PREVALENCE OF HYPERTENSION AND OTHER CARDIOVASCULAR RISK FACTORS IN KIBERA SLUM, NAIROBI.

BY:

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A dissertation presented in part fulfillment of the requirements for the Degree of Master of Medicine in Internal Medicine of the University of Nairobi

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DECLARATION

This dissertation is my original work and has not been presented for a degree award in any other university**.**

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ABBREVIATIONS

ADA	-	American Diabetes Association
BMI	-	Body Mass Index
BP	-	Blood pressure
CAD	-	Coronary Artery Disease
CHD	-	Coronary heart disease
CI	-	Confidence Interval
CRP	-	C- Reactive Protein
CVD	-	Cardiovascular Disease
d	-	margin of error
DALYs	-	Disability adjusted life years
DBP	-	Diastolic Blood pressure
DM	-	Diabetes Mellitus
f	-	design effect
FBG	-	Fasting Blood Glucose
HDL-C	-	High-density lipoprotein cholesterol
hs CRP	-	Highly sensitive C Reactive Protein
ICSHB	-	The International Collaborative Study on Hypertension in Blacks
IGT	-	Impaired Glucose Tolerance
ISH	-	International society of Hypertension
JNC VII	-	The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure
KNH	-	Kenyatta National Hospital
LDL	-	Low density Lipoprotein
MI	-	Myocardial Infarction
MRFIT	-	The Multiple Risk Factor Intervention Trial
N	-	Numbers
n	-	required sample size
NCD	-	Non Communicable Disease
NHANES	-	National Health And Nutrition Examination Survey
p	-	estimated prevalence of diabetes in the project area
RBS	-	Random Blood Sugar
SBP	-	Systolic blood pressure

SPSS	-	Statistical package for social scientist
SSA	-	sub-Saharan Africa
STEPS	-	Stepwise approach to surveillance of non-communicable diseases.
THUSA	-	The Transition and Health during Urbanization of South Africans () study
UKPDS	-	The United Kingdom Prospective Diabetes Study
UON	-	University of Nairobi
USA	-	United States of America
VLDL	-	Very Low Density Lipoprotein
WC	-	Waist Circumference
WHO	-	World Health Organization
WHR	-	Waist Hip Ratio
Z	-	confidence level at 95%

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ABSTRACT

Background: Non- Communicable Diseases (NCDs), and more specifically cardiovascular diseases (CVD), are a major cause of the morbidity and mortality burden worldwide and in the Sub-Saharan Africa. Hypertension is an important public health challenge worldwide. Information on the burden of disease from hypertension is essential in developing effective prevention and control strategies. An up-to-date and comprehensive assessment of the evidence concerning hypertension in Kenya is lacking. NCDs, and particularly CVD, are strongly related to a few lifestyles and physiological risk factors. Detrimental lifestyles include smoking, unhealthy nutrition (mostly high intake of saturated fats, salt, and low intake of fruit and vegetables) and sedentary habits.

Physiological risk factors, which are strongly linked to lifestyles, include overweight, high blood pressure, blood lipid disorders (e.g. high blood cholesterol) and diabetes. It is well established that up to 80% of cases of premature CVD, and a substantial proportion of other chronic diseases could be prevented or delayed if these few risk factors were kept at favorable levels throughout life in the population, using strategies targeting both the entire population and high risk individuals.

Aim of the survey: To assess, the prevalence of Hypertension and associated cardiovascular risk factors in a representative sample of the adult population of Kibera slum in Nairobi Kenya.

Methods

Study population: The study population included adults 18 years and above who have been residents of Kibera for a minimum of three months.

Study design: Crossectional community cluster household survey utilizing both qualitative and quantative methods of data collection.

The methodology of the survey used the STEPwise approach a tool for epidemiologic survey advised by the World Health Organization (core, expanded and optional modules).The questions assessed tobacco use, physical activity, and alcohol intake and socio demographic variables. Blood pressure, weight, height, hip and waist circumferences were measured. Blood glucose, cholesterol and hs CRP measured for the subjects who were found to be hypertensive.

Results: The prevalence of hypertension was found to be 13%; with female prevalence of 15.9% significantly greater than males of 10.3%. The prevalence increased significantly with age. The hypertensives were found to have a collestellation of other CVD risk factors namely cigarette smoking, obesity, less physical activity, and high risk CRP levels.

Conclusion: The study results indicate a significant burden of hypertension and other CVD risk factors. Therefore there is need to further strengthen health promotion and prevention programs in the general population in order to reduce new cases of hypertension and CVDs and improve health care to patients with hypertension in order to reduce mortality and morbidity.

INTRODUCTION

Arterial hypertension is a worldwide health problem with high prevalence and its attendant cardiovascular and renal complications. (1 Hypertension is defined as systolic BP >140 mm Hg and diastolic BP >90 mm Hg according to The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC VII) (2) . More than 25% of adults in the world have hypertension and this percentage is expected to increase in the coming years in all areas including Sub-Saharan Africa. There were approximately 80 million patients with hypertension in sub-Saharan Africa in 2000 and projections based on current epidemiologic data suggest that this figure will rise to 150 million by 2025.(1)

Worldwide, high BP causes an estimated 7.1 million deaths a year, or approximately 13% of total mortality. It is also a major cause of stroke death and disability. In 2000, about 62% of strokes were attributable to systolic BP greater than 115 mm Hg. This population attributable fraction represents about 3.2 million stroke deaths and 27.8 million DALYs in stroke disability worldwide.(2) The corresponding stroke deaths and disability attributable to hypertension in sub-Saharan Africa are 73 000 deaths in men and 107 000 deaths in women and a total disability of 2.6 million DALYs. (4)

The impact of hypertension on mortality in an African population was assessed by Olatunbosun ST et al. in 1996. They reported that the risk of death in rural Nigeria increased by 60%, with an increase of 20 mmHg in diastolic blood pressure (BP) and estimated that the population attributable risk (the reduction in total mortality that would have been observed if hypertension were not present) was 7%, showing the impact of hypertension on all-cause mortality in rural Nigeria.(5)

The WHO (World Health Organization) estimates that hypertension-associated mortality in Sub-Saharan Africa will rise to 20% by the year 2020.In Kenya the previous population data on hypertension prevalence, mortality and morbidity indicators is lacking or outdated and therefore need for a study

LITERATURE REVIEW

Worldwide, hypertension is common and now regarded as a major public health problem.(4) In a recent study, the prevalence of hypertension was found to be 28% in North America and 44% in Western Europe.(3) Until recently, hypertension was thought to be rare in rural Africa (6,7); on the other hand, hypertension and its complications, including stroke, heart failure, and renal failure, have been reported in blacks all over the world. Hypertension is now being widely reported in Africa and is the most common cause of cardiovascular disease on the continent.(8) It is also a major factor in the high mortality of adults in sub-Saharan Africa.(9)

In America 1 in 3 adults is hypertensive and with the lifetime risk of developing hypertension being greater than 90%, hypertension can be considered a national burden.1 The risk of CVD doubles for every increment of 20/10 mm of mercury in blood pressure (BP), starting at 115/75 mm Hg. (9) Untreated elevated systolic BP may galvanize artery stiffness, and coronary heart disease (CHD) risk rises as systolic BP rises. Thus, emphasis on diastolic pressure as a risk assessment tool can be misleading, particularly in advanced age. Other risk factors for CHD include elevated cholesterol, low high-density lipoprotein cholesterol (HDL-C), smoking, and diabetes. This means that a BP as low as 135/85 mm Hg indicates increased risk. (10)

Blood pressure is a powerful, consistent, and independent risk factor for cardiovascular disease and renal disease. According to the National Health And Nutrition Examination Survey (NHANES), at least 65 million adult Americans, or nearly one-third of the US adult population, have hypertension, defined as a systolic blood pressure >140 mm Hg, diastolic blood pressure >90 mm Hg, and/or current use of antihypertensive medication.11 Another one-quarter of US adults have blood pressure in the “prehypertension” range, a systolic blood pressure of 120 to 139 mm Hg or diastolic blood pressure of 80 to 89 mm Hg, i.e., a level above normal yet below the hypertensive range. The prevalence of hypertension rises progressively with age, such that more than half of all Americans aged 65 years or older have hypertension. (12)

The Hong Kong Cardiovascular Risk Factor Prevalence Study is a large and unique cohort of urbanized Hong Kong Chinese subjects, with more than 12,000 person-years of follow up.

Analysis of the baseline data has showed that hypertension and diabetes are common in Hong Kong, and there is a clustering of cardiovascular risk factors. It has particularly highlighted the importance of obesity and its close relationship with insulin resistance diabetes, dyslipidemia, and hypertension. In this prospective study, a number of factors were identified that are related to the development of hypertension. These include age, history of hypertension in a parent, indices of obesity, baseline blood pressure, blood glucose, lipids, and indices of insulin resistance. Multivariate analysis narrows this list to age, history of hypertension in a parent, baseline SBP, BMI, and the triglycerides/HDL ratio. (13)

The Strong Heart Study showed that abdominal obesity and abnormal lipid profile are the major predictors of development of arterial hypertension after 8 years in a group of American Indian subjects with initial blood pressure in the optimal range.(14) Raised blood pressure, triglycerides, and low HDL are all related to obesity,(15,16) and constitute the definition of the metabolic syndrome.17 Thus, the metabolic syndrome is not only a predictor of the development of type 2 diabetes but is also a predictor of hypertension, even in Asian population which is generally not obese by Western standards. The International Collaborative Study on Hypertension in Blacks (ICSHB) studied blood pressure and associated CVD risk factors among seven populations of West-African origin, including rural Nigeria, urban and rural Cameroon, three Caribbean sites and a site in the USA. They observed a clear increase in blood pressure along the gradient of urbanisation.(18,19)

According to The World Health Organization Report 2001, cardiovascular diseases accounted for 9.2% of the total deaths in the African Region in 2000 compared with 8.15% in 1990. The most important CVDs are hypertension, stroke, cardiomyopathies (especially the dilated form) and rheumatic heart disease. (20)

High blood pressure is estimated to have caused 7.6 million premature deaths (13.5% of the total) and contributed 92 million disability adjusted life years (DALYs) worldwide in 2001. (20)

Hypertension is a main physiological risk factor for other CVDs. It is estimated that more than 20 million people are affected in the African Region, mainly in urban areas. Prevalence ranges from 25% to 35% in adults aged 25 to 64 years (21).Hypertension is common in the black population of Africa. (21) It has been suggested that the prevalence of cardiovascular disease and hypertension is increasing rapidly in sub-Saharan Africa (SSA) (22)

The current prevalence in many developing countries, particularly in urban societies, is said to be already as high as those seen in developed countries.(7,8) Hypertension is a primary cause of hemorrhagic stroke, hypertensive heart disease, and hypertensive kidney failure, even before coronary artery disease and atherothrombotic stroke became major causes of mortality.(23)

Hypertension end organ damage is a major source of morbidity and mortality in sub-Saharan Africa.(24) A recent study from urban and rural Tanzania reported rates of stroke mortality higher than those of England and Wales, and suggested that untreated hypertension is an important etiological risk factor.(25) Until recently, hypertension was generally considered to be rare in rural African communities.(26,6) Studies have revealed that urbanization is associated with elevation of blood pressure in Africans,(27,28) and that hypertension is now likely to be the most common cardiovascular problem in Africa. In sub-Saharan Africa, hypertensive patients accounted for 40%–60% of adult cardiology practices. (28)

Cappuccio et al in West Africa in a study with a total of 4733 subjects, ranging in age from 25 to 102 years. The crude prevalence rate of hypertension (blood pressure $140/90 mm Hg, and/or treatment) was 28.4% (confidence interval, 26.5%–30.1%).The prevalence rate increased with age in both men and women, and in both rural and semi-urban participants (29)

In Accra, Amoah (2003) studied 4733 subjects with age ranging from 25 to 102 years and found overall crude and age-standardized prevalence rates of hypertension (BP >140/90 mm Hg) to be 28.3% and 27.3%, respectively. Hypertension was more common in women than men. (30)

The prevalence of hypertension was higher in women. Hypertension prevalence decreased with higher education; however, the wealthiest quintile had higher prevalence of hypertension than the poorest. Adults with a family history of hypertension or stroke had a higher prevalence, as did the obese. For BMI, the adjusted risk for hypertension was about 2-fold higher in obese participants than in those of normal weight. Being underweight had a protective effect. A family history of stroke and of hypertension was significantly associated with hypertension. (31)

South Africa’s Demographic and Health Survey in 1998 studied 12 952 participants and described the national prevalence of hypertension.32Using a cut-off point of 140/90 mmHg and age adjusting, 25% of men and 26% of women had hypertension (32) Another important cross-sectional cardiovascular disease (CVD) risk factor survey in South Africa was conducted by Connor *et al (2005)* in randomly selected general practices across the country. The study population comprised 9 731 persons, 30 years or older, attending the private sector primary health-care services. Hypertension was found to be the commonest of the CVD risk factors among all the study participants, but stood out as the risk factor with the highest prevalence in the black African community. After age and gender standardisation the overall hypertension prevalence rate was 55%, with 59% of black African people (95% CI 57-61), 55% of Indian and coloured people (95% CI 52-59 and 52-58, respectively) and 50% of white people (95% CI 49-52) diagnosed with the condition. In this study, hypertension was defined as having a current BP ≥140/90 mmHg or having a history of hypertension. (33)

Although Jamaican and US blacks derived approximately 75% of their ancestry from populations similar to the Nigerians, (34) the prevalence of hypertension in blacks was 16% in West Africa, 26% in the Caribbean, and 33% in the USA. (35) Studies in the USA and Europe observed that among people of black African descent the prevalence of CVD risk factors, such as hypertension and obesity, is higher and that at a given blood pressure level the risk of target-organ damage, especially cerebrovascular accidents, is higher compared with the general population. (36) This suggests there may be a lower threshold for target-organ damage in African populations.

It has been argued that certain genetic factors that could convey a selective survival advantage for common infectious diseases may put people at increased risk of CVD in a different environment; this hypothesis is known as the 'thrifty genotype'.(37)

An alternative explanation is known as the 'thrifty phenotype'. This argues that early life events, in particular foetal undernutrition at critical periods of growth, lead to permanent adaptations in metabolic processes. In later life this increases the risk of hypertension, obesity, diabetes, CVD and premature death. (38)

Neither of these theories is as yet proven, nor are they mutually exclusive. Both are consistent with the observation that the risk of CVD in the black African population increases with urbanisation, in and out of Africa. In a study done in Urban Cameroon 1991–95 Cooper R et al showed that the prevalence of hypertension was 22.8% in Males, 16.0% in female and an overall prevalence of 19.1% (18)

In 2000 Edwards et al did two concurrent studies at Ilala (770 participants) and Shari (928) all ab0ve 15 years and found age-standardized hypertension (to the New World Population) prevalence was 37.3% (32.2-42.5%) among men and 39.1% (34.2-44.0%) in women in Illala, and 26.3% (22.4-30.4%) in men and 27.4% (24.4-30.4%) in women in Shari. Hypertensive subjects were older, had greater body mass indices and waist: hip ratios, and had more risk factors for hypertension and its complications (smoking, heavy alcohol consumption, physical inactivity, obesity and diabetes) than non-hypertensives. (39)

In Zimbabwe a study by Mufunda J. et al they found the age-adjusted prevalence of hypertension in Marondera (SBP >/=140/DBP >/=90/antihypertensive medication) were 30% for women and 21% for men. (42)In a study done in Cameroon (2003) Kamadjeu RM et al found the prevalence of hypertension in male was 25.6% and 23.1% in females and an overall of 24.6%.(40)

Studies in Kenya of rural men migrating to the cities suggested factors associated with developing hypertension. In Kenya the Luo migration study of Poulter *et al*. (42) was the first to show that migration of people living in traditional rural villages on the northern shores of Lake Victoria to the urban settings of Nairobi was associated with an increase in blood pressure.

The urban migrants had higher body weights, pulse rates, and higher urinary sodium/potassium ratios than those who remained in the rural areas. This suggests a marked change in the diet of the new arrivals in Nairobi with a higher salt and calorie intake along with a reduced potassium intake due to consuming less fruit and vegetables. The higher pulse rates in Nairobi participants suggest that mechanisms related to increased autonomic nervous system activity could contribute to the higher levels of BP observed. (42)In a recent cross-sectional population-based survey carried out in Nakuru, Kenya, Mathenge et al in a population aged ≥50 years found the prevalence of hypertension in this age group to be 50.1% (CI 47.5-52.6%). (43)

CARDIOVASCULAR RISK FACTORS

Various risk factors contribute to the development of hypertension and account for the age, gender and regional variations. These include high dietary salt intake, sedentary lifestyle, increasing age, male gender, obesity among others. The increase in the incidence of hypertension appears to be closely correlated with aging of the population as well as with the growing number of overweight and obese persons. These trends show regional variations with prevalence being associated with the rate of urbanization and westernization of lifestyle.

The Multiple Risk Factor Intervention Trial (MRFIT) Research Group assessed the combined influence of BP, serum cholesterol level, and cigarette smoking on death from CHD, with a special emphasis on age. Using a large sample (N=316,099 men) who had been followed for 12 years, the group identified strong associations between SBP above 110 mm Hg and DBP above 70 mm Hg and mortality due to CHD, with SBP being a stronger predictor of death than DBP. Patients with BPs of 160/80 mm Hg were at the same risk as those with BPs of 160/100 mm Hg, indicating that a “normal” diastolic pressure was of little consequence. CHD risk rises as SBP rises. (44)

Research has confirmed a “multiplier effect” for systolic pressure when several risky conditions are present. With kidney disease or end-stage renal disease, the relative risk approaches 2.8. Stroke incurs a relative risk of 2.7, and coronary disease increases relative risk 1.5 times. (45, 46). Therefore, systolic pressure drives cardiovascular risk as gasoline fuels fire.

The 10-year risk for CHD is clearly associated with SBP and is further influenced by other risk factors: elevated cholesterol, low high-density lipoprotein cholesterol (HDL-C), smoking, and diabetes. (47)

Insulin resistance

Central obesity is the most common cause of insulin resistance, which can lead to impaired glucose tolerance (IGT) and eventually to diabetes mellitus (DM). Apart from its direct metabolic effects, DM is a major risk factor for CVD. Type 2 diabetes is the predominant diabetes form in Sub-Saharan Africa. Reported prevalence in rural populations are generally below 1%,(48,49) but higher in elderly urban populations, in which they vary between 2.4% in Sierra Leone (50) to 8.4% in The Gambia.(51) IGT on the other hand is common in both urban and rural areas, reported prevalence ranging from around 8% in rural Tanzania (52) to over 20% in The Gambia.(51) Although there is some debate on the relative importance of IGT as a precursor of DM in SSA,(53) this high prevalence nevertheless suggests that diabetes can be expected to increase considerably in the near future

Insulin becomes elevated with obesity because higher insulin levels are necessary to send glucose into the cells. The beta cells in the pancreas become exhausted, increasing the risk of diabetes. Elevated serum fat content leads to dyslipidemia. The triad of hypertension, elevated lipids, and elevated risk for diabetes contributes to inflammation and accelerated risk of developing atherosclerosis.(10)

Obesity

Recent studies, however, show that the prevalence of obesity has been accelerating among both the poor and the rich in developing countries. It has become a societal issue (54). Researchers predict that the burden of chronic diseases in many developing countries will soon be equal to burden of acute infectious diseases (55). Recent projections also show that in the next two decades over 60% of the public health problems caused by chronic, non-communicable diseases will be in developing countries. Three quarters of the growth in the number of people affected by diabetes worldwide will be in developing countries (56).

Africa is experiencing a similar trend. More and more Africans are becoming overweight or obese. The prevalence of obesity in South Africa, for instance, is as high as that of the US. In Egypt, 70% of women and 48% of men were overweight or obese In Morocco 40% and in Kenya 12% of the population were overweight, in 2004 (57).

Unlike hypertension, which is prevalent in all parts of society, overnutrition and central obesity appear currently limited to specific segments of Sub-Saharan Africa society, particularly those in which lifestyles have become most urbanised and westernised. A study in The Gambia showed that while overall prevalence of obesity (body mass index (BMI) >30) was low (2.3%), nearly a third (32.3%) of the urban women aged 35 and over were obese (58) This is similar to data obtained in Cameroon,(59) and in the earlier mentioned the International Collaborative Study on Hypertension in Blacks (ICSHB) sites, where BMI (as blood pressure) increased along the degree of urbanisation.(60) Abdominal or central obesity is considered particularly detrimental; increases in central obesity are correlated closely with urbanised lifestyle.(61)

The prevalence of obesity has increased alarmingly, with characteristics of a real epidemic, and obesity is currently considered one of the 10 major risk factors related to morbidity, disability and mortality by the World Health Organization. (62) Obesity is an important risk factor for hypertension, and can be pointed out as the cause of this disease in more than 30% of hypertensive individuals. (63)

In USA obesity is now considered epidemic, and metabolic syndrome is an interplay of lipids, BP, and obesity. Forty-seven million people have metabolic syndrome. The diagnosis requires 3 or more of the following: obesity, low HDL-C, a BP in the pre-hypertensive range above 130/85 mm Hg, elevated triglycerides, and elevated fasting glucose. Metabolic syndrome increases diabetes and CVD risk. Mexican Americans have the highest age adjusted prevalence (31.9%) of metabolic syndrome, followed by whites (23.8%) and African Americans (21.6%), who have similar incidences within their populations. Obesity is a real problem, wherein 5% of males aged 12 to 19 years have metabolic syndrome, doubling in prevalence to more than 10% in males aged 30 to 39 years and reaching 45% in males aged 60 to 69 years. Approximately one third of Americans between the ages of 50 and 59 years of both genders have metabolic syndrome. (64)

In a cross-sectional study carried out among Luo, Kamba and Maasai in rural and urban Kenya among 1430 individuals (58.3% females) aged 17–68 years, abdominal visceral and subcutaneous fat, BMI, and waist circumference (WC) increased with age, and were highest in the Maasai and in the urban population. The prevalence of overweight (BMI >25) (39.8% vs. 15.8%) and obesity (BMI (>30) (15.5% vs. 5.1%) was highest in the urban vs. rural population (65)

Dyslipidemia

Elevated serum cholesterol (>5.2 mmol/l) is reported in up to a quarter of the population aged 35 and over in studies in rural Tanzania and The Gambia. (66, 67) In Tanzania, hypertriglycerides (triglyceride ≥1.7 mmol/l) were also found among 15% of the over 35 group.(68) This suggests that within the next generation significant increases in coronary heart disease may occur as well.

An analysis of the Physicians' Health Study prospectively examined data from 3110 participants who were free of hypertension, CVD, and cancer at baseline. Over an average of 14 years of follow-up, approximately one third of the men developed hypertension. Elevated levels of total cholesterol, non-HDL-cholesterol, and the total cholesterol/HDL-cholesterol ratio were independently associated with an increased risk of hypertension in middle aged and older men. Furthermore, higher levels of cholesterol were associated with a higher risk of hypertension. Genetic studies in humans and in animal models suggest that a predisposition to the development of both hypertension and dyslipidemia may result from the inheritance of shared genetic factors. (69)

Diabetes

Hypertension is more prevalent in people with Type 1 and Type 2 diabetes than in the non-diabetic population, whether or not they are overweight. With the much less common Type 1 diabetes, hypertension is mostly a consequence of kidney damage. (70)

With Type 2 diabetes, the causative factor is thought to be insulin resistance or 'metabolic syndrome', but the mechanism is not fully understood. (71)

In England, surveys have found the prevalence of hypertension to be as high as 70% of adults with Type 2 diabetes – with about 50% having blood pressure of 160/95mmHg or higher.(72)

People who have both hypertension and Type 2 diabetes have double the risk of a cardiovascular event.(73) The UKPDS 36 study found that the risk of diabetic complications for patients with Type 2 diabetes was strongly associated with blood pressure. (74)

Smoking

The direct effect of smoking on the development of atherosclerosis was assessed in the ARIC (Atherosclerosis Risk in Communities) study. (75) This study consisted of 10,914 patients in whom intimal-medial thickness of the carotid artery was measured by ultrasound over a three-year period. Current smoking was associated with a 50 percent increase in the progression of atherosclerosis versus nonsmokers during the study period, and patients with environmental tobacco smoke exposure had a 20 percent greater rate of atherosclerosis progression compared to patients without environmental tobacco smoke exposure Although blood pressure rises briefly while people are smoking, any independent long-term effect on blood pressure is small. However, the risk of cardiovascular disease for any particular level of blood pressure is higher in smokers and strategies for hypertension should include helping people to stop smoking. (76)

Multiple factors may be involved since smoking has a variety of effects that may contribute to atherogenesis. Smoking is associated with an adverse effect on serum lipids (elevated low density lipoproteins and triglycerides and reduced high density lipoproteins). In addition, free radicals in cigarette smoke damage lipids, resulting in the formation of proatherogenic oxidized particles, specifically oxidized low density lipoprotein cholesterol. (77) Cigarette smoking activates the sympathetic nervous system, producing an increase in heart rate and blood pressure, and cutaneous and perhaps coronary vasoconstriction. (78) Smoking can damage the vascular wall, possibly leading to impaired prostacyclin production and enhanced platelet-vessel wall interactions. This can reduce the elastic properties of the aorta, resulting in stiffening of and trauma to the wall (79).

Alcohol

While a low-to-moderate habitual consumption of alcohol is associated with a lower risk of cardiovascular disease, heavy alcohol use is a well-established risk factor for hypertension and stroke. For example, a large study of almost 6,000 Scottish men aged 35-64 followed up for 21 years found that there was a strong correlation between alcohol consumption and mortality from stroke: drinkers of more than 35 units of alcohol a week doubled their risk of mortality compared with non-drinkers. (80)

Epidemiological evidences demonstrate a strong association between alcohol consumption and the prevalence of High Blood Pressure, independent of gender, age, physical activity, BMI, smoking, and sodium intake, and dependent of the amount of alcohol consumed and of the exposure time. Epidemiological studies are consistent as regards systolic (SBP) and diastolic (DBP) blood pressure elevation when the individuals consume three or more drinks (30g of alcohol per day), with a higher elevation for the systolic blood pressure.(81)

Physical inactivity

People who do not take enough aerobic exercise (such as brisk walking, running, cycling, swimming or dancing) are more likely to have or to develop hypertension. Large cross-sectional and longitudinal studies have shown a direct positive correlation between habitual aerobic physical inactivity and hypertension. (82) For example, in a study following up male college alumni over many years, those who were habitually active were up to 30% less likely to have hypertension than their inactive colleagues. (83)

Only 37% of men and 24% of women in England meet the recommended level of physical activity of a total of at least 30 minutes of at least moderate intensity activity a day on five or more days a week. (84)

STATEMENT OF THE PROBLEM AND JUSTIFICATION

Hypertension is one of the main risk factors for cardiovascular events. The prevalence of hypertension has been shown to be on the increase in the developing countries and approaching the levels reported in the developed countries. This has been attributed to the change in lifestyle and includes changes in dietary habits and urbanization. The previous hypertension studies were done in institutional or hospital settings. There are few hypertension prevalence studies in Kenya and this study is an attempt to fill that gap. Knowledge on the prevalence of the hypertension and the associated cardiovascular risk factors will enable informed health services planning and implementation of preventive strategies to arrest the increase in the cardiovascular diseases morbidity and mortality**.** The results will provide a useful tool for assessing hypertension prevalence, identifying and characterizing risk populations, and for designing and evaluating health care services as well as health promotion and disease prevention programs and policies. The study results may indicate a need to further strengthen health promotion and prevention programs to promote healthy lifestyles in the general population in order to reduce new cases of chronic diseases and improve health care to patients with hypertension in order to reduce complications of these conditions.

OBJECTIVES

Broad objective

To determine the prevalence of hypertension and associated cardiovascular risk factors in the urban population of Kibera

Specific primary objectives

1. To determine the prevalence of hypertension.
2. To determine the prevalence of obesity as determined by BMI and Waist Hip Ratio.
3. Determine the prevalence of cigarette smoking.
4. Determine the prevalence of alcohol consumption.
5. To assess the level of physical inactivity.

Specific Secondary objectives

In the subsample of identified hypertensive:

1. To determine the fasting lipid profile.
2. To determine the High sensitivity CRP
3. To determine the prevalence of diabetes mellitus utilizing Random blood sugar/Fasting blood sugar or history of current use of insulin or oral hypoglycemic agents.

METHODOLOGY

Study design

Cross-sectional community cluster household survey utilizing both qualitative and quantitative methods of data collection was used.

Study population

The study population included the adults 18 years and above who had been residents of Kibera for a minimum of three months.

Study area

Kibera is located southwest of Nairobi City Centre and is approximately 2.5 square kilometers, 256 hectares. Kibera is in Langata division which is in Nairobi West district. Nairobi West District is one of the three districts on Nairobi Province, comprising of three administrative divisions of: Langata, Dagoretti, and Westlands. It is sited approximately 5 km south west of the City Centre of Nairobi. The estimated population density is 2000/hectare. There are nine villages which are Kianda, Soweto, Gatwekera, Kisumu Ndogo, Lindi, Laini Saba, Siranga/Undugu, Makina and Mashimoni. According to the 1999 Kenyan census[39], the total population of Langata was projected to be 429,394 with Kibera taking up 64% of that population which is approximately 274,812. The adult population of Kibera is postulated to be 70% of the total population which gives an approximate figure of 192,368. The 1999 census projected an annual growth rate of the Kibera population to be 4.4 to 4.8% per year. Taking an average growth rate of 4.6%, the projected adult population of Kibera is 301,605.

Sample size

For a survey design based on cluster sampling, the sample size required was calculated using following formula:

$n = \{Z^2 x\ p(1-p)/d^2\}\ x\ f$

Description: n = required sample size ;

Z= confidence level at 95% (standard value of 1.96)

p = estimated prevalence of hypertension in the project area = 24.6%

d = margin of error at 3.0% (standard value of 0.03)

f= design effect = 2

For the estimated prevalence we used the prevalence for a study done in urban Cameroon (2003) by Kamadjeu RM et al that found the prevalence of hypertension to be 24.6%. (41)

$$N = \frac{1.96^2 \times 0.246\,(1-0.246)}{0.03^2} \times 2 = 1588$$

Sample size = 1588

Participant's recruitment

The participants were recruited by the Primary investigator together with a team of 12 research assistants. Initially we had to liaise with the provincial administration and then organized for a meeting to meet the participants and explain to them about the essence and the details of the study. The randomly selected households were visited. Consent was obtained. A questionnaire –The WHO STEPwise approach to non-communicable disease (STEPS) (85) was administered.

Inclusion criteria

1. Adults above 18 years
2. Residents of Kibera.
3. Those willing to give consent to participate in the study.

Exclusion criteria

1. Those below the age of 18 years
2. Failure to give consent for the study.
3. Pregnant women-self reported.

STUDY TOOLS

Information was collected from the study households using WHO STEPS. (85) The WHO STEPS questionnaire (The WHO STEPwise approach to surveillance of non-communicable diseases) is an instrument developed by WHO for collection of surveillance data on NCD'S. It is a sequential process made up of 3 main sections which are the risk stratification questionnaire (step1), anthropometric measurements (step 2) and biochemical measurements (step3). The STEPS instrument provides a standard tool for surveillance with a disadvantage of recall bias regarding the past medical history of hypertension.

Sampling procedure

Cluster sampling with probability proportional to size was used. Using the area map and existing nine villages, the area was divided into 9 study areas. The area was divided into 80 clusters each containing 25 households. A sampling frame with the list of villages and the projected populations of each was obtained. A sampling interval was obtained by dividing the total population by the number of clusters i.e. 2000/80= 25. A random number which is less than or equal to the sampling interval was selected and known as the random start. The number had the same number of digits as the sampling interval. Next the village in which cluster 1 is located was identified. This was done by locating the first community listed in which the cumulative population equaled or exceeded the random start .Identifying the village in which cluster 2 and subsequent clusters is located was done by adding the sampling interval to the running total of adding the sampling interval to the random number/start.

The households in each cluster were visited in a random walk method. Using this method, the nearest health centre, church or school was used as the focal point in each cluster. The direction to be followed was randomly selected by using a random number between 11 and 49.the first digit indicating the direction (1= North 2= East 3= South and 4= West). The second digit indicating how many households should be skipped before the first household in the cluster. The next household was the one nearest to the one previously visited until the sample size for the given cluster was achieved.

Data was collected by the primary investigator assisted by 12 study assistants who are qualified clinical officers.

Local guides from the community who are fluent in English and Kiswahili assisted in the introduction of the research team as well as the security. These guides had been used in other research studies done in the community. The primary investigator supervised data collection and measurements.

Data collection and methods

The field trips were done on Saturdays from 7 am by a team comprising of 12 research assistants who were clinical officers and supervised by the primary investigator with an overall supervision by the faculty investigator/supervisor. The household members who were not present on the visit day were followed three more times on Saturday and Sunday.

Cluster sampling of households was done and household members above 18years were enumerated. Consent was obtained from willing participants in the randomized households.

Pregnancy status for the females was assessed by self-reporting. The participants completed a risk factor stratification questionnaire. The questionnaire covered: family and personal history of diabetes and hypertension, smoking habits, alcohol use and patterns of physical activity pattern.

Anthropometric measures were taken. These included waist and hip circumference, waist: hip ratio, height, weight and calculated body mass index.

Height was measured to the nearest 0.5cm using a metal measuring tape against a wall and a flat headboard at right angles to the wall. The following procedures was followed in a chronological sequence: -assembling of the instrument on a vertical solid surface; the respondents standing on the board without footwear or head wear, facing the interviewer, placing their feet together, heels against the back of the board, knees straight and looking straight ahead; and the interviewer moving the measuring stick down and placing it on top of the head and recording the height in centimeters.

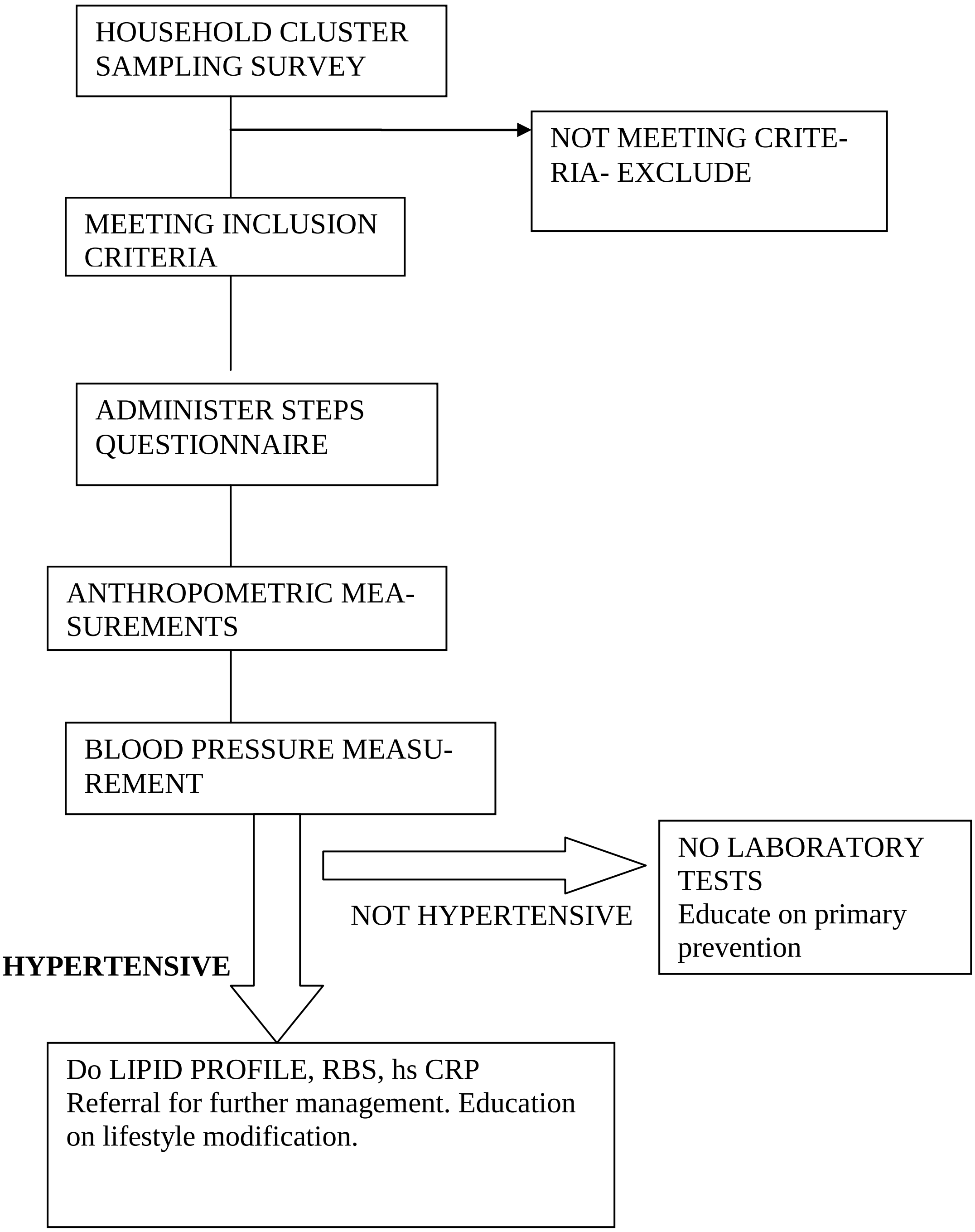
Weight was determined with a good quality bathroom scale with the subject in light clothing and without shoes. The scales were standardized daily against a beam balance to determine the zero setting. In the field the fieldworker's own weight was used as a reference before weighing each participant.

Waist circumference measurement was done by tension measuring tape graduated to 1mm and done in privacy. The sequential steps were as follows: identification of the inferior margin of the last rib and the superior border of the iliac crest in the mid-axillary plane with a pen; identification and marking of the midpoint between the two with a tape measure; application of the tension tape over the marked point making sure that the tape is horizontal across the back; and making the recording at the point of normal expiration.

Blood pressure measurement was done according to WHO criteria (85) with patient in sitting position using an adult cuff mercury sphygmomanometer after an initial rest period of 15min. A mercury sphygmomanometer connected to a standard cuff (12.5x23cm) for participants with a mid-upper arm circumference less than 33cm and a larger cuff (15.5x32.5cm) for participants with a mid-upper arm circumference more than 33cm. The systolic pressure was taken as the appearance of the Korotokoff sound (phase 1) and the diastolic blood pressure taken as the disappearance of the Korotokoff sound (phase 5). An average of three readings were taken at least 5min apart and recorded. At the initial examination, the subjects were classified into one of the three hypertensive blood-pressure categories on the basis of the criteria of JNC VII. (2).

If the systolic and diastolic pressure readings belong to different categories, the higher of the two readings was used to assign the blood-pressure category.

STUDY FLOW CHART



Laboratory methods

A random blood sugar was done on the Accucheck® glucose meter using a capillary sample from a finger prick. The participants who had a RBS >11.1mmol/l were required to be done a fasting blood sugar after an overnight fast of at least 8 hours.

For analysis of lipids, hs CRP and fasting glucose five milliliters of venous blood was drawn aseptically from the antecubital fossa and collected in a plain red top tube. The sample was allowed to clot .Serum was separated by centrifugation at 5000 rotations per minute for 5 minutes and 1.0mls of serum was aliquoted into 3 serum vials and refrigerated.

The serum was used to estimate the fasting blood sugar, total cholesterol, HDL cholesterol, LDL cholesterol and Triglycerides using enzymatic calorimetric methods by Olympus 400 systems. The serum was also used to estimate hsCRP using an automated turbidometric method on the Olympus 400.

Quality assurance

The research assistants underwent training on how to fill the STEPS questionnaire and take the anthropometric measurements to ensure standardization. The sphygmomanometers, weighing scales and tape measures assessed weekly by taking measurements of one person on each of the instruments to ensure they were standardized.

Recommended procedures for specimen collection, preparation and storage were followed to minimize pre-analytical errors.

Before analysis, all the assays were calibrated according to the manufacturer's specifications. Commercial controls used to validate the calibrations.

Results were transcribed onto data sheets which were checked by two people to minimize post analytical transcriptional errors.

Data Management and Analysis

All participant data bore no names or unique identifiers of the participants but rather a serial number. Data forms were kept in a secure lockable cabinet only accessible by the study investigator and the statistician. The investigator upon completion of data entry checked all the entered data against the hard copy forms and sorted out any inconsistencies. All data collected on the study proforma and questionnaire was entered into MS access password protected computer data base and the open-ended responses in the qualitative arm questionnaire were synthesized then coded prior to entry into the data base. The data was cleaned and verified. Statistical analysis was done using statistical package for social scientists (SPSS) version 16.0. Continuous data e.g. age, blood pressure, weight, height, BMI, blood sugar, Lipid profile, High sensitivity C-reactive protein are presented as means, standard deviations, medians, proportions and frequencies while categorical data such as marital status, education level, occupation, smoking habits, alcohol intake and sedentary lifestyle are presented in proportions, frequencies and percentages. Associations between the subjects sociodemographic, clinical and laboratory characteristics were examined using chi-square test for the categorical data while for the continuous variables the Student t-test was used to determine statistical significance and Mann Whitney U test used in the analysis where such continuous data is skewed. Associations are considered significant only when p value is equal or less than 0.05. Analyzed data is presented in the form of tables, pie-charts and graphs.

Ethical considerations

The study was carried out after approval from the Department of Internal Medicine, University of Nairobi and KNH Ethics Committee. Regulatory approvals were obtained from the Ministry of Science and Technology and the City Council of Nairobi.

Only patients who gave informed consent were enrolled. Patients were free to withdraw during the study period without discrimination. Information gathered from patients was kept confidential. The laboratory results of the tests performed on the patients was appropriately communicated to them. Follow up care for clinical conditions detected was facilitated by referral to KNH and Mbagathi District Hospital clinics as appropriate. Study results shall be disseminated to heath care providers for the role of policy formulation for intervention and preventive health measures.

RESULTS

Demographics characteristics

The study was done over a period of two months from June 2010 to August 2010.Nine villages were to be studied but one village was excluded due security concerns. Nine hundred and thirty six households of Kibera location were studied. A total of 1890 subjects were screened. Twenty six of these declined to give consent and this gave a response rate of 98.6%. Forty female subjects were excluded because they were pregnant. The total population analyzed in this study is 1824.The study recorded more males at 51.4% compared to 48.6% .with a male to female ratio of 1:1.1.

Age distribution

The study population age ranged from 18 to 90 years. The mean age was 33.3 years (SD 11.7).The mode was in the age cluster of 25 to 34 years. More than 60% of the population was below 35 years and only 5.2% were above 55 years.

Table 1: Age distribution of the study population

Age	**Frequency (n) (N=1824)**	**Frequency (%) p=100%**
15-24	519	28.5%
25-34	591	32.4%
35-44	395	21.7%
45-54	226	12.4%
55-64	65	3.6%
65-74	23	1.3%
≥75	5	0.3%

Education level

The literacy in the population was high with 98.6% have had at least primary education and this compares with Kenya literacy rate of 85.1%. About 50% had attended secondary school and beyond.

Table 2: Education level completed for the study population

Education level	Frequency (n=1790)	Frequency (%) (n=1790)
None	26	1.4%
Primary	871	48.7%
Secondary	718	40.1%
Tertiary	175	9.8%

Tobacco use

Of the 236 current smokers, majority (78.8%) were smoking cigarettes daily.They had smoked for a mean duration of 16.8 years (SD 5.4) with median Pack years of 6 (IQR 2.5-10.9).

Table 3: Tobacco use among study population

Variable	Frequency (%)
Currently smoking, n (%)	236 (12.9)
Smoking daily, n (%)	184 (10.1)
Age subjects started smoking mean (SD)	19.6 (5.4)
Duration of smoking in years, mean (SD)	16.8 (10.3)
Pack years, median (IQR)	6 (2.5-10.9)

Alcohol consumption

The study found that 538 of the population had ever consumed an alcoholic drink .Of those who had ever taken alcohol 62.6% had taken alcohol within the last thirty days. Twenty percent were taking alcohol daily. .

Table 4: Alcohol consumption among study subjects

Variable	Frequency (n) / Median (IQR)	Frequency (%)
Ever consumed alcoholic drink (n=1824)	538	29.5%
Alcohol intake within past 12 months (n=1824)	404	22.1%
Alcohol intake within past 30 days(n=1824)	337	18.5%)
Frequency of alcohol intake in the last 30 days		
Daily	81	20.0%
5-6 days	55	13.6%
1-4 days	119	29.5%
1-3 days	89	22.0%
Less than once a month	60	14.9%
Occasions of more than one drink in the past 30 days(IQR)	10 (4-22)	-
Average number of drinks on one occasion (IQR)	4 (3-6)	-
Largest number of drinks on single occasion(IQR)	6 (4-9)	-

Physical Activity

The study population was found to be physically active in all areas of assessment: at work, travel and recreational. Seventy six percent were involved in moderate to vigorous activity at work. More than three quarters walked or used a bicycle for more than 10 minutes daily. More than 30% were involved in recreational activities of moderate to vigorous intensity.

Table 5. Patterns of Physical activity in the study subjects

Intensity	Proportion of study population, n (%)	Days per week Median (IQR)	Time per day (hrs.) Median (IQR)
Vigorous intensity activity (work)	543 (29.8)	6 (5-7)	8 (3.5-9)
Moderate intensity activity(work)	835 (45.8)	6 (5-7)	6 (3-8)
Walk or use bicycle (travel)	1413(77.5)	6 (5-7)	1 (0.75 – 2)
Vigorous intensity activity (recreational)	278 (15.2)	2 (1-3)	2 (1-2)
Moderate intensity activity(recreational)	294 (16.1)	2 (1-6)	1 (0.75-2.0)
Time sitting or reclining	-	-	4 (2-6)

OBESITY

The measures of obesity used in the study were BMI, Waist hip ratio and Waist circumference. Most of the subjects (50.1%) had normal BMI, while 28.9% and 16.2% were overweight and obese respectively. Results of waist circumference and waist hip ratio showed 21.2% had high waist circumference while 12.3% had high waist hip ratio.

Table 6. Obesity measures for the study population

Variable	Frequency (n)	Frequency (%)
BMI		
Underweight(<18.5 kg/m2)	87	4.8
Normal(18.5–24.9 kg/m2)	947	50.1
Overweight(25–29.9 kg/m2)	528	28.9
Obese(≥30 kg/m2)	295	16.2
Waist circumference		
High(Male > 102 cm, Female > 88 cm)	386	21.2%
Normal(Male < 102 cm, Female > <88 cm)	1438	78.9%
Waist Hip ratio		
High (male >0.95, female >0.85)	225	12.3%
Normal (male <0.95,female < 0.85	1569	87.6%

Sex and obesity

Comparing the genders in terms of obesity all measures i.e. BMI, Waist circumference and Waist hip ratio we found that the female were significantly obese. There were 26.5% obese females compared to 7.0% in the males. Over 41% of the females had their waist circumference high versus 2.5% in males. High waist hip ratio was found in the females at 22.9% versus 2.8% in the males. These differences reached statistical difference (P value = <0.001).

Table 7: Association between sex and obesity for the study population

Variable	Male (n)/ (%)	Female (n)/ (%)	P value
BMI			
Underweight(<18.5 kg/m2)	57 (6.2%)	30 (3.5%)	<0.001
Normal(18.5–24.9 kg/m2)	556 (60.2%)	325 (37.4%)	
Overweight(25–29.9 kg/m2)	245 (26.5%)	283 (32.6%)	
Obese (≥30 kg/m2)	65 (7.0%)	230 (26.5%)	
Waist circumference			
High(Male > 102 cm, Female > 88 cm)	23 (2.5%)	363 (41.6%)	<0.001
Normal(Male < 102 cm, Female > <88 cm)	903 (97.5%)	510 (58.4%)	
Waist Hip ratio			
High (male >0.95, female >0.85)	26 (2.8%)	199 (22.9%)	<0.001
Normal (male <0.95,female < 0.85)	898 (97.2%)	671 (77.1%)	

Prevalence of hypertension

Of the 1824 study subjects 237 were found to be hypertensive giving a prevalence of 13% (CI 11.5-14.7%).The prevalence in male and female was 10.3% and 15.9% respectively with a male to female ratio of 1:1.5. Eighty percent of these hypertensive were newly diagnosed and were unaware of their hypertension status previously.

Hypertension and age

There was a progressive increase in prevalence I of hypertension with age ranging from 4% in 15- 24 age group to 60% in the greater than 75 years. There was a dip in the prevalence in the age group 64 to 75 and this was due to the low representative population sample in the study.

Table 8: Prevalence of hypertension by age distribution of the study population

Age	**Age distribution**		**Prevalence of hypertension within each age group**	
	Frequency (n=1824)	Percent (%)	Frequency	Percent (%)
15-24	519	28.5	21	4.0
25-34	591	32.4	62	10.5
35-44	395	21.7	46	11.7
45-54	226	12.4	70	31.0
55-64	65	3.6	28	43.1
65-74	23	1.3	7	30.4
>=75	5	0.3	3	60.0

Hypertension and sex

There were more females than males who were hypertensives. The females were 59.6% compared to 40.5% males and the difference between the sexes was significant (P value=<0.001)

Table 9: Hypertension and sex

	Hypertensive n (%)	**Normotensive n (%)**	**P value**
Sex			
Male	95 (40.4%)	836 (53.0%)	<0.001
Female	140 (59.6%)	741 (47.0%)	

Hypertension and tobacco use

There was a significantly higher proportion of hypertensives who were smokers (17.7%) compared to normotensive smokers (12.7%, P value =0.047). The duration of smoking and median pack years were also significantly different between the two groups. Hypertensives had smoked for 21.1 years compared to 15.6years for the normotensives, and smoked median 8.7 pack years compared to 5.7 pack years for normotensives.(P value = 0.022)

Table 10: Association of Tobacco use with hypertension

Variable	N (%)		P value
	Hypertensive	Normotensive	
Currently smoking, n (%)	38 (17.7)	198 (12.7)	0.047
Smoking daily, n (%)	31 (53.4)	155 (54.8)	0.854
Age subjects started smoking, mean(SD)	20.8 (6.2)	19.4 (5.2)	0.184
Duration smoking in years, mean (SD)	21.1 (11.6)	15.6 (9.7)	0.006
Pack years, median (IQR)	8.7 (5.1-12.3)	5.7 (2.4-10.5)	0.022

Hypertension and alcohol

There were 32.1% of hypertensives who had ever consumed alcohol. Sixty eight percent of whom had consumed alcohol within the past one year and among this population 80.8% had taken alcohol in the past 30 days. There was no difference between the average number of drinks and the largest number of drinks between the normotensives and the hypertensives. The drinking habits of the hypertensives compared with the rest of the population.

Table 11: Patterns of alcohol intake in subjects with hypertension

Variable	Hypertension (n) /%)		P value
	Hypertensive	Normotensive	
Ever consumed alcoholic drink(n=1824)	76 (32.1%)	462 (29.1%)	0.352
Alcohol intake within past 12 months (n=538)	52 (68.4%)	348 (75.3%)	0.202
Occasions of more than one drink in the past 30 days(IQR)	42 (80.8%)	274 (78.7%)	0.737
Frequency of alcohol intake in the last 30 days			
Daily	12 (23.1%)	69 (19.7%)	
5-6 days	2 (3.8%)	52 (14.8%)	0.088
1-4 days	19 (36.5%)	100 (28.5%)	
1-3 days	8 (15.4%)	81 (23.1%)	
Less than once a month	11 (21.2%)	49 (14.0%)	
Occasions of alcohol intake in the past 30 days(IQR)	7 (3-25)	10 (4-22)	0.285
Average number of drinks at one occasion(IQR)	4 (4-5)	4 (3-6)	0.313
Largest number of drinks at one occasion(IQR)	6 (4-8)	6 (4-9)	0.290

Hypertension and physical activity

The hypertensives were significantly less likely to be involved in vigorous intensity activity at work (P value= 0.011). The hypertensives were also significantly less likely to be involved in vigorous intensity recreationally (P value = 0.018). The hypertensives were significantly less likely to walk or ride a bicycle as a means of travel compared to the normotensives (P value =0.009). This implies that the hypertensives were less active physically compared to the normotensives

Table 12: Patterns of physical activity in the subjects with hypertension

Intensity	**Hypertensives**	**Normotensives**	**P value**
Vigorous intensity activity (work)	54 (22.9%)	489 (31.0%)	0.011
Moderate intensity activity(work)	101 (46.8%)	734 (48.0%)	0.725
Walk or use bicycle (travel)	164 (70.1%)	1249 (79.5%)	0.009
Vigorous intensity activity (recreational)	23 (10.2%)	255 (16.2%)	0.018
Moderate intensity activity(recreational)	27 (13.2%)	267 (17.4%)	0.138

Hypertension and Obesity

Out of the 237 hypertensives subjects 31.8% and 33% were found to be overweight and obese respectively. More than 39% had high Waist circumference and 22% had high waist hip ratio.

In all these measures of obesity when compared with the normotensives, the hypertensives were found to be significantly overweight and obese (P value = <0.001).

Table 13: Hypertension and Obesity

Variable	Hypertension (n)/ (%)	Normotension (n)/ (%)	P value
BMI			
Underweight(<18.5 kg/m2)	9 (3.9%)	78 (5.0%)	<0.001
Normal(18.5–24.9 kg/m2)	73 (31.3%)	841 (51.9%)	
Overweight(25–29.9 kg/m2)	74 (31.8%)	454 (29.1%)	
Obese(≥30 kg/m2),k	77 (33.0%)	218 (14.0%)	
Waist circumference			
High(Male > 102 cm, Female > 88 cm)	92 (39.5%)	294 (18.8%)	<0.001
Normal(Male < 102 cm, Female > <88 cm)	141 (60.5%)	1297 (81.2%)	
Waist Hip ratio			
High (male>0.95, female >0.85)	51 (22.1%)	174 (11.1%)	<0.001
Normal (male<0.95,female< 0.85)	180 (77.9%)	1389 (90.5%)	

Hypertension and diabetes

The study found 15.6% of hypertensives group were diabetics. Hypertensives were more likely to be diabetic as compared to the general population (P=<0.001).

Table 14: Association of Hypertension and diabetes

Variable	Hypertension		P value
	Yes (n)(%)	No (n)(%)	
Diabetes			
Yes	37 (15.6%)	22 (1.4%)	<0.001
No	200 (84.4%)	1565 (98.6%)	

Biochemical Measurements

Hypertension and lipids

Among the hypertensives the lipid profiles i.e. total cholesterol, LDL cholesterol, HDL cholesterol and triglycerides were done. The total cholesterol was high in 8.1%, triglycerides in 9.6%and 12.8% in LDL cholesterol. Only 11.9% of the hypertensive population had a low HDL.

Table 15: Serum Lipids among the subjects with hypertension.

Variable	Frequency (n) (%)
Total cholesterol	
Desirable (<5.17mmo/l)	125 (91.9)
High (>5.17mmo/l)	11 (8.1)
Triglycerides	
Normal (< 1.7mmol/l)	122 (90.4)
High (>1.7mmol/l)	13(9.6)
HDL	
Desirable (>1.05 mmol/l)	118 (88.1)
Low (<1.05 mmol/l)	16 (11.9)
LDL	
Optimal (<2.6 mmol/l)	88 (66.7)
Near optimal (2.6-3.35mmo/l)	27 (20.5)
Borderline high (3.36-4.42mmol/l)	13 (9.8)
High (≥4.43mmol/l)	4 (3.0)

Hypertension and CRP

Among the hypertensives subjects, 62.8% had hsCRP levels in the moderate and high risk category with 56% being in the high risk category. There was no significant difference in hsCRP values in the hypertensives with and without diabetes mellitus.

Table 16: High sensitivity CRP in the subjects with hypertension.

Hs CRP	Frequency (N)/(%)
<2(low risk)	42(37.2)
2-3(moderate risk)	7 (6.2)
>3(high risk)	64(56.6)

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DISCUSSION

This was a large Cross-sectional study done in the urban slum area of Kibera, examining the prevalence of hypertension and other cardiovascular risk factors. We found that the burden of hypertension and other risk factors to be a reality. The study found the prevalence of hypertension 13%, obesity 16.2%, cigarette smoking 12.9%, and current alcohol intake 18.5%.

The study was done using WHO STEPS questionnaire (85) which is a validated and standardized tool and therefore the outcomes of this study can be compared with other studies done in other countries. In this study we recorded a high response rate of 98.6% and is higher compared to 88% was found by Mathenge eta l in the Nakuru study (43). The population of this study was relatively young with a mean of 33.3 years with more than 60% below age 35yrs.This was an slum urban study and may be a reflection of rural-urban migration trend for the young generation have emigrated to the city.

The study recorded more males at 51.4% compared to 48.6% with a male to female ratio of 1:1.1 which compares with Kenya Census 2009 for age group 15-64 years. (86) Education is a key determinant of the lifestyle and status an individual enjoys in a society. Studies have consistently shown that educational attainment has a strong effect on health behaviors and attitudes. The literacy in the population was high with 98.6% having had at least primary education and this compares with Kenya national literacy rate in 2009 of 88.3 %.(87) About 50% had attended secondary school and beyond. In this context the population was well educated compared to the national standards..

The prevalence for current alcohol intake was 18.5%. Of that population 20% were taking alcohol daily. The average number of drinks on one occassion was 4 (IQR 4-9). The largest number of drinks on single occassion was 9 (IQR 4-9). Therefore this population was found to have a high rate of alcohol consumption in terms of frequency and quantity. Mathenge et al reported a prevalence of 18.8% (43) which is similar to what was found in this study. Current smokers were about thirty percent of our population. The rate of smoking in the study population was higher than that recorded in the Kenya Demographic and Health Survey (2009) that recorded 17.6% tobacco users in Nairobi province. (87)

The population is physically active and more than three quarters were involved in moderate to vigorous activity at work and recreationally. A greater proportion at 77.7% walked or rode a bicycle as a means of travel. They spent little time idling or sitting down. Therefore the measures of obesity for this population are expected to be better than for other sedentary populations.

The measures of obesity used in the study were BMI, Waist hip ratio and Waist circumference. Most of the subjects (50.1%) had normal BMI, while 28.9% and 16.2% were overweight and obese respectively. Results of waist circumference and waist hip circumference showed 21.2% had high waist circumference while 12.3% had high waist hip ratio. These findings were in keeping with a population that we have found that it is physically active.

The prevalence of overweight of 28.9% and obese 16.2% are low compared to other studies. Christensen et al in 2008 compared urban and rural and found higher urban prevalence of overweight at 39.8% and obesity at 15.5%.The difference could be explained by the fact that our study population was physically active. In a cross-sectional study carried out among Luo, Kamba and Maasai in rural and urban Kenya among 1430 individuals aged 17–68 years, abdominal visceral and subcutaneous fat, BMI, and waist circumference (WC) increased with age, and were higher in the urban population. The prevalence of urban overweight was 39.8% and obesity 15.5%. (62) Comparing the genders in terms of obesity all measures i.e. BMI, Waist circumference and Waist hip ratio we found that the female were significantly more obese. There were 26.5% obese females compared to 7.0% in the males. Over 41% of the females had their waist circumference high versus 2.5% in males. High mean waist hip ratio was found in the females at 22.9% versus 2.8% in the males. These differences reached statistical difference (P value = <0.001).Females were significantly more obese than males. . A study in The Gambia (58) showed that while overall prevalence of obesity (body mass index (BMI) >30) was low (2.3%), nearly a third (32.3%) of the urban women aged 35 and over were obese. This is similar to data obtained in Cameroon, (59).

The study found the prevalence of hypertension to be 13%; with female prevalence significantly greater than male at 15.9% and 10.3% respectively. We also noted that the prevalence increased significantly with age as has been documented in other studies. The importance of raising awareness on hypertension was highlighted in this study in that 80.1% of the hypertensives were newly diagnosed. The prevalence for this study different compared to other studies and the differences may arise due to different age cut offs and also that even though the other studies were done in urban areas they did not study a similar population i.e. the low socioeconomics group in the slums.

In Mufunda J. et al(41) conducted a random, population-based, cross-sectional survey of people 25 years and older in Marondera and evaluated the relationship between systolic blood pressure (SBP) and age, body mass index (BMI), waist circumference, sodium to potassium ratio (Na/K), and tobacco use in an urban population They found the age-adjusted prevalence of hypertension in Marondera (SBP ≥140/DBP ≥90/antihypertensive medication) were 30% for women and 21% for men. (41) In a study done in Cameroon (2003) Kamadjeu RM et al found the prevalence of hypertension in male was 25.6% and 23.1% in females and an overall of 24.6%.(43) The findings in Seychelles national STEPS study showed a prevalence of high blood pressure (44% in men and 36% in women in a population aged 25-64. (88)

In a study done in Urban Cameroon 1991–95 Cooper R et al showed that the prevalence of hypertension was 22.8% in Males, 16.0% in female and an overall prevalence of 19.1%. (18) In Tanzania 1996/97 Edward et al showed that the urban age adjusted prevalence was 30% for males and 28.6% for females. (39) South Africa's Demographic and Health Survey (32) in 1998 studied 12 952 participants and described the national prevalence of hypertension. Using a cut-off point of 140/90 mmHg and age adjusting, 25% of men and 26% of women had hypertension (32)

Hypertension was found to be the commonest of the CVD risk factors among all the study participants, but stood out as the risk factor with the highest prevalence in the black African community. After age and gender standardisation the overall hypertension prevalence rate was 55%, with 59% of black African people (95% CI 57-61). (33). *Cappuccio et al* in West Africa in a study with a total of 4733 subjects, ranging in age from 25 to 102 years, Male to female ratio was 1:1.5. The crude prevalence rate of hypertension (blood pressure ≥140/90 mm Hg, and/or treatment) was 28.4% (CI, 95% 26.5%–30.1%).The prevalence rate increased with age in both men and women, and in both rural and semi-urban participants (29)

In Accra, *Amoah* (2003) studied 4733 subjects with age ranging from 25 to 102 years and found overall crude and age-standardized prevalence rates of hypertension (BP >140/90 mm Hg) to be 28.3% and 27.3%, respectively. Hypertension was more common in women than men. (30)

In terms of risk factors there was no difference in alcohol consumption between hypertensives and normotensives in a population that had high consumption of alcohol. Heavy alcohol intake increases BP and the risk of hypertension through several potential mechanisms, such as directly influencing the heart or the vascular smooth muscle or stimulating the sympathetic nervous system or the renin-angiotensin- aldosterone system. Alcohol may increase plasma cortisol levels through magnesium loss into the urine, by an increase in endothelin release, or by a decrease in NO production in the arterial endothelium (89).

In terms of the overall significance of the effects of alcohol to elevate blood pressure, an analysis from the landmark World Health Organization Global Burden of Disease 2000 Comparative Risk Analysis study assessed the risks and benefits of alcohol by region and then globally and attributed 16% of all hypertensive disease to alcohol.(90) .

Daily low-dose alcohol has been shown to improve HDL-C levels, insulin sensitivity, post-prandial glucose levels, and excess sympathetic tone, while also decreasing inflammation as measured by levels of hsCRP, tumor necrosis factor α, and interleukin-6.However, alcohol has also been shown to increase risk of HTN, cancer, stroke, HF, dementia, and DM in a dose-dependent fashion when more than 2 drinks are consumed daily. (91)

On tobacco use hypertensives were more likely to be smokers than the normotensives. The hypertensives had smoked significantly longer and had greater pack years. The toxic effects of long-term tobacco smoking on CV and general health are profound. A graded relationship exists between the number of cigarettes smoked and the risk of MI. Persons who smoke 1 pack of cigarettes per day are twice as likely to experience an MI or stroke compared with aged-matched nonsmokers. Within 12 to18 months after successful smoking cessation, most of the increased CV risk disappears; by 3 to 5 years, the risk of CV events is no different than that of a nonsmoker. Among all the modifiable CV risk factors evaluated in the INTER-HEART study, current smoking was second only to dyslipidemia in importance for determining attributable risk of MI. (92)

The hypertensives were significantly less likely to be involved in vigorous intensity activity at work. The hypertensives were also significantly less likely to be involved in vigorous intensity recreationally. The hypertensives were significantly less likely to walk or ride a bicycle as a means of travel compared to the normotensives (P value =0.009). All this shows that the hypertensives were less active physically compared to the normotensives.

Large cross-sectional and longitudinal studies have shown a direct positive correlation between habitual aerobic physical inactivity and hypertension. (82) For example, in a study following up male college alumni over many years, those who were habitually active were up to 30% less likely to have hypertension than their inactive colleagues. (83)

The study found 15.6% of hypertensives group were diabetics. Hypertensives were more likely to be diabetic as compared to the general population (P=<0.001).Hypertensives were significantly found to be overweight and obese by all measures of obesity. Among the hypertensives the lipid profiles i.e. total cholesterol, LDL cholesterol, HDL cholesterol and triglycerides were done. The total cholesterol was high in 8.1%, triglycerides high in 9.6%and 12.8% had high LDL cholesterol. Only 11.9% of the hypertensive population had a low HDL. This population had favourable cholesterol which could be expected in a physically active population. Majority of the hypertensives had a favourable cholesterol levels and only a minority had dyslipidemias.

Among the hypertensive subjects, 62.8% had hsCRP levels in the moderate and high risk category with 56% being in the high risk category. There was no significant difference in hsCRP values in the hypertensives with and without diabetes mellitus. Studies measuring CRP in the general adult population in the United States have found median values of approximately 0.8 mg/L with 33% of subjects between 3 and 10 mg/L.(93), One criticism of CRP as a marker of cardiovascular risk is, due to its nonspecific nature, is that levels may increase sporadically unrelated to any cardiac pathology. One study found that in patients with stable coronary artery disease (CAD), when stratifying their CRP level as low, average, and high-risk, the change from the first to second measurement of CRP adjusted the patients risk category in 40% of patients. (94)

The stability of serial measurements of CRP has reported no significant difference in variability of CRP as compared to that seen in the measurement of blood pressure or serum cholesterol. These data suggest that increased hs-CRP is associated with a significant risk of incident cardiovascular events after correcting for traditional risk factors. Furthermore, studies have also shown that the relative impact of elevated hs-CRP on the prediction of cardiovascular events is as large, individually, as that of LDL cholesterol, HDL cholesterol, blood pressure, and smoking. (95)

Study limitations

In this study we did not assess diet and dietary habits and we cannot deduce the probable effect of diet on obesity and lipids. Due to the fact that we were doing our study during the day time we missed majority of the head of households who were the bread winners due to work commitments and therefore the high proportion of younger population that we recorded in this study. The small numbers of the older population is a limitation for the risk factors are more prevalent with advanced age. Interpretation of the significance of hsCRP is limited by the fact that it was only don in the hypertensives and we do not have a population baseline data There could be unknown confounders that were not studied in this study

Conclusion and recommendations

The main finding of this study is that even in the low socioeconomic communities similar to the Kibera slums there is evidence that hypertension and other cardiovascular risk factors are prevalent. It is evident from this study that the hypertensives had a constellation of CVD risk factors: cigarette smoking, obesity, less physical activity, and high risk CRP levels. There is need for more screening of hypertension and other cardiovascular risk factors as evidenced by the fact that more than four fifths of our population was not aware that they are hypertensive. Therefore, more education and awareness needs to be put in place to identify hypertension and other cardiovascular risk factors. This study provides the impetus in designing and evaluating health care services as well as health promotion and disease prevention programs and policies in this population. This calls for further strengthening of health promotion and prevention programs to promote healthy lifestyles in the general population in order to reduce new cases of NCDs and improve health care to patients with hypertension in order to reduce mortality and morbidity.

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APPENDIX 1: CONSENT EXPLANATION

I am Dr Elijah Kaharo Njau, a Post-graduate student in the department of Medicine University of Nairobi.

We are conducting a study at Kibera division of Nairobi.

I would like to introduce you to a study I am conducting entitled:

"PREVALENCE OF HYPERTENSION AND ASSOCIATED CARDIOVASCULAR RISKS IN KIBERA DIVISION OF NAIROBI ,KENYA"

What is the study about?

The study is about getting to know the number of people with hypertension in the community and also the other associated cardiovascular risk factors like diabetes mellitus, lipid abnormalities, obesity, smoking and alcohol consumption.

What does the study involve?

The study involves taking history from you and filling a questionnaire. We will examine you which will include taking your weight, height, waist circumference and blood pressure. It also involves taking about 3mls of your blood sample for measurement of lipid profile, blood glucose, high sensitivity C- reactive Protein. All information you shall provide shall be kept confidential.

Are there any dangers involved?

Apart from the slight pain of taking your blood, there are no dangers involved.

Will I benefit from the study?

Yes. After analyzing this study results we will be able to make new suggestions on the level of hypertension in our urban area and this can be used to in planning for prevention and treatment of Hypertension and associated risk factors. If any an abnormality is noted on the measurements or tests done appropriate referral will be done to KNH or Mbagathi DH.

Can I withdraw from the study?

You are free to withdraw from the study and this shall not affect your care in any way and you will not be discriminated in any way.

Thank you for your co-operation.

Dr Elijah k. Njau (Primary Investigator)

Tel 0722615955

APPENDIX 2: CONSENT FORM

Study number………………………………… Sex…………

Name:…………………………………………………… Age..………

I, the above named, has been requested to take part in a study concerning
"Prevalence of hypertension and associated cardiovascular risks in urban Kibera of Nairobi Kenya".

This will involve taking a full history, general examination including blood pressure, waist circumference measurements, weight, and height. This study will also involve taking sample of my blood (3mls) for assessment of Lipid profile, Blood sugar and High sensitive CRP. I will also be required to respond to a study questionnaire. The blood results and any information provided shall be confidential.

This will put me at no risk.

I understand that I am free to either agree or refuse to participate in the study
and this shall not interfere with my medical care.

Having agreed on the above I voluntarily agree to participate in the study.
Signed…………………………. Date………………………….

Witnessed by………………………Date……………………..

APPENDIX 3: INVESTIGATOR'S STATEMENT.

I the investigator have educated the research participant on the purpose and implications of this study.

Signed………………………….. Date……………………………………

APPENDIX 4: LABORATORY METHODS

LIPID PROFILE

Tests included: Cholesterol, LDL, Cholesterol/HDL ratio, Triglycerides, HDL

Enzymatic measure by automated chemistry analyzer.- Olympus A 4400.

CHOLESTEROL

Enzymatic assay of serum or plasma for quantification of cholesterol on Olympus A4400 Systems.

Cholesterol esters are enzymatically hydrolyzed to cholesterol and Free fatty acids.

Free cholesterol including that originally present is oxidized to Cholesterol-4-ene-one and hydrogen peroxide. Hydrogen peroxide combines with Hydroxybenzoic acid.

Specimen collection- serum or plasma are acceptable specimens.

Patient instructions: Fasting for at least 9 hours

- Collection:-- 1.0 ml serum, 1 red top tube.
- Collect specimens for lipid profile and cholesterol testing in red top tubes.

TRIGLYCIRIDES

Enzymatic Hydroxylation of the Triglycerides by the lipases to Free fatty acids and glycerol.

Methodology is by Glycerol Phosphate Oxidase on Olympus A4400 Systems.

Reference Range:

Normal - <1.7mmol/l (<150mg/dl)

Borderline high - 1.7-2.25mmo/l (150-199mg/dl)

High - 2.26- 5-64mmo/l (200 – 499mg/dl)

Very High - <5.65mmo/l (>500mg/dl)

LOW DENSITY LIPOPROTEIN (LDL)

Determination of LDL Cholesterol on serum or plasma on Photometric systems at 37 C at 600 /700 nm Wavelength.

LDL –C Select is a homogenous method without centrifugation steps for the direct measurement of LDL- Cholesterol.

REFERENCE RANGE

Desirable 3.4mmo/l (<= 130mg/dl)

Borderline Risk 3.4-4.1mmo/l (130-160mg/dl)

High Risk >4-1mmol/l (>160mg/dl)

HIGH DENSITY LIPOPROTEIN

Direct homogenous Test for determination of HDL cholesterol by Enzymatic colorimetric Test at 37 C using Olympus A 4400 analyzer.

Assay combines two specific tests: in the first step chylomicrons, VLDL, and LDL cholesterol are specifically eliminated and destroyed by enzymatic reactions. In the second step remaining Cholesterol from the HDL fraction is determined by well established specific enzymatic surfactants for HDL.

HIGH SENSITIVITY C- REACTIVE PROTEIN

Determination of the CRP in human serum or plasma on Photometric systems by turbidimetric immunoassay done at 37 C.

Preferred specimen 1 ml of serum. Overnight fasting preferred but not required.

Minimum 0.5ml of serum

Collection TECHNIQUE – Red topped bottles

Chemistry Analyzer- Olympus A4400.Reference Range-Adults- < 5mg/dl

Appendix 5: Outcome variables

Body mass index

BMI (kg/M^2) = WEIGHT (Kg) /$(HEIGHT)^2$ (M^2)

Classification of BMI

Underweight	<18.5 kg/m2
Normal weight	18.5–24.9 kg/m2
Overweight	25–29.9 kg/m2
Obesity (Class 1)	30–34.9 kg/m2
Obesity (Class 2)	35–39.9 kg/m2
Extreme obesity (Class 3)	≥40 kg/m2

WAIST CIRCUMFERENCE

HIGH RISK

Men > 102 cm (> 40 in)

Women > 88 cm (> 35 in)

<u>Total cholesterol</u>

< 200MG/DL (<5.172mmo/l)- desirable

200- 239(5.172 – 6.19) Border line High

>240 (>6.20) High

<u>LDL CHOLESTEROL</u>

<100mg/dl--- -(<2.6 mmo/l)--- Optimal

100-129 -- (2.586- 3.35) ------- Near Optimal/Above Optimal

130-159—(3.36- 4.42)……Borderline High

160-189---- (4.13-4.89) ------ High

190—--- (>4.90) --------Very high

<u>HDL CHOLESTEROL</u>

<40mg/dl---- (<1.03) ------Low (MEN)

<50mg/dl ----- (<1.30) ------- Low (WOMEN)

<u>TRIGLYCERIDES</u>

>1.7 mmol/l – High

<1.7mmol/l-----OPTIMAL

Hypertension classified according to the JNC VII (2) classification with systolic BP ≥14OmmHg and diastolic BP ≥90mmHg or on anti- hypertensive medication

A diagnosis of diabetes will be taken as described by WHO/ADA as a RBS >11.1 and FBS > 7.0mmol/L.

Significant waist circumference recorded as more than 102cm (40 inches) for males and more than 88cm (35 inches) in females.

Waist-to-hip ratios greater than 0.95 in men and 0.85 in women are considered elevated.

High sensitivity CRP <2mg/dl classified as low risk, 2-3 moderate risk and >3 as patients with high risk of a cardiovascular event.

Cigarette smoking defined as use of cigarettes, pipes or cigar in the last 12 months.

Alcohol use defined as the use of beer, wine, spirit or local alcoholic brews in the last 12 months.

APPENDIX 6: WHO STEPS Instrument

(Core and Expanded)

The WHO STEPwise approach to chronic disease risk factor surveillance (STEPS)

orld Health Organization

20 Avenue Appia, 1211 Geneva 27, Switzerland

*For further information:*www.who.int/chp/steps

WHO STEPS Instrument

for Chronic Disease

Risk Factor Surveillance

<insert country/site name>

Survey Information

Location and Date		Response	Code
1	Cluster/Centre/Village ID	└─┴─┴─┘	I1
2	Cluster/Centre/Village name		I2
3	Interviewer ID	└─┴─┴─┘	I3
4	Date of completion of the instrument	└─┴─┘ └─┴─┘ └─┴─┴─┴─┘ dd mm year	I4

Participant Id Number └─┴─┴─┘ └─┴─┴─┘ └─┴─┴─┘			
Consent, Interview Language and Name		**Response**	**Code**
5	Consent has been read and obtained	Yes 1 No 2 **If NO, END**	I5
6	Interview Language *[Insert Language]*	English 1 *[Add others]* 2 *[Add others]* 3 *[Add others]* 4	I6
7	Time of interview (24 hour clock)	└─┴─┘ : └─┴─┘ hrsmins	I7
8	Family Surname		I8
9	First Name		I9
Additional Information that may be helpful			
10	Contact phone number where possible		I10

Record and file identification information (I5 to I10) separately from the completed questionnaire.

Step 1 Demographic Information

CORE: Demographic Information

Question		Response	Code
11	Sex (*Record Male / Female as observed*)	Male 1 Female 2	C1

– 1 2	– What is your date of birth? *Don't Know 77 77 7777*	└─┴─┘ └─┴─┘ └─┴─┴─┴─┘ *If known, Go to C4* dd mm year	C2
13	How old are you?	Years └─┴─┘	C3
14	In total, how many years have you spent at school or in full-time study (excluding pre-school)?	Years └─┴─┘	C4

Step 1 Behavioural Measurements

CORE: Tobacco Use

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

Question		Response	Code
22	Do you currently smoke any **tobacco products**, such as cigarettes, cigars or pipes? *(USE SHOWCARD)*	Yes 1 No 2 *If No, go to T6*	T1
23	Do you currently smoke tobacco products **daily**?	Yes 1 No 2 *If No, go to T6*	T2
24	How old were you when you **first started** smoking daily?	Age (years) └─┴─┘ *If Known, go to T5a* Don't know 77	T3
25	Do you remember how long ago it was? *(RECORD ONLY 1, NOT ALL 3)* *Don't know 77*	In Years └─┴─┘ *If Known, go to T5a*	T4a
		OR in Months └─┴─┘ *If Known, go to T5a*	T4b
		OR in Weeks └─┴─┘	T4c
26	On average, **how many** of the following do you smoke each day? *(RECORD FOR EACH TYPE, USE SHOWCARD)* *Don't Know 77*	Manufactured cigarettes └─┴─┘	T5a
		Hand-rolled cigarettes └─┴─┘	T5b
		Pipes full of tobacco └─┴─┘	T5c
		Cigars, cheroots, cigarillos └─┴─┘	T5d
		Other └─┴─┘ *If Other, go to T5other, else go to T9*	T5e
		Other (please specify): └─┴─┴─┴─┴─┴─┘ *Go to T9*	T5other

CORE: Alcohol Consumption

The next questions ask about the consumption of alcohol.

Question		Response	Code
36	Have you **ever** consumed an alcoholic drink such as beer, wine, spirits, fermented cider or *[add other local examples]*?	Yes 1 No 2 *If No, go to D1*	A1a
37	Have you consumed an alcoholic drink within the **past 12 months**?	Yes 1 No 2 *If No, go to D1*	A1b
38	During the past 12 months, **how frequently** have you had at least one alcoholic drink? *(READ RESPONSES, USE SHOWCARD)*	Daily 1 5-6 days per week 2 1-4 days per week 3 1-3 days per month 4 Less than once a month 5	A2
39	Have you consumed an alcoholic drink within the **past 30 days**?	Yes 1 No 2 *If No, go to D1*	A3
40	During the past 30 days, on how many **occasions** did you have at least one alcoholic drink?	Number Don't know 77 └─┴─┘	A4
41	During the past 30 days, when you drank alcohol, **on average**, how many **standardalcoholicdrinks** did you have during one drinking occasion? *(USE SHOWCARD)*	Number Don't know 77 └─┴─┘	A5
42	During the past 30 days, what was the **largest number** of standard alcoholic drinks you had on a single occasion, counting all types of alcoholic drinks together?	Largest number Don't Know 77 └─┴─┘	A6
43	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 occasion?	Number of times Don't Know 77 └─┴─┘	A7

CORE: 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 a physically active person.

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, study/training, household chores, harvesting food/crops, fishing or hunting for food, seeking employment. *[Insert other examples if needed]*. In answering the following questions 'vigorous-intensity activities' 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.

Question		**Response**	**Code**
Work			
52	Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate like *[carrying or liftingheavy loads, digging or construction work]* for at least 10 minutes	Yes 1 No 2 *If No, go to P 4*	P1
53	In a typical week, on how many days do you do vigorous-intensity activities as part of your work?	Number of days └─┘	P2
54	How much time do you spend doing vigorous-intensity activities at work on a typical day?	Hours : minutes └─┴─┘ : └─┴─┘ hrsmins	P3 (a-b)
55	Does your work involve moderate-intensity activity, that causes small increases in breathing or heart rate such as brisk walking *[or carrying light loads]* for at least 10 minutes continuously?	Yes 1 No 2 *If No, go to P 7*	P4
56	In a typical week, on how many days do you do moderate-intensity activities as part of your work?	Number of days └─┘	P5
57	How much time do you spend doing moderate-intensity activities at work on a typical day?	Hours : minutes └─┴─┘ : └─┴─┘ hrsmins	P6 (a-b)
Travel to and from places			
The next questions exclude the physical activities 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. *[Insert other examples if needed]*			
58	Do you walk or use a bicycle *(pedal cycle)* for at least 10 minutes continuously to get to and from places?	Yes 1 No 2 *If No, go to P 10*	P7
59	In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to	Number of days └─┘	P8
60	How much time do you spend walking or bicycling for travel on a typical day?	Hours : minutes └─┴─┘ : └─┴─┘ hrsmins	P9 (a-b)

CORE: Physical Activity, Continued			
Question		**Response**	**Code**
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), *[Insert relevant terms]*.			
61	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 continuously?	Yes 1 No 2 *If No, go to P 13*	P10
62	In a typical week, on how many days do you do vigorous-intensity sports, fitness or recreational *(leisure)* activities?	Number of days └─┘	P11
63	How much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day?	Hours : minutes └─┴─┘ : └─┴─┘ hrsmins	P12 (a-b)
64	Do you do any moderate-intensity sports, fitness or recreational *(leisure)* activities that cause a small increase in breathing or heart rate such as brisk walking, *[cycling, swimming, volleyball]* for	Yes 1 No 2 *If No, go to P16*	P13
65	In a typical week, on how many days do you do moderate-intensity sports, fitness or recreational *(leisure)* activities?	Number of days └─┘	P14
66	How much time do you spend doing moderate-intensity sports, fitness or recreational *(leisure)* activities on a typical day?	Hours : minutes └─┴─┘ : └─┴─┘ hrsmins	P15 (a-b)

EXPANDED: Physical Activity			
Sedentary behavior			
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, traveling in car, bus, train, reading, playing cards or watching television, but do not include time spent sleeping. *[INSERT EXAMPLES] (USE SHOWCARD)*			
67	How much time do you usually spend sitting or reclining on a typical day?	Hours : minutes └─┴─┘ : └─┴─┘ hrsmins	P16 (a-b)

CORE: History of Raised Blood Pressure			
Question		Response	Code
68	Have you ever had your blood pressure measured by a doctor or other health worker?	Yes 1 No 2 *If No, go to H6*	H1
69	Have you ever been told by a doctor or other health worker that you have raised blood pressure	Yes 1 No 2 *If No, go to H6*	H2a
70	Have you been told in the past 12 months?	Yes 1 No 2	H2b

EXPANDED: History of Raised Blood Pressure			
71	Are you currently receiving any of the following treatments/advice for high blood pressure prescribed by a doctor or other health worker?		
	Drugs (medication) that you have taken in the past two weeks	Yes 1 No 2	H3a
	Advice to reduce salt intake	Yes 1 No 2	H3b
	Advice or treatment to lose weight	Yes 1 No 2	H3c
	Advice or treatment to stop smoking	Yes 1 No 2	H3d
	Advice to start or do more exercise	Yes 1 No 2	H3e
72	Have you ever seen a traditional healer for raised blood pressure or hypertension?	Yes 1 No 2	H4
73	Are you currently taking any herbal or traditional remedy for your raised blood pressure?	Yes 1 No 2	H5

CORE: History of Diabetes			
Question		Response	Code
74	Have you ever had your blood sugar measured by a doctor or other health worker?	Yes 1 No 2 *If No, go to M1*	H6
75	Have you ever been told by a doctor or other health worker that you have raised blood sugar or	Yes 1 No 2 *If No, go to M1*	H7a

76	Have you been told in the past 12 months?	Yes 1 No 2	H7b

EXPANDED: History of Diabetes

77	Are you currently receiving any of the following treatments/advice for diabetes prescribed by a doctor or other health worker?		
	Insulin	Yes 1 No 2	H8a
	Drugs (medication) that you have taken in the past two weeks	Yes 1 No 2	H8b
	Special prescribed diet	Yes 1 No 2	H8c
	Advice or treatment to lose weight	Yes 1 No 2	H8d
	Advice or treatment to stop smoking	Yes 1 No 2	H8e
	Advice to start or do more exercise	Yes 1 No 2	H8f
78	Have you ever seen a traditional healer for diabetes or raised blood sugar?	Yes 1 No 2	H9
79	Are you currently taking any herbal or traditional remedy for your diabetes?	Yes 1 No 2	H10

Step 2 Physical Measurements

CORE: Height and Weight

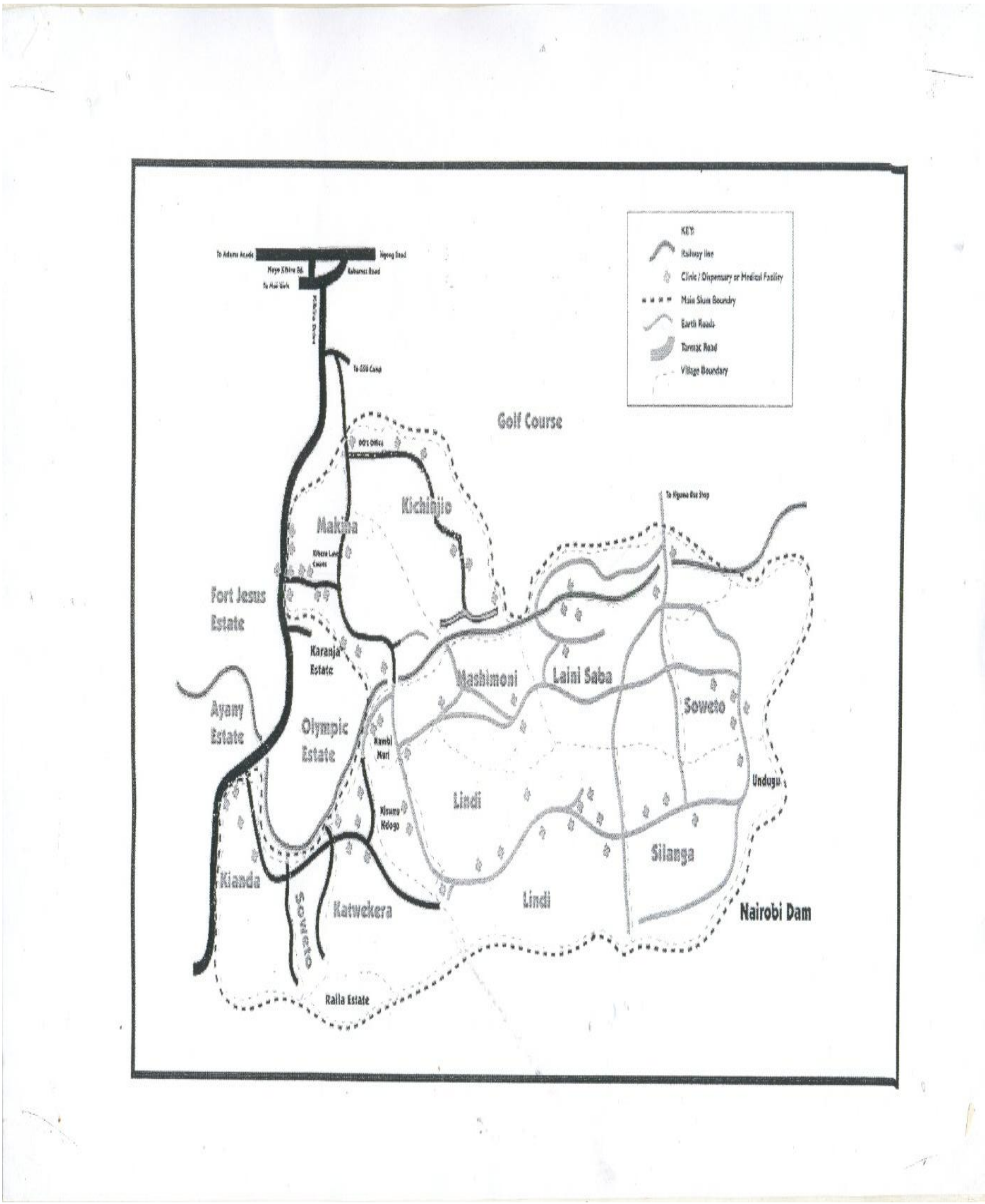
Question		Response	Code
– 0	– Interviewer ID	└┴┴┘	M1
– 1	– Device IDs for height and weight	– Height └┴┘ – Weight └┴┘	M2a M2b
▪ 82	▪ Height	– in Centimetres (cm) –	M3
▪ 83	▪ Weight ▪ *If too large for scale 666.6*	– in Kilograms (kg) – └┴┴┘.└┘	M4
▪ 84	▪ **For women:** Are you pregnant?	Yes 1 *If Yes, go to M 8* No 2	M5

CORE: Waist circumference			
▪ 85	▪ Device ID for waist	▪ └─┴─┘	M6
▪ 86	▪ Waist circumference	in Centimetres (cm) _	M7
CORE: Blood Pressure			
– 7	– Interviewer ID	└─┴─┴─┘	M8
– 8	– Device ID for blood pressure	▪ └─┴─┘	M9
– 9	– Cuff size used	Small 1 Medium 2 Large 3	M10
▪ 90	▪ Reading 1	Systolic (mmHg) └─┴─┴─┘	M11a
		Diastolic (mmHg) └─┴─┴─┘	M11b
▪ 91	▪ Reading 2	▪ Systolic (mmHg) └─┴─┴─┘	M12a
		Diastolic (mmHg) └─┴─┴─┘	M12b
▪ 92	▪ Reading 3	▪ Systolic (mmHg) └─┴─┴─┘	M13a
		Diastolic (mmHg) └─┴─┴─┘	M13b
▪ 93	▪ During the past two weeks, have you been treated for raised blood pressure with drugs (medication) prescribed by a doctor or other	Yes 1 No 2	M14

EXPANDED: Hip Circumference and Heart Rate			
▪ 94	▪ Hip circumference	in Centimeters (cm) └─┴─┴─┘.└─┘	M15
▪ 95	Heart Rate		
	▪ Reading 1	Beats per minute └─┴─┴─┘	M16a
	▪ Reading 2	Beats per minute └─┴─┴─┘	M16b
	▪ Reading 3	Beats per minute └─┴─┴─┘	M16c
Step 3 Biochemical Measurements			
CORE: Blood Glucose			
Question		**Response**	**Code**
▪ 96	▪ During the past 12 hours have you had anything to eat or drink, other than water?	Yes 1 No 2	B1

– 7	– Technician ID	– └─┴─┴─┘	B2
–	– Device ID	– └─┴─┘	B3
▪ 99	▪ Time of day blood specimen taken (24 hour clock)	Hours : minutes └─┴─┘ : └─┴─┘ hrsmins	B4
▪ 100	▪ Fasting blood glucose ▪ *Choose accordingly: mmol/l or mg/dl*	– mmol/l – └─┴─┘ . └─┴─┘ – mg/dl – └─┴─┴─┘ . └─┘	B5
▪ 101	▪ Today, have you taken insulin or other drugs (medication) that have been prescribed by a doctor or other health worker for raised blood glucose?	Yes 1 No 2	B6
CORE: Blood Lipids			
– 02	– Device ID	– – └─┴─┘	B7
– 03	– Total cholesterol – *Choose accordingly: mmol/l or mg/dl*	– mmol/l – └─┴─┘ . └─┴─┘ – mg/dl – └─┴─┴─┘ . └─┘	B8
– 04	– During the past two weeks, have you been treated for raised cholesterol with drugs (medication) prescribed by a doctor or other health worker?	Yes 1 No 2	– B 9
EXPANDED: Triglycerides and HDL Cholesterol			
– 05	– Triglycerides – *Choose accordingly: mmol/l or mg/dl*	– mmol/l ▪ └─┴─┘ . └─┴─┘ – mg/dl – └─┴─┴─┘ . └─┘	B10
– 06	– HDL Cholesterol – *Choose accordingly: mmol/l or mg/dl*	▪ mmol/l – └─┘ . └─┴─┘ – mg/dl – └─┴─┴─┘ . └─┘	B11
EXPANDED: High Sensitivity CRP			
– 07	– Hs CRP – *Choose accordingly: mmol/l or mg/dl*	– mmol/l ▪ └─┴─┘ . └─┴─┘ – mg/dl – └─┴─┴─┘ . └─┘	B12
–	–	▪ – – –	

APPENDIX 7: MAP OF KIBERA SUBLOCATION, LANGATA DIVISION



Courtesy of Nairobi West Public Health Office