyk, Belli *et al.* 2006; Pavela, 2017). The analysed data provides vital insights into the influence of childhood SES on adult health in Botswana. The interest is to test the hypothesis that SES in childhood and current SES influence adult health through social, behavioural and physiological processes important for health later in life.

In order to examine the association between childhood socioeconomic status and health, adjusted odds ratios (AORs) were derived by applying logistic regression model. Two models were fitted to data to ascertain the association between childhood SES and health outcomes which are as follows:

Model 1: It assessed the association between childhood SES and risk factors for NCDs. In this model childhood SES is a key independent variable, and its association with risk factors for NCDs is assessed. The current demographic and socioeconomic factors such as sex, age education, place of residence, marital status, work status and current wealth status were used as control variables. Conceptually, these variables are poised to have association with the risk factors for NCDs. The adjusted model by including the other covariates gives the association between childhood SES and NCD risk factors that becomes isolated and discernable.

Model 2: assessed the association between childhood SES and the selected NCDs. In this model childhood SES is a key independent variable, and its association with selected NCDs is assessed. Moreover, sex, age education, place of residence, marital status, work status and current wealth status were used as control variables.

Both models would assess the effects of childhood SES on adult health independent of (after controlling for) adult SES.

Childhood SES variables were constructed from questions relating to socioeconomic experiences during childhood. These variables have been used by previous life course studies to assess the influence of childhood socioeconomic circumstances on adult health. Table 3.2 in the methods section shows life course variables used for analysis section.

8.2 Childhood Socio-Economic Status and Risk Factors for NCDs

8.2.1 Childhood Socioeconomic Characteristics of Study Population

Table 8.1 gives the childhood characteristics of study population collected during the NCD survey. The table reveals that majority of the respondents (79.1%) reported that their father's educational level was low. This was also true for the mother's education level (78%). As regards the occupation of the father, most respondents reported that their father was employed in the private sector (32.8%), while almost half (49%) of respondents indicated that their mothers were unemployed.

Table 8.1: Percentage distribution of childhood characteristics of the study population, NCD Survey 2016

Variable	%	N
Father's Education		
High	20.9	193
Low	79.1	732
Mother's education		
High	21.8	214
Low	78.2	768
Father's Occupation		
Public Sector	25.7	267
Private Sector	32.8	341
Self-employed	25.0	260
Unemployed	16.5	171
Mother's occupation		
Public Sector	12.7	145
Private Sector	15.2	174
Self-employed	23.1	265
Unemployed	49.0	562
Stressful childhood		
Yes	34.1	379
No	65.9	732
Kind of food taken during childhood		
Vegetarian	2.5	24
Non-vegetarian	97.5	939
Self-perceived childhood health		
Below average	8.4	97
Average	66.5	767
Above average	25.1	290
Major ailment during childhood		
Yes	21.9	258
No	78.1	920
Childhood SES Index		
Low	25.6	223
Middle	44.5	388
High	29.9	260

About one third (34.1%) of respondents indicated that they had a stressful childhood. When asked about how they perceived their health during childhood, 8.4% reported that their health was below average, 66.5% was average while only 25.1% reported that their health was above average. Just over one fifth (21.9%) of respondents reported that they had major ailment during childhood. For the childhood SES indicator it was observed that one fourth of the respondents had a low SES and majority (44.5%) of them belongs to a medium level childhood SES.

8.2.2 Association between Childhood SES and NCD Risk Factors

8.2.2.1 Bivariate Analysis

Table 8.2 shows percentage distribution of respondents' childhood SES by socioeconomic and behavioural characteristics. The results indicate significant association between childhood SES and some behavioural characteristics of the study population. For instance, it was found that smoking was more prevalent among individuals who were from middle childhood SES (44.3%) although the association was not statistically significant. This is discordant to previous research evidence which linked low childhood SES with smoking.

Previous evidence has shown that stressful childhood events such as child abuse, neglect and poverty are known to be associated with significantly higher rates of smoking in low SES adults (Nelson, Heath, Lynskey *et al.* 2006; Wisdom, Marmorstein and White 2006; Jun, Rich-Edwards, Boynton-Jarrett *et al.* 2008) but are not usually assumed of as risk factors for the onset of cigarette smoking. In this study the observed no link between low childhood SES and smoking implies that there we no differences in the proportion of smokers versus non-smokers for different childhood SES groups.

Significant association was observed between childhood SES and poor fruit and vegetable consumption. It was found that poor fruit and vegetable consumption was highest among people with middle (46.4%) and high (44.9%) childhood SES than those who reported low SES. Consistent with this finding, there is evidence that dietary patterns established in the early years will remain throughout life (Skinner, Carruth, Wendy *et al.* 2002) because early exposure to certain foods or flavours has a heavy influence on their acceptance in the short and long-term. Consequently the high proportion of individuals with medium and high SES who reported poor fruit and vegetable consumption may be explained by dietary patterns established during their childhood, where the non-poor people's diet may be characterised by a shift from traditional foods to high energy density foods such as sweets, soft drinks and snacks. Similarly, a study performed in Brazil observed that increased consumption of foods with high energy density may be associated with reduced consumption of traditional foods in the diet of Brazilians of medium to high SES (Instituto Brasileiro de Geografia e Estatística (IBGE), 2011).

This is mainly due to the dietary patterns characterized by high intake of sweets, soft drinks, and snacks which are more frequent in populations with higher purchasing power (Instituto Brasileiro de Geografia e Estatística (IBGE), 2011; Sichieri and Castro, 2003). Studies in other developing countries found similar results, associating highly energetic dietary patterns with higher-income families (Shi, Lien, Kumar *et al.* 2003; Zaborskis, Lagunaite, Busha *et al.* 2012).

It was also found that a high proportion of individuals who consumed alcohol were reported among individuals with middle childhood SES (42.8%). This finding corroborates evidence from previous studies (Goodman and Huang, 2002). It has been shown that poor-middle childhood SES is associated with the elevated risk of alcohol consumption (Bensley, Spieker, Van Eenwyk et al. 1999; Hussey, Chang and Kotch 2006; Sartor, Lynskey, Bucholz *et al.* 2007; Keyes, Hatzenbuehler and Hasin, 2013) and adult alcohol consumption (Anda, Whitfield, Felitti *et al.*2002; MacMillan, Fleming, Streiner *et al.* 2001; Nelson, Heath, Lynskey *et al.* 2006; Keyes 2013). This is so because social disadvantage early in the life course predisposes to later problems of substance use, both of illicit drugs and alcohol. Children from low-middle SES families in Botswana are often predisposed to health damaging behaviours, particularly alcohol consumption (Mphele and Manyanda, 2014).

Table 8.2: Bivariate analysis of association between risk factors for NCDs and childhood SES.

Childhood SES	**Alcohol****		**Poor fruit and vegetable consumption****		**Poor physical activity**		**Smoking**		**Overweight/Obesity****	
	%	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**
Low	35.5	54	8.7	6	26.0	146	26.1	204	22.1	79
Middle	42.8	65	46.4	32	42.1	236	44.3	347	46.5	166
High	21.7	33	44.9	31	31.9	179	29.6	232	31.4	112

Note:**statistically significant at 5%

Quite conversely it was found that overweight/obesity was more prevalent among individuals with middle (46.5%) and high (31.4%) childhood SES. Evidence on the association between childhood socioeconomic status and overweight /obesity is at best mixed in developing countries and differs by gender. In Brazil for instance, it has been found that a higher frequency of obesity is high among women with lower SES in childhood (González, Nazmi and Victora, 2009;Brisbois, Farmer, McCargar *et al.* 2012;Wagner, Bastos, Navarro, 2018) while international literature shows that among men better SES at the beginning of the life cycle is associated with greater occurrence of obesity in adulthood (Silva, Vasconcelos, Bettiol, 2010; Aitsi-Selmi, Batty, Barbieri *et al.* 2013; Gigante, Victora, Matijasevich *et al.* 2013).

In the context of Botswana, the observed prevalence of overweight/obesity among people who had non-poor childhood SES may be explained by increased consumption of foods with high energy density and reduced consumption of traditional foods during childhood. This has also been shown by studies in other developing countries which associate highly energetic dietary patterns with higher-income families (Zaborskis, Lagunaite, Busha *et al.* 2012).These highly energetic diets leads to overweight/obesity in later life through the accumulation of fats in the body overtime (González, Nazmi, Yudkin *et al.* 2010).

8.2.2.2 Multivariate Logistic Regression Analysis

This section presents results for the association between childhood SES, NCD risk factors and selected NCDs. This analysis tests whether childhood SES is associated with NCD risk factors independent of adulthood SES.

Alcohol Consumption and Poor Fruit and Vegetable Consumption

Table 8.3 below shows logistic regression results for the likelihood of association between childhood SES, alcohol consumption and poor fruit and vegetable consumption. It was observed that individuals who had low child hood SES were 3 times (AOR=3.29) more likely to report alcohol consumption than respondents who had high childhood SES, when controlling for current socioeconomic characteristics of respondents. This corroborates previous findings which have shown that childhood poverty was associated with earlier onset of adolescent alcohol consumption and with alcohol use disorders in adulthood (Enoch 2010). This has also been supported by several reasons to believe that an association between childhood SES and later alcohol consumption is plausible. For instance, stressful life events during childhood such as low SES, sexual, emotional and physical abuse, emotional or physical neglect have been linked to increase in the risk of alcohol disorders during adulthood (Keyes, Hatzenbuehler and Hasin, 2011).

In Botswana, individuals raised from families of low SES are more likely to have conduct problems and consequently may consume alcohol. Contrary to attestations that the association between poor childhood SES and alcohol consumption is not only influenced by early circumstances but by conditions in adulthood (Blanden, Gregg and Macmillan, 2013; Erola, Jalonen and Lehti, 2016), findings from this analysis show that childhood circumstances drive alcohol consumption independent of adulthood socioeconomic conditions

It was also found that poor fruit and vegetable consumption was significantly associated with poor childhood SES. For instance, individuals who had low childhood SES were four times (AOR=4.87) more likely to report poor fruit and vegetable consumption than those with high SES. Similarly previous studies have shown a positive link between poor childhood SES and poor fruit and vegetable consumption (Sabanayagam, Shankar, Wong *et al.* 2006; Zhang and Wang 2012; Fruhstorfer, Mousoulis, Uthman *et al.* 2016).

A recent study conducted in Japan, for instance, concluded that after adjustment for age and sex, older people who had low childhood SES were more likely to have poor fruit and vegetable intake than those with high childhood SES (Yanagi, Hata, Kondo *et al.* 2018). All these studies have harmoniously noted that childhood socioeconomic disadvantage is consistently associated with lower consumption of fruits and vegetables and higher consumption of energy-dense foods in later life (Fahlman, McCaughtry, Martin *et al.* 2008, Zhang and Wang 2012; Kirkpatrick, Dod, Reedy *et al.* 2012). This is because food preference is determined early in life suggesting that the association between poor childhood SES and poor fruit and vegetable consumption during adulthood observed in this study may be explained by the type of diet that individuals from poor socioeconomic background were exposed to during their childhood.

Table 8.3: Odd ratios giving association between Childhood SES and NCD risk factors

Childhood SES	**Alcohol**		**Poor fruit and vegetable consumption**		**Poor Physical activity**		**Smoking**		**Overweight/Obesity**	
	UOR	**AOR**	**UOR**	**AOR**	**UOR**	**AOR**	**UOR**	**AOR**	**UOR**	**AOR**
Low	2.19**	2.19**	4.87**	2.67**	0.81	0.87	1.11	2.18**	0.66**	0.92
Middle	1.38	1.32	1.49	1.34	0.68**	0.73	1.08	1.46	0.94	0.98
High	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Note: **Statistically significant at 5%; UOR-unadjusted odd ratios, AOR- Estimated adjusted odd ratios controlling for age, sex, education, residence, work status and current wealth status. N=694.

Furthermore, it was noted that the odds of smoking were two times (AOR=2.18) higher among people who reported low childhood SES than those who reported high childhood SES. This corroborates findings of a longitudinal study by Barbara, *et al*. (2004) which found that poor childhood socioeconomic circumstances, which were measured by the occupation-based score and parental education significantly, increased the risk of persistent smoking among adults.

Important mediators identified in this study were factors related to family background, including parental education, self-perceived childhood health, parental occupation and childhood diet. Consequently this implies that childhood SES and not adulthood SES is a key determinant of smoking in Botswana. Furthermore, the cumulative effects of poor early life circumstances observed in this study may predispose individuals to smoking initiation, increased risk of progression to regular smoking and a reduced likelihood of cessation during adulthood. This finding emphasises how important it is, in the context of the policy debate, to recognise the accumulation of disadvantages that can occur during childhood which ultimately leads to inequality in adult morbidity and mortality.

It was also found that individuals who reported low childhood SES were less likely (AOR=0.66) to be overweight/obese. Contrary to this finding, most of research in both developed and developing countries have found that childhood disadvantage (i.e., low childhood SES) is associated with increased weight among adults (Parsons, Powers, Logan *et al.* 1999, Mayer, 2009; Senese, Almeida, Fath *et al.* 2009). More recent research tends to find a more consistent association (Pavela, 2017, Newton, Braithwaite and Akinyemiju, 2017). These studies suggest that indicators of childhood SES may be associated with adult weight through a number of mechanisms, including parental modelling of daily weight-related behaviours (such as the consumption of energy dense foods and sedentary lifestyles). However, the observed negative association between low childhood SES and adulthood overweight/obesity may be explained through a variety of mechanisms. For instance in Botswana, children from high SES background have been found to be predisposed to early markers of overweight/obesity such as the consumption of high energy dense food and sedentary lifestyles (WHO, 2016).

On the other hand children from low SES families have traditionally been found to eat traditional diets and do a lot physical work. Meanwhile, the negative association between SES and overweight and obesity in this study compared to other studies is likely due to many factors, including variation in material resources, social-psychological resources, and reverse causation. However, critical information gaps remain eminent in relation to the influence of childhood and life course SES on overweight/obesity in many developing countries. This information gaps limits a comparative discourse on the impacts of childhood SES on overweight/obesity in the context of limited resource settings.

It was noted that there was no significant association between childhood SES and poor physical activity. This finding implies that there was no difference whether one had poor or non-poor childhood SES and their current physical activity status. Meanwhile there is little evidence of studies showing any significant association between childhood SES and poor physical activity in LMICs. Consequently, mechanisms and pathways by which early childhood low income/SES impacts on physical health in adulthood remain elusive (Braveman and Barclay, 2009).

It is critical to point out that little available evidence has shown that early life exposure to low income/SES has an adverse effect on physical health in adulthood although odds ratios vary by outcome studied and timing and duration of poverty exposure, and not all studies report statistically significant odds ratios at the 5 % level (Spencer, Thanh and Louise, 2012). The observed lack of inequality in childhood SES and poor physical activity in this study may be explained by the adoption of sedentary lifestyles which have led to physical inactivity among both the poor and non-poor. It may also mean that current SES and not childhood SES better explains the non-variation in poor physical activity.

8.3 Association between Childhood SES and NCDs

This section presents results on the association between childhood SES and selected NCDs. Some chronic conditions like stroke, arthritis, angina, chronic lung disease, nerves problem and depression which did not show any relationship with childhood SES were left out of the multivariate analysis, while only hypertension, asthma, diabetes and eye/vision problem were presented in this section. It should however, be noted that the lack of association between childhood SES and some NCD conditions left out of this analysis was due to few cases in the sample which yielded unstable coefficients

Table 8.4: Odd ratios giving association between Childhood SES and selected NCDs

Childhood SEP	**Hypertension-N=999**		**Asthma-N=684**		**Diabetes-N=955**		**Eye/vision problem-N=235**	
	UOR	**AOR**	**UOR**	**AOR**	**UOR**	**AOR**	**UOR**	**AOR**
Low	0.41**	1.53**	3.29**	2.83**	1.77	2.34	1.01	1.52
Middle	0.79	1.07	1.00	0.98	1.96	2.31	1.52**	1.72**
High	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Note: **Statistically significant at 5%;UOR-unadjusted odd ratios, AOR- Estimated adjusted odd ratios controlling for age, sex, education, residence, work status and current wealth status.

Table 8.4 shows the odds ratios on the association between childhood SES and selected NCD. It was found that before adjusting for current SES characteristics individuals who had low SES were less likely (OR=0.41) to report hypertension that those with high SES. However after controlling for current SES variables, the odds of reporting hypertension were higher (AOR=1.53) among people who reported low SES during childhood. This finding suggests that childhood SES and not adulthood SES is positively associated with hypertension.

The literature on the potential confounders and mediators of hypertension has emphasized the role family level of socioeconomic status (SES) plays in the development of hypertension (Kivimaki, Lawlor, Smith *et al.* 2006; Brummett, Babyak, Siegler *et al.* 2011). Consistent with the finding of this study, these studies suggest that children who are from low-SES families are likely to have worse health outcomes later in life. Furthermore, they are at a higher risk of CVD, elevated BP, metabolic syndrome, greater BMI and other negative health outcomes (Goodman, McEwen, Huang *et al.* 2005; Grotto, Huerta and Sharabi, 2008).

Children from poorer families are also more likely to engage in risk-for-health behaviours than their better-off peers, consequently predisposing them to conditions such as hypertension. Consequently, SES of the parents is vital for the acquisition of knowledge and skills that promote health behaviours associated with a high SES. Individuals who reported hypertension and were from low SES families may have been predisposed to mediating factors for hypertension such as poor parental knowledge and skills promoting healthy behaviours. Moreover, unfavourable effects of low childhood SES such as lack of vigorous or moderate physical activity, lack of a proper nutritionally balanced diet, high salt intake, low potassium and low calcium intake, tobacco use, alcohol intake and high stress may have increased the risk for the development of adulthood hypertension.

Asthma stood out as significantly associated with poor childhood socioeconomic status before and after the introduction of control variables. When holding constant the effect of current SES on asthma, it was found that respondents who had low childhood SES were two times (AOR=2.83) more likely to report to have been diagnosed with asthma compared to those who had high SES. Consistent with this finding some studies have also demonstrated that poor childhood SES is a key determinant of asthma (Taylor-Robinson, Wickham, Campbell *et al.* 2017).

Childhood poverty is likely to reflect various aspects of low SES in childhood and affect later-developing health-risk behaviours (Umeda, Oshio and Fujii, 2015). Indeed, childhood poverty is often accompanied by parental absence or less parental structure (lack of rules or routines, such as regular bedtimes), poor quality housing, poor diet, and family conflicts which predispose people to health risk behaviours earlier in life. For example a study by Hwang, Hee, Hwang *et al.* (2012) found that parental smoking has an important impact on asthma and wheezing illnesses in children.

Bearing this in mind, the rational explanation for smoking among adults in this study could be poor environmental exposures during childhood (both physical and social environment). It has been observed that poor childhood SES exposes individuals to smoking initiation which is more common among disadvantaged children, and this is largely explained by regular exposure to an adult smoker in the same room (Taylor-Robinson, Wickham, Campbell *et al.* 2017). Reducing childhood exposures to asthma like adult smoking in front of children may reduce inequalities in asthma prevalence and improve both childhood and adult health.

Furthermore results in table 8.5 above did not shown any significant association between poor childhood SES and diabetes, suggesting that diabetes affects both those who had poor childhood SES and non-poor childhood SES. Few studies which have examined whether childhood SES is associated with the risk of diabetes in adulthood have revealed inconclusive results (Langenberg, Kuh, Wadsworth, *et al.* 2006; Lucove, Kaufman, James *et al.* 2007; Ramsay, Whincup, Morris *et al.* 2008; Montez, Bromberger, Harlow *et al.* 2016).

This study, like most other studies, found no associations between childhood SES and adult diabetes or they did not persist after taking into account adult SES (Langenberg, Kuh, Wadsworth, *et al.* 2006; Montez, Bromberger, Harlow *et al.* 2016). The impact of childhood

SES on the risk of having diabetes in adulthood remains poorly understood when one's own adult SES is considered. There is therefore need for further research using longitudinal data and cross sectional data representative of the general population.

It has been noted that individuals with middle childhood SES (AOR=1.72) were more likely to report eye/vision problem than did those with high SES. This finding is indicative on the influence of life course factors on adult health. A study conducted by Katz and Berlin (2014) on "Psychological Stress in Childhood and Myopia Development" found that individuals who had low to middle childhood SES were more prone to Myopia (a common human vision problem) in later life.

Low to middle childhood SES and its correlates such as stress during childhood has been observed to affect respiration, posture, and muscle tension, which ultimately leads to less oxygenation of the eyes and brain (Liberman 1995, American Psychiatric Association 2013), hence leading to vision problem. Moreover, the experience of strong emotions may directly lead to myopia by affecting the brain (Duke-Elder 1949). Definitely if stress can cause the blindness of conversion disorder; it is likely that it could cause blurring of vision over a period of time. Consequently, the most plausible explanation for the observed socioeconomic difference in eye/vision problem may relate to unfavourable psychosocial childhood conditions experienced by respondents in the poor to middle childhood SES.

8.4 Association between Childhood SES and Multi-Morbidity

This section assesses the association between childhood SES and multimorbidity in the sampled population. This tests whether childhood SES is associated with multiple chronic conditions among adults, and whether these associations persist independent of adult SES. This is done with the understanding that early life conditions have the potential to affect the development of chronic conditions later in life, including hypertension, diabetes, and heart disease (Curhan, Chertow, Willett, *et al.* 1996; Osmond and Barker, 2000; O'Rand and Hamil-Luker, 2005). Multinomial logistic regression model was used to test the association between childhood SES and multimorbidity (Table 8.5).

Table 8.5: Odd ratios giving association between Childhood SES and multi-morbidity

Childhood SES	**Single NCD condition/ no condition**		**Multiple NCD conditions/no condition**	
	UOR	**AOR**	**UOR**	**AOR**
Low	0.65	1.17**	0.57	1.78**
Middle	0.69	0.78	1.04	1.32
High	1.00	1.00	1.00	1.00

Note: Reference category is '0 NCD conditions', Statistically significant at 5%;UOR-unadjusted odd ratios, AOR- Estimated adjusted odd ratios controlling for age, sex, education, residence, work status and current wealth status. N=882.

After controlling for current SES it was found that multi-morbidity was associated with childhood SES, with individuals from poor SES background more likely to report both single (AOR=1.17) and multiple NCD conditions (AOR=1.78). Similarly, a recent study in Denmark by Jensen, Pedersen, Vestergaard *et al.* (2017) noted that multi-morbidity is more prevalent among people of lower SES (both early and later SES). There is further evidence to suggest that socioeconomic inequalities in health persist as advantages and disadvantages accumulate over the lifespan (Marmot and Shipley 1996) and that socioeconomic inequalities in health become gradually smaller over life (Huisman, Kunst and Mackenbach *et al.* 2003). The initial assertion seems to correlate well with findings of this study that childhood disadvantages accumulate over lifetime, predisposing individuals to the possibility of multiple NCDs later in life.

The rising prevalence of multiple chronic diseases in the adult population poses considerable challenges in the highly individualised Botswana health care system, which has been primarily focusing on treatment of infectious disease conditions (especially HIV/AIDS related morbidity). This is because multi-morbidity is often associated with several adverse health outcomes, including high health care utilization, unplanned hospital admission, lower quality of life, higher prevalence of pain, and higher mortality rates (Forjaz, Rodriguez-Blazquez, Ayala A, *et al.* 2015; Alonso-Moran , Nuno-Solinis , Orueta *et al.* 2015; Koroukian, Warner, Owusu *et al.* 2015). As a result, Botswana's health care system is likely to be over burdened by the double burden of NCDs and infectious diseases.

8.5 Summary of key findings

- Socioeconomic inequalities during childhood were found to have significant association with NCD risk factors. For instance, it was found that after adjusting for current SES, childhood SES had a positive association with alcohol consumption, and poor fruit and vegetable consumption.

- No childhood SES variation was observed for poor physical activity
- It was found that individuals who reported poor childhood SES were more likely to have hypertension and asthma, after controlling for current SES.
- It was also noted that individuals with middle childhood SES were more likely to report eye/vision problem than did those with high SES.
- After controlling for current SES it was found that multi-morbidity was associated with childhood SES, with individuals from poor SES background more likely to report both single and multiple NCD conditions.

Overall findings from this chapter indicate evidence of association between childhood SES and adult health. It has been found that childhood SES influences adult health outcomes such as NCD risk factors, NCDs and multi-morbidly independent of current SES. For example, it was found that people who had low childhood SES were more likely to report alcohol consumption, smoking and poor fruit and vegetable consumption; hypertension, asthma and multi-morbidity. This evidence confirms initial evidence which suggested that behavioural risk factors such as tobacco smoking, heavy alcohol consumption, and unhealthy eating are socially patterned, with individuals of low socioeconomic status generally experiencing a higher burden of risk factors and NCDs (Stringhini, Sabia, Shipley *et al*. 2010; Stringhini, Sabia, Shipley *et al*. 2011).

This research adds to the evidence that early life conditions have a lasting influence on adult health, and that their influence may be independent of adult SES. Consequently, future research should more precisely identify the timing of the influence childhood SES and its relative contribution to adult health in relation to other early life stages (e.g. foetal and adolescence), which requires the synthesis of sociological, physiological, and psychological perspectives of human development.

Even though this research provides insights into the nature of the relationship between early life disadvantage and adult health, it must be viewed within the context of important research limitations. The reliance on self-reports for both early life disadvantage and chronic conditions is a major limitation of this research. Blackwell, Hayward and Crimmins (2001) have noted the potential of those with current chronic conditions to construct an explanation for their adult conditions, including having had a childhood condition. Current health status is based on a physician or health care professional diagnosed self-reports, which is subject to healthcare access selectivity.

Previous chapters 5, 6, 7 and 8 discussed socioeconomic inequalities in health looking at NCDs risk factors; NCDs and childhood SES and adult health. The next chapter looks at the measurement and decomposition of socioeconomic inequalities in a selected NCD and NCD risk factors

CHAPTER 9: MEASUREMENT AND DECOMPOSITION OF SOCIOECONOMIC INEQUALITIES IN A SELECTED NCD AND NCD RISK FACTORS

9.1 Introduction

It has been observed across the world that there are inequalities in health, no matter what measure of socioeconomic status has been used. These inequalities are inherent among populations at national and subnational levels. Understanding the impacts of social, economic and demographic factors (or social determinants) on health is an important policy challenge, especially in the context of Botswana where universal primary health care may blur impressions of health inequalities.

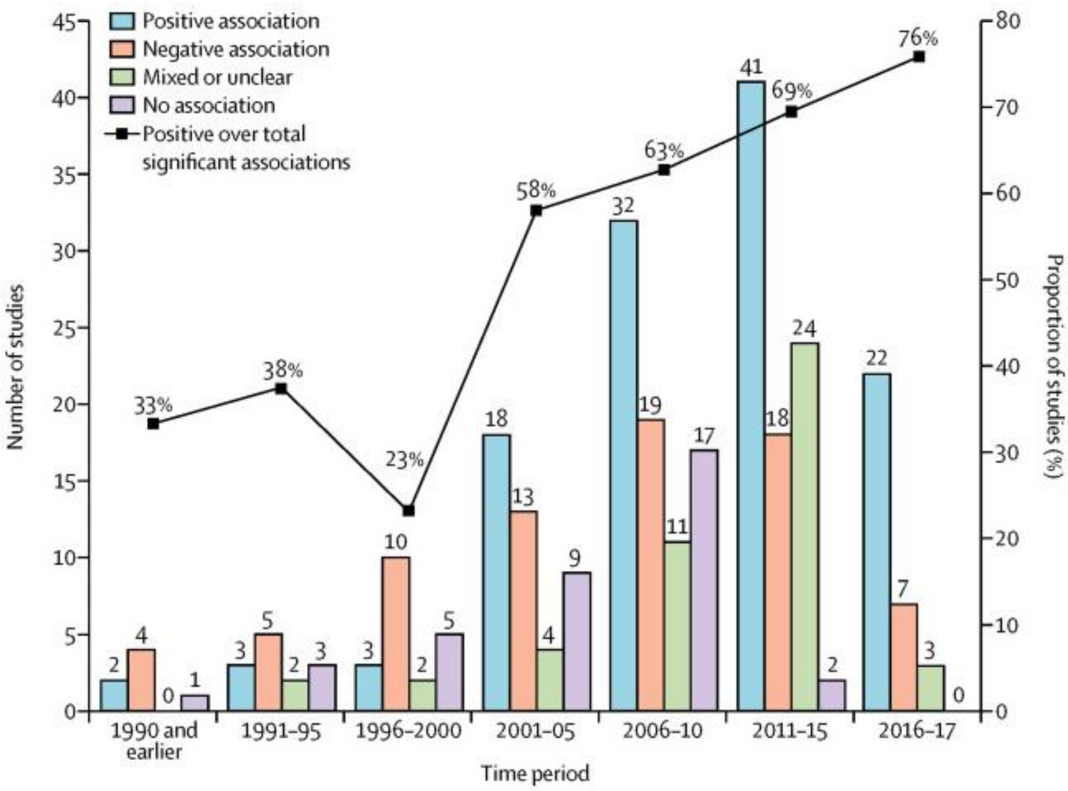
In some countries it has been observed that at all income levels the NCD burden is relatively higher amongst disadvantaged and marginalised individuals and groups, compared with those with higher socioeconomic status (SES) (WHO, 2008; WHO, 2011). There is evidence of well-documented inverse health and wealth gradient in many contexts (Clougherty, Souza, and Cullen, 2010; Hämmig and Bauer, 2013). In other contexts, positive gradient between wealth and health has been observed (Bendaoud and Callens, 2017).

Much of work on health inequalities in high-income countries (HIC) has reported that people of low SES are more likely to have NCDs (Schäfer, von Leitner, Schön, *et al.* 2010). On the other hand, studies on the association between SES and NCDs in low-income and middle-income countries (LMICs) are relatively scarce, and little systematic evidence exists to support the interaction between SES and health (Niessen, Mohan, Akuoku, *et al.* 2018).

The evidence of health inequalities is at best mixed in LMICs. While some studies show that people of low SES are more likely to report NCDs (Forde, Chandola, Garcia, *et al.* 2012; Ginsburg, Griffiths, Richter *et al.* 2013; Khan, Trujillo Ahmed *et al.* 2015; Chen, Hu, Chen *et al*. 2015; Yu and Sloan, 2017) others show that NCDs are more likely to be seen among the high SES group (Xu, Brown, Pan *et al.* 1996; Fagundes, Rocha, Glória et al. 2006; Elwell-Sutton, Jiang, Zhang *et al.* 2013; Yan, Liu, Meng *et al.* 2017) and still other studies show no significant association between SES and NCDs (Yeole, Sankaranarayanan, Sunny *et al.* 2000; Yan, Liu, Meng *et al.* 2017).

A Taskforce paper by Niessen, Mohan, Akuoku *et al.* (2018) examined the interactions between socioeconomic inequalities and NCDs in LMICs and also found mixed conclusions. Figure 9.1 below shows the distribution of quantitative studies by type of association between NCDs and risk factors and SES over time. It can be seen that the quantitative information on the correlation between SES and NCDs is diffuse, changes over time, and provides heterogeneous results.

Figure 9.1: Distribution of quantitative studies by type of association between non-communicable diseases and risk factors and SES, over time



Source: Niessen, Mohan, Akuoku *et al.* 2018

Although much of work on health inequalities is from HICs and has shown that people of low SES are more likely to have NCDs it would be unwise to draw conclusions or generalize from evidence collected in HICs because what is defined as low SES population in HICs may not necessarily be low SES population in LMICs. Likewise, it would be difficult to draw conclusions from evidence generated in LMICs because NCDs are under-diagnosed and under-treated (Pati, Agrawal, Swain *et al.* 2015; Vellakal, Subramanian, Millett *et al*. 2013; Vellakal, Millett, Basu *et al*. 2015). Moreover, NCDs have been given little attention in LMICs compared to infectious diseases. However, understanding health inequalities within country context is essential for policy and programming.

In the context of Botswana there is no evidence of empirical studies on health inequalities. Consequently, epidemiological inquiry into socioeconomic inequalities in health in Botswana is at most important for health policy and planning. Botswana, like many other LMICs is faced with major health challenges which may lead to the need to re-design systems and re-organising infrastructure to achieve universal access to equitable, affordable and effective healthcare in line with the global post-2015 development agenda for health.

Botswana is faced with increasing numbers of people living with NCDs such as hypertension, diabetes, arthritis and angina and the rising prevalence of these NCDs is shaped by socioeconomic and demographic factors (Letamo, Keetile, Navaneetham, *et al.* 2017). Unemployment and poverty levels are currently high in Botswana providing the possibility of widening health inequality gaps. The main aim of this chapter was to measure, compare and decompose socioeconomic inequalities in NCD and risk factors among respondents aged 15 years and above. The work provides ground breaking evidence on levels of socioeconomic inequalities in NCD and the factors associated with it in Botswana. Decomposition analysis was done for hypertension while other NCDs were left out due to few cases which could not allow for decomposition analysis.

For measurement and decomposition of socioeconomic inequalities in selected NCD (hypertension) and NCD risk factors, concentration curves and concentration indices (CI) were used. Concentration curves have been used to plot the cumulative share of the health sector variable against the cumulative share of the living standard variable. If any health outcome variable is equally distributed, the curve will be running from the bottom left hand corner to the top right-hand corner (a 45° line) and if any health outcome is low among the poor, the concentration curve will lie below the line of equality.

Concentration indices were used to describe the magnitude of observed inequalities. If the outcome is positive (e.g. hypertension prevalence or NCD risk factor) that means the health variable is more concentrated among the non-poor and the concentration curve will lie below the line of equality. In contrast, a negative value means hypertension or NCD risk factor is more concentrated among the poor and the concentration curve will lie above the line of equality (O 'Donnell, van Doorslaer, Wagstaff *et al.* 2008; Wagstaff, Bilge, Sajaia *et al.* 2011). For a complete model and description of decomposition analysis, refer to chapter 3 in the methodology section.

9.2 Inequalities in NCD Risk Factors

Results of the inequality statistics estimated by concentration indices (CI) for NCDs risk factors are presented in Table 9.1 below. The positive CI value of 0.1859 for alcohol consumption indicates skewness towards the non-poor population and the corresponding standard achievement index is low, while the low CI values of 0.0546 and 0.0308 shows that poor physical activity and overweight/obesity, respectively are close to the line of equality but slightly concentrated among the non-poor. The corresponding achievement indexes are high indicating a relatively high achievement of inequality in poor physical activity and overweight/obesity. The negative CI values of -0.0308 for daily smoking and -0.1909 for poor fruit and vegetable consumption indicates skewness towards the poor population. These negative CI values (for poor physical activity and overweight/obesity) are also accompanied by high corresponding standard achievement indices. When CI values are high, standard achievement indices are expected to be low and vice versa.

Table 9.1: Measurement of inequalities in risk factors for NCDs in Botswana (2016)

	Poor Physical Activity	**Alcohol consumption**	**Daily smoking**	**Poor fruit and vegetable consumption**	**Overweight and obesity**
Standard concentration index	0.0546	0.1859	-0.0308	-0.1909	0.0308
Conc. index with inequality-aversion parameter = 3	0.0801	0.2120	0.0137	-0.2945	0.0601
Conc. index with inequality-aversion parameter = 4	0.1099	0.2489	0.0352	-0.3205	0.0911
Standard achievement index	1.5069	0.1451	0.0863	0.1126	1.303
Achievement index with inequality-aversion parameter = 3	1.4661	0.1404	0.0879	0.1224	1.2947
Achievement index with inequality-aversion parameter = 4	1.4187	0.1338	0.0860	0.1249	1.2690

Source: Computed from NCDs Study data, 2016

Based on the concentration indices derived from table 9.1 above concentration curves were plotted. Figure 9.1 below shows the concentration curves plotting the cumulative share of selected risk factors for NCDs against the proportional cumulative SES of individuals for the NCDs study. The curve for alcohol consumption lie below the line of equality, which confirms that alcohol consumption, is more concentrated among the non-poor.

Positive CI value (CI=0.1859) was observed for alcohol consumption indicating the skewness towards the non-poor population. There are several possible explanations to the observed pattern of alcohol consumption being found to be concentrated among the non-poor. Consumption of alcohol (especially commercial beverages) in Botswana has been seen as a symbol of masculinity and high SES (Weiser, Karen, Heisler *et al.* 2006). However; this does not imply that alcohol consumption is at bare minimum in the low SES group. The low SES group consume low-cost, homemade sorghum beer; while moderate-high drinking is often associated with higher intake of commercial beverages which is common among the non-poor. This low-cost, home-made sorghum beer and other traditional beverages are also risk factors for NCDs.

Evidence provided by this study substantiates some studies on cross-sectional associations between alcohol use, individual and area level of income and economic factors which have also supported a positive relationship between SES and alcohol use. Ultimately this is such that individuals with higher SES (or living in areas with higher SES) engage in more frequent and heavier drinking (Karriker-Jaffe, Zemore, Mulia *et al*. 2012; Collins, 2016). Although people with high SES have been found to consume greater amounts of alcohol compared with people with lower SES, the latter group seems to bear a disproportionate burden of negative alcohol-related consequences (Collins, 2016).

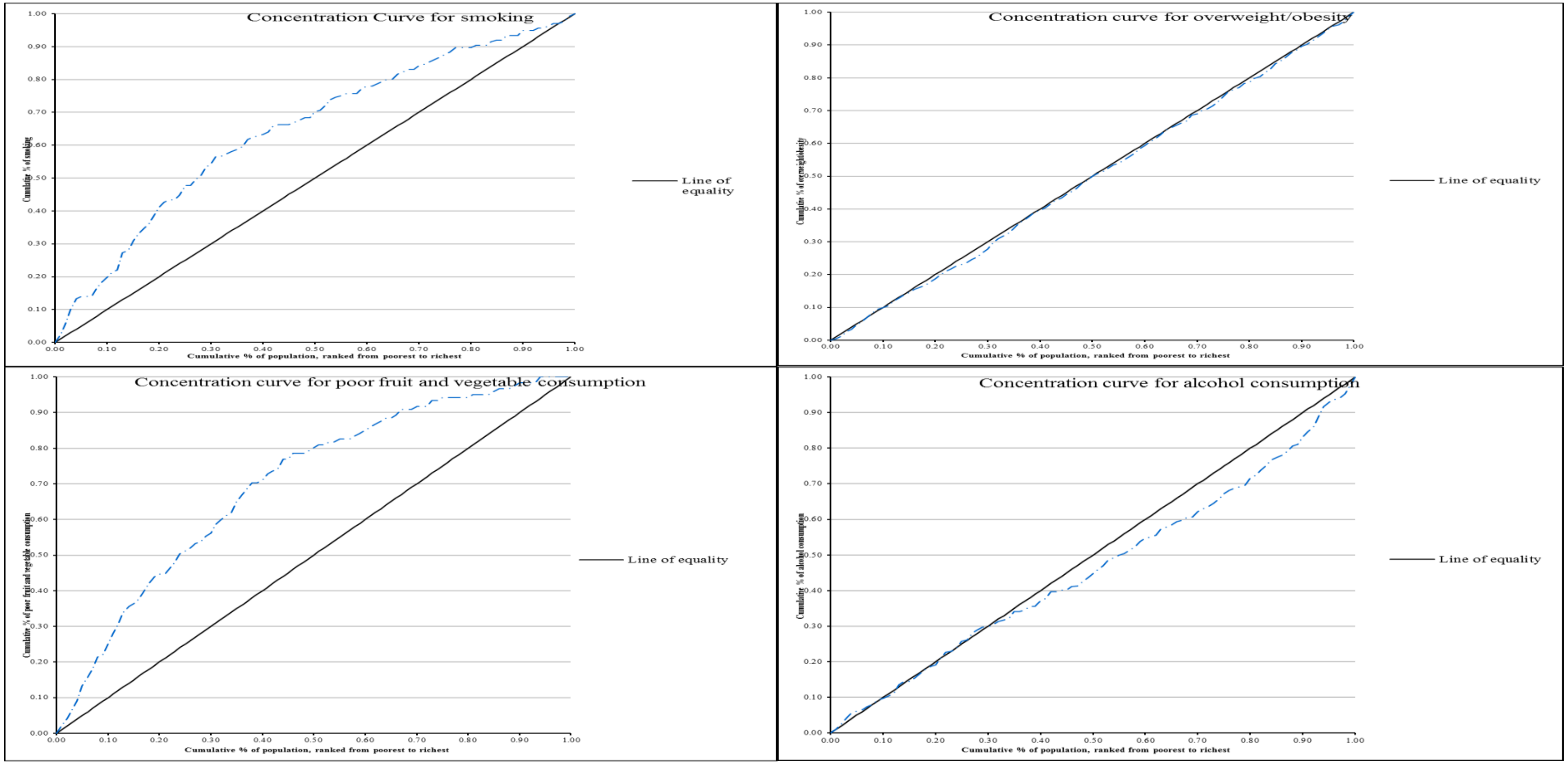
Concentration curves for daily smoking and poor fruit and vegetable consumption were above the line of equality suggesting that these two risk factors were more concentrated among the poor. This finding corroborates multivariate results which have also shown that smoking and poor fruit and vegetable consumption were more likely to be found among the poor. There is research evidence to suggest that purchasing and consumption of unhealthy diets, in particular, eating fewer fruits and vegetables is strongly patterned by socioeconomic status (SES) (Appelhans, Milliron, Woolf *et al.* 2012; Pechey, Jebb, Kelly *et al.* 2013).

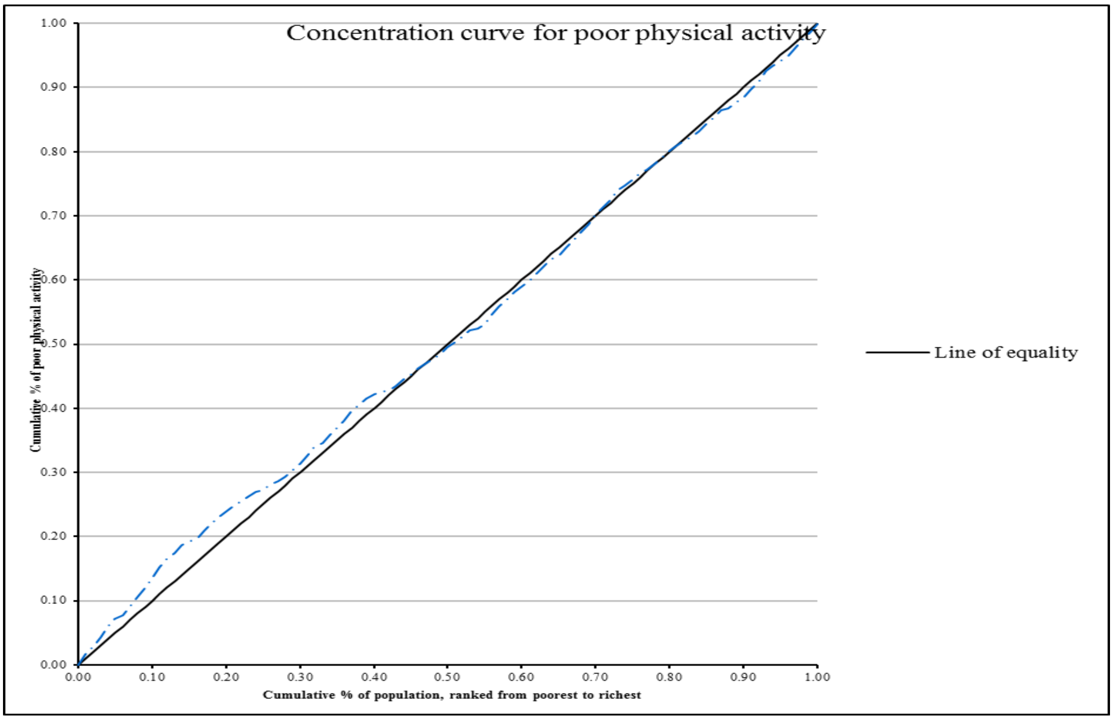
This research evidence indicates that poor fruit and vegetable consumption is more concentrated among the poor due to the fact that the poor cannot afford fruits and vegetables (Aggarwal, Monsivais, Cook *et al.* 2011; Pechey, Monsivais, Yin-Lam Ng *et al.* 2014). Moreover, poor fruit and vegetable consumption is more concentrated among the poor because individuals of lower SES generally tend to have less healthy diets than those of higher SES. Similarly, less nutritious food (with no fruit and vegetable) and energy-dense foods are often eaten by the poor while higher diet quality (with fruit and vegetable) associated with higher cost is found among the non-poor.

The concentration of smoking among the poor is also an established finding. It has been found that smoking is disproportionately high among the poor and affects their health (Hiscock, Bauld, Amos *et al.* 2012; Greenhalgh, Bayly and Winstanley, 2015). Consequently poor people suffer more from diseases caused by smoking than do smokers with higher SES (Aggarwal, Monsivais, Cook *et al.* 2011; Pechey, Monsivais, Yin-Lam Ng *et al.* 2014).

The poor smoke in much higher numbers than the non-poor in Botswana, a disparity that is rooted in many inequities. This is because the poor have the least information about the health hazards of smoking, the fewest resources and social supports, and often the least access to services to help them quit. On top of that, the tobacco industry has a long history of targeting low SES individuals and communities. Meanwhile multivariate analysis in chapter 5 did not indicate any significant effects of smoking on prevalence of any of the NCDs mainly due to the small sample of current tobacco smokers in the population.

Figure 9.1: Concentration curves of risk factors for NCDs





Source: Computed from NCD study data, 2016

The concentration curves for physical activity and overweight/obesity almost overlap with the line of equality showing that wealth- related differences in physical activity and overweight/obesity were negligible but slightly skewed towards the non-poor. This indicates that these two risk factors were skewed towards the non-poor although the inequality is relatively small.

This finding is indicative of behavioural shift from traditionally active lifestyles to more industrialized and sedentary lifestyles among both the poor and non-poor in Botswana. This behavioural shift is partly responsible for observed negligible inequality for physical activity and overweight/obesity favouring the non-poor. One of the plausible explanations for the small inequality in overweight/obesity in Botswana could be due to industrialization, modernization, sedentary lifestyles and changing diets which are experienced by both the poor and non-poor. Furthermore Botswana has experienced economic development and the consequent increases in income and the availability of inexpensive, high-calorie foods, and low physical activity which has led overweight/obesity to disproportionately afflict the upper and middle classes to becoming widespread among the poor.

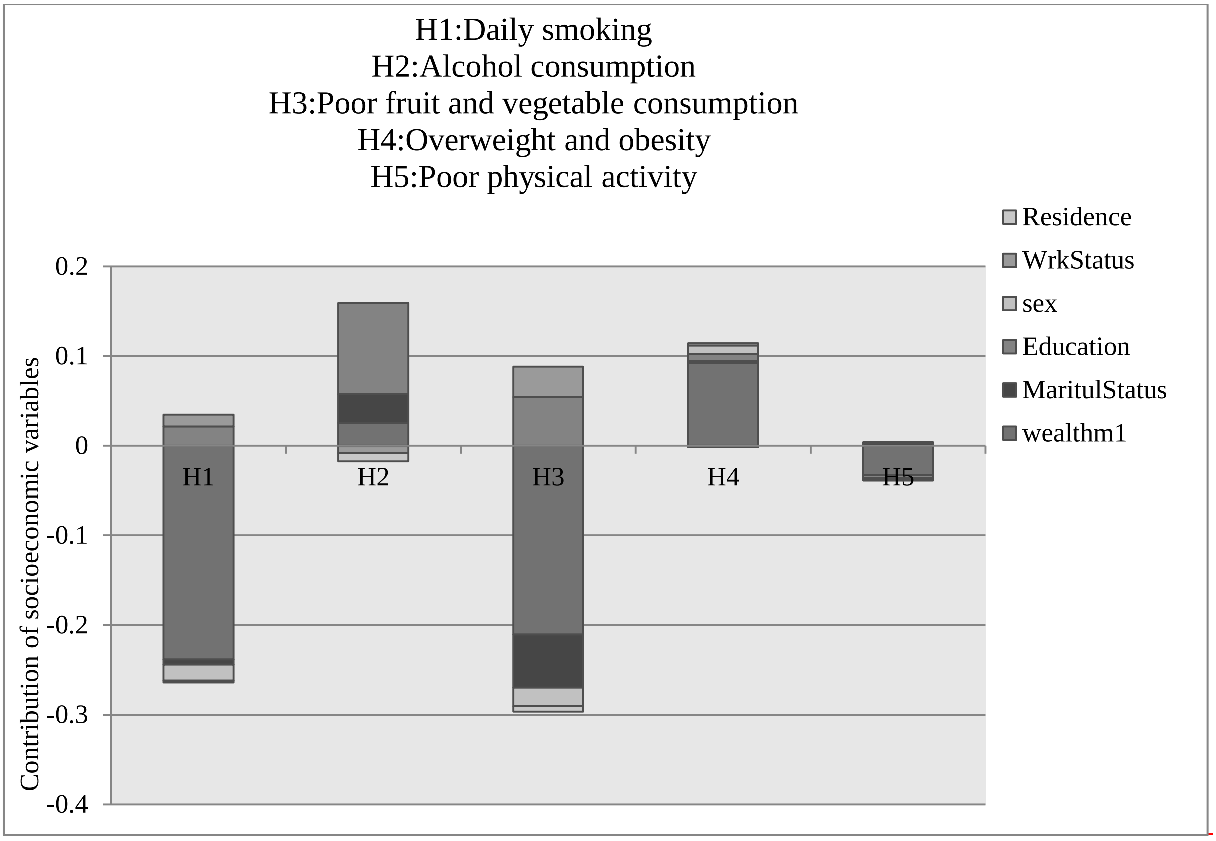
Such patterns are consistent with fundamental cause theory (Link and Phelan 1995), which emphasizes the emergence and persistence of SES as a fundamental cause of health disparities even when the mechanisms linking SES and health undergo dramatic changes, as in the case of the nutrition transition.

9.2.1 Decomposing Inequalities in Risk Factors for NCDs

In order to identify dominant factors contributing to the observed inequalities in risk factors for NCDs decomposition analysis was employed. It is possible that a particular NCD risk factor may be concentrated among the poor because the poor are on an average less educated, reside in rural areas, engage in poverty induced jobs, or might belong to certain age groups. Figure 9.2 below presents a contribution of the selected socioeconomic determinants on the overall concentration index.

The height of the bar corresponds to the impact and severity of a socioeconomic factor (e.g. education, wealth status, sex, residence and work status) in explaining the observed wealth status inequality. For example, the concentration for H1 (daily smoking) and H3 (poor fruit and vegetable consumption) are -0.0308 and -0.1909 respectively, indicating that smoking and poor fruit and vegetable consumption were more concentrated among the poor. In these inequalities, wealth status is linked with smoking and poor fruit and vegetable consumption rates observed among the poor. Since the contribution of wealth status is negative, this implies if inequality in smoking was solely determined by inequality in wealth status, it would favour the better-off. This type of wealth inequality is especially relevant because smoking among poor population groups can have additional effects that go beyond the direct health effects, further exacerbating NCDs related inequality.

Figure 9.2: Decomposition of the concentration index for risk factors for NCDs



Source: Computed from NCD study, 2016

It was found that the concentration for H2 (alcohol consumption=0.1859), H4 (overweight/obesity=0.0308) and H5 (poor physical activity=0.0546) were positive indicating that these outcomes are more concentrated among the non-poor.

Inequalities in these risk factors; alcohol consumption, poor physical activity and overweight/obesity can be explained by inequalities in education and wealth status. But the effects of contribution of education and wealth status to these three outcomes were different. For alcohol consumption inequalities are explained by inequalities in education, while for overweight/obesity the dominant factor is wealth status. Wealth inequalities in poor physical activity are explained by wealth status itself. Since the contribution of the wealth status is negative this implies if inequality in poor physical activity was solely determined by the wealth status, it would favour the poor. Overall wealth status was observed to be the leading contributor to wealth status-related concentration index for four risk factors; daily smoking, poor fruit and vegetable consumption, overweight and obesity and poor physical activity. Education was the leading contributor to wealth status-related concentration index for alcohol consumption.

9.2.2 Inequalities in Hypertension-General population

This section presents socioeconomic inequalities in hypertension. Among the NCDs, only hypertension was considered for this analysis due to fewer cases for other NCDs. The concentration curves, concentration indices and decomposition of inequality for hypertension were done for the entire study population. Results of the inequality statistics estimated by concentration indices (CI) for hypertension among the whole study population are presented in table 9.2 below. The positive CI value for hypertension indicates that hypertension was more concentrated among the non-poor population. The positive CI value of 0.148 is close to the line of equality suggesting small inequality.

Table 9.2: Concentration index for hypertension

Standard concentration index	**0.1485**
Conc. index with inequality-aversion parameter = 3	0.2224
Conc. index with inequality-aversion parameter = 4	0.2786
Standard achievement index	0.4438
Achievement index with inequality-aversion parameter = 3	0.4053
Achievement index with inequality-aversion parameter = 4	0.3760

Source: Computed from NCD survey data, 2016

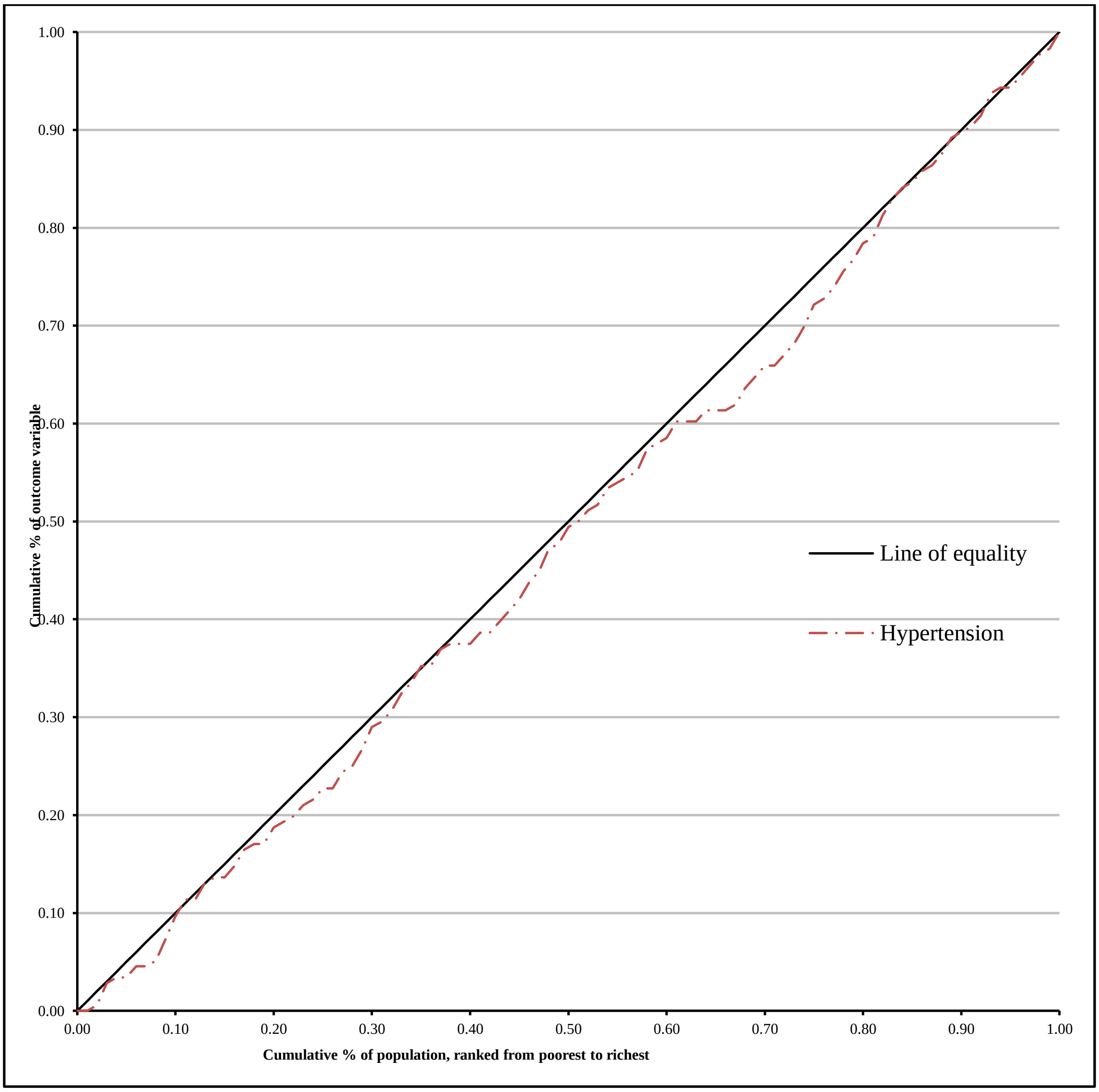
Figure 9.3 below shows the concentration curve plotting the cumulative share of hypertension against the proportional cumulative SES of individuals. The curve for hypertension lies just a little below the line of equality, which confirms that hypertension in the general study population was more concentrated among the non-poor, although the level of inequality is minimal as shown by small deviation of the curve from the line of equality.

The relationship between socioeconomic status (SES) and hypertension has been shown in public health literature. However, the association between SES and hypertension remains unclear with some studies showing that hypertension is more concentrated among the poor while for other studies the inverse holds. In developed countries there is sufficient evidence showing an inverse association between socioeconomic status and hypertension (Kaplan and Keil 1993; Yu, Nissinen, Vartiainen *et al.* 2000, Mendez, Cooper, Wilks *et al.* 2003; Fikadu and Lemma 2016).

On the other hand it has been found that in LMICs patterns of association of hypertension and socioeconomic position are inconsistent (Gulliford, Mahabir and Rocke, 2004). For instance, some studies from India suggest that hypertension is concentrated among the lower SES groups (Mathers, Fat, Boerma *et al.* 2004;Gupta, Kaul, Agrawal, *et al.* 2010; Deepa, Anjana, Manjula, *et al.* 2011) whereas other studies reported positive associations between SES and hypertension (Subramanian, Corsi, Subramanyam, *et al.* 2013).

Evidence from South Africa also suggests that hypertension is being increasingly reported among lower SES people (Ataguba, Akazili, McIntyre *et al.* 2011). In Botswana small inequalities for hypertension found in this study can be explained by the fact that non-poor population groups could be early adopters of harmful lifestyles characterized by smoking, alcohol consumption, diets with high energy and fats, and sedentary lifestyles while the poor are late adopters of such behaviours. Consequently prevalence of NCDs such as hypertension is found to be concentrated among the non-poor during the early stages of the transition period but later among the poor (Mounier-Jack, Mayhew and Mays, 2017). Meanwhile greater exposure to NCDs risk factors among lower SES groups may produce a reversal of hypertension SES patterning over time.

Figure 9.3: Concentration curve for inequalities in hypertension for the entire study population



Source: Computed from NCD study data, 2016

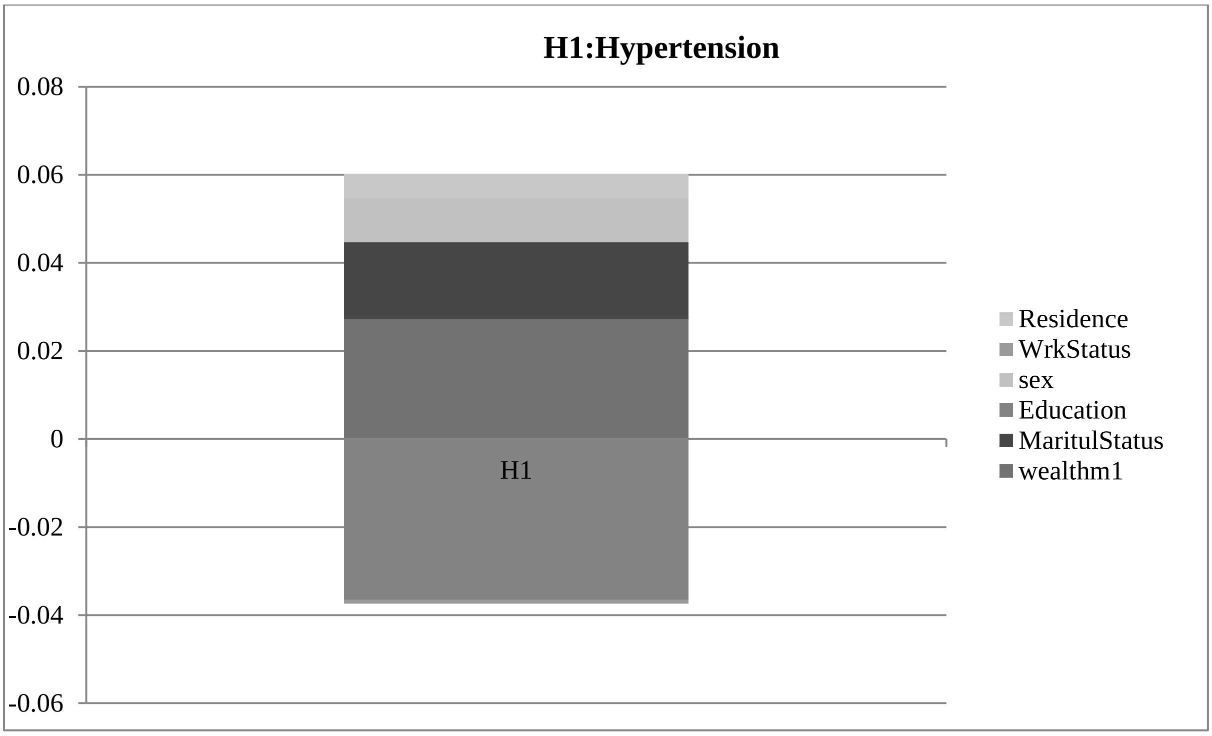
9.2.3 Decomposing Inequalities in Hypertension

In order to understand the dominant factors explaining inequalities for hypertension in the sample, decomposition analysis was done by considering the inequality for the covariates. The decomposition of the CI sheds light on why inequalities in hypertension exist and what factors contribute to the inequality reflected in the index. Further, the decomposition of the concentration index clarifies how each determinant contributes to the socioeconomic inequality in hypertension.

There is evidence suggesting that both education and wealth status positively affect health, but we do not know how the relationship would turn out when we consider two variables at once. It is possible that a hypertensive person, who does not have higher education but has higher SES, has a higher likelihood of having hypertension. It could also be possible that a hypertensive person with lower SES, but with higher education, would have a higher likelihood of having been diagnosed with hypertension. Figure 9.4 below presents a summary of the contribution of the determinants to the overall concentration index of the variable.

It can be observed that CI is positive suggesting that hypertension is more concentrated among the non-poor. It is clearly observed that most of the inequality in hypertension can be explained by inequality in respondent's wealth status, marital status, sex and place of residence. However education was the leading contributing factor to the observed wealth-status-related inequality. Since the contribution of education is negative, this implies if inequality in hypertension was solely determined by education, it would favour the better-off. Thus the negative contribution of education means this relative variable reduces pro-rich inequality. Consequently the government should come up with policies that are aimed at reducing inequalities in education.

Figure 9.4: Decomposition of the concentration index for hypertension



Source: Computed from NCD study data, 2016

9.3 Inequalities in Hypertension-50+ years

This section presents results on the concentration curves and indices for hypertension among participants aged 50 and above years of the NCDs study. Table 9.3 below shows results of the inequality statistics estimated by concentration indices (CI) for hypertension among individuals aged 50 years and above. The CI value for hypertension indicates minimal skewness towards the non-poor population and the positive CI value of 0.1573 is close to the line of equality. This result corresponds with a standard achievement index of 43.9% which is an index constructed as a weighted average of hypertension with higher weights attached to poorer people.

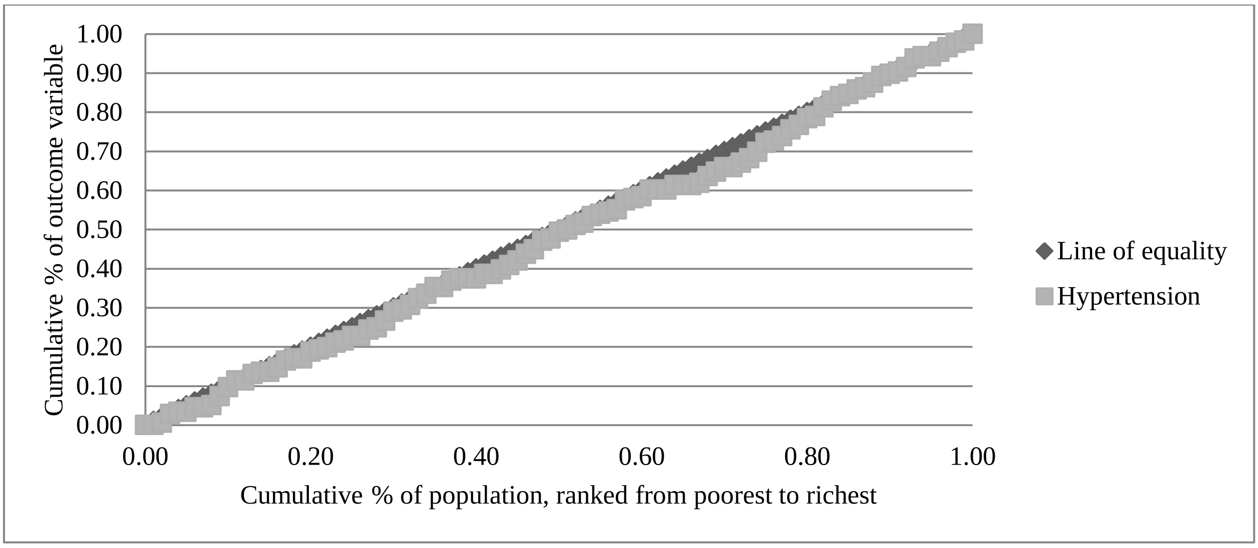
Table 9.3: Inequalities for hypertension among individuals aged 50 years and above, Botswana (2016)

	Hypertension
Standard concentration index	0.1573
Conc. index with inequality-aversion parameter = 3	0.2326
Conc. index with inequality-aversion parameter = 4	0.2886
Standard achievement index	0.4392
Achievement index with inequality-aversion parameter = 3	0.4000
Achievement index with inequality-aversion parameter = 4	0.3708

Source: Computed from NCD study data, 2016

The figure 9.5 below shows the concentration curve for hypertension in the population aged 50 years and above. Among individuals aged 50 years and above, the concentration curve lies just below the line of inequality indicating that hypertension was concentrated among the non-poor although the inequality is small, as shown by the deviation from the line of equality. This finding indicates that hypertension in the general study population and among individuals aged 50 and above years was more concentrated among the non-poor.

Figure 9.5: Concentration curve for inequalities in hypertension, 50 years and above



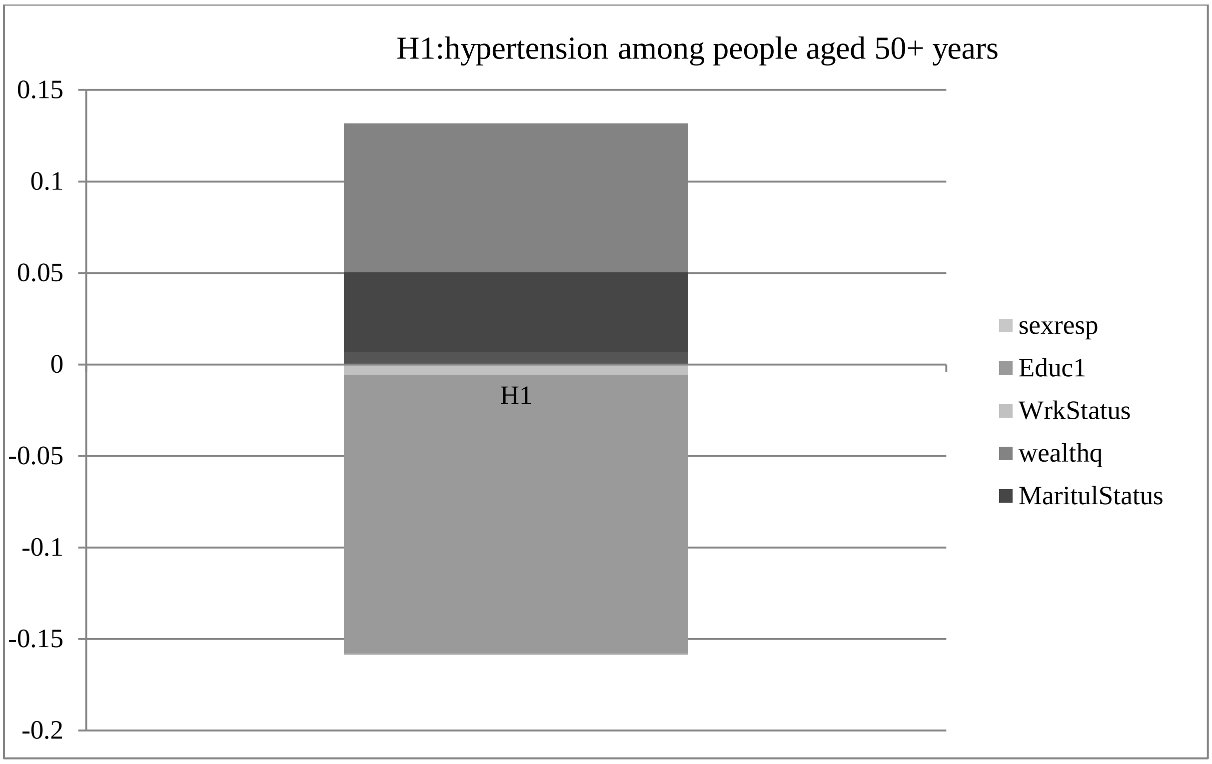
Source: Computed from NCD study data, 2016

9.3.1 Decomposing Inequalities in Hypertension, 50 years and above

Figure 9.4 below shows the concentration index of the covariates for hypertension among individuals aged 50 years and above. The decomposition of the concentration index sheds light on why inequalities in hypertension exist and what factors contribute to the inequality reflected in the index. In the decomposition of the (small) CI for hypertension among individuals 50 years and above, education dominate as a key covariate explaining inequalities for hypertension observed among respondents aged 50+ years.

Since the contribution of education is negative, this implies if inequality in hypertension was only determined by education, it would favour the better-off. Thus the negative contribution of education means this relative variable reduces pro-rich inequality. Among the elderly inequalities in hypertension are small due to aging which predisposes both the poor and non-poor to high blood pressure. It has also been found in this study that SES is related to the prevalence of hypertension via health behaviours such as poor physical activity and overweight/obesity. People in the highest SES were found to be significantly more likely to be physically inactive and overweight/obesity. Early intervention, especially in older adults regardless of their economic status, is necessary to prevent the observed health inequity related to hypertension.

Figure 9.1: Concentration index of the covariates for hypertension, 50 years and above



Source: Computed from NCD study data, 2016

9.4 Summary of Key Findings

Chapter 9 presented results on socioeconomic inequalities in health using concentration curves and concentration indices (CI). Concentration curves were used to plot the cumulative share of the health sector variable against the cumulative share of the living standard variable. The following are some of the key findings from the chapter;

- It was found that alcohol consumption, poor physical activity and overweight/obesity were concentrated among the non-poor.
- Smoking and poor fruit and vegetable consumption were more concentrated among the poor.
- Observed inequalities in NCD risk factors; alcohol consumption, poor physical activity and overweight/obesity were explained by inequalities in education and wealth status. But the effects of contribution of education and wealth status to these

three outcomes were different. For example- education was the dominant contributing factor for inequalities in alcohol consumption, for overweight/obesity and poor physical status the dominant factor was wealth status itself. However, since the contribution of the wealth status is negative, this implies if inequality in overweight and poor physical activity was solely determined by the wealth status, it would favour the non-poor.

- Overall wealth status was observed to be the leading contributor to wealth status-related inequality for four risk factors; daily smoking, poor fruit and vegetable consumption, overweight/obesity and poor physical activity while education was the leading contributor to wealth status-related inequality for alcohol consumption. However it should be noted that the contribution of education was negative for smoking and poor fruit and vegetable consumption but positive for overweight and poor physical activity. The negative contribution of wealth status to smoking and poor fruit and vegetable consumption suggests that if inequalities for these two variables were only determined by wealth status it would favour the non-poor while the positive contribution of wealth status to overweight/obesity and poor physical activity implies that if inequalities for these two variables were only determined by wealth status it would favour the poor.
- Hypertension was found to be concentrated among the non-poor in the general population and among persons aged 50+ years. However, the inequality was observed to be small.
- Education was found to be a dominant covariate explaining inequalities for hypertension in the general population and among persons aged 50+ years. Meanwhile the contribution of education was negative in both instances; suggesting that if inequality in hypertension was only determined by education, it would favour the

better-off. Thus the negative contribution of education means this relative variable reduces pro-rich inequality.

Findings from this chapter provide salient information for the on-going debate about whether NCDs and risk factors are concentrated among the rich or the poor.

Although exposure to NCD risk factors such as smoking, alcohol consumption, poor physical activity, poor fruit and vegetable consumption and overweight/obesity and consequent NCDs such as hypertension are hypothesised to be initially greater in affluent elites in LMICs (Aggarwal, Monsivais, Cook *et al*. 2011; Pechey, Monsivais, Yin-Lam Ng *et al.* 2014), evidence from this study show mixed findings.

Daily smoking and poor fruit and vegetable consumption showed skewness towards the poor population while poor physical activity, alcohol consumption and overweight/obesity were concentrated among the non-poor population. It was found that hypertension was concentrated among the non-poor population in the general population and among people aged 50+ years.

Overall, these results indicate socioeconomic inequalities in NCD risk factors and hypertension, with high concentration found among the non-poor. The next chapter discusses overall findings from the study, policy and future research recommendations.

CHAPTER 10: DISCUSSION, CONCLUSION AND POLICY RECOMMENDATIONS

10.1 Introduction

Botswana is experiencing health transition. The disease profile is changing, with most deaths and disability in the foreseeable future likely to be accounted for by NCDs and their risk factors. This study was prompted by the on-going concern about socioeconomic inequalities in health and how to tackle them. Socioeconomic inequalities in health were chosen as a particular area of interest in order to stir debate and provide basis for research on health inequalities in Botswana within the context of emerging burden of NCDs. This study introduces the debate on SES and health into the intellectual questions raised by empirical research on SES and health into Botswana context of universal primary health care system at a time when the country is faced with the double burden of NCDs and communicable diseases. This is done with the belief that examination of SES and health in the context of little empirical evidence on NCDs research promises improved insights into SES and health research in Botswana.

Previous chapters (5-9) of this study dealt with presentation and discussion of socioeconomic inequalities for various health outcomes. These discussions were guided by following notions which motivated the undertaking of this study;

- Inequalities in health are undesirable to the extent that they are unfair, or unjust and poor health itself may be the consequence of an unjust distribution of the underlying social determinants of health (for example, unequal opportunities in education, employment, wealth status)
- fairness (or social justice) is likely to be the most influential argument in favour of taking action to reduce disparities in health; and

- that reducing inequalities will diminish “spill over” effects on the health of society at large. The conceptual model presented in this study (chapter 2) was used to predict the main mechanisms through which socioeconomic status influences health and to clarify the above notions.

It has been observed, for the larger part in the analysis of this study that there was association observed between SES and selected health outcomes. Consequently, this study propagates the notions of social justice and emphasises the influence of childhood and current SES and on health. From childhood to adulthood, SES and health interact and influence each other. It has been shown from the analysis in this study that socioeconomic inequalities in health still exist in Botswana, some in favour of the poor and others in favour of the non-poor. This comes at a time when equity in health is now an uncontested goal for modern healthcare systems and a common consensus among countries across the world. Health equity and means to achieve it should be a social objective.

Although from a social justice perspective, the Government of Botswana provides universal health care system as a commitment to reducing inequalities in health, this effort seems inadequate. If a commitment to equity in health care seems to be an inadequate response then the underlying policy question is: what more should be done in Botswana to reduce socioeconomic inequalities and attain social justice in the context of emerging burden of NCDs? The answer to this question can be shaped by empirical evidence from this study which links NCDs, risk factors, health expenditure and health care utilization with the social and economic circumstances in which people find themselves. This categorically applies to how and where they were brought up as children, the education they received in early life, their employment, and various aspects of their ‘material’ standard of living. Understanding these processes provides an opportunity to further strengthen Botswana’s primary health care system to take cognizance of the socioeconomic determinants of health. This chapter presents and discusses main findings of the study. It further draws conclusions from the findings and comes up with policy recommendations.

10.2 Main Findings

The main objective of this study was to explore the influence of SES on the following health outcomes; prevalence and correlates of NCDs and their risk factors; health care utilization and health expenditure; and the pathways that link childhood SES and adult health. It sought to establish whether there is evidence of SES-health gradient in Botswana and what policy relevant measures should be initiated to reduce such inequalities.

Findings from this study indicate evidence of inequalities and confirm that health differs by socioeconomic status (SES). Overall findings on the SES related inequality in health for this study is at best mixed. The thesis has five research questions to address the main objective of this study. Below is a summary of findings in relation to these questions.

10.2.1 How does SES influence NCD Risk Factors in Botswana?

The overall results from chapter 5 showed significant socioeconomic differences in NCD risk factors in Botswana. It was found that there were signnificant gender differences for NCD risk factors. For instance, after adjusting for other socioeconomic factors it was found that men were more likely to report to be currently smoking tobacco and having insufficient intake of fruits and vegetables. Women, on the other hand, were observed to report poor physical activity and to be overweight/obese. This finding therefore validates previous findings (Ezzati and Riboli, 2011; Kontis, Mathers, Rehm *et al.* 2014; Khademi, Babanejad, Asadmobini *et al.* 2017). It has been found largely that men tend to use tobacco products at higher rates than women and such differences relate to a combination of physiologica1, cultural, and behavioural factors (Stanton, Keith, Gaale, *et al.* 2016).

In the case of Botswana, cultural and behavioural factors interact to influence gender differences in smoking. Traditionally, tobacco consumption is not a common place for women in Botswana. This is because general characteristics of traditional sex roles lead to social pressure against female smoking and also cause differences in personal characteristics leading to more acceptance of smoking among men than women. However, due to industrialization and acculturation tobacco smoking among women is now observed to be increasing (WHO, 2011).

Gender differences in alcohol consumption remain universal, although the sizes of gender differences may vary (Holmila and Raitasalo, 2004). As is the case elsewhere (WHO,2014), in Botswana more drinking and heavy drinking occur among men, while more long-term abstention occurs among women, and this is true for many cultures, ethnic tribes and at national level. However, as there are few universals in human social behaviour observed, gender variations in alcohol consumption suggest that biological differences may have some role in how men and women drink. For instance, for men alcohol consumption may suggest men’s superiority to women in status and authority, while for women it maybe an effort to counteract this superiority (Sinkamba, 2015).

On the other hand, gender differences in overweight/obesity in the context of Botswana can be explained by a wide array of sociocultural dynamics. Firstly, considering food consumption women are more inclined to consuming healthier food, although they consume sugar laden food than men. Secondly, acculturation through complex sociocultural pathways affects weight gain among women than men. For instance, among women overweight/obesity is often associated with high social status, fertility, good health, and prosperity. This has been noted by Letamo (2011) that like in many African societies in Botswana overweight/obesity may be associated with good health, successful living and good welfare. Lastly, since women reported high levels of poor physical activity in this study, observed gender differences in overweight/obesity may be explained by women being physically inactive.

It was also seen that women were more likely to report poor physical activity than men even after controlling for both socioeconomic and other behavioural risk factors. WHO (2016) has noted that social inequality, poverty and inequitable access to resources, including health care, result in poor physical activity among women. The following are some of the reasons why females generally have lower physical activity levels than their male counterparts: Some studies have shown that the income of women is often lower than that of men and therefore the costs of access to physical activity facilities may be a barrier (Segar, Jayaratne, Hanlon *et al.* 2002). Others suggest that an agreement may be required from senior members of the household who control household resources before a woman can engage in physical activity (Booth, Roberts and Laye, 2012).

In Botswana, women often have a workload in the home and care-giving roles for other family members which may limit the time available for them to engage in physical activity. Furthermore, women who have limited mobility may be unable to travel to health centres or physical activity facilities and lastly there are cultural expectations that may restrict the participation of women in certain forms of physical activity. Moreover, women were found to be nine times more likely to report single NCD risk factor than men, while multiple risk factors cut across the gender divide. The single NCD risk factor found to be highest among women was overweight/obesity. This finding confirms studies on clustering of behavioural risk factors for NCDs which have shown that in LMICs overweight/obesity is the most common single NCD risk factor among women (Khuwaja and Kadir 2010; Rawal, Biswas, Khandker *et al.* 2017). Similarly, in this study it was found that overweight/obesity was the most prominent risk factor among women. The presence of one risk factor (overweight/obesity) among women is likely to increase the chances of having other risk factors ultimately leading to a clustering phenomenon. In this study overweight/obesity was found to cluster with poor physical activity in women effectively leading to high odds of multiple risk factors among women than men. Meanwhile lack of significant statistical association between sex and multiple risk factors may suggest that multiple NCD risk factors were unvaryingly distributed among both men and women.

Residential differences were also noted for risk factors for NCDs. It was found that individuals who resided in urban and rural villages were more likely to report poor fruit and vegetable consumption. In the context of Botswana the diets of urban dwellers (cities and towns) are generally more diverse than for residents of rural areas. These variations may be due to a combination of factors including the availability and access to a wider variety of foods in urban markets, availability of storage facilities, changes in lifestyles and cultural patterns.

On the other hand the odds of having single and multiple NCD risk factors were noted to be lowest in urban and rural villages than in cities and towns. Similar findings were observed in Uganda where participants residing in urban areas were found to be more likely to have two or more risk factors than those in rural areas (Teo, Chow, Vaz, *et al*., 2009). Another related study also noted that urban residence is a primary determinant of risk factors for NCDs impacting on the health of the population (Karabarinde, Ssenyomo *et al.* 2014).

The most plausible explanation for the observed residential differences in single and multiple NCD risk factors is that since cities and towns are centres of industrialization and modernization, the urban population is often exposed to various changes in lifestyles. Consequently the urban population are exposed to and ultimately adopt health risk behaviours. No significant residential differences were observed for smoking, alcohol consumption and overweight/obesity indicating that the three risk factors may be uniformly distributed across urban and rural areas.

Education was also found to be a key correlate for NCD risk factors. It was found that respondents who had tertiary or higher education were less likely to report poor fruit and vegetable consumption, while individuals who had secondary and tertiary/higher education were more likely to be overweight/obese. High intake of fruit and vegetable in the high education group corroborates the findings of some studies in South Africa (Peltzer 2012; Perreira, 2014) and Zambia (Rakotoniaina, 2017).

In Botswana the observed educational level differences in fruit and vegetable consumption can be explained by the close relationship between nutritional knowledge and health considerations among the high education group on the one hand and food choices on the other. Since wealth status was also found to be a significant determinant of poor fruit and vegetable educational difference in the intake of quality and quantity of fruit and vegetable in the study may be closely linked to wealth status inequalities in the study population, because high education individuals are also more likely to be rich and can afford fruits and vegetables. Meanwhile, no significant education differences were observed for smoking, alcohol consumption and reporting multiple NCD risk factors.

Significant association was found between wealth status and NCD risk factors with positive link observed between poor SES and NCD risk factors. For example, individuals who had poor wealth status were more likely to smoke tobacco, report poor physical activity, poor fruit and vegetable consumption and report multiple NCD risk factors. Consistent with this finding there is sufficient evidence of wealth-related inequalities in smoking in many LMICs (Hosseinpoor, Parker, D'Espaignet, *et al.* 2012; Palipudi, Gupta, Sinha *et al.* 2012).

These studies have shown that in most LMICs the poorest men and women are more likely to smoke than the richest, which is similar to results of this study. In Botswana tobacco smoking was initially spurred by tobacco companies which targeted low-income populations over many years, creating smoking rate disparities. In fact, in this study smoking rates were found to be highest among the older adults perhaps because the aged population started smoking at a time when the health effects of smoking were not widely known. The banning of tobacco marketing came a little bit late in Botswana in 2002 (Mbongwe, 2004).

Poor physical activity among the poor is an unexpected finding in this study. Incongruous with findings from some studies in LMICs as it may be (Albarwani, Al-Hashmi, *et al.* 2009; Al-AbrIsmailov and Leatherdale 2010; Micklesfield, Pedro, Kahn *et al.* 2014) this finding suggests that Botswana has undergone a transition from an agrarian to industrial society due to urbanization subsequently leading to industrial modernity. Consequently this has led to an increase in poor physical activity among the poor. This is because during the transition period the poor also adopt sedentary lifestyles which are common among the rich.

Although wealth status was found to be significantly associated with poor fruit and vegetable consumption other factors such as marriage status, age and work status were not linked with poor fruit and vegetable consumption. After adjusting for other socioeconomic factors there was a slight increase in the odds of poor fruit and vegetable consumption among the poor suggesting that the introduction of controls in the model made the association between wealth status and poor fruit and vegetable consumption more discernible and credible.

It is widely accepted that consumption levels of fruits and vegetables is strongly associated with wealth status, and that high level of poor fruit and vegetable consumption disproportionately affects the poor (Peltzer, 2012; Pechey 2014; Pechey, 2015). In Botswana energy-dense foods often provide cheaper sources of calories and are more affordable to people of low SES than fruits and vegetables. Moreover, food preference and food availability play a key role in the consumption of fruits and vegetables. For instance, the poor are more likely to prefer and have access to meat (especially red meat) and energy-dense foods while the non-poor have access to and prefer fruits and vegetables. The wealthy are likely to be more educated and therefore much aware of the health benefits of fruits and vegetables.

Evaluating relationships between multiple risk behaviours for NCD was done in this study with the hope that it may help to identify groups at higher risk and assist in designing intervention programs. Evidence of NCDs risk factor clustering was found in the study population. It was found that SES was a significant determinant of both single and multiple NCD risk factors. For instance, the poor were two times more likely to report single NCD risk factor compared to the rich and they were also found to be six times more likely to report multiple NCD risk factors compared to the non-poor. This finding conforms to the evidence from other LMICs. For example in Brazil it was found that a significant proportion of the poor people reported at least on NCD risk factor than non-poor people (Rodrigues, Padez, Ferreira, Gonçalves-Silva et al. 2016), while in Bangladesh Zaman, Bhuiyan, Karim found *et al.* 2015 found that prevalence of NCD risk factors was fairly high in Bangladeshi adults with a tendency of clustering towards older age groups.

Generally, in many LMICs studies have shown that the poor bears the greatest risk of both single and multiple NCD risk factors (Gupta, Deedwania, Sharma *et al.* 2012; Zaman, Patel, Jan, *et al*, 2012;Neufeld, Peters, Rani *et al.* 2012; Hosseinpoor, Parker, Tursan *et al.* 2012; Corsi, Subramanian, Lear, *et al* 2014).The disproportionate prevalence of NCD risk factors among the poor in Botswana may relate to lack of knowledge and reluctance about the negative health effects of health risk behaviours among this population group.

Contrasting with findings from other studies in LMICs (Ruhm, 1995; Mullahy and Sindelar, 1996; Roche, Kostadinov, Fischer and Nicholas, 2015), this study found that the odds of alcohol consumption were high among the non-poor. The relationship between alcohol and wealth status is often complex with other factors such as education levels, and gender likely to influence the relationship between SES and alcohol consumption. In the case of this study gender was found to be a key determinant of alcohol consumption. The non-poor group observed in this study may include the middle to the top-cadre of society which has high education and income levels to afford commercial beverages. This group may consume light to moderate alcohol which is often found in higher socioeconomic groups. Moreover, the non-poor are also more likely to participate in activities that may involve drinking such as dining out at restaurants, going on vacation or socializing with co-workers than the poor.

Unlike previous studies which have shown that overweight and obesity is more common among the poor in HICs (Sobal and Stunkard 1989; McLaren 2007) and more common among the non-poor in LMICs (Rtveladze, Marsh, Barquera *et al*. 2014), findings of the study did not show any significant wealth status differences in overweight and obesity in the general population. This evidence suggests that overweight and obesity cuts across different wealth status groups in Botswana. This may be explained by the fact that there is little diet differences based on the wealth status of individuals due to nutrition transition facing the country.

Both the poor and non-poor have access to and consume diets with more fat, more meat, added sugars and bigger portion sizes, and have lower physical activity. Although there were no significant wealth differences for overweight/obesity in the general study population and among women, among men it was however noted that men with low wealth status were less likely to be overweight/obese.

10.2.2 How does SES and Behavioural Factors influence NCDs Prevalence in Botswana?

The results indicated gender differences for prevalence of most NCDs in the bivariate analysis. However, the analysis for most NCDs was restricted to bivariate analysis due to smaller samples. These results are only indicative of patterns and a larger sample survey is needed to confirm these findings. It was found that prevalence of NCD conditions such as stroke, angina, diabetes, asthma and hypertension was significantly highest among women while only chronic lung disease and skin problem were found to be highest among men. Multimorbidity prevalence was also found to be highest among women. This finding concurs with other studies which have shown that women have often reported a high burden for most disease conditions (both NCDs and communicable diseases) than men. Several biological and social explanations for observed gender differences have been put forward (Appelros, Stegmayr , and Terént, 2009), particularly in studies where self-reports are used to collect morbidity data (Carandang, Seshadri, Beiser *et al.* 2006;Petrea, Beiser, Seshadri *et al.* 2009).

It has been argued that women's greater need for health care is often approximated by their worse state of health (greater morbidity, worse perception of health, worse health-related quality of life, and greater degree of disability than men). The different social construction of the disease (roles, attitudes, beliefs and behaviours of men and women when they are sick or worried about ill-health) can possibly explain the observed gender differences in self-reported morbidity (Saeed, Xicang, Yawson, *et al.* 2015). Similarly, in Botswana men are unlikely to go for health care when they feel sick due to cultural and gender role norms that portray them as strong. Consequently, it is safe to note that studies using self-reports are likely to face underreporting of morbidity among men.

Consistent with other previous studies, it was noted in bivariate analysis that factors such as increasing age, low education level, low SES, urban and rural area residence were significantly associated with prevalence of most NCDs (stroke, angina, diabetes, asthma and hypertension)(Pepine, Kerensky, Lambert et al. 2006; Hemingway, Langenberg, Damant *et al.* 2008; Ojuka and Goyaram, 2014; Pastakia, Pekny, Manyara *et al.* 2017). Only asthma was observed to be highest among young ages than old ages. Similar to what other previous studies have suggested, asthma among the adult population may be underdiagnosed or misdiagnosed (Global Initiative for Asthma, 2009; Gibson, McDonald, and Marks, 2010) due to atypical presentation, age-related reduction of dyspnea perception, and associated comorbidities (Tzortzaki, Proklou, and Siafakas, 2011). Moreover, similar conclusion has been made by Kiboneka, Levin, Mosalakatane, *et al.* (2016) that in Botswana, asthma and

COPD have been found to overlap and converge in older people ultimately leading to under-estimation of the other in the older population.

In the adjusted multivariate models for the two most common NCDs (hypertension and diabetes) it was found that women were more likely to report hypertension compared to men, while for diabetes no significant gender difference was found. Previous study by Keetile, Letamo and Navaneetham (2015) also found that women were more likely to report hypertension than men. These gender variations have been explained in different ways. For instance, Sandberg and Ji (2012) argue that gender differences in hypertension, which exist in human populations, may be due to both biological and behavioural factors. Sandberg and Ji, (2012) further posit that biological factors include sex hormones, chromosomal differences, and other biological sex differences that are protective against hypertension in women (Sandberg and Ji 2012; Vitale, Mendelsohn, and Rosano 2009).

These biological factors become evident during adolescence and persist through adulthood until women reach menopause, at which point gender differences in hypertension become correspondingly smaller or non-existent (Everett and Zajacova, 2015). Observed gender differences in hypertension for this study may also be explained by relatively high prevalence of poor physical activity and overweight/obesity among women in the sample.

It was also found that increasing age, high SES, being currently married, poor physical activity, overweight/obese and reporting multiple NCD risk factors was significantly associated with hypertension. This is consistent with previous studies which also found that hypertension increases with age, and is significantly associated with poor physical activity, overweight/obesity and NCDs risk factor clustering in both developed and developing countries (World Health Organization 2010, Prince, Ebrahim, Acosta *et al.* 2012). For wealth status, it was found that wealth status was significantly linked to hypertension. However, the effects of wealth status on hypertension were minimal. The observed small effect of wealth status on hypertension in this data may be explained by small variations for overweight and obesity among the poor and non-poor. On the other hand, the association between SES and hypertension in Botswana may also be explained by the notion that suggests that economic prosperity and urbanization increase the prevalence of risk factors for hypertension such as overweight/obesity, a sedentary lifestyle and excessive salt intake (Busingye, Arabshahi, Subasinghe et al., 2014).

For diabetes, it was found that there were no significant sex, education, residence, and work status differences. This lack of statistical significance may suggest that both men and women, high and low education, rural and urban populations have similar chances of reporting diabetes hence there are no variations with respect to these factors. The other plausible explanation could be that lack of statistical significance could be due to the relatively small sample. On the other hand, it was seen that after adjusting for other socioeconomic and behavioural factors, increasing age and poor wealth status were the only significant determinants of diabetes.

Multimorbidity prevalence was observed to be high; among women, increased with age, formerly married, low education, urban villagers and among retired individuals. This is in line with other studies elsewhere which also established that increasing age, being female; being separated or widowed, having low education, low wealth status, and residing in an urban area were associated with the presence of multiple chronic conditions (Marengoni, Winblad, Karp *et al.* 2008; Hosseinpoor, Bergen, Kunst *et al.* 2012; Omoleke, 2013; Phaswana-Mafuya, Peltzer, Chirinda *et al*. 2013).

Furthermore, the association between multimorbidity and low socioeconomic position has been found in literature. For instance, strong association between multimorbidity with socioeconomic deprivation has also been found in countries in Western Europe (Afshar, Roderick, Kowal *et al.* 2015), Asia (Pati, Swain, Hussein et al. 2015) and South America (De Carvalho, Roncalli, Cancela *et al.* 2017).

The odds of reporting single NCD condition were observed to be high among overweight/obese persons. Since hypertension was the most prevalent NCD which was found to be strongly associated with overweight/obesity, it is safe to conclude that hypertension could be that one NCD condition associated with overweight/obesity in the population. It was discovered that persons who reported alcohol consumption were four times more likely to report multimorbidity.

Recent evidence has also shown that alcohol consumption is strongly associated with an increasing prevalence of multimorbidity among adults (Han, Moore, Sherman *et al.* 2017; Piano, Mazzucco, Kang *et al.* 2017). Similarly in Thailand it was also noted that alcohol consumption of four or more glasses per occasion, even if the occasions were infrequent, was associated with elevated risk of multimorbidity (Wakabayashi, McKetin, Banwell *et al.* 2015). These findings categorically confirm that alcohol consumption is a risk factor for several diseases (Han, Moore, Sherman *et al.* 2017; Piano, Mazzucco, Kang *et al.* 2017), and can exacerbate existing diseases particularly NCDs and can complicate the management of chronic diseases

10.2.3 How does SES Influence Health Care Utilization and Health Expenditure?

Levels, patterns and determinants of health care utilization and health expenditure in Botswana were assessed. This was done with the aim to understand socioeconomic differences in health care utilization and health expenditure in the context of emerging burden of NCDs. Significant gender differences were observed for health care utilization. For instance, women were found to be more likely to use public health facilities and less likely to use private health facilities compared to other health facilities than men.

Several reasons explain why women are more likely to report the use public health facilities compared to men. First, utilization of public health facilities among women can be explained by affordability of public health facilities to women who are often economically disadvantaged. Second, women's greater need as approximated by their worse state of health (greater morbidity, worse perception of health, worse health-related quality of life, and greater degree of disability than men). This, combined with the different social construction of the disease (roles, attitudes, beliefs and behaviours of men and women when they are sick or worried about ill-health) can also explain observed gender differences in utilization of health facilities (Saeed, Xicang, Yawson, *et al.* 2015).

Gender differences were also observed in health expenditure, with women eight times more likely to report to have incurred out-of-pocket expenditure than men. This is in accord with findings from other LMICs such as Ethiopia (Guda, Akadu, Tamiru *et al.* 2012) and India which showed that women were four times and five times respectively, more likely to pay OOP expenditure for health than men. High odds of OOP expenditure for women may be explained in part by health seeking behaviour of women.

Generally, women in Botswana have been found to visit health facilities frequently than men (Seitio-Kgokgwe, Gauld, Hill *et al.* 2014). Subsequently, they are likely to expend on health services than men. Usually, men do not use healthcare if their illness is not severe, whereas women may utilize healthcare services even at the early stages of disease resulting in OOP health expenditure.

It was found that the elderly population (65+ years) were four times more likely to spend out-of-pocket for health services than individuals in ages less than 24 years. It was also observed that the elderly population in the sample sought for medical care more than young adolescents. Plausibly, this may explain why the elderly people were more likely to expend on medical care. The increased use of medical care may contribute to the elderly with chronic conditions having higher out-of-pocket medical expenses.

In the United States for instance, it was also found that out-of-pocket expenditures for elderly adults were higher compared with non-elderly adults (Soni, 2017). This is because longevity is strongly, positively correlated with OOP health care expenses (Banerjee, 2018). The longer a person lives, the more likely they are likely to pay higher OOP health care expenses. But what might not be obvious is the extent of the difference longevity makes in terms of these expenses.

Educational and wealth status inequalities have been observed to exist for different indicators of health care utilization in this study. It was found that people with low education and wealth status were less likely to; have needed health care in the last one year, to report to have received health care when they needed it, and to have sought health care for NCDs than other disease conditions. However, the poor and less educated people were more likely to report to have used public health facility than other-health facilities for their health care. Overall, previous studies have also shown similar trend whereby the poor and less educated were fund to have poor health seeking behaviour. The poor and less educated have been found not to need and seek for medical care even when ill or sick compared to the non-poor (Ahmed, Adams, Chowdhury, et al 2000; Ghosh, Chakrabarti, Chakraborty, et al. 2013; Muriithi, 2013).

In Botswana the reason why the poor and less educated persons in the sample were less likely to report seeking health care for NCDs could be that although NCDs which were previously thought to be most prevalent among individuals of a higher SES, are now also occurring among individuals of a lower SES, infectious diseases especially HIV have a higher prevalence among individuals with lower SES (Fox, 2010; WHO, 2014). Consequently, people with low SES are less likely to seek health care for NCDs than for infectious diseases.
In line with previous studies the finding that people with low wealth status were more likely to report to have visited public health facilities when they felt sick or needed to consult anyone about their health may be explained by affordability and geographical proximity (Blackwell, Iacus, King, *et al.* 2009; Muriithi, 2013; Abera, Ncayiyana, and Levin, 2017). This is because public health facilities in Botswana are free, while other facilities are paid for. Thus, people with low wealth status inevitably visit public health facilities than private health facilities when they are sick because of affordability and geographical proximity.

This study also established that wealth status was significantly associated with out-of-pocket health expenditure. Individuals with low wealth status were less likely to report out-of-pocket expenditure for health care. This finding is sensible in the context of Botswana where a significantly high proportion of the poor reported utilization of public health facilities which are often accessed for free. On the other hand, the non-poor in Botswana have the option of accessing private health facilities where user fees are paid. In conformity with the above finding, studies in countries such as Kenya, Namibia, Nigeria, Albania, Bangladesh, and India also found that poorer individuals and households had no or lower absolute out-of-pocket expenditures on health care than wealthier households (Chuma and Maina 2012; Karan, Selvaraj, and Mahal 2014; Onwujekwe, Uzochukwu, Obikeze *et al.* 2014; Rahman, Hann, Wilson *et al.* 2015).

People residing in urban and rural villages were seen to be five and seven times, respectively, more likely to use public health facilities than individuals staying in cities and towns. It was also found that people in urban villages and rural villages were less likely to have spent out-of-pocket for medical care than those in cities and towns. This is consistent with previous findings which have postulated that OOP health expenditures are more significantly associated with urban communities (Onwujekwe, Uzochukwu, Obikeze *et al.* 2010).

Urban communities in Botswana can afford to access private health care, which is accessed through out-of-pocket payment and medical insurance coverage. Meanwhile rural communities mainly use public health facilities for their healthcare needs which are normally free. It was also found that people in villages and urban villages were less likely to be covered under any medical insurance than residents of cities and towns.

In Botswana, residential differences in medical insurance coverage may be due to the fact that urban residents have access to, can afford and use private health facilities where medical insurance is used, while in rural areas there are no or few private health facilities where people can use medical insurance. Quite often rural areas tend to have fewer insurance companies offering plans in the health insurance marketplaces. Even in rural areas where there is existence of insurance companies premiums tend to be higher because there is less competition among insurers.

Medical insurance coverage is relatively low in Botswana, with about 21.8% of study participants reporting that they were covered by some medical insurance. Majority of people who are under medical insurance are covered by private insurance schemes (Health Policy

Project, 2016). Both the public and private sectors already heavily subsidize employees' health insurance, so mandating enrolment for private companies is likely to face resistance in the future. Meanwhile, the current system of tax-financed health services has been successful in pooling risk, contributing to reductions in catastrophic expenditure and promotion of equity in health (PEPFAR. 2015).

Education and wealth status differences for medical insurance coverage were observed, with people who had low education and wealth status less likely to have any medical insurance coverage compared to those with high education and wealth status. Medical insurance coverage is often associated with non-poor households which can afford insurance premiums while the poor usually access public health medical care for free. The coverage of medical insurance in Botswana benefits the non-poor, creating inequality in the ability to purchase quality care. This is because the non-poor are covered under public health medical care but they also have an option to purchase private health care, through medical insurance.

10.2.4 How does Childhood SES Influence Prevalence of NCD Risk Factors, and NCDs?

Overall findings from chapter 8 indicated evidence of association between childhood SES and adult health. It has been found that childhood SES influences adult health outcomes such as NCD risk factors, NCDs and multi-morbidly independent of current SES. Socioeconomic inequalities during childhood were found to have significant association with NCD risk factors. For instance, it was found that after adjusting for current SES, childhood SES had a positive association with alcohol consumption.

It was observed that individuals who had low childhood SES were three times more likely to report alcohol consumption than respondents who had high childhood SES, when adjusting for current socioeconomic characteristics of respondents. This finding corroborates previous findings which have shown that poor childhood SES is associated with earlier onset of adolescent alcohol consumption and with alcohol use disorders in adulthood (Enoch, 2010). In Botswana individuals raised from low SES families are more likely to have conduct problems and consequently may consume alcohol (Sinkamba, 2015). Contrary to attestations that the association between poor childhood SES and alcohol consumption is not only influenced by early circumstances but by conditions in adulthood (Blanden, Gregg, and Macmillan, 2013; Erola, Jalonen and Lehti, 2016), findings from this analysis show that childhood circumstances drive alcohol consumption independent of adulthood socioeconomic conditions.

It was also found that poor childhood socioeconomic status was associated with poor fruit and vegetable consumption. For instance individuals who had low childhood SES were four times more likely to report poor fruit and vegetable consumption than those with high SES. Similar findings were found by previous studies (Sabanayagam, Shankar, Wong *et al.* 2006; Zhang and Wang 2012 Fruhstorfer, Mousoulis, Uthman *et al.* 2016). A study conducted in Japan by Yanagi, Hata, Kondo *et al.* (2018) also concluded that after adjustment for age and sex, older people who had low childhood SES were more likely to have poor fruit and vegetable intake than those with high childhood SES. In Botswana, it is common for poor households to have lower consumption of fruits and vegetables but higher consumption of energy-dense foods. Consequently dietary patterns built during childhood persist into adulthood. This is because food preference is determined early in life suggesting that the association between poor childhood SES and poor fruit and vegetable consumption during adulthood observed in this study may be explained by the type of diet that individuals from poor socioeconomic background were exposed to during their childhood.

Furthermore it was noted that the odds of smoking were two times higher among people who reported low childhood SES than those who reported high childhood SES. This finding confirms findings of a longitudinal study by Barbara, Jefferis, Graham *et al*. (2004) which showed that poor childhood socioeconomic circumstances, which were measured by the occupation-based score and parental education significantly increased the risk of persistent smoking among adults. Important mediators identified in this study were factors related to family background, including parental education, self-perceived childhood health, parental occupation and childhood diet. As a result, the cumulative effects of poor early life circumstances observed in this study may predispose individuals to smoking initiation, increased risk of progression to regular smoking and a reduced likelihood of cessation during adulthood. This finding emphasises how important it is, in the context of the policy debate, to recognise the accumulation of disadvantages that can occur during childhood which ultimately leads to inequality in adult morbidity and mortality.

The research established that individuals who reported low childhood SES were less likely to be overweight/obese. Contrary to this finding, most of research in both developed and developing countries have found that childhood disadvantage is associated with increased weight among adults (Parsons, Powers, Logan et al. 1999, Mayer, 2009; Senese, Almeida, Fath *et al.* 2009). Studies which found positive association between low childhood SES and overweight/obesity suggest that indicators of childhood SES may be associated with adult weight through parental modelling of daily weight-related behaviours (such as the consumption of energy dense foods and sedentary lifestyles).

However, the observed negative association between low childhood SES and adulthood overweight/obesity may be explained by the fact that children from high SES background are often predisposed to early markers of overweight/obesity such as the consumption of high energy dense food and sedentary lifestyles (WHO, 2016). Inversely, children from low SES families have traditionally been found to eat traditional diets and do a lot physical work.

There was no significant association found between childhood SES and insufficient physical activity. This therefore suggests that there is no difference whether one had poor or non-poor childhood SES and their current physical activity status. There is no evidence of studies showing any significant association between childhood SES and poor physical activity in LMICs. The observed lack of inequality in poor physical activity in this study may be explained by the adoption of sedentary lifestyles which have led to physical inactivity among both the poor and non-poor. It may also imply that current SES and not childhood SES better explains the non-variation in poor physical activity.

It is however important to note that childhood SES was found to be significantly linked with some NCD conditions. Persons who reported poor childhood SES were found to be more likely to report having been diagnosed with hypertension and asthma, after controlling for current SES. After controlling for current SES variables, the odds of reporting hypertension were higher among people who reported low SES during childhood.

Children from poorer families are more likely to engage in risk-for-health behaviours than their better-off peers, consequently predisposing them to conditions such as hypertension. As SES of the parents is vital for the acquisition of knowledge and skills that promote health behaviours associated with a high SES, individuals who reported hypertension and were from low SES families may have been predisposed to mediating factors for hypertension such as poor parental knowledge and skills promoting healthy behaviours. Moreover, unfavourable effects of low childhood SES such as lack of moderate or vigorous physical activity, lack of a proper nutritionally balanced diet, high salt intake, low potassium and low calcium intake, tobacco use, alcohol intake and high stress may have increased the risk for the development of adulthood hypertension.

When holding constant the effect of current SES on asthma, it was found that respondents who had low childhood SES were two times more likely to report to have been diagnosed with asthma compared to those who had high SES. Childhood poverty is likely to reflect various aspects of low SES in childhood and affect later-developing health-risk behaviours (Umeda, Oshio and Fujii, 2015). Poor childhood SES is often accompanied by parental absence or less parental structure (lack of rules or routines, such as regular bedtimes), poor quality housing, poor diet, and family conflicts which predispose people to health risk behaviours earlier in life. For example children from low SES households may be exposed to parental smoking which has an important impact on asthma and wheezing illnesses in children. Consequently poor environmental exposures during childhood (both physical and social environment) may have exposed respondents to acquisition of asthma. Reducing childhood exposures to asthma like adult smoking in front of children may reduce inequalities in asthma prevalence and improve both childhood and adult health.

It was seen that individuals with medium childhood SES were more likely to report eye/vision problem than did those with high SES. A study conducted by Katz and Berlin (2014) on "Psychological Stress in Childhood and Myopia Development" also found that individuals who had low to medium childhood SES were more prone to Myopia (a common eye vision problem) in later life. Low to medium childhood SES and its correlates such as stress during childhood has been observed to affect respiration, posture, and muscle tension, which ultimately leads to less oxygenation of the eyes and brain (Liberman 1995, American Psychiatric Association 2013), hence leading to vision problem. Consequently, the most plausible explanation for the observed childhood socioeconomic difference in eye/vision problem may relate to unfavourable psychosocial childhood conditions.

After controlling for current SES, it was found that multi-morbidity was associated with childhood SES, with individuals from poor SES background more likely to report both single and multiple NCD conditions. This corroborates previous evidence which suggest that socioeconomic inequalities in health persist as advantages and disadvantages accumulate over the lifespan (Marmot and Shipley 1996; Huisman, Kunst and Mackenbach *et al.* 2003; Jensen, Pedersen, Vestergaard *et al.* 2017). Consequently, childhood disadvantages accumulate over lifetime, predisposing individuals to the possibility of multiple NCDs later in life. From this study it was seen that multiple NCD conditions were more prevalent among the older population suggesting that NCDs cluster at old ages.

10.2.5 What are the Key Factors explaining Inequalities in Health?

In chapter 9 socioeconomic inequalities in NCD risk factors and a selected NCD (hypertension) were measured, compared and decomposed. It was found that alcohol consumption was concentrated among the non-poor population. Consumption of alcohol (especially commercial beverages) in Botswana has been seen as a symbol of high SES (Weiser, Karen, Heisler *et al.* 2006). Consequently, the poor consume low-cost, homemade sorghum beer; while the non-poor usually take commercial beverages and moderate-high drinking has been reported in this group (Sinkamba, 2015).

Evidence provided by this study corroborates some cross-sectional studies which have also supported a positive relationship between SES and alcohol use, such that individuals with higher SES engage in more frequent and heavier drinking of commercial beverages (Karriker-Jaffe, Zemore, Mulia *et al*. 2012; Collins, 2016). Concentration curves for daily smoking and poor fruit and vegetable consumption were above the line of inequality suggesting that these two risk factors were more concentrated among the poor.This corroborates findings of the logistic regression models which indicated high odds of poor fruit and vegetable consumption and smoking among the poor. In Botswana the purchasing and consumption of unhealthy diets, in particular, eating fewer fruits and vegetables, is strongly patterned by SES (Setshegetso, 2017).

Poor fruit and vegetable consumption may be more concentrated among the poor due to the fact that the poor may not afford fruits and vegetables. Moreover poor fruit and vegetable consumption is more concentrated among the poor because individuals of lower SES generally tend to have less healthy diets than those of higher SES. Similarly, less nutritious food (with no fruit and vegetable) and energy-dense foods are often eaten by the poor while higher diet quality (with fruit and vegetable) associated with higher cost is found among the non-poor.

The concentration of smoking among the poor is also an established finding. It has been found that smoking is disproportionately high among the poor and affects their health (Hiscock, Bauld, Amos *et al.* 2012; Greenhalgh, Bayly and Winstanley, 2015). The poor smoke in much higher numbers than the non-poor in Botswana, a disparity that is rooted in many inequities. Firstly, the poor have the least access to information about the health hazards of smoking, secondly they have the fewest resources and social supports, and lastly often the least access to services to help them quit. On top of that, the tobacco industry has a long history of targeting low SES individuals and communities.

The concentration curves for physical activity and overweight and obesity almost overlapped with the line of equality showing that wealth- related differences in physical activity and overweight/obesity were small but slightly skewed towards the non-poor. The slight inequality for poor physical activity and overweight/obesity may be explained by behavioural shift from traditionally active lifestyles to more industrialized and sedentary lifestyles among both the poor and non-poor in Botswana. Moreover, Botswana has experienced economic development and the consequent increases in income and the availability of inexpensive, high-calories foods, and low physical activity which has led overweight/obesity to disproportionately afflict the upper and middle classes to becoming widespread among the poor.

Decomposition analysis showed that inequalities in alcohol consumption, poor physical activity and overweight/obesity can be explained by inequalities in education and wealth status. But the effects of contribution of education and wealth status to these three outcomes were different. For alcohol consumption, inequalities were explained by inequalities in education, for overweight/obesity the dominant factor was wealth status while for poor physical activity inequalities were explained by wealth status itself. However the contribution of wealth status for poor physical activity was negative implying that if inequality in poor physical activity was solely determined by wealth status, it would favour the poor. Education was the leading contributor to wealth status-related concentration index for alcohol consumption.

The curve for hypertension was just a little below the line of equality, which implied that hypertension was more concentrated among the non-poor in both the general study population and among individuals aged 50+ years, although the level of inequality was small. Small inequalities for hypertension found in this study may be explained by the fact non-poor population groups could be early adopters of harmful lifestyles characterized by smoking, alcohol consumption, diets with high energy and fats, and sedentary lifestyles while the poor are late adopters of such behaviours. This is because hypertension is found to be concentrated among the non-poor during the early stages of the transition period but later among the poor in most LMICs (Mounier-Jack, Mayhew and Mays, 2017). Consequently, greater exposure to NCDs risk factors among lower SES groups may produce a reversal of hypertension SES patterning over time.

10.3 Strengths of the Study

This study is the first study to explore socioeconomic inequalities for various health outcomes in Botswana. Accordingly, it provides a starting point for further research into health inequalities within the context of universal primary health care coverage. The main strength of this study is that the data were collected from a large and randomly selected representative population. The data contained information on potential confounding factors, with a low proportion of missing information. Moreover, the main advantage for using cross-sectional design for this study is that it was possible to record and assess several outcomes. The study design allowed for the recording and assessment of socioeconomic inequalities for NCD risk factors, NCDs, Health care utilization and expenditure and childhood SES and adult health.

There are several measures of SES that have been used to measure socioeconomic inequalities in health. For this study like for many studies in LMICs wealth status was used as a measure of SES. Wealth status is a more relevant measure of SES in the context of Botswana because it is a measure of long-term economic position. It reflects accumulated assets that can be drawn upon in times of economic instability such as short-term unemployment or illness.

Money-metric measures are not appropriate to use in Botswana due to issues of under or over reporting of income. Income may fluctuate over time more than wealth status, and it is particularly difficult to measure in countries such as Botswana where households may have multiple sources of income, including home production. Income may vary substantially between seasons or years. Income may sometimes be in the form of goods or livestock, which are difficult to place a monetary value on.

Multiple household members may also have an income but household income data is frequently estimated by questioning a single household member who may have incomplete knowledge of all income sources, and generating income can have costs to the household in terms of lost home-production. In order to compensate for the insufficiency of income data, wealth index and education were used as measures of socioeconomic status in this study. The wealth index and education provide rational, simple and reliable information on SES (Filmer and Pritchett, 2001). Moreover, wealth index approach relies on simple questions less likely to suffer from recall bias than income and expenditure questions.

One of the objectives of this study was to test the hypothesis that SES in childhood influences adult health through socioeconomic trajectories and behavioural processes important for health later in life (Chapter 8). Although this is not a longitudinal study, it was able to test this hypothesis. Cross-sectional data as the one used in this study are often referred to as pseudo-life-course data because although not tracking the same individuals as they age, they allow for tracking the average socioeconomic patterns for group of individuals using self-reports and recall while controlling for possible confounders. Although this study is not a pure 'life course' study in the sense that it does not follow the same individuals as they age, it provides vital insights into the influence of life course factors (child SES) on adult health.

10.4 Implications of Study Findings

This part discusses implications of findings from this study.

10.4.1 Contribution to Literature

This study contributes immensely to literature on socioeconomic inequalities in health in a variety of ways. First, there is paucity of research evidence on health inequalities in LMICs in the context of emerging burden of NCDs, especially in Sub-Saharan Africa (SSA) where much focus has been on infectious disease epidemiology. At global level, this study updates existing literature on socioeconomic inequalities in health, while at regional level it introduces empirical debates on socioeconomic inequalities in health in the context of emerging burden of NCDs. This is because most of the countries in the SSA region are now faced with double burden of communicable and non-communicable diseases. This study reintroduces the call for more empirical research of socioeconomic inequalities in health, in the context of emerging burden of NCDs.

Secondly, the findings from this study indicate some divergent findings and conclusions on the association between SES and different health outcomes assessed in this study. Contrary to evidence from reviewed literature (both from LMICs and HICs), this study shows that in Botswana, poor physical activity, alcohol consumption and overweight/obesity were more concentrated among people with high SES. On the other hand commensurate with literature from studies from both HICs and LMICs it was observed that poor fruit/vegetable consumption and tobacco smoking were concentrated among low SES individuals.

Hypertension in the study population and among individuals aged 50+ was concentrated among the non-poor, although the observed inequality was small. The mixed findings in the association between SES and various health outcomes in this study indicate the need for more research between SES and health in Botswana. This study has provided a baseline platform for further research and debate on socioeconomic inequalities in health.

Third, findings from this study propagate the notion that socioeconomic status (SES) exposures during childhood are powerful predictors of adult health. It was observed that when controlling for behavioural and socioeconomic factors (current SES) individuals who had low childhood SES were more likely to be alcohol consumers, and were also likely to have hypertension and asthma. The study provides provocative evidence for the hypothesis that childhood SES contributes to adult health, independent of adult socioeconomic conditions. Unlike other studies on childhood SES and adult health which uses assessments of only one SES marker, usually father's or mother's occupation or education, this study created an composite index including a variety of markers of childhood SES.

Fourth, unlike other life course studies this study addresses a wide range of health outcomes, such as the five NCDs risk factors, NCDs and multimorbidity. This provided the opportunity to test the robustness of the marker of childhood SES used. The consistency of results on the association between the constructed childhood SES index across various health outcomes indicates its (SES index) methodological rigour and reliability. Like the wealth index is used as an appropriate measure of SES in low income settings, this measure was appropriate for the context of Botswana where parental education and income alone may not sufficiently measure childhood SEP.

10.4.2 Contribution to Policy and Practice

Policy implications derived from this study are numerous. First, the Government of Botswana has to strengthen and broaden national surveillance systems for NCDs, and ensure that these are integrated into the national health information systems, to enable regular reporting/auditing/benchmarking and monitoring progress. This is premised on the fact that the social gradient in NCDs and risk factors is expected to change over the stages of the epidemiological transition, and there is a need to examine trends in the socioeconomic patterning of NCDs in Botswana through repeated surveys.

This emphasises the need to systematically collect data for socioeconomic variables (asset-based variables) in all population surveys of NCDs, and the equally important need to adequately communicate findings according to socioeconomic indicators, as emphasised in the WHO Global Action Plan for the Prevention and Control of NCDs 2013–2020 and the related Global Monitoring Framework.

Secondly, considering that socioeconomic differences were observed for health care utilization and health expenditure it can be concluded that inequality in benefitting from health services is reflective of the socioeconomic situation of households. As a result, it is expected that by taking steps to improve the living conditions, the equity in service utilization will be increased.

Furthermore, there is need for enhanced education, especially in rural areas and among the poor about healthy lifestyles to dispel apprehensive health seeking behaviours. Although inequalities were observed for health expenditure (for the non-poor) it should be noted that Botswana's health financing system has over the years served the population well, but is now faced with several challenges and therefore cannot be sustainable. This should offer Botswana the opportunity to come up with innovative reforms of health financing through output based provider payments systems. Health insurance for all should be seen as an option for providing a platform for promoting accountability and long term sustainability.

Lastly, since there is evidence that childhood SES is an important factor associated with the development of health inequality pathways, the life stages at which intervention to reduce socioeconomic inequalities should be determined. Results indicate a significant association between childhood SES and health outcomes (NCD risk factors and NCDs).

There is need to design more studies to identify developments in early life through which exposures to deprivation have long-term effects on health particularly during key life transitions, e.g. late adolescence to early adulthood. There is need to provide safety nets which can alter life course trajectories with implications for subsequent health, especially during childhood. Further research is needed in this area using longitudinal data and other more robust life course methods.

10.5 Key Policy Recommendations

The following are some of the key policy recommendations derived from this work;

- Due to the increasing prevalence of different NCDs the government should establish and encourage multi-sectoral collaboration for prevention and control of NCDs by setting national NCD targets, consistent with WHO global targets, covering NCD risk factors, national systems performance, and mortality, based on Botswana context.
- The government should also strengthen the health system at all levels, with emphasis on primary care, and define a national set of NCD interventions (like screening of people) to achieve universal health coverage. The focus should also be on strengthening the information, education and communication (IEC) and the behaviour change communication (BCC) strategy to educate and warn people of the dangers of tobacco, alcohol, physical inactivity, poor fruit and vegetable consumption and encourage people to eat healthy and exercise regularly. This can be done by tightening all policy options for tobacco products and alcohol consumption such as increasing prices and ban all form of advertising, promotion and sponsorship.
- Since it was found that people who had low education, wealth status and resided in rural or urban villages were less likely to report any medical insurance coverage. It is imperative that affordable medical insurance coverage should be extended to the poor and rural or urban villages in order to create equality in the ability to purchase high quality secondary care.
- It was found that public health facilities were the commonly visited place for health care. Since they are a predominant place of choice, effort should not be

spared to make them even more accessible. Proximity to clients should be further improved by reducing the distances even further.

- There is need for further research on life course and health. This research should more precisely identify the timing of the influence childhood SES and its relative contribution to adult health in relation to other early life stages which requires the synthesis of sociological, physiological, and psychological perspectives of human development.
- With hypertension apparently as the number one NCD especially among the non-poor, efforts need to be made to educate people on its management. This could be done by strengthening IEC activities so as to prevent it.
- Many respondents were not covered by insurance (especially the poor), hence the likelihood of them failing to pay for services such as consultation and drugs was null.
- More education on causes and management of NCDs is needed among both the poor and non-poor.
- There is need for more in-depth research on the interaction between SES and health.

10.6 Limitation of the Study and Scope for Further Research

10.6.1 Limitations

As in any research, this study has some limitations to consider. First, the NCDs study sample was not designed to be representative of Botswana, and I am cautious about generalizing these study findings. Meanwhile the main limitation is that because data on each participant was recorded only once it was difficult to infer the temporal association between an explanatory and an outcome variable. Therefore, only an association, and not causation, can be inferred from this study.

More generally, limitations of self-reported data such as under and over-reporting were borne in mind for this study. In order to fully explore the influence of life course factors on health, longitudinal surveys are preferred than cross-sectional data. One of the key characteristics of a longitudinal study is that it takes into cognizance the following concepts; cohorts, transitions, trajectories, life event, and turning points. The focus of this study was on trajectory (childhood SES) and life events (adulthood health behaviours) and the insufficiency of this approach calls for more methodological work, which looks at the different stages of life course from the embryonic to adulthood stage. Future research needs to focus on 'full life course data', where individuals' SES and health are traced through life trajectories, from childhood into adulthood.

10.6.2 The Socioeconomic Inequalities in Health Gap –What can be done to address Socioeconomic Inequalities in Health Gap?

Although this study provides ground breaking evidence on SES and health in Botswana there is need for more research. Most health studies (especially on NCDs) in Botswana have been purely descriptive. This is because the dominant perspective of biomedical research in Botswana has mainly focussed on describing prevalence and patterns of few NCDs through WHO STEPS surveys. As a result, future research should focus more on examining key factors associated with various NCDs in Botswana. This should be done bearing in mind that NCDs are fast replacing communicable diseases, especially HIV/AIDs because antiretroviral treatment has led to increased life expectancy. Plausibly, HIV/AIDS is no longer a major cause of morbidity and mortality in Botswana.

In order to reduce socioeconomic inequalities research must focus on the pathways that lead some groups of people into lower health status than others. The focus should be more on social contexts including not only economic but also political and cultural factors that affect people's health. Further research is needed on SES and health expenditure. There is also need for more focussed research on health care utilization and expenditure in Botswana.

10.6.3 Further Methodological Work on Life Course Perspective

In order to fully explore the influence of life course factors on health, longitudinal surveys are needed. One of the key characteristics of a 'full' life course study is that it takes into cognizance the following concepts; cohorts, transitions, trajectories, life event, and turning points. In this study the focus was on trajectory (childhood SES) and life events (adulthood health behaviours) and the insufficiency of this approach calls for more methodological work, which looks at the different stages of life course from the embryonic to adulthood stage.

According to Burton-Jeangros, Cullati, Sacker, and Blane (2015) analysing health trajectories requires repeated measurements and a minimum of two measures is necessary to observe change over time, while a minimum of three measures allows description of patterns in trajectories. Creating longitudinal databases, as the one initiated in the United Kingdom with birth cohorts as early as 1946, are needed in Botswana. Unlike in this study which required respondents to recall events during childhood, longitudinal studies would eliminate the problem of recall bias.

Additionally, there is need for household panel data available to offer repeated measurements of indicators related to health and social conditions. In this panel data unique identification numbers could be attributed to each respondent to allow for linkage of data from a range of sources (census, social surveys, medical records) providing rich information over the individual life span (Blane, Netuveli, and Stone, 2007).

Botswana operates a robust civil and vital registration system which can be used to facilitate the linkage of health data and data from other sources. Retrospective data collected through life-grid techniques (for example in the SHARE study), may also give access to longer periods of time, making possible connections between earlier life events and later health trajectories, although it presents a risk of information bias.

10.6.4 Further Work on Health Expenditure

Data collected for this study did not sufficiently address questions of catastrophic health expenditure. This was so because household income was under-reported for this study rendering efforts to link household income with household expenditure on health unsuccessful. The reliability and validity of health expenditure data was compromised by at least two factors that influence the results: the number of expenditure categories used and the recall period (Browning, Crossley and Weber, 2003).

Among the few validation studies undertaken in developing countries, none have explored the issue of how to collect valid, reliable and comparable information on health expenditures. This therefore means that there is need for further methodological work on collecting valid, reliable and comparable information on health expenditure in the Sub Saharan Africa context.

10.7 Conclusion

This study has already raised critical points from which meaningful conclusion can be drawn. It is crucial to highlight from the onset that overall findings from this study have shown mixed findings on existence of socioeconomic inequalities in health even though the poor were the most disadvantaged for several health outcomes.

Gender differences were found with women more likely to report poor physical activity, being overweight/obese, stroke, angina, diabetes, asthma, hypertension and multimorbidity. NCD risk factors such as alcohol consumption, poor physical activity and overweight/obesity were found to be concentrated among the non-poor, while smoking and poor fruit and vegetable consumption were more concentrated among the poor.

Socioeconomic factors such as increasing age, low education level, low SES, urban and rural area residence were significantly associated with prevalence of most NCDs (stroke, angina, diabetes, and hypertension). The poor and less educated were found not to need and seek for medical care even when ill or sick compared to the non-poor, and they used public health facilities for their health care. Moreover, the poor were less likely to have been covered under any medical insurance and spent out-of-pocket for health.

It was also found that people who had low childhood SES were more likely to report alcohol consumption, smoking and poor fruit and vegetable consumption; hypertension, asthma and multi-morbidity. Findings from this study are critical for achieving health equity and designing effective interventions. Subsequently, recognizing socioeconomic differences in health is necessary for targeting investments to the worst-off groups through the creation of laws and programs that seek to eliminate social group differences in health. Since socioeconomic inequities in health are shaped by unfair distributions of the social determinants of health, tracking social group differences in health is important for monitoring the state of equity in the country.

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List of Appendices

Appendix 1 Methodology for the NCDs study, 2016 (Chapter 3)

Data sources

The study on ‘Chronic Non communicable Diseases in Botswana; A study on chronic disease prevalence, Health care Utilization, Health Expenditure and the Life course used a multistage probability sampling technique. The study was conducted in March 2016 and collected additional information on CNCDs in Botswana beyond what is provided for by the WHO NCDs surveillance survey.

The NCD study collected information on other chronic diseases and their risk factors in the country. It also collected information on health care utilization, health expenditure and indicators about the childhood experiences associated with NCDs. Self-reported data on several NCDs as classified by the WHO classification of diseases and their associated risk factors was collected. The collection of self-reported morbidity on diabetes and hypertension would serve as baseline for comparison between clinical and self-reported prevalence of CNCDs in Botswana.

Design and Selection of the Sample

The study on ‘Chronic Non communicable Diseases in Botswana; A study on chronic disease prevalence, Health care Utilization, Health Expenditure and the Life course’’ adopted a representative cross-sectional descriptive study design as well as a qualitative design. The survey was carried in selected urban and rural areas of Botswana, among males and females aged 15 years and over[11].

[11]Qualitative data will be collected to assess the readiness or preparedness of the Botswana health system in dealing with non-communicable diseases.

A list of districts, localities and enumeration areas (EAs) together with their households was made based on the 2011 Botswana Population and Housing sampling frame. The survey used a multi-stage probability sampling technique, where first the population was stratified into cities and towns, urban villages and rural settlements. A listing of all 26 census districts in each strata was made at the initial stage, and from these districts a total of all 4845 EAs were listed for rural and urban localities. At the second stage, localities in urban and rural districts were randomly selected. A third and fourth stage comprised a random selection of EAs and Households in that order. Lastly, individuals aged 15 years and over were selected for interview from the list of households with persons 15 years and over.

Sampling Procedure

Using the multistage probability sampling, census districts for Botswana were divided into rural and urban clusters at the first step. Urban districts were further divided into cities, towns and urban villages; while rural clusters were randomly selected (thus rural settlements in lands area, cattle posts, freehold farms, mixture of lands and cattle posts, and camp or other locality where type of locality is not .stated were excluded from the sample).

From cities and towns, the following were randomly selected: Gaborone, Jwaneng and Selebi Phikwe. For the urban village's strata the villages of: Kanye, Letlhakeng, Maitengwe, Maun, Mochudi, Molepolole, Serowe, Tsabong, Tlokweng, Tutume, Kopong, Mmadinare, Lerala, Gumare, and Thamaga were randomly selected. While the rural villages strata included the following randomly selected villages; Nthanthe, Ditshegwane, Senete, Sehithwa, Mathubudukwane, Serinane, Moiyabana, Omaweneno, Dikwididi, Makuta, Kgope, Tobane, Maunatlala, Etsha 6 and Kubung.

Enumeration areas were selected using probability proportional to size sampling method for the different strata and localities. The number of enumeration areas to be selected in each stratum will be fixed according to the total sample size distributed to the district as per the procedure explained below.

Calculation of the study sample

The sample size of the study was calculated using the sample size calculator and yielding a sample size of 1280. The sample size is powered to produce estimates for Botswana and for broad socioeconomic categories. The final selection of respondents for inclusion in the study was that 28.5% of the respondents were recruited from cities and towns, 47.3% from urban villages and 24.1% from rural villages. This is proportionate to the size of the population as estimated during the 2011 Botswana Population and Housing Census.

Hence the total respondents from towns and cities=28.5/100*1280=365 respondents; 47.3/100*1280=606 respondents from urban villages, and a total of 24.1/100*1280=309 respondents from rural villages were targeted.

Furthermore, the selection of the sample within each enumeration area is calculated in relation to the proportion of population in that district. E.g. for Gaborone = 178654/226649*365=288 (see table1).

Table 4: Summary of sampled districts with their enumeration areas and proportion of study respondents.

Proposed Localities	Population aged 15-65 years (2011 Census)	Proposed Number of EA's	Proposed Number of Population Aged 15-65 years
Cities and Towns (324291)	**226049**	**18**	**365**
Gaborone	178654	14	288
Selebi-Phikwe	34093	3	55
Jwaneng	13302	1	21
Urban Villages (538585)	**271900**	**30**	**606**
Kanye	31108	3	69
Letlhakeng	5439	1	12
Maitengwe	2969	0	7
Maun	40796	5	91
Mochudi	29331	3	65
Molepolole	43103	5	96
Serowe	35614	4	79
Tsabong	6131	1	14
Tlokweng	28211	3	63
Tutume	10626	1	24
Kopong	6856	1	15
Mmadimare	9192	1	20
Lerala	3943	0	9
Gumare	5180	1	12
Thamaga	13401	1	30
Rural Villages (274363)	**21702**	**15**	**309**
Nthanthe	1321	1	19
Ditshegwane	1209	1	17
Senete	1415	1	20
Sehithwa	2928	2	42
Mathubudukwane	1233	1	18
Serinane	358	0	5
Moiyabana	3014	2	43
Werda	1905	1	27
Dikwididi	225	0	3
Makuta	464	0	7
Kgope	521	0	7
Tobane	1455	1	21
Maunatlala	2871	2	41
Etsha 6	2783	2	40
Kubung	188	0	3

For each selected EA, 20 households were selected using systematic sampling method. This followed guidelines used in most Demographic Health Surveys where 20-25 households (hhs) were selected from the primary sampling units (PSUs). For instance, in the case of cities and town; 365/20=18 EAs. The above procedure was followed for all districts, where each of the sampled EAs, 20 households were selected using systematic sampling method. The Kish grid was used to select the eligible respondents from the selected households. Thus, once a household is selected, the interviewer created a listing (sampling frame) of all the persons in the household that are eligible for the interview process. This listing includes the name of the person, their gender, their relationship to the head of the household and their age. Once the listing was done, each eligible member was assigned a unique number. Then using a randomized response table a particular member was chosen for the interview.

Survey Instruments

A population based survey comprising of quantitative and qualitative[12] data collection approaches was proposed.

i. *Design of NCD study Instruments*

The adapted instruments in the NCD study were based on several resources. These were mainly from the WHO Study on Global Ageing and Adult Health (SAGE), and WHO STEPS Survey. These were then reviewed and subsequently adopted by the research team. The review took into account the recommendations by the World Health Organization on undertaking population-based surveys.

ii. Quantitative data collection instrument

This employed a structured questionnaire and collected data from a representative sample of Batswana using the interview method. The focus of the interview was on the following key issues:

i. Socioeconomic and demographic information.
ii. Housing characteristics.
iii. Known or perceived risk factors associated with self or an individual known to have a NCD condition.
iv. Health care utilization and health expenditure patterns associated with CNCDs.
v. Level of awareness and perceptions of the population regarding the listed non communicable diseases.
vi. Childhood socioeconomic status and adolescence behavior on prevalence of CNCDs and their risk factors in later life.
vii. Anthropometric Measurements.

iii. Qualitative data collection instrument - Key informant interviews

This method sought to collect data on perceptions regarding the readiness or preparedness of the Botswana health system in dealing with non-communicable diseases. This method was used to collect data from significant actors in the community and health facilities who are expected to be knowledgeable on the disease load and profiles of in their communities. Health facilities managers were contacted for information regarding reported NCDs to their facilities and the facilities readiness to address reported NCD conditions.

Data Collection Procedures and Management

Scientific procedures for data collection and management are important for data quality and therefore its utilization. This is particularly relevant where scientific research undertaking has an expectation to inform policy direction. The quality and utility of a CNCD study data was dependent on the manuals, control forms and questionnaires used in the survey. The CNCD study as a consequence opted to use validated instruments and manuals that were informed by past research and United Nations bodies such as WHO.

Data collection Instruments

In the CNCD study two instruments were administered (a questionnaire and interview guide). Their design was made to serve the purpose of: (i) of extracting specific information, (ii) collecting the appropriate data, (iii) making data comparable and amenable to analysis, (iv) minimizing bias in formulating and asking question, and (V) making questions engaging and varied. Careful consideration was accorded the type of instrument regarding; its format, wording and sequencing of the questions, the method of enumeration, the data being collected, and how the data will be processed.

Preparatory Activities

A number of preparatory activities were undertaken before the commencement of the study on CNCD. These were: (i) communication, publicity and advocacy and (ii) recruitment, training and deployment of the field research staff.

i. Communication, Publicity and Advocacy

Prior to the field work survey the research team made contact with District Administration/Office, Local Authority and Tribal Administration to make them understand and appreciate the object of the study, importance of the study and use of the data and underscoring the confidentiality of responses, and when enumeration is scheduled to take place in their of area of jurisdiction.

On arrival at the survey sites, the first point of entry was to make contact with the tribal authority to make them aware of the presence of enumerators in their village/locale as well as to make an appointment for in-depth interviews with them or local structures (e.g. VDC, VHC etc).

ii. Field staff recruitment, training and deployment

In endeavour to adhere to the aforesaid principles, the study recruited ten (10) research assistants with a minimum qualification of a bachelor's degree (in the social sciences), two (2) field supervisors and one (1) project administrator. They were then trained on field survey methodology, interview skills and research ethics. These were based on the WHO Training Manual on the Study on Global Ageing and Adult Health (SAGE and other documents were used to reinforce this.

Two (2) teams of 6 people each were deployed with enough material to cover their target areas of enumeration. The supervisors in these teams were tasked with receiving, holding, dispatching, collecting and returning to the Project Administrator all the project documents and materials

Testing of CNCD Instruments

The pretesting of the instrument prior to the nationwide field survey is common practice. The CNCD study undertook this exercise in one of the sampled settlements (Dikwididi, Kgatleng District) to familiarize the research assistant's with the utility of the questionnaire focusing on: the suitability of intended survey questions, their formulation and the instructions provided, as well as the suitability of the questionnaire design. Testing of the instruments revealed information relating to the average duration of administering questionnaires (approximately 60 minutes), which questions respondents found relevant/irrelevant/intrusive/less so, and how many questionnaires were successfully completed in a specified time (8/13=62 percent). Furthermore, it gave us insights into how the field work can be organized, what further training was needed to improve the skills of the interviewers as well as the extent of respondent burden.

Enumeration Strategy

The enumeration strategy for the CNCD study encompassed delineation of activities and definition of responsibilities, type and method of enumeration so as to better execute field operations.

i. *Activities and Responsibilitie*s

In achieving the overall goal of the study, the following principles were encouraged:

a) Full coverage of sampled localities and EAs;
b) Confidentiality;
c) Communication and advocacy
d) Accountability and
e) Consistency of procedures in all the survey localities.

ii. *Type of enumeration*

The CNCD study adopted modified de facto type of enumeration whereby respondents 15-65 years old were enumerated at the place where they were found at the time of survey. This, however, excluded members of the household who were not usual residents.

iii. *Method of enumeration*

The method of enumeration adopted by CNCD study was the interviewer (canvasser) method. The CNCD study adopted this approach given the budget, content and scope of the study. In enumerating an EA, first a coin was tossed to decide the cardinal point (see Figure 1 for illustration) where the enumeration will start. The first household to be interviewed was determined using the day code. For example, on the 25th March 2016 – the first household to be enumerated would be the 7th household from the farthest point of the EA. This code was arrived at by adding the digits 2 and 5. For subsequent selection of a household, a sampling interval was determined based on the size of the EA and the total number of interviews per EA.

Figure 3.1: Cardinal Directions

Problems that came up during the Survey

On the basis of the observations made on the pilot and main survey, though some respondents found some questions of no relevance and intrusive, overall there were no major weaknesses in the questionnaire or in the enumeration procedure that might affect the quality of data. However, the data analyst should be cautious in their interpretation of data and be on the lookout for emerging patterns on household assets and income. This is because observations by field research assistants were that some respondents withheld information with the belief that if they were to disclose their assets and/or income, they may not get financial assistance from government.

Quality assurance

To ensure that data collected is of high quality, a number of quality assurance mechanisms were adopted:

i. Recruitment and training of experienced research assistants

ii. Pre-test of data collection tools

iii. Field and office editing of completed tools by data collection supervisors

iv. Data cleaning: This was done before analysis to ensure consistency and completeness.

Implications of the proposed study

The proposed study is vital for both policy and intellectual reasons. CNCDs feature in many health policy agendas worldwide and in the post 2015 health agenda. For intellectual reasons because there is need for prospects of developing new methods of CNCDs research in Botswana based on her unique health context. The proposed study will help to inform and target effective interventions for CNCDs and increase awareness about CNCDs.

Response Rate

Summary of Sampled Districts with their Enumeration Areas, Proposed Population to be Interviewed, Number Interviewed and Response Rate

Proposed Localities	**Population aged 15-65 years (2011 Census)**	**Proposed Number of EA's**	**Proposed Number of Population Aged 15-65 years**	**Number of Interviews Successfully Conducted**	**Response rate**
Cities and Towns (324291)	**226049**	**18**	**365**	**355**	**97.3**
Gaborone	178654	14	288	276	95.8
Selebi Phikwe	34093	3	55	55	100.0
Jwaneng	13302	1	21	24	114.3
Urban Villages (538585)	**271900**	**30**	**606**	**534**	**88.1**
Kanye	31108	3	69	74	107.2
Letlhakeng	5439	1	12	12	100.0
Maitengwe	2969	0	7	9	128.6
Maun	40796	5	91	68	74.7
Mochudi	29331	3	65	65	100.0
Molepolole	43103	5	96	54	56.3
Serowe	35614	4	79	80	101.3
Tsabong	6131	1	14	14	100.0
Tlokweng	28211	3	63	50	79.4
Tutume	10626	1	24	20	83.3
Kopong	6856	1	15	15	100.0
Mmadinare	9192	1	20	20	100.0
Lerala	3943	0	9	10	111.1
Gumare	5180	1	12	19	158.3
Thamaga	13401	1	30	24	80.0

Rural Villages (274363)	**21702**	**15**	**309**	**288**	**93.2**
Nthanthe	1321	1	19	17	89.5
Ditshegwane	1209	1	17	13	76.5
Senete	1415	1	20	20	100.0
Sehithwa	2928	2	42	34	81.0
Mathubudukwane	1233	1	18	20	111.1
Serinane	358	0	5	6	120.0
Moiyabana	3014	2	43	41	95.3
Werda	1905	1	27	18	66.7
Dikwididi	225	0	3	12	400.0
Makuta	464	0	7	5	71.4
Kgope	521	0	7	7	100.0
Tobane	1455	1	21	20	95.2
Maunatlala	2871	2	41	40	97.6
Etsha 6	2783	2	40	30	75.0
Kubung	188	0	3	5	166.7
National (1137239)	519651	63	1280	1178	92.0

Ethical Clearance

All ethical clearance formalities were completed before the start of the study. The study proposal along with the necessary documents were submitted to Institutional Review Board of the University of Botswana for ethical clearance. Privacy and confidentiality of highest standard shall was maintained by treating all respondents as anonymous, and none of the respondents names were mentioned or implied when presenting findings of the study.

Internal Validity

The CNCD has adopted a cohort research design to:

i. Assess the magnitude and patterns of the listed CNCDs[13] in Botswana;

ii. Assess the levels and patterns of behavioral risk factors for CNCDs.

iii. Investigate the health care utilization associated with CNCDs.

[13] WHO Classification of diseases was used for this purpose.

iv. Investigate the health expenditure associated with CNCDs and its implications on household poverty.

v. Investigate the level of awareness and perceptions of the population regarding the listed non communicable diseases;

These types of survey designs are poor in internal validity because of their inability to manipulate the independent variable (cause), and because cause and effect are measured at the same point in time which defeats temporal precedence making it equally likely that the expected effect might have influenced the expected cause rather than the reverse (Bhattacherjee, 2012). Despite this, the use of a cohort design allows for measurement of potential causes before the outcome has occurred, they can demonstrate that these “causes” preceded the outcome, thereby avoiding the debate as to which is the cause and which is the effect ("Organizing Your Social Sciences Research Paper: Types of Research Designs,").

Appendix 2: The Principal Component Analysis

Principal component analysis (PCA) is the most commonly used data reduction technique. This technique extracts a set of 'uncorrelated principal components' from a set of correlated variables. Each principal component is a weighted linear combination of the original variables. The components are ordered so that the first principal component (PC1) explains the largest amount of variation in the data. For the NCD study data collection was done for 33 asset variables, from which principal component analysis was done to derive wealth index. These included ownership of other assets such as livestock and land. From the initial 33 asset variables 10 variables were excluded from the procedure because they did not correlate with other variables (Table 3.2).

Principal component analysis output (SPSS) for NCDs study,2016 (Chapter 3)

Total Variance Explained							
	Initial Eigen values			Extraction Sums of Squared Loadings			
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	
1	6.202	26.966	26.966	6.202	26.966	26.966	
2	1.859	8.084	35.050				
3	1.465	6.369	41.419				
4	1.175	5.108	46.526				
5	1.046	4.546	51.073				
6	0.985	4.284	55.357				
7	0.916	3.984	59.341				
8	0.899	3.908	63.249				
9	0.853	3.707	66.956				
10	0.809	3.515	70.471				
11	0.769	3.341	73.813				
12	0.760	3.302	77.115				
13	0.715	3.110	80.225				
14	0.653	2.840	83.065				
15	0.642	2.790	85.856				
16	0.622	2.706	88.562				
17	0.556	2.418	90.980				
18	0.522	2.271	93.251				

19	0.445	1.933	95.184				
20	0.327	1.421	96.604				
21	0.301	1.308	97.913				
22	0.269	1.170	99.082				
23	0.211	0.918	100.000				
Extraction Method: Principal Component Analysis.							

The estimation of relative wealth using PCA is based on the first principal component. Formally, the wealth index for household *i* is the linear combination,

$$y = \left(\frac{x_1 - \ddot{x}_1}{S_1}\right) + \alpha_2\left(\frac{x_2 - \ddot{x}_2}{S_2}\right) + \cdots + \alpha_k\left(\frac{x_k - \ddot{x}_k}{S_k}\right)$$

Where, $\ddot{x}_k$and $S_k$are the mean and standard deviation of asset *k x*, and α represents the weight for each variable $x_k$for the first principal component. By definition the first principal component variable across households or individuals has a mean of zero and a variance of λ, which corresponds to the largest eigenvalue of the correlation matrix of *x* . The first principal component *y* yields a wealth index that assigns a larger weight to assets that vary the most across households so that an asset found in all households is given a weight of zero (McKenzie 2005). The first principal component as shown in table above shows an eingenvalue of 6.202.

Appendix 3_ Table: Prevalence of underweight and normal weight by socioeconomic and behavioural characteristics of the study population (Chapter 5)

Prevalence of underweight and normal weight by socioeconomic and behavioural characteristics of the study population

Variable	Under weight		Normal weight	
Sex*	%	N	%	N
Male	16.9	59	57.6	201
Female	14.6	112	36.8	282
Age*				
≤24	21.5	56	56.7	148
25-34	14.4	42	48.8	142
35-44	11.9	22	35.1	65
45-54	9.8	12	35.8	44
55-64	7.4	5	30.9	21
65+	14.6	7	41.7	20
Marital status*				
Never-married	16.3	135	48.2	398
Currently-married	11.4	21	26.5	49
Formerly-married	14.3	170	31.6	31
Education*				
Primary or less	14.5	55	40.1	152
Secondary	17.4	86	45.8	226
Tertiary or higher	11.3	166	44.1	98
Residence				
Cities and towns	17.1	59	45.1	156
Urban villages	14.9	75	44.1	222
Rural villages	13.9	37	39.3	105
Work status*				
Public sector	13	15	34.8	40
Private sector	14.4	25	48.9	85
self-employed	9.7	12	46	57
Not employed	16.2	66	38	155
Home-maker/student	20.4	43	50.2	106
Retired/other	13.9	10	45.8	33
Wealth status				
Lowest	18.7	41	42.5	93
second	11.7	26	45	100
middle	16.5	37	42.4	95
Fourth	15.6	35	44.6	100
Highest	14.1	32	41.9	95
Alcohol consumption				
Yes	14.6	49	52.1	100
No	19.8	21	42.5	45
Smoking*				

Yes	20.3	26	50	64
No	14.7	145	42.4	419
Poor physical activity*				
Yes	17.1	126	41.4	305
No	12	42	48.4	170
Poor fruit/vegetable consumption				
Yes	15.3	18	47.5	56
no	15.4	153	42.8	425
Overall	**15.3**		**43.3**	

Appendix 4:Enrolment in medical insurance by different socioeconomic characteristics (Chapter 7)

Are you/your household members covered under any medical insurance?					
		Not enrolled		Enrolled	
		%	N	%	N
Sex	Male	66.7	104	33.3	52
	Female	82.6	351	17.4	74
Age	≤24	70.5	91	29.5	38
	25-34	78.1	107	21.9	30
	35 - 44	73.3	77	26.7	28
	45 - 54	72.4	55	27.6	21
	55 - 64	84.4	38	15.6	7
	65+	96.4	27	3.6	1
Education	Primary or Less	92.8	192	7.2	15
	Secondary	75.9	192	24.1	61
	Tertiary & higher	57.1	68	42.9	51
Wealth Status	Poorest	96.9	95	3.1	3
	Poor	92	104	8	9
	Middle	90.7	107	9.3	11
	Wealthy	76.9	90	23.1	27
	wealthiest	43.4	59	56.6	77

Appendix 5: Logistic regression for the likelihood of association between childhood SES and poor physical activity (Chapter 8)

Variable	Exp (B)-95% CI
Childhood SES	
Low	0.86 (0.53-1.40)
Medium	0.74 (0.50-1.10)
High	1
Sex	
Male	2.45** (1.71-3.50)
Female	1
Age	
≤24	1
25-34	0.60* (0.36-1.01)
35-44	0.50** (0.28-0.90)
45-54	0.42* (0.21-0.84)
55-64	0.93 (0.39-2.24)
65+	2.19 (0.64-7.42)
Marital status	
Never-married	1.18 (0.51-2.74)
Currently-married	1.53 (0.64-3.65)
Formerly-married	1
Education	
Primary or less	0.67 (0.37-1.22)
Secondary	0.72 (0.46-1.14)
Tertiary or higher	1
Residence	
Cities and towns	1
Urban villages	0.79 (0.53-1.17)
Rural villages	0.65 (0.40-1.07)*
Work status	
Public sector	1.41 (0.64-3.14)
Private sector	1.18 (0.56-2.48)
self-employed	1.13 (0.58-2.81)
Not employed	1.38 (0.64-2.99)
Home-maker/student	1.40 (0.70-2.82)
Retired/other	1
Wealth status	
Lowest	1.94** (1.00-3.75)
second	1.79** (1.01-3.19)
middle	1.35 (0.78-2.32)
Fourth	1.74 (1.06-2.84)
Highest	1

Notes:**Statistically significant at p≤0.05,* Statistically significant at p≤0.1

Appendix 6: Logistic regression for the likelihood of association between childhood SES and overweight/obesity

Variable	Exp (B)-95% CI
Childhood SES	
Low	0.99 (0.60-1.60)
Medium	0.99 (0.67-1.47)
High	1
Sex	
Male	2.27** (1.55-3.34)
Female	1
Age	
≤24	1
25-34	1.51 (0.91-2.50)
35-44	3.06** (1.71-5.46)
45-54	3.42** (1.71-6.81)
55-64	3.92** (1.70-9.06)
65+	1.97 (0.68-5.72)
Marital status	
Never-married	0.93 (0.42-2.08)
Currently-married	2.06** (0.88-4.80)
Formerly-married	1
Education	
Primary or less	0.51** (0.27-0.93)
Secondary	0.95 (0.60-1.51)
Tertiary or higher	1
Residence	
Cities and towns	1
Urban villages	1.04 (0.70-1.55)
Rural villages	1.47 (0.90-2.41)
Work status	
Public sector	1.25 (0.56-2.79)
Private sector	1.06 (0.50-2.26)
self-employed	1.05 (0.47-2.34)
Not employed	1.29 (0.64-2.60)
Home-maker/student	0.96 (0.44-2.09)
Retired/other	1
Wealth status	
Lowest	0.82 (0.42-1.59)
second	0.82 (0.46-1.45)
middle	0.79 (0.45-1.39)
Fourth	0.74 (0.44-1.23)
Highest	1

Notes:**Statistically significant at $p \leq 0.05$,* Statistically significant at $p \leq 0.1$

Appendix 7: Logistic regression for the likelihood of association between childhood SES and smoking

Variable	Exp (B)-95% CI
Childhood SES	
Low	1.41 (0.58-3.40)
Medium	1.15 (0.57-2.32)
High	1
Sex	
Male	0.14** (0.06-0.28)
Female	1
Age	
≤24	1
25-34	4.39** (1.30-14.8)
35-44	5.35** (1.45-19.6)
45-54	5.52** (1.26-24.1)
55-64	13.1** (2.79-61.6)
65+	6.67** (1.12-39.5)
Marital status	
Never-married	0.48 (0.15-1.56)
Currently-married	0.52 (0.14-1.86)
Formerly-married	1
Education	
Primary or less	1.36 (0.47-3.94)
Secondary	1.10 (0.46-2.61)
Tertiary or higher	1
Residence	
Cities and towns	1
Urban villages	1.21 (0.59-2.50)
Rural villages	1.18 (0.48-2.86)
Work status	
Public sector	0.24** (0.05-1.14)
Private sector	0.84 (0.24-2.91)
self-employed	1.63 (0.50-5.36)
Not employed	0.94 (0.30-2.97)
Home-maker/student	0.92 (0.20-4.08)
Retired/other	1
Wealth status	
Lowest	2.52 (0.77-8.22)
second	1.16 (0.37-3.56)
middle	1.03 (0.35-3.02)
Fourth	1.15 (0.43-3.08)
Highest	1