AN EPIDEMIOLOGICAL INVESTIGATION OF RISK FACTORS FOR HYPERTENSION IN WINDHOEK, KHOMAS REGION, NAMIBIA

DIANAH MUKUTURE KAPUTJAZA

APRIL 2017

AN EPIDEMIOLOGICAL INVESTIGATION OF RISK FACTORS FOR HYPERTENSION IN WINDHOEK, KHOMAS REGION, NAMIBIA

A RESEARCH THESIS SUBMITTED IN PARTIAL FULLFILLMENT

OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE IN APPLIED FIELD EPIDEMIOLOGY

OF

UNIVERSITY OF NAMIBIA

BY

DIANAH MUKUTURE KAPUTJAZA

STUDENT NUMBER: 200731734

APRIL 2017

SUPERVISOR: PROF. L. HAOSES-GORASES (UNAM)

ABSTRACT

Hypertension is a major and preventable risk factor for cardiovascular diseases Khomas region has a hypertension prevalence of 57%, which is the highest in Namibia. Cardiovascular diseases related mortality is the highest among adults in Namibia. No analytical studies have been done to determine risk factors for hypertension in Namibia. We conducted a study to determine lifestyle and socio-demographic factors associated with hypertension in Khomas region.

We conducted an un-matched 1:1 case-control study in Khomas region. Anthropometric measurements and a questionnaire were administered to both cases and controls. A case was defined as any primary hypertension patient 18 to 60 years reporting to the selected health facility. A control was defined as any person aged 18 to 60 years residing in the same neighbourhood as the selected cases. Cases were selected using consecutive sampling from four selected health facilities. Community controls were selected using simple random sampling. Bi-variate analysis was conducted to determine the odds ratios and 95% confidence level. Factors which were significant at p-value less than 0.05 were retained in multiple logistic regression model to determine significant associations.

A total of 131 cases and 131 community controls were interviewed**.** The mean (±SD) age of the participants was 39.8 (±13.5) years. Overall, 184 (70.2%) of participants were female. Central obesity was found to be associated with hypertension (OR=3.42, 95% CI=1.99 – 5.87, P = 0.001) at the bivariate level. The multivariate analysis found that older age (OR = 1.08, 95% CI= 1.05 – 1.13, P = 0.001), attaining tertiary education (OR = 0.28, 95% CI= 0.08 – 0.92, P = 0.04) were found to be protective against hypertension, while BMI ≥ 25 (OR = 2.29, 95% CI: 1.06 – 4.96, P = 0.03) was significantly associated with hypertension.

Being Overweight/obesity and primary education are major risk factors for hypertension in Khomas region. Interventions targeted at reducing obesity in the general population are needed to curb the increase of hypertension.

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LIST OF ABBREVIATIONS

AOR	**Adjusted Odds Ratio**
BMI	**Body Mass Index**
BMR	**Basal Metabolic Rate**
CDC	**Centers for Disease Control and Prevention**
CHD	**Coronary Heart Disease**
CI	**Confidence Interval**
CVDs	**Cardiovascular Diseases**
DALYs	**Disability Adjusted Life Years**
HEWs	**Health Extension Workers**
HIC	**High Income Countries**
HP	**Hypertension**
HR	**Hazard Ratio**
KHC	**Katutura Health Centre**
KMC	**Khomasdal Clinic**
LMIC	**Low and Middle Income Countries**
MET	**Metabolic Equivalent of Task**
MoHSS	**Ministry of Health and Social Services**
NCDs	**Non-Communicable Diseases**
NDHS	**Namibia Demographic and Health Survey**
NSA	**Namibia Statistics Agency**

OKC	**Okuryangava Clinic**
OR	**Odds Ratio**
PHC	**Primary Health Care**
RMC	**Robert Mugabe Clinic**
SES	**Socio-Economic Status**
SSA	**Sub-Saharan Africa**
UNAM	**University of Namibia**
WC	**Waist Circumference**
WEF	**World Economic Forum**
WHO	**World Health Organization**

ACKNOWLEDGMENTS

I would like to convey my heartfelt appreciation and thanks to all the various individuals who made it possible for me to organize and write this thesis and for their insightful suggestions and comments.

My sincere appreciation is extended to my supervisor Professor Lischen Hoases-Gorases and the FELTP Resident Advisor Dr K.M Nyarko. I am thankful for your words of encouragement and helpful insight. Moreover, I highly treasure and appreciate your academic support and guidance which ultimately enabled me to bring this research to a conclusion.

I am especially thankful to the Khomas Regional Director Ms Elizabeth Muremi and granting me permission to conduct this research work in the region and for their unconditional support.

I extend my thanks to the in-charge nurses and nursing staff at Katutura Health Centre, Okuryangava Clinic, Khomasdal Clinic and Robert Mugabe Clinic for providing space and support during data collection.

Special thanks to Ms. Melinda Hansen and Ms. Loide Nakambunda conducting the data interviews with study participants during the data collection.

Additionally, I am especially grateful to all participants who voluntarily participated in this study.

I acknowledge Ms Zoey Mbarandongo and Ms C. M Tjiurutue for editing this study.

I acknowledge (NamFELTP) residents for their encouragement and moral support.

I greatly appreciate CDC Namibia and Ministry of Health and Social Services (MoHSS) for funding this study.

My sincere gratitude goes to the University of Namibia (UNAM) and MoHSS for approving this study and providing the ethical clearance certificate.

I sincerely thank Dr. Simon Antara (former NamFELTP Advisor), for his encouragement & support.

I would like to thank Mr. Renathus Shilangale, the Head of Food Science department; Mr. Maseke the previous head of the Central Veterinary Laboratory (CVL) and public service commission for their cooperation and for granting me study leave.

I extend my most sincere appreciation to my family and friends for their prayers, support and encouragement throughout my studies.

Above all, I thank God Almighty, who gave me health, strength and wisdom throughout my academic pursuit. I give all the glory to The Almighty God.

DEDICATION

This thesis is dedicated to my loving husband, Christian Ewaga for his continuous encouragement, support, unconditional love, and understanding. May all that has been sown into this endeavour bring a hundredfold return.

DECLARATION

I, Dianah Mukuture Kaputjaza, hereby declare that this study is a true reflection of my own research, and that this work, or part thereof has not been submitted for a degree at any other institution of higher learning.

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Dianah Mukuture Kaputjaza   Date

CHAPTER ONE

INTRODUCTION AND BACKGROUND INFORMATION

1.1 INTRODUCTION

Non-communicable diseases (NCDs) are a growing global public health problem, accounting for 38 million deaths worldwide annually (World Health Organization, 2015). According to the World Health Organization (WHO), cardiovascular diseases (CVDs) account for most NCDs deaths, totalling 17 million out of the 36 million deaths due to NCDs worldwide (World Health Organization, 2011a, 2013). Furthermore 80% of deaths due to cardiovascular diseases occur in low and middle income countries (LMIC) (World Health Organization, 2013). Modifiable behavioural risk factors such as tobacco use, physical inactivity, unhealthy diet and harmful use of alcohol lead to hypertension and other metabolic and physiological changes that increase risk of CVDs and other NCDs (World Health Organization, 2015).

Elevated blood pressure or hypertension is the leading global metabolic risk factor responsible for 18% of global deaths (Lim et al., 2012) . Hypertension accounts for 45% of deaths due to heart disease and 51% of deaths due to stroke (World Health Organization, 2013) . Complications of hypertension are responsible for 9.4 million or more than half of all CVDs deaths worldwide (World Health Organization, 2013).

This makes hypertension the single most important risk factor for CVDs and a condition of public health importance. Hypertension is a state in which blood vessels have constantly elevated pressure. Normal adult blood pressure is defined as a systolic blood pressure of 120 mm Hg and a diastolic blood pressure of 80 mm Hg. Hypertension is defined as systolic blood pressure of equal to or greater than 140 mm Hg and/or diastolic blood pressure equal to or greater than 90 mmHg (World Health Organization, 2013). Elevated systolic and diastolic blood pressure levels interfere with efficient function of vital organs such as the heart, brain and kidneys and with overall health and wellbeing of individuals (World Health Organization, 2013). This leads to complications such as coronary heart disease (heart attack), cerebrovascular disease, heart failure, renal impairment, peripheral vascular disease and blindness (World Health Organization, 2011a).

The World Heart Federation reports that there are approximately 970 million hypertensive people in the world with more than 60% or 640 million of hypertensive people in LMIC (World Heart Federation, 2016). The prevalence of hypertension among African adults aged 25 years and above is 46% (World Health Organization, 2013). This presents double burden of disease for LMIC due to an already existing high burden of communicable diseases.

In Namibia stroke, ischaemic heart disease and hypertensive heart disease are among the top 10 causes of death accounting for 16.7% of all deaths in 2012 (World Health Organisation, 2015). In 2012, cardiovascular disease and diabetes accounted for 100, 000 Disability Adjusted Life Years (DALYs) in Namibia (World Health Organisation, 2015). DALYs are a sum of the number of years of life lost due to premature death and the number of years of healthy life lost due to disability. DALYs are a measure of disease burden.

The Namibia Demographic and Health Survey (NDHS) of 2013 reported that 44.2% of Namibians are hypertensive (Ministry of Health and Social Services, 2013). Khomas region has a 57% prevalence of hypertension (Ministry of Health and Social Services, 2013). This is the highest prevalence of hypertension reported in all 14 regions of the country. The prevalence of hypertension in Khomas region is higher in females, 57.3%, than in males, 56.5% (Ministry of Health and Social Services, 2013). Khomas region hosts the capital city of Namibia, Windhoek and is situated in the central plateau with an area of 37, 590 km^2 (Ministry of Health and Social Services, 2016) . The Khomas region has one health district, Windhoek district and is bordered by Otjozondjupa in the north, Omaheke in the east, Hardap in the south and Erongo in the west (Ministry of Health and Social Services, 2016).

Khomas region has a population of 342, 141 people, 50.4% female and 49.6% male and an annual growth rate of 3.1% (Namibia Statistics Agency, 2011). The Khomas region is 95% urban and only 5% rural. The largest age group population is 15 – 59 years with 69% of total regional population in this age group (Namibia Statistics Agency, 2011). Wages and salaries which account for 73% of household income and non-farming businesses which account for 14% are the main sources of income for most households in Khomas region (Namibia Statistics Agency, 2011). Farming, cash remittance and pension accounts for the remaining 10% of household income in Khomas region. According to Namibia Statistic Agency (NSA), the unemployment rate is 30%, meaning that 30% of employable people in Khomas region are unemployed (Namibia Statistics Agency, 2011).

Tobacco use, unhealthy diet, physical inactivity and harmful use of alcohol are the four main behavioural risk factors for hypertension. These unhealthy behaviours individually and collectively contribute to raised blood pressure and other metabolic/physiological changes that cause damage to the cardiovascular system and lead to the development of CVDs (World Health Organization, 2011a). We now expand on the prevalence of the four main behavioural risk factors for hypertension globally, regionally and locally in the Khomas region of Namibia.

A total of 5.8 trillion cigarettes were smoked worldwide in 2014(Eriksen, Mackay, Schluger, Gomeshtapeh, & Drope, 2015). Smoking is estimated to cause 10% of CVD deaths and is the second leading cause of CVDs after hypertension (World Heart Federation, 2012). Tobacco use and exposure to tobacco smoke causes 6 million deaths per year and accounts for 6% of female deaths and 12% of male deaths worldwide (World Heart Federation, 2012). All forms of tobacco use are harmful and cause damage to blood vessels (Blecher & Ross, 2013; Öberg, Woodward, Jaakkola, Peruga, & Prüss-Ustün, 2010). The harmful effects of tobacco use on blood pressure are exerted by causing an acute increase in blood pressure and lowering exercise intolerance. The WHO African region has a 10% prevalence of smoking which is the lowest in all WHO regions (World Health Organization, 2011a). According to the NDHS 20.3% of men and 6% of women in Namibia aged 15 – 49 years use tobacco (Ministry of Health and Social Services, 2013). In Khomas region, 18.3% of men and 5.6% of women are tobacco users (Ministry of Health and Social Services, 2013).

Harmful use of alcohol defined by regular consumption of large volumes of alcohol or heavy episodic drinking elevates blood pressure (Puddey & Beilin, 2006). It is estimated that 16% of hypertensive disease worldwide is attributed to alcohol consumption (Puddey & Beilin, 2006). According to the global status report on alcohol and health of 2014, 27.7% of Namibians aged 15 years and above consume alcohol, with beer accounting for 97% of all consumed alcohol (World Health Organisation, 2014).

The NDHS (2013) reported that 9.5% of women and 12.4% of men consumed alcohol on an average of 5 days or more in the two weeks preceding the survey. Additionally the report specified that men consumed more alcohol than women, with 52.8% of men reporting to have three or more alcoholic drinks per day compared to 34.1% of women (Ministry of Health and Social Services, 2013). Among drinkers in Khomas region, 47% consumed three or more alcoholic drinks per day and were likely to engage in heavy episodic drinking (Ministry of Health and Social Services, 2013).

Unhealthy diet is defined as the consumption of food containing too much salt, fat and little or no fruits and vegetables (World Health Organization, 2005). According to one study, global burden of disease dietary risk factors and physical inactivity collectively accounted for 10.0% (95% UI 9·2–10·8) of global DALYs in 2010 (Lim et al., 2012). Diets low in fruits and high in sodium are the most important dietary risk factors due to the direct effect of sodium on blood pressure and an increased risk of obesity. Namibians generally have a low consumption of fruits and vegetables. The average consumption of fruit and vegetable in people aged 15 – 49 years is one serving per day on one to two to days per week (Ministry of Health and Social Services, 2013). People in Khomas region consume fruit and vegetable on more days each week (three to four days) compared to the national average.

Physical inactivity is defined as less than 5 times of 30 minutes moderate physical activity per week or less than 3 times of 20 minutes vigorous physical activity (World Health Organization, 2011a). Physical inactivity is the fourth leading risk factor for mortality, causing 3.2 million deaths and accounting for 32.1 million DALYs (2.1%) worldwide (World Health Organization, 2011a). Physical activity plays a key role in energy balance and weight management leading to positive changes in weight loss and improved blood pressure. The NDHS of 2013 reported that 73% of Namibians aged 15 – 64 years are physically inactive (Ministry of Health and Social Services, 2013). The prevalence of physical inactivity in Namibia is higher in women than men, with 79.6 % physically inactive women and 58.1% physically inactive men (Ministry of Health and Social Services, 2013). Similarly 76.2 % of women and 50.8% of men in Khomas region are physically inactive.

Obesity is defined as an atypical or extreme accumulation of fat that has a negative impact on the health and wellbeing of individuals (Ellulu, Abed, Rahmat, Ranneh, & Ali, 2014). Unhealthy diet and physical inactivity lead to imbalance between energy intake and expenditure that often results in overweight or obesity. In 2014, the global prevalence of overweight or obesity among adults aged 18 years and over was 39% and 13% respectively (World Health Organization, 2016b). In addition, overweight and obesity cause approximately 3·4 million deaths, 3·9% of years of life lost, and 3·8% of disability-adjusted life-years (DALYs) worldwide (Ng et al., 2014)

. In Africa, obesity is higher in urban compared to rural settings.Furthermore, the prevalence of obesity in women in Africa is more than double that of their male counterparts (World Health Organization, 2016a). Data from a meta-analysis of prevalence studies in Sub-Saharan Africa (SSA) indicate that the prevalence of overweight and obesity is 15.9% (95% CI: 17.7 – 16.0) and 6.7% (95% CI: 6.6-6.8) respectively. The prevalence of overweight and obesity is higher in Namibian women compared to men (Ministry of Health and Social Services, 2009). Findings from the STEPS II survey of 2005 indicate that 43.2% of women in Namibia were overweight/obese compared to 20.3% overweight/obese men (Ministry of Health and Social Services, 2009). There is a great disparity in the prevalence of overweight/obese by sex in Khomas region with 40.8% women classified as overweight/obese compared to 16.9% overweight/obese men (Ministry of Health and Social Services, 2013).

1.2 STATEMENT OF THE PROBLEM

The hypertension prevalence in Khomas region is 57% of adults aged 35 to 64 years of age (Ministry of Health and Social Services, 2013). This is the highest prevalence of hypertension reported in all 14 regions of the country. Data on the prevalence of known risk factors for hypertension in Namibia and Khomas region is available through findings from the NDHS and the WHO STEPS surveys.

Even though Khomas region has the highest prevalence of hypertension in Namibia, prevalence studies show that the region does not have the highest prevalence of all known risk factors for hypertension. Thus, an explanation for the high prevalence of hypertension in Khomas region cannot be derived from current published literature. Published literature on risk factors for hypertension in Namibia employed cross sectional study methods which only determine prevalence and cannot be used to infer causal associations. Furthermore, there are no known analytical studies conducted in Khomas region, Namibia on the risk factors of hypertension.

It is therefore important to determine the risk factors of hypertension in Khomas region using an analytical epidemiological study method. Published literature from studies that compare the prevalence of hypertension to the prevalence of various risk factors in Khomas region in particular is sparseThere is a need to identify population specific risk factors of hypertension in Windhoek due the high prevalence of hypertension in the Khomas region. This will generate region specific data which might be used in designing population and risk factor specific interventions for control of hypertension in the region and in the country at large.

1.3 PURPOSE , RESEARCH OBJECTIVES AND HYPOTHESES

1.3.1 Purpose of the study

The purpose of the study is to determine the socio-demographic and behavioural risk factors for cases of essential/primary hypertension among residents of Windhoek in the Khomas region of Namibia.

1.3.2 Research objectives

1. To determine the association between primary hypertension and socio-demographic characteristics (age, sex, level of education, ethnicity, marital status, type of occupation and income) among residents of Windhoek in Khomas region.
2. To determine the association between primary hypertension and tobacco use, alcohol use, diet, physical activity and overweight/obesity among residents of Windhoek in Khomas region.

1.3.3 Hypotheses of the study

Hypothesis 1:

H_o: Primary hypertension is not associated with age, sex, level of education, ethnicity, marital status, type of occupation and income among residents of Windhoek in Khomas region.

H_A: Primary hypertension is associated with age, sex, level of education, ethnicity, marital status, type of occupation and income among residents of Windhoek in Khomas region.

Hypothesis 2

H_o: Primary hypertension is not associated with tobacco use, alcohol use, diet, physical activity, and overweight/obesity among residents of Windhoek in Khomas region.

H_A: Primary hypertension is associated with tobacco use, alcohol use, diet, physical activity, and overweight/obesity among residents of Windhoek in Khomas region.

1.4 SIGNIFICANCE OF THE STUDY

Hypertension is the single most important risk factor for cardiovascular diseases. The prevalence of hypertension in Khomas region is high compared to other LMIC (Hendriks et al., 2012). Controlling the growing epidemic of hypertension and cardiovascular diseases in Khomas region will require the employment of population wide primary prevention strategies (World Health Organization, 2008). Such prevention strategies require population specific data on important risk factors and risk group to ensure that interventions are targeted to important risk factors and high risk groups. Hence, findings from this study will provide the major risk factors for hypertension for Khomas region, which will be used to inform policy and also develop prevention strategies for hypertension. Secondly, the findings will form an important foundation for analytic epidemiological research and inform further studies in hypertension research. This will enable government agencies to make informed decisions and make efficient use of limited resources when designing interventions to control and prevent hypertension and its associated conditions.

1.5 OPERATIONAL DEFINITIONS

1.5.1 Socio-demographic factors: This refers to indices of person characteristics such as age, sex, marital status, ethnicity, average family size income and education level (http://www.businessdictionary.com, 2016).

1.5.2 Behavioural factors: These are lifestyle factors that may affect personal risk for hypertension. These are modifiable factors such as diet, level of physical activity and alcohol and tobacco use (World Health Organization, 2013).

1.5.3 Hypertension: Also known as an elevated blood pressure or high blood pressure is defined as systolic blood pressure of equal to or greater than

140 mm Hg and/ or diastolic blood pressure equal to or greater than 90 mmHg (World Health Organization, 2013).

1.5.4 **Residents:** These are all persons who lives or has their home Windhoek Health District permanently or for a minimum period of six months or more (Cambridge University Press, 2008).

1.5.5 **Essential/Primary hypertension:** This refers to hypertension in which secondary causes such as renovascular disease, renal failure, pheochromocytoma, aldosteronism, or other causes of secondary hypertension are not present (Carretero & Oparil, 2000).

1.5.6 **Unhealthy diet:** This means high dietary intake of saturated fat, trans fat cholesterol, and salt and low intake of fruits, vegetables and fish (World Health Organization, 2011a).

1.5.7 **Harmful use of alcohol:** This can be explained as alcohol consumption that causes detrimental health consequences for the drinker, as well as the patterns of drinking that are associated with increased risk of adverse health outcomes (World Health Organisation, 2014).

1.5.8 **Tobacco use:** This refers to any habitual use of the tobacco plant leaf and its products. This includes smoking cigarettes, pipes and cigars as well as use of smokeless tobacco in the form of snuff and chewing tobacco (Al-Ibrahim & Gross, 1990).

1.5.9 **Physical activity:** Any bodily movement produced by skeletal muscles that requires energy expenditure – including activities undertaken while working, playing, carrying out household chores, travelling, and engaging in recreational pursuits (World Health Organization, 2016c).

1.5.10 **Overweight and obesity:** This is defined as abnormal or excessive fat accumulation that may impair health (World Health Organization, 2006).

1.5.11 **Body Mass Index (BMI):** This refers to a measure of weight adjusted for height, calculated as weight in kilograms divided by the square of height in meters (kg/m^2) A BMI over 25 kg/m^2 is defined as overweight, and a BMI of over 30 kg/m^2 as obese (Centers for Disease Control and Prevention, 2011).

1.6 LIMITATIONS OF THE STUDY

The proposed study will be carried out at four state health centres in the city of Windhoek; therefore the findings will not be generalized to the residents who make use of private clinics. The study results will only be generalized to people of middle to low income groups who make use of state health facilities. Interviewer-administered questionnaires will be used to collect data therefore interviewer bias due to differential probing of cases and controls may occur. Interviewers will be trained on how to use the data collection tool and carry out the interview in an unbiased manner in order to prevent occurrence of interviewer bias.

1.7 SUMMARY

This chapter presented background information on hypertension as it relates to cardiovascular diseases as a global, regional, and local problem of public health importance. The chapter focused on the prevalence of known risk factors for hypertension on global, regional and local levels. The researcher expounded the research problem, purpose, objectives and hypotheses, significance and operational definitions of the study. The next chapter will deal with reviewing literature on studies carried out on the risk factors of hypertension in High Income Countries (HIC) and LMIC with special focus on analytic epidemiological studies carried out in LMIC.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

The literature review is a critical assessment of existing research in the area of study to determine the strength and weakness of exiting research and find a common thread of the major research trends (Penn State Graduate Writing Centre, 2010). The purpose of this review is to provide background knowledge on the topic of hypertension and its risk factors and establish a basis for undertaking the current study based on gaps in knowledge or research. An in-depth review providing evidence between the relationship and each hypothesized risk factor based on mechanisms of action and findings from epidemiological studies will be outlined.

2.2 PREVALENCE OF HYPERTENSION

2.2.1 Global Perspective

Hypertension is the leading cause of premature death worldwide. According to the WHO (2011a), hypertension accounts for approximately 7.5 million deaths and attributes to 12.8% of the total of global deaths. Global mortality caused by hypertension accounts for 57 million disability adjusted life years (DALYS) or 3.7% of total DALYS. According to a systematic analysis of population based studies from 90 Countries, the global prevalence of adults with hypertension in 2010, was 31.1% (95% confidence interval, 30.0%–32.2%); with 28.5% (27.3%–29.7%) in high-income countries and 31.5% (30.2%–32.9%) in low- and middle-income countries (Mills et al., 2016). Although the age-standardized prevalence of hypertension decreased by 2.6% in HIC, the prevalence in LMIC increased by 7.7% from 2000 to 2010 (Mills et al., 2016).

2.2.2 Regional Perspective

According to the reviewed literature, the prevalence of hypertension in LMIC ranges from 22.4% to 29.4% (Abebe, Berhane, Worku, & Getachew, 2015; Guwatudde et al., 2015; Helelo, Gelaw, & Adane, 2014; Olack et al., 2015; Yang et al., 2016). The NDHS of 2013 determined the prevalence of hypertension in Namibia using blood pressure measurements, self-reported hypertension diagnosis and the use of hypertensive medication. NDHS found that 44% of women and 45% of men aged 35 to 64 years in Namibia have hypertension (Ministry of Health and Social Services, 2013). The prevalence of hypertension in Windhoek is even higher with 57% of adults in Windhoek aged 35 to 64 years found to have elevated blood pressure or taking hypertensive medication. This prevalence is higher than the 22.4% to 29.4% found in studies in other LMIC.

Although the prevalence rates being compared here are not age standardized, these studies indicate that the magnitude of hypertension in Windhoek may be higher than in other communities in LMIC. These findings are reiterated in a study by (Hendriks et al., 2012) in which they conducted four household cross sectional surveys in two rural and two urban populations in Sub-Saharan Africa with Windhoek being one of the urban populations. The study found that prevalence of hypertension was higher in urban populations in Tanzania and Namibia compared to rural populations in Nigeria and Kenya. Age standardized prevalence of hypertension in Windhoek was 38% (95% CI: 35.9 – 40.1), while Dar es Salaam (urban Tanzania) had a prevalence of 23.7% (21.3 – 26.2) (Hendriks et al., 2012).

The prevalence of hypertension in Windhoek found in this study is comparable to the prevalence of hypertension in adults in the USA, where overall prevalence is 31% and 38.6% in non-Hispanic blacks (Gillespie, Kuklina, Briss, Blair, & Hong, 2011). The observation that the prevalence of hypertension in Windhoek is comparable to that of HIC is of great concern and calls for introspective and scientific research to determine the factors driving this epidemic.

2.3 CONCEPTUAL FRAMEWORK

A conceptual framework is defined as a map that is constructed to characterize the causal relationship between a problem and the factors that contribute to it (Shi & Singh, 2011). In epidemiology, using an appropriate conceptual framework model plays a fundamental role in guiding the data analysis process and ensuring correct interpretation of research findings. Non-communicable diseases such as CVDs are not caused by a single factor but a complex web of multiple risk factors (Department of Health, 2007). Conditions attributed by multiple causes and risk factors are often displayed in a hierarchical model of causes, in which some causes are the proximal or direct and others are distal or indirect causes.

In a hierarchical conceptual model, direct causes are known as precipitating factors and the indirect caused are enabling factors (Bonita, Beaglehole, & Kjellstrom, 2006). Hierarchical relationships between potential causal factors are represented by arranging the factors in a tree-like diagram. In this study a hierarchical conceptual model based on the nature of the relationship between factors associated with hypertension was constructed. Figure 2.1 shows the conceptual framework for this study.

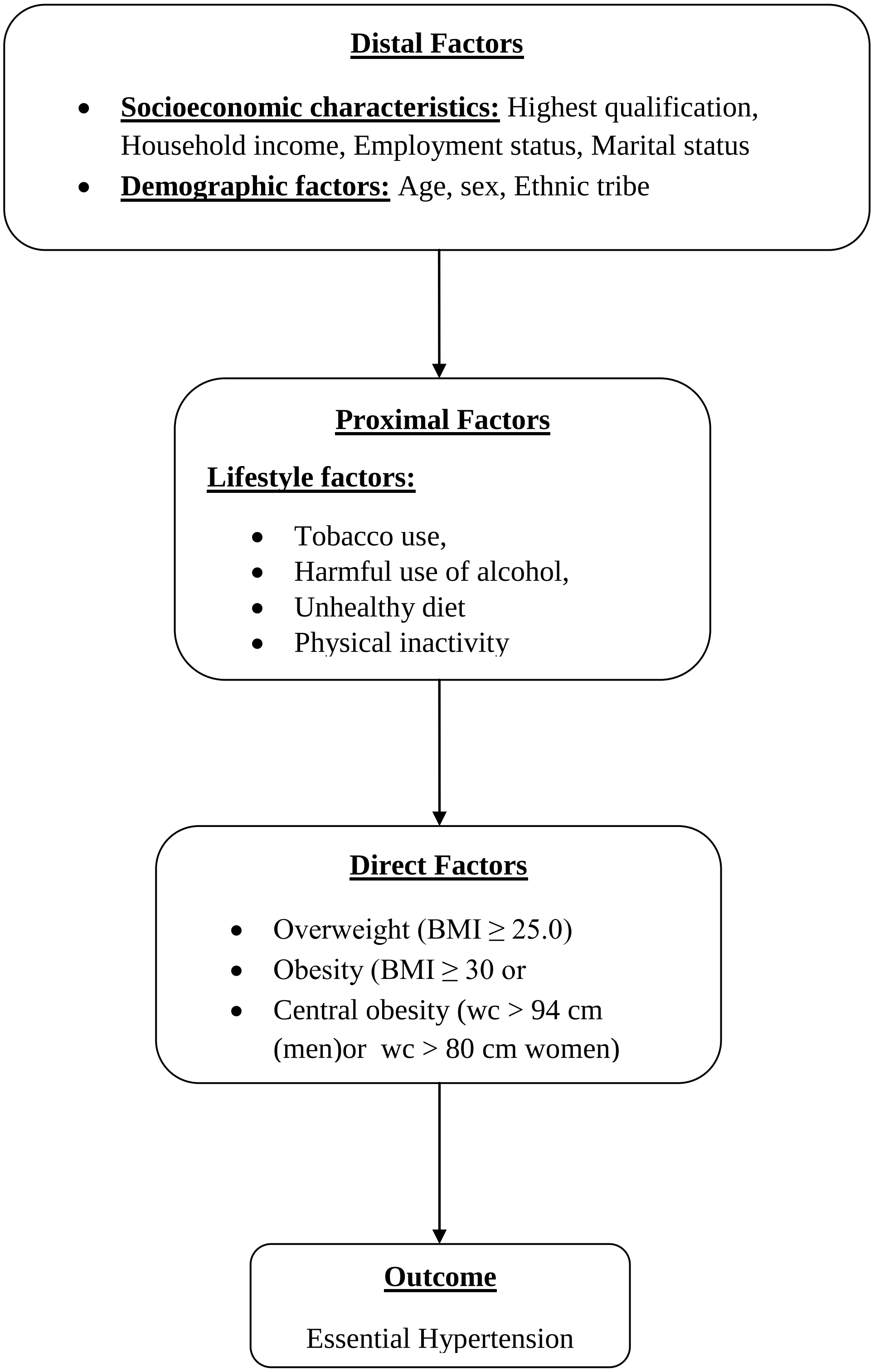

Figure 2.1 Conceptual framework model showing relationship between factors associated with hypertension.

The model shown in Figure 2.1 was adapted from a similar model used by Fuchs and Camey (2008). In Figure 2.1, independent variables are grouped into different hierarchical levels of determination. Socio-economic characteristics (highest level of qualification obtained, average monthly household income, employment status, and marital status) and demographic factors (age, sex, ethnic tribe) are characterized as distal determinants in the top tier. Lifestyle factors such as tobacco use, harmful use of alcohol, unhealthy diet, and lack of vigorous or moderate physical activity are characterized as proximal lifestyle risk factors in the second tier.

These proximal factors lead to the physiological changes of overweight and obesity (determined by BMI and waist circumference) known as direct risk factors for hypertension. However it is important to note that some factors classified as distal determinants of hypertension in this model have been shown to have a direct causal relationship with hypertension not mediated through the proximal determinants. This relationship is shown by the arrows that go from the top tier directly to outcome (hypertension) from the arrows in Figure 2.1.

2.4 RISK FACTORS FOR HYPERTENSION

As discussed in the previous chapter, hypertension is the most significant intermediate risk factor for CVDs. Controlling the growing epidemic of hypertension and subsequent

CVDs requires population wide primary prevention intervention to reduce of exposure of the population and individuals to known risk factors. Determining country specific risk factors for hypertension is important as it provides information for interventions that can be targeted to high risk groups or towards the most important risk factors. WHO has identified four main risk factors for all NCDs including hypertension, namely; obesity, tobacco use, physical inactivity and harmful use of alcohol.

Numerous cross sectional studies have been done on the prevalence of risk factors for hypertension in LMIC and in the African continent. The most common factors that have been found to be associated with hypertension are older age, obesity, male sex, family history, education level, marital status, physical inactivity, diabetes, added table salt and low vegetable diet (Helelo et al., 2014; Joshi et al., 2014; Olack et al., 2015; Yang et al., 2016). Although the prevalence of harmful alcohol use, tobacco use, unhealthy diet and physical inactivity in Windhoek have been determined, studies are lacking that show the association between these factors and hypertension. Furthermore, no epidemiological studies have been done using analytic study designs such as cohort or case control. There is scarcity of analytic epidemiological studies on the risk factors of hypertension in Sub-Saharan Africa (SSA), particularly in Namibia.

2.4.1 Non-Modifiable Risk Factors of Hypertension

A vast majority of studies in LMIC have demonstrated associations between hypertension and non-modifiable risk factors of older age, sex, family history of CVDs and ethnicity (Abed, 2013; Guwatudde et al., 2015; Hendriks et al., 2012; Joshi et al., 2014; Olack et al., 2015; Paolo, Michelle, & Miller, 2016; Pires, Sebastião, Langa, & Nery, 2013; Tadesse & Alemu, 2014; Yang et al., 2016; Zhang et al., 2013). Old age was the most common risk factor for hypertension found in most if not all of these cited studies. The NHDS found that the prevalence of hypertension among respondents increased with increasing age, with the lowest prevalence recorded in those aged 25 – 39 years and the highest prevalence in those aged 55 – 64 years (Ministry of Health and Social Services, 2013). The prevalence of hypertension by age for Khomas region was not reported in the findings from the NDHS of 2013.

According to the American Heart Association (2014), the elasticity of blood vessels increases with increasing age resulting in increased blood volume and a subsequent increase in blood pressure. Although blood pressure increases naturally with age, adopting a healthy lifestyle such as healthy diet, minimal use of alcohol, not using tobacco and engaging in regular physical activity, may reduce the effect of blood pressure due to age. That said, engaging in the unhealthy behavioral risk factors may further increase risk of hypertension in individuals of older age. (World Health Organization, 2011b)

2.4.2 Hypertension and Socio-Economic Factors

Background data in a report from the World Economic Forum (WEF) indicates that risk for hypertension has been shown to increase with increase in SES in LMIC while the opposite is true for HIC, where hypertension risk is greater in those with lower SES (Bloom et al., 2011). A meta-analysis of articles published on PubMed in English until 2014 found that low SES indicated by occupation, education and income is associated with increased risk for hypertension (Leng, Jin, Li, Chen, & Jin, 2015).

Similarly the NDHS found a non-linear proportional relationship between prevalence of hypertension and wealth in both men and women (Ministry of Health and Social Services, 2013). The prevalence of hypertension in Namibia was found to be higher in women with no formal training (53%) and men with more than a secondary education (59%). Lam (2011) stressed that the association between SES and hypertension is not a single direct one but a complex one mediated by the effects of income, occupation, and education on diet and exercise. Khomas region has reported the highest prevalence of hypertension in Namibia and an assessment of the effect of SES indicated by wealth, education and income, on hypertension in the region is required.

2.4.3 Overweight/Obesity and Hypertension

Excess body weight is associated with increase in arterial blood pressure and this has been shown to account for 60 to 70 % of hypertension cases in HIC (Kotchen, 2010). A great number of cross sectional studies have found a positive association between being overweight/obese indicated by a by BMI of 25 and above and hypertension (Guwatudde et al., 2015; Hendriks et al., 2012; Olack et al., 2015; Pires et al., 2013; Tadesse & Alemu, 2014; Yang et al., 2016; Zhang et al., 2013). Several other cross sectional studies also found high rates of hypertension in centrally obese people (Joshi et al., 2014; Pires et al., 2013; Yang et al., 2016).

The association between obesity and hypertension has also been found in case control studies in LMIC (Dalai et al., 2014; Pilakkadavath & Shaffi, 2016; Sagare, Rajderkar, & Girigosavi, 2011). Dalai et al. (2014), found being overweight/obese as indicated by mean BMI, waistline and hipline was significantly higher in hypertensive people compared to non-hypertensive people with $P < 0.01$. Similarly, Pilakkadavath and Shaffi (2016) conducted a hospital based matched case control study to determine the distribution of certain modifiable risk factors among cases and controls and to estimate the effect relationship of risk factors. Despite the presence of possible Berksonian bias as all study participants were overweight, obesity was still found to be significantly higher in cases compared to controls with a $P < 0.001$ (Pilakkadavath & Shaffi, 2016).

According to the NDHS 41% of women and 17% of men aged 15 – 49 years in Khomas region are overweight/obese (Ministry of Health and Social Services, 2013). The NDHS (2013) also found that overweight/obesity was higher in urban compared to rural populations in both men and women. Furthermore, the proportion of overweight/obese women and men increased with increasing age and wealth quintile (Ministry of Health and Social Services, 2013). Given that the NDHS is a cross sectional survey and does not have sufficient power to link the high prevalence of obesity in Khomas region to the high prevalence of hypertension, analytical studies are needed to further consolidate these findings and investigate possible existing associations.

2.4.4 Unhealthy Diet and Hypertension

An unhealthy diet consisting of high intakes of salt, saturated fat and trans-fat cholesterol and low intake of fish, fruits and vegetables is related to increased risk for CVD and hypertension (World Health Organization, 2011a). Unhealthy diet also increases risk for hypertension by escalating the risk for obesity in the physically inactive. Apart from exacerbating the age related increase in blood pressure, dietary salt also increases the blood pressure in the majority of people with hypertension and in about 30% of people with normal blood pressure (World Health Organization, 2011a). Several case control studies have shown a positive causal association between diet and hypertension (Dalai et al., 2014; Mishra & Kumar, 2011; Sagare et al., 2011). Dalai et al. (2014) conducted a case control study to determine the factors associated with the development of essential hypertension in Mongolians minority group in China. The study was conducted in the Mongolians due the high prevalence of hypertension, traditional nomadic lifestyle of this group. The study found that hypertensives consumed less milk, vegetables and fruits and had higher salt intake compared to the non-hypertensive ($p < 0.05$) (Dalai et al., 2014). The researchers concluded that dietary history and habits had the most important influence on the development of hypertension in the Mongolian population.

A similar study was done by Sagare et al. (2011), to study the risk factors of essential hypertension in a rural township, Tasgaon, in India. Salt intake and type of diet was assessed. Diet was defined as vegetarian or mixed diet where mixed diet was described as consuming eggs and meat in addition to a vegetarian diet. The risk of hypertension in persons with the mixed dietary pattern was nearly two times higher than in persons with the vegetarian diet (Sagare et al., 2011). Similarly, persons consuming more than 5 grams of salt per day also had twice the risk of developing hypertension compared to those who consumed less that 5 grams per day (Sagare et al., 2011). Comparable studies have been done examine the protective effect of low salt diet/intake on blood pressure (Mishra & Kumar, 2011; Villegas, Kearney, & Perry, 2008). Mishra and Kumar (2011) carried out a community based case control study to identify the risk factors of hypertension in rural Varanasi, in India. Nutritional status data was captured using an oral questionnaire using a 24 hours dietary recall method. The rate of energy expenditure was calculated in basal metabolic rate (BMR) using data on time that respondent spend on various activities and the corresponding multipliers.Villegas, Kearny and Perry (2008) aimed to determine the cumulative effect of factors associated with reduced hypertension and dyslipidemia in the adult population in Ireland. A modified food frequency questionnaire was used to obtain dietary data. They found strong protective associations between the number of protective factors including dietary pattern and hypertension and dyslipidemia (Villegas et al., 2008). This study demonstrates the protective effect of reducing exposure to risk factors of hypertension. The NDHS reported that residents of Khomas region consume fruits and vegetable an average of one or twice per day on an average of three to four days per week (Ministry of Health and Social Services, 2013). Other dietary measures such as the level of salt intake and saturated fat among residents of Khomas region was not evaluated in NDHS of 2013.

2.4.5 Physical inactivity and Hypertension

Regular physical activity reduces blood pressure in both normotensive and hypertensive people with greater decreases observed in the hypertensive people (Fagard & Cornelissen, 2007). The reduction of blood pressure produced by physical activity on blood pressure is mediated by its effect on the endothelial function of blood vessels thus enhancing vasodilatation and vasomotor function (World Health Organization, 2007). Furthermore, physical activity helps to prevent excessive weight gain by maintaining energy expenditure balance and healthy weight control.

Various observational and analytic studies have evaluated the role of physical inactivity and hypertension. Physical inactivity is associated with approximately 20% of hypertension cases worldwide (Campbell, Lackland, & Niebylski, 2014). Olack et al. (2015) conducted a community based cross sectional survey among adults aged 35 years and older in urban slum in Nairobi, Kenya. Responses from questions on physical activity were converted to metabolic equivalent of task (MET) minutes per week. Low activity was classified as < 600 MET/week, moderate activity classified as 600 to 1500 MET minutes/week and high activity classified as > 1500 MET minutes/week. The results showed that participants with moderate physical activity were 1.5 (AOR =1.5 (1.1-2.1)) times more likely to be hypertensive compared to those with high physical activity. Similar results were found in two case control studies carried out in India (Pilakkadavath & Shaffi, 2016; Sagare et al., 2011).

In a similar study, Sagare et al (2011) conducted a case control study using 165 cases and 330 age and sex matched controls. Leisure time physical activity was significantly higher in control than in cases, p value < 0.05 (Sagare et al., 2011). The odds of having no leisure time physical activity were two times higher in cases than in controls. Similarly, Pilakkadavath & Shaffi (2016), found that physical inactivity was among the significant risk factors for hypertension after adjusting for confounders (Pilakkadavath & Shaffi, 2016). According to the NDHS (2013), the prevalence of physical inactivity among people aged 15 – 54 years is 76.2% in women and 50.8% in men. Furthermore, more men (33.3%) engage in non-work related physical activity compared to women

(16.1%). Similarly, the prevalence of work related physical activity in Khomas region is higher in men (16.1%) than in women (7.6%) (Ministry of Health and Social Services, 2013). This low prevalence of physical inactivity coexisting with a high prevalence of hypertension in Khomas region is reason for concern and requires research to determine possible association.

2.4.6 Harmful Use of Alcohol and Hypertension

Studies have found both a protective effect and harmful effect of alcohol consumption on hypertension. Light to moderate consumption of alcohol has been shown to have a protective effect by reducing hypertension and overall CVD risk, whereas, heavy consumption of alcohol has associated with increased risk for hypertension and CVD risk in men and women (Briasoulis, Agarwal, & Messerli, 2012; Son, 2011). A systematic review and meta-analysis of prospective control studies which examined the risk of developing hypertension based on alcohol consumption was carried out by Briasoulis, Agarwal, and Messerli in 2012. Sixteen prospective studies (33,904 men and 193,752 women) were included in the analysis. The meta-analysis found that men who consumed less than 10 g/d and 11 to 20 g/d of alcohol had an increased risk of hypertension with an even greater risk among those who consumed 31 to 40 g/d of alcohol (Briasoulis et al., 2012). This reveals a dose-response relationship between amount of alcohol consumed by men and risk for hypertension. In women, the meta-analysis showed that women who consumed less than 10g/d and between 11 g/d to 20 g/d had reduced risk of developing hypertension (Briasoulis et al., 2012). However the meta-analysis by Briasoulis et al (2012) found an increased risk of developing hypertention in women who consumed 21 to 30 g/d and 31 to 40 g/d of alcohol. This analysis shows a J shaped relationship between alcohol consumption and hypertension risk in women with a protective effect observed at low to moderate consumption and a harmful effect observed with heavy consumption of alcohol.

A similar J shaped relationship between alcohol consumption and risk of hypertension was observed in a cross sectional study by Son in 2011. Son (2011) aimed to identify the association between alcohol consumption and hypertension, and verify whether this association is influenced by age. A decreased risk of hypertension was observed with light to moderate alcohol consumption of 4 to 10 drinks per week in people younger than 60 years (OR= 0.32; 95% CI, 0.11–0.97), but not in people older than 60 years (OR = 0.70; 95% CI, 0.31–1.58) (Son, 2011).

Thus, the relationship between alcohol consumption and hypertension risk in this study was mediated by age with smaller volumes of alcohol consumed associated with increased risk for hypertension among the elderly but not among the younger study participants. Some arguments against the protective effect of light to moderate consumption of alcohol on hypertension and CVD risk have been made. Critics against this effect argue that the inclusion of former drinkers who decreased their drinking or ceased altogehter due to old age or medical reasons in the non-drinkers category introduces confounding factors which result in a spurous association that there is a safe level of alcohol consumption (World Health Organization, 2007). A recent meta-analysis tested the hypothesis that including occational or fomer drinkers in the abstainer category results in misclassification error and possible spurious protective association of light to moderate alcohol consumption on all cause and coronary heart disease (CHD) mortality. The results from the meta-analysis show that studies that did not have the misclassification error found that abstainers and light to moderate drinkers were equally at risk to mortality due to all causes and CHD (Fillmore, Stockwell, Chikritzhs, Bostrom, & Kerr, 2007). This meta-analysis showed that the protective effect of moderate alcohol consumption may have been exagerated in previous epidemiological studies due to possible systematic errors. Further research examining these claims is needed to confirm the magnitude of protection or harm of various amounts of alcohol consumption on different categories of people.

Among women aged 15 to 54 years in Khomas region, 15.3% consume alcohol on three or more days and 47% consume three or more drinks per day (Ministry of Health and Social Services, 2013). Among men aged 15 to 54 years in Khomas region 35.8% consumed alcohol on three days or more and 57.2% consume three or more alcohol drinks per day (Ministry of Health and Social Services, 2013). This shows heavy consumption of alcohol in both men and women in Khomas region with men having a higher prevalence of this behaviour compared to women. The NDHS (2013) also shows that the percentage of Namibians who ever consumed alcohol increases with increasing level of education and wealth. In light of current debates in the role of alcohol consumption as a risk for hypertension and other CVDs, it is vital to determine the association between all levels of alcohol drinking in Khomas region and the high prevalence of hypertension in this region.

2.4.7 Tobacco Use and Hypertension

Various studies have been done to determine the association between tobacco and hypertension and CVDs. All forms of tobacco use, including use of smokeless tobacco and exposure to second hand smoke, exert a harmful effect on blood pressure and increase the risk for hypertension and CVDs (Aurelio, 2015; Ayo-Yusuf & Omole, 2008; Pandey et al., 2009). Smoking tobacco exerts a greater effect on blood pressure compared to smokeless tobacco and exposure to second hand smoking in adults and children. Aurelio (2012) analyzed the role of tobacco smoke products that interfere with blood pressure. Nicotine increases blood pressure directly by stimulating neuro-humoral metabolites and carbon monoxide causing an increase in blood pressure due to damaged artery walls resulting in toxic direct action on the endothelial and red blood cells (Leone, 2012). The relationship between tobacco use as a risk factor for hypertension is complex and not always detected by epidemiological studies. This is because the increased risk posed by smoking on hypertension is a cumulative in nature, with increased risk being dependent on the type and length of exposure to tobacco use.

A secondary data analysis undertaken using data from the Ukraine Household survey found no evident to support smoking as risk factors for hypertension (Pradhan, 2014). Odds ratios for daily smokers and occasional smokers compared to non-smokers were not significant before and after adjusting for possible confounders. On the contrary, a prospective cohort study 28, 236 women free from hypertension, CVD and cancer from the women's health study was undertaken to the prospectively evaluate the effect of cigarette smoking as a risk for developing hypertension (Bowman, Gaziano, Buring, & Sesso, 2007). Age adjusted Hazard Ratios (HR) of developing hypertension among never, former and current smokers of 1 – 14 and ≥ 15 cigarettes were computed and further adjusted for lifestyle, clinical and dietary factors. Former and current smoking of 1 -14 cigarettes was not associated with increased risk for developing hypertension (Bowman et al., 2007).

Cigarette smoking of ≥ 15 cigarettes was modestly associated with an increased risk of developing hypertension with a HR of 1.11 (95% CI 1.03 to 1.21) while those who smoked ≥25 cigarettes a day had a HR of 1.21 (95% CI 1.06 to 1.39) (Bowman et al., 2007). Although the association found in this study was modest, these findings provide vital epidemiological evidence for the cumulative effect of tobacco use with those who smoke more cigarettes being at greater risk for hypertension. Smokeless tobacco has also been shown to be associated with increased risk for hypertension while other studies fail to find this association (Pandey et al., 2009). A study on snuff use and risk for hypertension among black South African women found that, even though snuff use increased blood pressure to levels that are associated with increased risk for CVDs at population level, there was no significant association between snuff use and hypertension (Ayo-Yusuf & Omole, 2008). Contrary to these results, a study on exclusive smokeless use and hypertension among men in rural northern India found that smokeless tobacco use was associated with increased prevalence of hypertension (Pandey et al., 2009).

The prevalence of tobacco use in Namibia is higher in rural (26.5%) compared to urban (16.5%) populations and in people with no education (25.7%) compared to those with more than a secondary education (8.9%). Cigarette smoking is the most common form of tobacco use in Khomas region. The prevalence of tobacco use in Khomas region is higher in men (23.1%) compared to women (5.9%) (Ministry of Health and Social Services, 2013). The relationship between tobacco use and hypertension has not been evaluated in past cross sectional or analytic epidemiological studies.

2.5 SUMMARY

This chapter reviewed literature on current cross sectional and analytic studies on the risk factors of essential hypertension. The effect demographic, socio-economic and behavioural and physiological factors on hypertension were critically assessed by looking at the current research in HIC and LMIC in order to establish the need for this study in Khomas region of Namibia. The next chapter will provide a description of the research methodology used in this study.

CHAPTER THREE

METHODOLOGY

3.1 INTRODUCTION

This research methodology outlines the methods and procedures used in a study, that is the design or structure, specific details of the studied population, sampling approach and technique, sample size, data collection method and procedures, including ethical considerations and data processing and analysis (Brink, van der Walt, & van Rensburg, 2012; Miquel, Greenland, & Last, 2008). The purpose of this chapter is to provide a detailed description of the investigation carried out to provide answers for the proposed research questions and hypotheses. The description provided in this chapter will be detailed to allow replication of this study by other researchers in similar or in different settings

3.2 RESEARCH DESIGN

The research design is defined as the structure of a study and encompasses the specific details of the study population, time frame, method, procedures, and ethical considerations (Miquel et al., 2008). This research design of this study was quantitative, descriptive and analytical in the form of a case control study. The case control study design which employs a quantitative and non-experimental approach was used to determine the association between essential hypertension and the behavioural risk factors of diet, physical activity, harmful use of alcohol and tobacco use. The specific study design for this study was an unmatched case-control study.A quantitative approach is deductive in nature and focuses objectivity, replicability, and generalizability of findings (Harwell, 2011). Furthermore, quantitative studies involve the use and analyses of numerical data using statistical techniques to test the strength and significance of relationships between two or more variables. To test the strength and significant of a hypothesized relationship between essential hypertension and behavioural factors, anthropometric measurements and a questionnaire with close ended questions were used to collect numerical and categorical data on behavioural factors in people with hypertension (cases) and in those without hypertension (controls).

A case control study is an analytical study. Analytical studies examine hypothesized causal relationships and are primarily concerned with identifying or quantifying the effects risk factors (Miquel et al., 2008). An analytical approach was used to evaluate possible causal relationship between the variables and the outcome of interest. The analytical approach was applied by comparing the level of exposure of selected variables in hypertension cases to an appropriate comparison group of individuals without hypertension. This was done in order to determine the odds of disease and infer possible causation between test variables and hypertension. A case control study is an epidemiologic study that identifies and selects individuals who develop a particular health condition (cases), in this case hypertension, and comparable individuals who do not (controls) (Greg & Emily, 2015). Data on exposure history in the two groups are collected and compared to identify factors associated with developing the health condition or outcome. The researcher applied the case control study design to investigate differences in exposure to tobacco use, alcohol consumption, physical activity and diet between cases of essential hypertension and a comparison group of individuals from the same neighbourhood without hypertension. According to Song and Chung (2010), case control studies allow researchers to investigate the relationship between multiple exposures and the health outcome of interest. Furthermore, case control studies have been shown to have greater statistical power to detect differences between cases and controls compared to other observational studies with the same sample size (Song & Chung, 2010).

In addition, descriptive methods were applied to the analysis of data collected from study participants. A descriptive design is mainly focused on depicting the existing distribution of variables in a study population (Miquel et al., 2008). The frequency and proportion of variables in cases and controls was described using appropriate descriptive statistical methods. Furthermore, this study was non-experimental in nature as the researcher collected data without introducing a treatment or intervention to the either one of the study groups. In non-experimental studies the researcher merely observes and is described as a bystander (Brink et al., 2012).

3.3 STUDY POPULATION

The target population indicates the population or group from which a sample or study population is drawn and is frequently defined as the set of individuals about which inferences are desired (Miquel et al., 2008). The target population for this study was all residents of Windhoek health district aged from 18 to 65 years which total up to 260, 479 people (Namibia Statistics Agency, 2012). Criteria for this study cases included all essential hypertension patients aged 18 to 65 years reporting to Katutura Health Centre (KHC), Khomasdal Clinic (KMC), Robert Mugabe Clinic (RMC) and Okuryangava Clinic (OKC) residing in the Windhoek Health District.

All hypertension patients reporting to these facilities residing outside the Windhoek District were excluded from this study. Inclusion criteria for controls was all consenting residents aged 18 to 65 years, who reside in the same constituencies as cases and who are not hypertensive or not on hypertension medication and with blood pressure readings in the normal range. Due to a natural increase in the prevalence of hypertension with increase in age (World Health Organization, 2013), this study excluded cases and control aged above 65 years.

3.4 SAMPLE SIZE AND SAMPLING PROCEDURES

Greg and Emily (2015) define sampling as "the selection of a subset of members of a population for inclusion in the study". Sampling from a defined population allows statistical inferences made from the selected sample to be generalized to the target population (Miquel et al., 2008). Systematic random sampling and consecutive sampling methods were used to select and enrol participants into the study. These methods will be explained in the sections on sampling of cases and sampling of controls respectively.

3.4.1 Sample Size

A sample is defined as "a selected subset of a population" (Miquel et al., 2008), it includes the total number of participants who will be selected and enrolled in the study from the population. Sample size is the number of targeted study participants about which the researcher wishes to enrol in the study and obtain information from (Brink, 2012). Based on an estimated population of 260, 479 people in Khomas region aged from 18 to 65 years (Namibia Statistics Agency, 2012)**,** a sample size of 262 participants (131 cases and 131 controls) was calculated using the Epi-Info 7 StatCalc function for an unmatched case-control study. The parameters used to calculate this sample size are presented in Table 3.1. A 20% percentage of exposed controls was chosen based on findings from the NDHS (2013) on the percentage of Namibian adults with BMI ≥25. The next section will describe the approach used to select cases and controls from the target population of residents in Windhoek Health District.

Table 3.1 Parameters used for sample size sample size calculation

Parameter	Specification
Confidence level	95%
Power	80%
Ratio of control to case	1:1
Percentage of exposed controls	20
Minimum detectable odds	2.2

3.4.2 Sampling of Cases

A case is defined as a "particular ailment, health disorder, or condition under investigation found in an individual or within a population or study group" (Miquel et al., 2008). For this study, a case was defined as a person aged from 18 to 65 years, who has been diagnosed with hypertension by a healthcare worker and on hypertensive medication for at least two weeks preceding the study. In this study cases were identified by verifying diagnosis in the health passports of patients before obtaining consent and conducting the interview. Hypertensive cases were selected from the four state primary health facilities that render services for hypertension cases namely KHC, OKC, KMC and RMC. Due to a limited number of hypertension patients that reported to the health facilities each day, all consenting patients who reported to the facility on the day of visit to the facility were enrolled into the study as cases. Consecutive sampling was used to enrol participants from each facility into the study. The sample size of 132 cases was equally divided among the four chosen facilities; therefore 33 essential hypertension patients were selected from each of the four facilities.

3.4.3 Sampling of Controls

In a case control study, a control is defined as “person(s) in a group that is used for reference in comparison to a case group” (Miquel et al., 2008). In this study, a control was defined as any person aged 18 to 65 years who have not been diagnosed with hypertension by a healthcare worker and not on hypertensive medication for the two weeks preceding this study. The absence of disease (hypertension) in control was verified by querying participants on the present diagnosis of hypertension by a health worker and the use of hypertensive medication in the two weeks prior to their interview.

In this study neighbourhood controls were used. Controls were selected from constituencies where the chosen health facilities are located. The first house in the neighbourhood was randomly chosen using simple random sampling. Systematic random sampling was used to select the subsequent household, which is every second house. In each selected household, one consenting control was chosen using simple random sampling. The sample size of 132 was equally divided into the four neighbourhoods in which the health facilities are located. Thus 33 controls were selected from each of the following locations, Nama location (Katutura Health Centre), Okuryangava location (Okuryangava Clinic), Khomasdal (Khomasdal Clinic) and Soweto location (Robert Mugabe Clinic).Soweto location was randomly selected for controls at cases reporting to Robert Mugabe Clinic are from diverse locations.

3.4.4 Inclusion Criteria

Eligibility criteria (inclusion and exclusion criteria) are defined as the specific characteristics that delimit the study population and determine whether a member of the target population qualifies to be included in the sample for a study (Polit & Beck, 2010). Inclusion criteria are the set of conditions that need to be met in order to participate in a study (Greg & Emily, 2015).

Cases: Inclusion criteria for cases in this study was all essential hypertension cases reporting to the KHC, OKC, RMC and KMC aged from 18 to 65 years of years old.

Controls: Inclusion criteria for controls were all non-hypertensive persons randomly selected from the neighbourhoods where cases reside, aged from 18 to 65 years old.

3.4.5 Exclusion Criteria

Exclusion criteria are the set of conditions that disqualify members from the target population from participation in a study (Greg & Emily, 2015). Exclusion criteria for cases in this study were all essential hypertension cases aged less than 18 years or over 65 years.

Cases: Cases of secondary hypertension were not included in this study. Only hypertension patients who report to the four selected state primary health care facilities for follow up were included. No cases from private health facilities were included in this study.

Controls: Similarly, potential controls that were aged less than 18 or above 65 years old and have been diagnosed with hypertension by a healthcare worker and who were on hypertensive medication in the two weeks prior to their interview were excluded from this study.

3.5 DATA COLLECTION

Data collection is the process of obtaining predetermined information or facts from participants required to answer the research questions. This subsection is a description of the tasks and activities carried out by the researcher as well as the material or instruments used to accomplish these tasks. The methods used to ensure validity and reliability of the research instrument are also described here.

3.5.1 Data Collection Instruments

The use of data collection or research instruments such as tests or surveys to collect numerical data such as counts or values is an important characteristic of quantitative studies (Harwell, 2011). Data collected using these instruments are used to test statistical hypotheses that are based on the research questions of interest (Harwell, 2011). A questionnaire based on the WHO stepwise approach to chronic disease risk factor surveillance (STEPS) instrument was developed and used to capture data for hypertension risk factors in both cases and controls. The questionnaire was in English and was comprised of questions in three sections. Section one consisted of questions on demographic information, section two consisted questions on behavioural risk factors (tobacco use, alcohol consumption, diet and physical activity) and section three consisted of anthropometric measurements and blood pressure measurement readings. Blood pressure was measured using a digital blood pressure monitor with a cuff size of 34 to 44 cm. Height was measured using a height measuring board or measuring tape. Weight was measured using a digital weighing scale. Waist circumference was measured using flexible a measuring tape**.**

3.5.1.1 Validity of the Research Instrument

Instrument validity is the ascertainment that the instrument accurately measures what it is supposed to measure (Brink et al., 2012). Validity of the data collection instrument was verified using content and face validity methods. Content validity is an evaluation of how well the instrument represents all the components of the variable to be measured. The instrument used for this research was adapted from the WHO STEPS questionnaire which is designed by experts to capture data on the prevalence of risk factors for non-communicable diseases. All components that are required to measure the magnitude and frequency of harmful use of alcohol, tobacco use, physical activity and diet were well presented in accordance with WHO definitions for each of the risk factors. Furthermore, the questionnaire was adapted to include examples from the Namibia lifestyle context to ensure that participants are able to understand and respond to all questions accurately. A draft of the adapted questionnaire was sent to the research supervisor to assess content and face validity. The questionnaire was then edited and refined based on the comments before finalization and submission to the Ethical review board of UNAM.

3.5.1.2 Reliability of the Research Instrument

Reliability has to do with the ability of the research instrument to consistently yield the same results when the measurement is repeated over time on the same participant or when used by two researchers (Brink et al., 2012). The questionnaire used for this research study was adapted from the WHO STEPS instrument which has been used to over time by different researchers in different countries and settings to measure risk factors for non-communicable diseases. Reliability of the questionnaire used to capture data was assessed by measuring the stability. The same instrument was administered to the same individuals on two occasions within 24 hours. Their responses were examined for similarities. A correlation measure was used to measure the reliability of the questionnaire.

3.5.2 Pilot Study

The pilot study or pre-test is a small scale version of the main study conducted to test the methods and procedures to be used in the larger scale study (Miquel et al., 2008). The results from the pilot study are used to refine the methods, instruments and procedure used in the main study. The pilot study is carried out using a few individuals who meet the inclusion criteria but who must not form part of the sample for the main study (Brink et al., 2012). A pilot test was conducted prior to the commencement of the main study on participants with and without essential hypertension in Rocky Crests location and Okuryangava locations. Results from the pilot study were used to refine questions in the questionnaire and improve the content validity of the research instrument. The pilot test included a total of five participants, two cases and three controls. In order to minimize bias, participants included in the pilot study were not included in the main study.

3.5.3 Data Collection Process

Data is defined as a collection of items of information (Miquel et al., 2008). Therefore data collection is a systematic gathering of items of information. The principal investigator enlisted the help of two health extension workers (HEWs) as interviewers. The interviewers administered the questionnaire to cases and control to capture data on demographic and behavioural risk factor information. After completion of the questionnaire, participants' body weight, body height and waist and were measured to compute their body mass index (BMI) and waist circumference.

Blood pressure was measured using a digital blood pressure monitor with a cuff size of 34 to 44 cm. Blood pressure measurements were taken after the participant sat and at rested for at least 5 minutes. Three BP measurements were taken for each participant. The average blood pressure for each participant was computed using the second and third readings. Height was measured using a height measuring board in meters , with the participant standing upright and not wearing shoes or hats. Weight was measured in kilograms (kg) using an electronic weighing scale, with the participant having no shoes on. Waist circumference was measured over light clothing using a measuring tape in centimetres. A separate area was screened off to provide privacy for the interview and physical measurements within the health facility (cases) or house (controls).

3.6 ETHICAL CONSIDERATIONS

Ethics are the rules of conduct that differentiate between acceptable and unacceptable behaviour (Resnik, 2015). Research ethics refers to the moral principles that guide the process for research from start to finish including publishing of findings (The British Psychological Society, 2010). Research that involves human participants is required to adhere to ethical principles in order to ensure the protection of human rights involved in the research. The three fundamental principles required to guide researchers to comply good research ethics are: respect for persons, beneficence and justice (Brink et al., 2012). Ethical clearance and application of the fundamental ethical principles observed in this study are discussed below.

3.6.1 Ethical Clearance

The Researcher sought and obtained reviews and ethical clearance from the University of Namibia Postgraduate Committee and the School of Public Health (Annexure C). Permission to collect data from human participants was granted by the National Health Research Unit (HRU) of the Ministry of Health and Social Services (MoHSS) through the Permanent Secretary (Annexure D). A copy of the permission letter from MoHSS was submitted to the Regional Director for the Khomas Region Health Directorate in order to obtain approval (Annexure E) to collect data from hypertension patients at the four stipulated health facilities.

3.6.2 Respect for Persons

The principle of respect for persons involves respecting and ensuring participants right to be autonomous and provide additional protection for participants with diminished autonomy such as children, persons with mental disorders and patients who are unconscious or institutionalized (Brink et al., 2012).

- Informed Consent: Written informed consent was obtained from hypertensive cases and controls before conducting the interview and anthropometric measurements. The interviewers explained the purpose of the study, the information to be collected from the participants, and the expected use of the results and findings of the study (Annexure A)
- Voluntary Participation: Participants were informed of their right to decline participation in the study, to withdraw their consent at any given time during the interview and to decline to answer any question they deemed too personal to answer. Hypertension patients who did not wish to participate in the study were not coerced into taking part and did not suffer any penalty such as denial of their basic right to health care.

3.6.3 Beneficence

This principle refers to the responsibility of the researcher to safeguard the well-being of the participant by protecting them from discomfort and any form of physical, psychological, emotional, spiritual, economic, social, or legal harm (Brink et al., 2012). This research was observational and did not involve a potentially harmful intervention.

- Benefits: The interviewers explained the community benefits of the study in proving information to assist the MoHSS in developing interventions to reduce risk factors of hypertension in the community. The researcher also provided feedback to participants by informing them of their average blood pressure readings and BMI. Participants with a high average blood pressure reading were advised to visit their nearest health facility and general health education on diet and physical activity was given to participants classified as underweight, overweight or obese.

3.6.4 Justice

Justice in research ethics refers to the participants' right to fair selection and treatment. Fair selection involves selecting participants for reasons directly related to the research problem and not due to availability of or ease of manipulation. Fair treatment of participants refers to researcher respecting participants right to privacy (Brink et al., 2012).

- Confidentiality: Participants were ensured that their information will be kept confidential. Completed questionnaires were only accessible to the interviewers and the soft copy versions were stored in a password protected computer and were only made available to the main researcher, supervisors and data analyst. Participant's personal identifier information such as name and identification number was not recorded on the questionnaire. The interviewers used a unique code to ensure that the questionnaire responses were not be linked to any individual participant.
- Privacy: A private room or screened off area was used to carry out the anthropometric measurements of the participants.

3.7 DATA ANALYSIS

Data analysis is the reduction and organization of data to generate results that can be interpreted by the researcher (Farlex Inc, 2016) . It involves cleaning, classifying, coding, tabulating data in order to perform quantitative analyses. The responses from each questionnaire were entered into a data entry template in Epi-Info 7 software. The data were then cleaned and coded and edited for discrepancies before carrying out descriptive and analytic statistical analyses. Descriptive statistics were used to present continuous data in form of mean and standard deviations. Ordinal data were presented in tables, graphs and charts. The proportions of cases and controls with various demographic characteristics and risk factors for hypertension were computed. Bi-variate analysis was done to determine the odds ratios for each factor at 95% confidence level. Multiple logistic regressions was used to determine significant associations and eliminate effect of potential confounders.

3.8 SUMMARY

This chapter provided a detailed description of the study design, population, sample size and sampling methods, data collecting, processing and analysis as well the strategies use to ensure compliance with fundamental ethical principles. The aim of this chapter was to present information needed to enable other researchers to replicate this study in other settings. The next chapter will present the results obtained from the analysis of data collected through the methods, procedures and instruments described in this chapter.

CHAPTER FOUR

RESULTS OF THE STUDY

4.1 INTRODUCTION

This chapter presents the research findings based on the results of the data analysis procedures carried out on the data collected from hypertension cases and their appropriate controls in Windhoek health district. Descriptive analysis in the form of frequencies, proportions and means were used to describe the distribution of demographic characteristics and behavioural factors in cases and controls. The chi-square test for difference was used to determine statistical significance at 95% level of significance. Bivariate analysis was done by constructing two by two tables for each potential risk factor outcome to obtain the odds ratio to evaluate the relationship between each factor (exposure) and hypertension (outcome). Multiple logistic regression was carried by using all the factors found to be significant in the bivariate analyses as dependent variables. Multiple logistic regression was done to determine the most significant risk factors and alleviate the effect of confounders.

4.2 DESCRIPTIVE ANALYSIS

4.2.1 Demographic and Socio-Economic Characteristics of Cases and Controls

Using a 1:1 ratio of cases to controls, a total of 131 patients with essential hypertension and 131 neighbourhood controls were interviewed for this study. The mean (±SD) age of the participants was 39.8 (±13.5) years. Cases were significantly older in age compared to controls *(P* = 0.0001).The median (IQR) age was 40 (29-51) years. Table 4.1 below shows the demographic and socio-economic characteristics of cases and controls. The sex distribution of participants was 184 (70.2%) female and 78 (29.7%) male. A total of 167 (63.7%) participants were single. Furthermore, 53 (20.2%) of productive participants were unemployed while 58 (22.1%) were self-employed and 75 (40.8%) were employed by non-governmental organizations. Government employees comprised 12 (4.6%) of study participants. The employment status of cases and controls were not significantly different ($X^2 = 4.8$, $P = 0.09$)

Socio-economic status was assessed by level of education, average level of monthly household income and household size. A total of 178 (68.5) of participants had a Junior Secondary Certificate (JSC) or higher qualification while 82 (31.5%) completed primary school or had no formal schooling. Cases had a lower level of education compared to controls and this difference was statistically significant ($P = 0.001$). The average household income was not significantly different in cases compared to controls ($p = 0.18$). Similarly, the differences in the average household size in cases and controls were not significantly different ($p = 0.5$).

Table 4.1 Demographic and socio-economic characteristics of cases and controls

Characteristic	Variable	Total	Case	Control	χ^2	*P* value
Age (years)	18 - ≤ 39	128	33	95	59.3	0.0001*
	40 - ≤ 59	109	78	31		
	60 - ≤ 65	25	20	5		
Sex	Female	184	101	83	5.91	0.02*
	Male	78	30	48		
Marital Status	Divorced/Widowed	13	10	3	17.5	0.0002*
	Married/ Cohabitating	83	54	29		
	Single	166	67	99		
Employment Status	Employed (NGO/Gov)	87	49	38	4.8	0.09
	Self-employed	58	22	36		
	Unemployed	115	59	56		
Highest level of education completed	Primary/lower Education	82	58	24	21.7	0.001*
	Secondary Education	152	64	88		
	Tertiary Education	26	8	18		
Average monthly household income	≤ 10 000	205	106	99	3.41	0.18
	> 10 000 ≤ 20 000	36	13	23		
	> 20 000	10	6	4		

A total of 205 (81.7%) of participants had an average household income of ≤ N$ 10, 000.00 and 10 (3.98%) had an average household salary of greater than N$ 20, 000.00. The modal household size was 2 to 5 persons accounting for 182 participants (69.7%).

4.3 BIVARIATE ANALYSIS OF POTENTIAL RISK FACTORS

Two by two tables for each of the potential hypothesized factors as the exposure variables and disease status (case or control) as the outcome variables were computed to determine the odds ratio and any associations that exist. Odds ratio (OR) at 95% confidence interval (CI) were used to determine the strength and significance of associations. A *P*-value of less than 0.05 was interpreted as statistical significance. The results of the bivariate analysis are presented as per the two objectives set for this study. Objective one was to determine the association between socio-demographic characteristics and hypertension. Objective two was to determine the association between behavioural factors and hypertension.

4.3.1 Demographic, Socio-Economic Factors and Hypertension

Being female (OR = 1.95(1.13 – 3.35), *P* = 0.02), married or cohabitating (OR = 2.58 (1.50 – 4.44), *P* = 0.0005) and aged above 40 years (OR = 7.84 (4.52 – 13.6), *P* = 0.0001) was significantly associated with hypertension. Similarly, completing primary school or lower (OR = 3.56 (2.03 – 6.24), p = 0.000005) was significantly associated with being a hypertension patient. Table 4.4 shows the results of the bivariate analysis for each socio-demographic factor measured. The socio-economic factors of household size (OR = 1.60 (0.82 – 3.12), p = 0.17) and employment status (OR = 1.10(0.67 – 1.79), p = 0.71) and an average monthly household income of N$10, 000 or less (OR = 1.52 (0.80 – 2.90), p = 0.20) were not significantly associated with being a hypertension case.

Table 4.4 Bivariate analysis of socio-demographic factors and hypertension

Characteristic	Variable	Total	Case	Control	OR (95% CI)	P value
Age	< 40 years	128	33	95	7.84 (4.54 – 13.6)	0.00001*
	≥ 40 years	134	98	36		
Sex	Male	78	30	48	0.51 (0.30 – 0.88)	0.02*
	Female	184	101	83		
Marital Status	Married/Cohabitating	83	54	29	2.47 (1.44 – 4.23)	0.0009*
	Single/ Divorced/Widowed	179	77	102		
Employment Status	Employed	145	71	74	1.10 (0.67 – 1.79)	0.71
	Unemployed	115	59	56		
Highest level of Education	Primary Education or lower	82	58	24	3.56 (2.03 – 6.24)	0.000006*
	Secondary/ Tertiary Education	178	72	106		
Average household monthly income	≤ N$ 10, 000.00	107	107	100	1.52 (0.80 – 2.90)	0.2
	>N$ 10, 000.00	46	19	27		
Household size	≤5 adults	194	105	114	1.60 (0.82 – 3.12)	0.17
	>5 adults	42	25	17		

**P* statistically significant at 0.05

4.3.2 Behavioural/Lifestyle Factors and Hypertension

4.3.2.1 Tobacco Use and Hypertension

Smoking tobacco products such as manufactured cigarettes was not found to be associated with hypertension cases (p = 0.15). In the same way using smokeless tobacco such as snuff or chewing tobacco was not to be associated with higher odds of hypertension cases. A summary of the bi-variate analysis is presented in Table 4.5.

4.3.2.2 Harmful of Alcohol and Hypertension

Harmful use of alcohol, which is consumption of more than four drinks for women or five drinks for men in a single drinking occasion, was more frequent in controls 40 (68.9%) than in cases 18 (31.0%). The mean (±SD) number of times that participants consumed more than the recommended number of standard alcohol drinks was 2.32 ± 5.80 in controls and 0.37 ± 1.17 in cases. The frequency of harmful use of alcohol was significantly lower in cases compared to controls (p = 0.002).

Table 4.5 Bivariate analysis of lifestyle factors and hypertension

Factor	Variable	Case	Control	OR (95% CI)	P Value
Tobacco Smoking	Yes	14	22	0.59 (0.29 - 1.22)	0.15
	No	117	109		
Harmful Use of Alcohol (days/month)	< 1 days/month	100	84	0.12 (0.04 - 0.38)	0.002*
	≥ 1 days/month	17	38		
	> 3 days/ week	40	40		
Daily consumption of fruits	<1	23	35	0.58 (0.32 - 1.05)	0.07
	≥ 1	108	96		
	> 3 days/ week	42	39		
Daily consumption of fruits	<1	13	23	0.52 (0.25 - 1.07)	0.07
	≥ 1	118	108		
Weekly consumption of fast food	≤ 3 days/ week	8	16	0.47 (0.19 - 1.14)	0.09
	> 3 days/ week	112	115		
Oil/Fat Used for cooking	Animal fat/butter	37	40	0.88 (0.51 - 1.49)	0.63
	Vegetable oil/Margarine/None used	94	89		
Vigorous Intensity Activity (Work)	Yes	14	25	0.51 (0.25 - 1.03)	0.06
	No	117	106		
Vigorous Intensity Activity (Leisure)	Yes	3	27	0.09 (0.03 - 0.31)	0.0000025*
	No	128	104		
Moderate Intensity Activity (Work)	Yes	90	103	0.60 (0.34 - 1.04)	0.07
	No	41	28		
Moderate Intensity Activity (Leisure)	Yes	19	16	1.22 (0.60 - 2.50)	0.59
	No	112	115		
Daily Sedentary hours	> 4 hours/day	45	63	0.58 (0.38 - 0.95)	0.03*
	≤ 4 hours/day	84	68		
Body Mass Index	≥ 25	81	54	2.78 (1.67 - 4.64)	0.000077*
	< 25	41	76		
Central Obesity	Obese	93	59	3.42 (1.99 - 5.87)	0.000006*
	Non-obese	30	65		

*P statistically significant at 0.05

4.3.2.3 Diet and Hypertension

Bivariate analysis showed that there was no significant difference in the number of fruits (*P*=0.07) and vegetables (*P* =0.07) consumed per day and hypertension disease status (case or control). The number of fast food meals consumed per day was not associated with a significant increased or decreased odds of disease in hypertension cases compared to control (*P*>0.09). In addition to this, the type of oil/fat used for cooking did not significantly increase or decrease the odds of disease in hypertension cases or controls (*P* = 0.63).

4.3.2.4 Physical Activity and Hypertension

Engaging in vigorous intensity leisure physical activity significantly decreased the odds of hypertension (p = 0.00003). The daily number of sedentary hours was significantly more in controls compared to cases. Two by two analysis of showed a significant relationship between lower daily sedentary hours and being a hypertension case (p = 0.03). On the contrary, work related vigorous intensity (p = 0.06) and moderate intensity (p = 0.07) activity was not significantly associated with reduce odds of disease in hypertension controls compared to cases. In like manner, engaging in moderate intensity leisure physical activity did not reduce the odds of disease in hypertension cases compared to controls (p = 0.59).

4.3.2.5 Nutritional Status and Hypertension

The odds of being a hypertension were significantly higher in overweight and obese (BMI $\geq$25) participants compared to normal and malnourished participants, ($p = 0.00008$). Central obesity was significantly higher in females compared to males (OR = 11.2 (5.88 – 21.2), $p<0.05$). In the same way, the odds of being a hypertension case were significantly higher in centrally obese compared to non-obese participants (OR = 3.42 (1.99 – 5.87), $p <0.05$).

4.4 MULTIVARIABLE LOGISTIC REGRESSION ANALYSIS

Multivariable logistic regression analysis was run using the factors found to be significant form the bivariate analysis. This was done to eliminate the effect of possible confounders and determine the true significant factors among all factors with potentially significant associations with hypertension. The results of the of logistic regression analysis are presented in Table 4.6. Multivariable logistic regression analysis results show that age (P = 0.001), highest qualification obtained (P = 0.04), BMI (P = 0.03) were found to be significantly associated with hypertension.

Table 4.6 Multivariable logistic regression analysis of potential risk factors for hypertension among residents of Windhoek Health District, 2016

Characteristic	Odds Ratio (95% CI)	*P* Value
BMI (≥ 25/<25)	2.29 (1.06 – 4.96)	0.03*
Age	0.22 (0.11 – 0.47)	0.0001*
Sex	0.86 (0.38 – 1.95)	0.71
Central obesity (obese/non-obese)	1.59 (0.72 – 3.48)	0.25
Harmful use of alcohol	4.05 (1.24 – 13.20)	0.18
Marital status (married or cohabitating/ divorced or separated/widowed)	0.60 (0.08 – 4.78)	0.63
Marital status (single/divorced or separated or widowed)	0.59 (0.07 -4.76)	0.62
Sedentary hours/day	1.57 (0.82 – 3.01)	0.18
Vigorous intensity leisure physical activity (yes/no)	0.41 (0.11 – 1.58)	0.20
Highest qualification obtained (secondary school /primary school or lower)	0.56 (0.27 – 1.17)	0.12
Highest qualification obtained (tertiary education/primary school or lower)	0.28 (0.08 – 0.92)	0.04*

**P* value statistically significant at 0.05

However, male sex ($p = 0.17$), marital status ($p = 0.62$) were not significantly associated with hypertension. Similarly, the behavioural factors of harmful use of alcohol ($p = 0.18$), central obesity ($p = 0.52$), daily number of sedentary hours ($p = 0.18$) and vigorous intensity leisure physical activity ($p = 0.20$) showed no significant association with hypertension.

4.5 SUMMARY

This chapter presented a detailed description of the results obtained and the analysis of data collected from cases of essential hypertension and their controls. Data on demographic, socio-economic and behavioural factors of tobacco use, alcohol consumption, diet, physical activity and anthropometric measures was collected from a total of 262 participants (131 cases and 131 controls). Age ($P = 0.001$), highest qualification obtained ($P = 0.04$), and BMI ($P = 0.03$). The next chapter will deal with the discussion of findings, conclusions, recommendations and limitations of the study.

CHAPTER FIVE

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

This chapter presents a summary of the findings, a discussion of the implications of the findings and subsequent conclusions based on the study objectives and assumptions. Discussions of the findings based on literature on similar studies carried out on risk factors of hypertension in other settings and consequent conclusions and recommendations are provided. A summary of the limitations encountered in the present study is also given here.

5.2 DISCUSSION OF THE FINDINGS

The initial bivariate analysis found that the socio-demographic factors of older age ($P <$ 0.001), female sex ($P = 0.02$), primary level or education or lower ($P = 0.001$), and being married or cohabitating ($P < 0.001$) were significantly associated with increased odds of having hypertension. This study found that having a lower education level and lower household income was more prevalent in cases compared to controls. In a similar case control study carried out in India, moderate and heavy stress levels and lower education status were found to be associated with increased risk of hypertension (Aripin, 2016). Furthermore, according to WHO, social determinants of health such as income and education have an unfavourable effect on behavioural risk factors and may as a result influence the development of hypertension (World Health Organization, 2013). For instance, being unemployment or fear thereof may impact stress levels and therefore influence blood pressure. Furthermore, people who live and work in undesirable or poor conditions may encounter obstacles that limit access to diagnostic health care services and subsequently delay the primary prevention measures or timely detection and treatment of hypertension. Low Socio-Economic Status (SES) may also have an impact on diet as individuals may not afford healthy foods such as fruits and vegetables. This leads to a diet mainly based on carbohydrates that are cheaper such as maize and low quality fat or oils. All these factors help explain the higher prevalence of hypertension among participants who had lower SES. Contrary to most studies, in this study marital status was associated with hypertension.

Among the socio-demographic factors hypothesized to be associated with hypertension, older age and lower education level were found to be significantly associated with hypertension. As depicted in Figure 4.1, cases had a greater proportion (73.1%) of participants aged 40 years and above compared to controls (26.9%). A strong association between age and hypertension was observed even though this study excluded participants aged above 65 years of age. The relationship between age and hypertension has been well documented in various cross sectional and longitudinal epidemiological studies(Amira, Sokunbi, & Sokunbi, 2013; Franklin & Wong, 2013; Guwatudde et al., 2015; Pinto, 2007; Sreeramareddy, Pradhan, & Sin, 2014). One such study, the

Framingham study, one of the first longitudinal studies to characterize the prevalence and outcomes of hypertension has demonstrated a 90% risk of developing hypertension in middle aged and elderly people. Evidence of biological plausibility for the relationship between older age and hypertension is explained by arterial stiffness and loss of elasticity that occurs with aging(Franklin & Wong, 2013; Pinto, 2007). Although blood vessels age with advancing age, this process may be reduced through healthy lifestyles such as healthy eating and reducing salt intake in the diet.

In this study the associations between the modifiable behavioural factors of tobacco use, harmful use of alcohol, diet, physical inactivity and nutritional status as determined by high body mass index (BMI) and central obesity, determined by waist circumference, and hypertension were investigated. Overweight/obesity that is BMI ≥ 25.0 ($p < 0.001$), central obesity ($p < 0.001$), lower number of sedentary hours per day ($p = 0.01$), harmful use of alcohol ($p = 0.02$) and doing vigorous intensity leisure physical activity ($p < 0.001$) were independently associated with having hypertension. Furthermore, multiple logistic regression analysis which incorporated all the significant factors ($p<0.05$) from the bivariate analysis found that among lifestyle factors, only higher BMI ($p = 0.03$) was associated with hypertension.Even though tobacco use and harmful use of alcohol have been shown to be associated with hypertension in some studies, the present study did not find an association between these factors and hypertension. Delai et al (2014), Pilakkadavath and Shaffi (2016) and Zhang et al (2013) found an association between harmful use of alcohol (Delai et al) and use of tobacco products and hypertension. Conversely, Aripin (2016) and Olack et al (2015) found no association between tobacco use and hypertension. The dissimilar results from these studies with regards to the relationship between tobacco use and hypertension are testimony to some of the controversy that still remains concerning this relationship. However, a large proportion of the scientific community agrees that smoking is one of the risk factor for hypertension through its effect on arterial stiffness and wave reflection (Virdis, Giannarelli, Neves, Taddei, & Ghiadoni, 2016).

Although diet was not independently associated with hypertension, being overweight /obese which is largely determined by diet was associated with hypertension in both the bivariate and multiple logistic regression analysis. In this study diet was assessed by daily and weekly intake of fruits and vegetables and choice of fat/oil used for cooking. Daily dietary salt intake was not assessed in the present study. In this study, having less sedentary hour per day was significantly associated with hypertension in the bivariate and multivariate analysis. Furthermore, central obesity was independently associated with hypertension. The prevalence of obesity/overweight was significantly higher in cases (60%) than in controls (40%) in controls. Being overweight/obese is fundamentally a result of an imbalance between the energy intake and expenditure, where intake exceeds expenditure (World Health Organization, 2011a). Thus overweight/obesity is intricately related to diet and physical activity. Finding from other medical research studies provide evidence for the physiological mechanisms that explain the effect of obesity on increased blood pressure. Obesity exerts an effect on blood pressure through sodium retention, insulin resistance and increased activity of the sympathetic nervous system(Kotsis, Stabouli, Papakatsika, Rizos, & Parati, 2010; Landsberg et al., 2013).Excessive intake of dense energy food such as fats, sugars and salt and less fruits and vegetables that provide essential micronutrients coupled with lack of adequate amount of regular physical activity leads to excess body fat in the form of adipose tissue (World Health Organization, 2006). These lifestyle habits have led to a rise in the prevalence of overweight and obesity in both HIC and LMIC.

The demographic transition in LMIC has increased sedentary lifestyle due to increased urbanization and changes in types of occupation and forms of transport (Ellulu et al., 2014). Various epidemiological studies using cross sectional and case control study designs have consistently found that BMI is an important modifiable risk factor for hypertension (Abebe et al., 2015; Devadason, Dass, Fathima, & Mathiarasu, 2014; Guwatudde et al., 2015; Sagare et al., 2011; Tesfaye et al., 2007). The Framingham heart study prospectively demonstrated a directly proportional relationship between BMI and hypertension (Kotchen, 2010). A hospital based case control study by Pilakkadavath and Shaffi (2016) in Kerala, India found that obesity and lack of physical activity were significant risk factors for hypertension. Similarly finding from a case control study in Mongolia indicate that obesity, low consumption of fruits and vegetables, high salt intake and less regular physical activity are associated with hypertension (Dalai et al., 2014). Although doing vigorous intense physical activity was independently protective of hypertension the present study found that the number of sedentary hours was higher in controls compared to cases. This finding is contrary to what was expected based on the results from BMI and physical activity as well as findings from other abovementioned studies. This finding could be explained by earlier socio-economic differences observed in controls and cases. Controls were younger in age, had higher levels of education and a higher average household income. These factors suggests that controls had forms of employment that did not require the physical activity that is a part of most manual labour jobs that persons of lower SES have. Furthermore, a number of the controls were also students who are required to sit in lectures for up to five hours or more per day.

5.3 CONCLUSION

This study was carried out in Windhoek health district using a sample size of 131 cases and 131 controls. The purpose of this study was to determine both the socio-demographic and behavioural modifiable risk factors of hypertension among residents of Windhoek. The conclusions will now be presented for each objective.

5.3.1 Conclusions for Objective 1: To determine the association between primary hypertension and socio-demographic characteristics (age, sex, level of education, ethnicity, marital status, type of occupation and income) among residents of Windhoek in Khomas region.

Essential hypertension in Windhoek was independently associated with persons who are older in age (>40 years old), being female and being married or cohabitating. Furthermore, hypertension was also associated with lower level of education and an average monthly household income that is less than or equal to N$ 5,000. Employment status and ethnicity were not associated with hypertension. Thus hypertension in Windhoek district is more common among older females who are married or cohabitating and of low socio-economic status. Despite the fact that participants who were older than 65 years were excluded from this study, older age was still the most significant socio-demographic factor found to be associated with hypertension in Windhoek.

5.3.2 Conclusions for Objective 2: To determine the association between primary hypertension and tobacco use, alcohol use, diet, physical activity and overweight/obesity among residents of Windhoek in Khomas region.

In this study, the relationship between hypertension and behavioural modifiable factors was also evaluated. Essential hypertension was not associated with smoking or other form of tobacco use, harmful use of alcohol and dietary habits such as eating of fruits and vegetables. However, hypertension was independently associated vigorous physical activity, sedentary behaviour, overall overweight, obesity and central obesity. Doing vigorous forms of leisure physical activity significantly reduced the chances of having hypertension among the study participants. Sedentary behaviour was more common in non-hypertensive compared to hypertensive participants. Nonetheless, central obesity and being overweight or obese were the most significant modifiable factors associated with hypertension. Therefore reducing excess body weight through healthier eating habits and increased levels of aerobic physical activity will likely result in reduced number of hypertensive persons in Khomas region (National Heart, Lung and blood Institute, 2006).

5.4 LIMITATIONS OF THE STUDY

This study was limited by the following factors. Due to time and resource constraints, sampling of cases was by consecutive sampling. Therefore, systematic random sampling was only used for selecting of controls from the neighbourhoods and not for selecting cases.

Interviewing of controls from the neighbourhood was done primarily during the weekdays. Thus, most working participants who were at work during those times could not be included in this study. This study was carried out among cases who report to state health facilities and their neighbourhood controls. State patients often have a lower SES compared to private patients who have access to medical aid cover. Therefore the findings of this study can only generalized to Windhoek residents who have a lower SES.

5.5 RECOMMENDATIONS

Like other NCDs, essential hypertension is often caused by interplay of more than one factor. Therefore a multi-factor and multilevel approach is crucial to control and prevent the spread of hypertension and the consequential CVDs. The following recommendations are made based on the finding of this study and the reviewed literature.

5.5.1 Policy/Legal framework

- Political will to raise priority and advocacy for the prevention of hypertension through legislation and policies to reduce exposure of the population in Windhoek to risk factors
- Subsidizing the price of fruits and vegetables and healthy cooking oil options

- Regulating fat and salt content of food sold in restaurants and in the cafeterias of schools, tertiary institutions and public and private work environments

5.5.2 Research Areas

- Future studies with larger sample size with that include patients from higher SES as well as with special focus on older woman

5.5.3 Primary Prevention

- Incorporating screening for risk factors of hypertension at primary health care system through the implementation of the WHO package for essential NCDs

5.5.4 Infrastructure and work site Intervention to improve physical activity

- Adding of bicycle lanes to roads to ensure safety of cyclers and thereby improve population level of physical activity
- Implementing mandatory work site interventions such as health promotion and screening for behavioral risk factors, incentive programmes to walk, cycle or take public transport to work, exercise programmes during breaks or after work and improving the work physical environment to promote physical activity
- Building more affordable or free recreational infrastructure such the free outdoor gym to promote physical activity in the community

5.5.5 Education

- Health promotion in local television, radio and print media through health communication, responsible advertising, publicizing successes, exposing false claims and myths, and morning shows with aerobics

5.6 SUMMARY

This chapter granted a discussion of the findings made in this study by interpreting the results in accordance with the objectives outlines in chapter one. Comparisons of the findings in this study to the body of literature available on hypertension risk factors were made. The subsequent conclusions and recommendations were also presented. The limitations of the study with regard to study design and data collection procedures were also reviewed and outlined.

(Lam, 2011; Victora, Huttly, Fuchs, & Olinto, 1997)

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ANNEXURE A: CONSENT FORM

PARTICIPANT INFORMATION

Title of Study: *An epidemiological investigation of risk factors for hypertension in Windhoek, Namibia*

Aim of study: *This study will determine risk factors for high blood pressure (hypertension) in Windhoek*

Information will be gathered through two steps of data collection:

- *Step 1: Interview questions*
- *Step 2: Measurement of height, weight, waist and blood pressure*

We will now describe what is involved in this study in more detail. You may ask any questions you have. We will ask you to sign a consent form.

Step 1 of the survey will involve the interviewer asking you some questions about your:

- *Age and education*
- *Employment and income*
- *Tobacco and alcohol use*
- *Fruit and vegetable intake*
- *Physical activity*

Step 2 of the study will involve the interviewer taking some simple measurements of your:

- *Height*
- *Weight*
- *Waist circumference*
- *Blood pressure*

Timeframe: *It is estimated that step 1 and 2 of the study will take approximately 45 minutes.* **Community benefits:** *The results of this study will assist the Ministry of Health and Social Services (MoHSS) to develop public health programmes that target effort to lower the risk factors that lead to high blood pressure.*

Your rights: It is you right to

- *Decline to take part in this study*
- *Withdraw your consent at any time*
- *Decline to answer any questions in the interview that you do not wish to answer*

Confidentiality: *Your responses will remain confidential and anonymous. Your name will not be used in any report of the study.*

Results: *The result of this study may be published in research publications, media briefings and reports and can be made available to you through the researcher.*

Ethical approval: *This study has received ethical approval from the Research ethics review committee of the MoHSS and the University of Namibia (UNAM).*

CONSENT FORM

Dear Participant

Random selection: You have been randomly selected to be part of this survey and this is why we would like to interview you. This survey is conducted by a trainee field epidemiologist of the MoHSS and UNAM and will be carried out by professional interviewers from MoHSS.

Confidentiality: The information you provide is totally confidential and will not be disclosed to anyone. It will only be used for research purposes. Your name, address, and other personal information will be not be recorded on the instrument. A code will be used for the questionnaire with your answers without identifying you.

Voluntary participation: Your participation is voluntary and you can withdraw from the survey after having agreed to participate. You are free to refuse to answer any question that is asked in the questionnaire. If you have any questions about this survey you may ask me or contact me at +264 81 456 3792 or dkaputjaza@yahoo.com

Consent to participate: Signing this consent indicates that you understand what will be expected of you and are willing to participate in this survey.

Read by: Participant		Interviewer	
Agreed		Refused	

Signatures

I hereby provide INFORMED CONSENT to take part in Steps 1 and 2 of the Risk Factors Study. For participants under 21 years old, a parent or guardian must also sign this form.

Participant ID:______________________ Sign: ______________________

Parent/Guardian: ______________________ Sign: ______________________

<u>Statement by the researcher/person taking consent</u>

I/the participant has accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant understands. I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily. A copy of this consent form has been provided to the participant. **Name of Researcher/person taking the consent: _________________________**

Signature of Researcher /person taking the consent: __________________________

Date: ____________________________ (Day/month/year)

ANNEXURE B: RESEARCH QUESTIONNAIRE

Behavioural Measurements

Physical activity

Next I am going to ask you about the time you spend doing different types of physical activity in a typical week. Please answer these questions even if you do not consider yourself to be
Think first about the time you spend doing work. Think of work as the things that you have to do such as paid or unpaid work, studying/training, household chores, harvesting food/crops, seeking employment. In answering the following questions 'vigorous-intesnsity activites' are activities that require hard physical effort and cause large increases in breathing or heart rate, 'moderate-intensity activities' are activities that require moderate physical effort and cause small increases in breathing or heart rate.

Q1	Does your work require vigorous-intensity activity that causes large increases in breathing or heart rate like carrying or lifting heavy loads, digging or construction work, for at least 10 minutes continously? (Use showcard) *If no, go to Q4*	*Yes* *No*	
Q2	In a typical week, on how may days do you do vigorous-intensity activities as part of your work?		
Q3	How much time do you spend doing vigorous-intensity activities at work on a typical day? (Hours:Minutes)		
Q4	Does you work involve moderate-intesnsity activity, that causes small increases in breathing or heart rate such as brisk walking or carrying light loads, for at least 10 minutes continously? *If no, go to Q7*	*Yes* *No*	
Q5	In a typical week, on how many daysdo you do moderate-intensity activities as part of you work?		
Q6	How much time do you spend doing moderate-intesnsity activities at work on a typical day? (Hours:Minutes)		

Travel to and from place
The next questions exclude the physical activies at work that you have already mentioned. Now I would like to ask you about the usual way you travel to and from places. For example to work, for shopping, to market, to place of worship.

Q7	Do you walk or use a bicycle for at least 10 minutes continously to get to and from places? *If no, go to Q10*	*Yes* *No*	
Q8	In a typical week, on how may days do you walk or bicycle for at least 10 minutes continously to get to and from places?		
Q9	How much time do you spend walking or cycling for travel on a typical day? (Hours:Minutes)		

Recreational activities
The next questions exclude the work and transport activities that you have already mentioned. Now I would like to ask you about sports, fitness and recreational activities (leisure).

Behavioral Measurements

Diet

The next questions ask about the fruits and vegetables that you usually eat. I have a nutrition card here that shows you some examples of local fruits and vegetables. Each picture represents the size of a serving. As you answer these questions, please think of a typical week in the last year.

Q1 In a typical week, on how may days do you **eat fruit?** (Use showcard)
If zero, go to Q5

Don't know

Q2 How many **servings** of fruit do you eat on **one** of those days? (Use showcard)

Don't know

Q3 In a typical week, on how may days do you eat **vegetables?** (Use showcard)
If zero, go to Q5

Don't know

Q4 How many servings of **vegetables** do you eat on one of those days? (Use showcard)

Don't know

Q5 What type of **oil or fat is most often** used for meal preparation in your household? (Use showcard) Select only one

Vegetable oil
Lard or suet (pig or beef/mutton fat)
Butter
Margarine
None in particular
None used
Don't know

Other

Q6 **On average, how may meals per week do you eat that were not prepared at a home? By a meal, I mean breakfast, lunch and dinner.**

Behavioural Measurement

Alcohol Consumption

The next questiona ask about the consumption of alcohol

Q1	Have you **ever** consumed an alcoholic drink such as beer, wine, castello, tombo, ombike? (Use showcard) *If no, go to next section: Diet.*	*Yes* *No*	
Q2	Have you consumed an alcoholic drink within the **past 12 months?** (Use showcard)	*Yes* *No*	
Q3	During the past 12 months, **how frequently** have you had at least one alcoholic drink? (Read responses, Use showcard) *If no, go to next section: Diet.*	*Daily* *5-6 days per week* *1-4 days per week* *1-3 days per month* *Less than once a month*	
Q4	Have you consumed an alcoholic drink within the **past 30 days?** *If no, go to next section: Diet.*	*Yes* *No*	
Q5	During the past 30 days, on how may **occassions** did you have at least one alcoholic drink?	Don't know	
Q6	During the past 30 days, when you drank alcohol, **on average**, how many **standard alcoholic drinks** did you have during one drinking occassion (Use showcard)	Don't know	
Q7	During the past 30 days, what was the **largest number** of standard alcoholic drinks you had on a single occassion, counting all types of alcoholic drinks together (Use showcard)	Don't know	
Q8	During the past 30 days, how many times did you have for **men:five or more** for **women: four or more** standard alcoholic drinks in a single drinking occassion?	Don't know	
Q9	In the past 30 days, when you consumed an alcoholic drink, how often was it with meals? Please do not count snacks as meals	*Usually with meals* *Sometimes with meals* *Rarely with meals* *Never with meals*	
Q10	During each of the **past 7 days**, how may standard alcoholic drinks did you have each day? (Use showcard)	Monday... Tuesday Wednesday Thursday Friday Saturday Sunday Don't know	

Behavioural Measurements

Tobacco Use

Now I am going to ask you some about various health behaviours. This includes things like smoking, drinking alcohol, eating fruits and vegetables and physical activity. Let's start with tobacco.

Q1	Do you currently smoke any **tobacco products**, such as cigarettes, cigars or pipes? (Use showcard) If no, go to Q6.	*Yes*	
		No	
Q2	Do you currently smoke tobacco products... (If no, go to Q6.)	*Daily*	
		Weekly	
Q3	Do you currently smoke tobacco products monthly? (If no, go to Q6)		
Q4	How old were you when you **first started** smoking daily/weekly (years)		
Q5	On average **how many** of the following do you smoke each day/ week?	*Manufactured cigarettes*	
		Hand-rolled cigarettes	
		Pipes full of tobacco	
	Others	*Cigars*	
Q6	In the past, did you **ever** smoke... (If no, go to Q9)	*Daily?*	
		Weekly?	
Q7	In the past did you ever smoke monthly?		
Q8	How old were you when you **stopped** smoking **daily/weekly**? (age in years)		
Q9	How old were you when you **stopped** smoking **monthly**?		
Q10	Do you **currently use** any **smokeless tobacco** such as snuff or chewing tobacco? (If no, go to Q12, Use showcard)	*Yes*	
		No	
Q11	Do you **currently use smokeless tobacco** products **daily/weekly**? (If no, go to Q12)	*Yes*	
		No	
Q12	On average, how many **times a day** do you use? (Use showcard)		
	Snuff, by nose		
	Chewing tobacco		
	Other (Go to Q13)		
Q13	In the past, did you **ever use** smokeless tobacco such as snuff or chewing tobacco daily/weekly?	*Yes*	
		No	
Q14	During the past 7 days, on how may days did someone **in your home** smoke when you were present? (number of days)		
	Don't Know		
Q15	During the past 7 days, on how many days did someone smoke in closed areas **in your workplace** (in the building, in a work area or a specific office) when you were present?		
	Don't Know or don't work in a closed area		

Q5	What is your ethnic group?	Damara Caprivian Coloured Baster Himba Herero Owambo Okavango Nama San Tswana White
	Other	
Q6	Which of the following best describes your **main work status** over the past 12 months?	Government employee Non-governmental employee Self-employed Student Homemaker Retired Unemployed (able to work) Unemployed (Unable to work)
	Other	
Q7	How many people older than 18 years, including yourself, live in your household?	
Q8	Taking the **past year**, can you tell me what the average earnings of the household have been per month	<N$5,000.00 >N$5,000.00<N$10,000.00 >N$10,000.00<N$20,000.00 >N$20,000.00<N$30,000.00 >N$30,000.00 Don't know Refused

Survey Information

Location and Date

Q0_1	**Region**	
Q0_2	**Constituency**	
Q0_3	**Interviewer ID**	
Q0_4	**Date of completion of instrument (dd/mm/yyyy)**	
Q0_5	**Participant ID**	

Demographic Information

Q1	**Sex (record male/ female as observed)**	*Male* *Female*
Q2	What is your date of birth? (dd/mm/yyyy)	
Q3	What is the **highest level of education** you have completed?	Less than primary school Primary school completed Secondary school completed Undergraduate degree completed Post graduate degree Refused
Q4	What is your **marital status?**	Single Currently married Seperated Divorced Widowed Cohabitating Refused

Q10	**Do you do any vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate like running or football, for at least 10 minutes continuoulsly? (Use showcard)** ***If no, go to Q13***	*Yes* *No*	
Q11	**In a typical week, on how many days do you do vigorous-intensity sports, fitness or recreational (leisure) activities?**		
Q12	**How much time do you spend doing vigorus-intensity sports, fitness or recreational (leisure) activities on a typical day? (Hours:Minutes)**		
Q13	**Do you do any moderate-intensity sports, fitness or recrational (leisure) activities that cause small increases in breathing or heart rate such as brisk walking, cycling, swimming, volleyball, for at least 10 minutes continuously? (Use showcard)** ***If no, go to Q16***	*Yes* *No*	
Q14	**In a typical week, on how many days do you do moderate-intensity sports, fitness, or recreational (leisure) activities?**		
Q15	**How much time do you spend doing moderate-intensity sports, fitness or recreational (leisure) activities on a typical day (Hours:Minures)**		

The following question is about sitting or reclining at work, at home, getting to and from places, or with friends including time spent sitting at a desk, sitting with friends, travelling in a car, bus, train, reading, playing cards or watching television, but do not include time spent sleeping. (Use showcard)

Q16	How much time do you spent sitting or reclining on a typical day? (Hours:Minutes)	

ANNEXURE C: RESEARCH PERMISSION LETTER FROM UNAM

RESEARCH PERMISSION LETTER

Date: 20/06/2016

TO WHOM IT MAY CONCERN

RE: RESEARCH PERMISSION LETTER

1. This letter serves to inform you that student: **DIANAH KAPUTJAZA,** (Student number: **200731734**) is a registered student in the Department/ school of PUBLIC HEALTH for the **MASTER IN FIELD EPIDEMIOLOGY** degree at the University of Namibia. His/her research proposal was reviewed and successfully met the University of Namibia requirements.
2. The purpose of this letter is to kindly notify you that the student has been granted permission to carry out postgraduate studies research. The School of Postgraduate Studies has approved the research to be carried out by the student for purposes of fulfilling the requirements of the degree being pursued.
3. The proposal adheres to ethical principles.

Kind regards

Signed: HoD, Fac. of Health, PGS.

Name of Main Supervisor: Prof. L. Haoses-Gorases

Signed:

Dr. M. Hedimbi

Director: School of Postgraduate Studies

Tel: 2063523

E-mail: mhedimbi@unam.na

Centre for Postgraduate Studies
Office of the Director
2016 -07- 04
University of Namibia
UNAM

ANNEXURE D: PERMISSION LETTER FROM MOHSS

REPUBLIC OF NAMIBIA

Ministry of Health and Social Services

Private Bag 13198
Windhoek
Namibia

Ministerial Building
Harvey Street
Windhoek

Tel: 061 – 203 2562
Fax: 061 – 222558
E-mail: hnangombe@gmail.com.na

OFFICE OF THE PERMANENT SECRETARY

Ref: 17/3/3
Enquiries: Ms. H. Nangombe

Date: 09 September 2016

Ms Diana M. Kaputjaza
School of Public Health
University of Namibia
P.O. Box 99357
Windhoek
Namibia

Dear Ms Kaputjaza

Re: An Epidemiological investigation of risk factors for Hypertension in Windhoek, Namibia

1. Reference is made to your application to conduct the above-mentioned study.

2. The proposal has been evaluated and found to have merit.

3. **Kindly be informed that permission to conduct the study has been granted under the following conditions:**

3.1 The data to be collected must only be used for academic purpose;

3.2 No other data should be collected other than the data stated in the proposal;

3.3 Stipulated ethical considerations in the protocol related to the protection of Human Subjects should be observed and adhered to, any violation thereof will lead to termination of the study at any stage;

3.4 A quarterly report to be submitted to the Ministry's Research Unit;

3.5 Preliminary findings to be submitted upon completion of the study;

3.6 Final report to be submitted upon completion of the study;

3.7 Separate permission should be sought from the Ministry for the publication of the findings.

Yours sincerely,

09 SEP 2016

Andreas Mwoombola (Dr)
Permanent Secretary

"Health for All"

ANNEXURE E: PERMISSION LETTER FROM KHOMAS REGIONAL DIRECTOR

9 - 0 / 0001

REPUBLIC OF NAMIBIA

MINISTRY OF HEALTH AND SOCIAL SERVICES

Private Bag 13322
Windhoek
Namibia

Tel: (061) 2035006
Fax: (061) 235997

Enquiries: Ms. E Muremi

Date: 15 September 2016

KHOMAS REGIONAL DIRECTORATE
OFFICE OF THE DIRECTOR

TO WHOM IT MAY CONCERN

RE: PERMISSION TO CONDUCT A STUDY ON RISK FACTORS FOR HYPERTENSION AMONG RESIDENTS OF WINDHOEK

Kindly be informed that Ms. Dianah Mukuture Kaputjaza has been granted permission to conduct the abovementioned study at Katutura Health Centre, Robert Mugabe Clinic, Khomasdal Clinic and Okuryangava Clinic and in the neighborhood locations of Windhoek.

Please render her the necessary assistance and support.

Ms. F. Vahekeni
Acting Regional Director
Khomas Region

"Health for All"