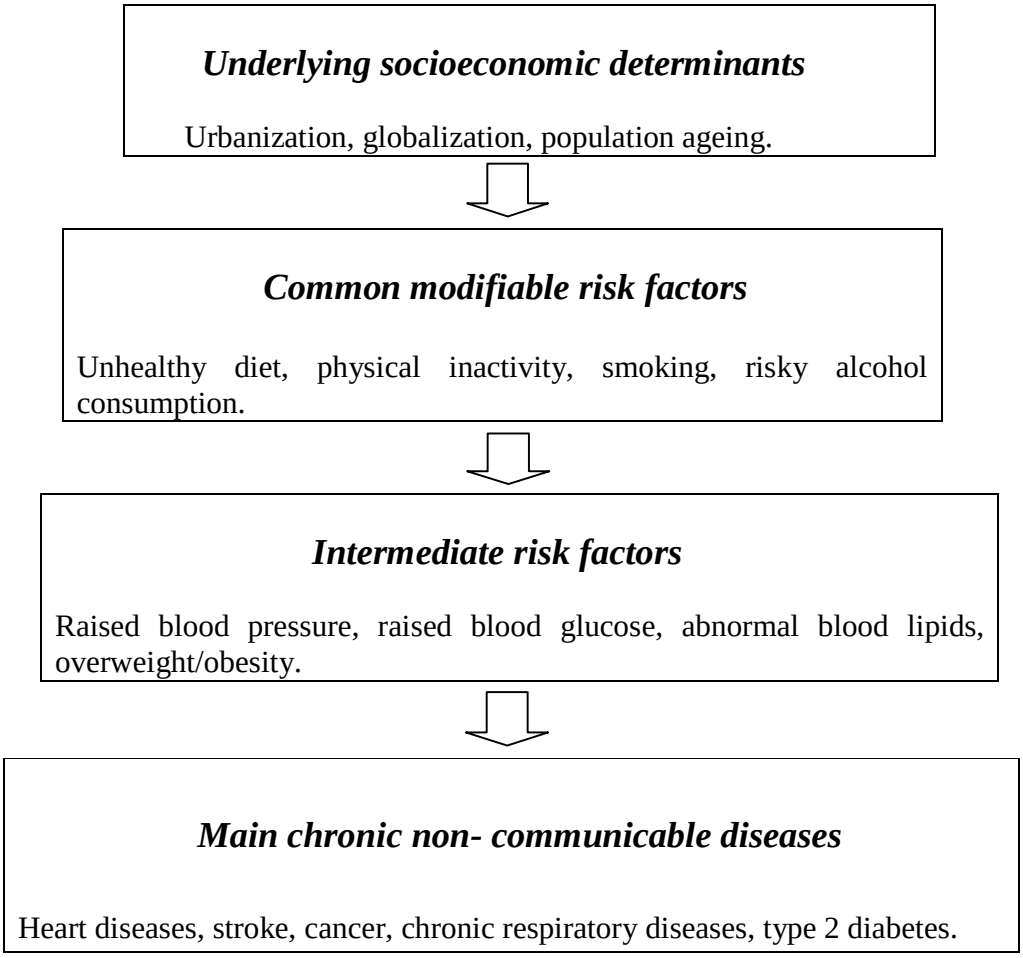

Figure 2.2 Causes of chronic non-communicable diseases (WHO, 2005a).

In America, a chronic disease primary prevention study by Grundy, Bazzarre, Cleeman, D'Agostino, Hill and Houston-Miller (2000) indicated that most chronic non- communicable diseases share common preventable risk factors. Although a considerable number of studies have described the prevalence of individual common risk factors, little has been documented concerning the most recent patterns of risk factors occurring among populations (Fine, Philogen, Gramling, Coups and Sinha, 2004). As stated in an Indonesian risk factor surveillance study by Nawi, Stenlund, Bonita, Hakimi, Wall and Weinehall (2006), risk factors often co-occur and this clustering significantly increases the risk of morbidity and mortality from non-communicable diseases.

Although the Nawi et al study findings cannot be generalized, due to the fact that the study setting was purely rural, consistent observations that risk factors do not occur at random but rather in specific combinations were made in a previous nationally representative study of multiple behavioural risk factor patterns in the United States by the American Institute of Medicine (2001).

The literature in this field reveals a considerable consistency in multiple risk factor trends, through investigations conducted in different settings. In support of this observation, studies by Frantz (2006) and Lazcano-Ponce et al (2003) among public high-school adolescents in the Western Cape, South Africa, and in Morelos, Mexico, reported a high prevalence of multiple risk factors, setting the stage for non-communicable disease epidemics later in their adulthood. Though the findings could be criticised on the grounds that the authors focused on institutionalized adolescents, rather than across a whole population, these reports, in the opinion of Ezzati et al (2002), have literally shifted the causal attribution of risk factors from the traditional context of individual risk factor to combined patterns of occurrence.

It is clear that a gap exists in the epidemiological knowledge concerning multiple risk factor prevalence, especially in developing countries. This in my opinion could be primarily due to the rudimentary state of the public health research infrastructure. This situation poses a great challenge to public health planners in their endeavors to plan and execute prevention and control programs for chronic non- communicable diseases.

2.6 Prevalence of individual health risk factors

2.6.1 Physical inactivity

Sedentarism or the lack of sufficient appropriate physical activity is generally recognized as a by-product of increased mechanization, economic transitions and the shift to physically less demanding modes of transportation. Physical inactivity is currently one of the leading modifiable causes of chronic non-communicable diseases globally (WHO, 2002).

According to statistics by the World Health Organization (2008), it is one of the ten leading global causes of death and disability. Approximately two million deaths each year are attributable to physical inactivity, according to the global cause-specific mortality rate data (WHO, 2003).

Physical inactivity has therefore become a major public health concern as patterns of sedentarism seem to worsen among people of all ages worldwide (CDC, 2001). In the United States, 25% of the population did not participate in physical activities, according to a report by the international Center for Disease Control and Prevention (1996). This low level of participation could be associated with the observed lack of awareness about physical activity and health among one third of the American population, as reported by Morrow, Jackson, Bazzarre, Milne and Blaire (1999). Recent data from the Center for Disease Control and Prevention (2003) further indicates that only about one in five Americans engage in adequate physical activities.

Diminishing physical activity levels have been observed in several countries, including Australia by Baumann and Campbell (2001) and Britain (Health Education Authority, 1998). In Canada, according to Katzmarzk, Gledhill and Shepherd (2000), the trend was rapidly worsening, eventually prompting an integrated intervention from government, the private sector and communities.

Although these studies were conducted in the developed countries, the findings could represent a global profile because, with industrialization, populations in the middle- and low-income developing countries have adopted westernized sedentary lifestyles.

A regional documentation of physical activity levels among high-school learners in the Western Cape, South Africa, by (Frantz, 2006) and (Philips, 2001) reported respectively a 32% and 65% prevalence of physical inactivity. Though based on high-school participants, these analyses present a picture of the future distribution of physical inactivity-related

diseases in this community. According to observations made by Frantz (2006), physical inactivity is prevalent in most countries of the world, including sub-saharan Africa. The rapid increase in the number of people exposed to the hazard of low physical activity levels poses a major public health challenge.

Data on the local profile of physical activity levels in Kenya, as reported in a comprehensive National Health Survey in Kenya (WHO, 2004), demonstrate that 9.4% of both males and females aged 18 – 69 years are physically inactive. This should concern the public health authorities since it directly promotes overweight and obesity, the intermediate risk factors for heart diseases, stroke and type 2 diabetes.

2.6.2 Smoking

The World Health Report (2002) presented smoking as one of the common modifiable risk factors for chronic non-communicable diseases and the second leading cause of death worldwide. According to Guindon and Boisclair (2003), it is currently estimated that approximately 1.3 billion people smoke globally. Among these, about 84% live in developing and transitional economy countries.

They also observed that while smoking rates are declining in the established market economies like America, there is an alarming rise in the developing countries, where 70% of the global tobacco-related deaths occur. The decline in smoking in the established market economies is a result of advances made in public health policy-making, research and practice regarding chronic non-communicable disease prevention. In the developing countries, on the other hand, the increasing trend in smoking rates is considered as a negative effect of urbanization. This suggests that, as the socioeconomic status of a population improves, adoption of health risk behaviour becomes predominant, as noted by Levenson, Skerrett and Gaziano (2002).

The WHO (2008) projections demonstrate that by 2020 smoking will account for more than 12% of total deaths in the developing countries, the highest single-disease death toll ever registered. Without an integrated action by the governments, private sector and communities, this trend would translate into a future epidemic of cancers and chronic obstructive pulmonary disorders. It would increase the total disease burden in these countries where researchers, including Murray and Lopez (1996) in their comprehensive global burden of disease analysis, have shown that infectious diseases and nutritional deficiencies are still a major public health challenge.

The Global Youth Tobacco Survey and the Global School–Based Student Health Survey (WHO, 2004) reported that smoking begins at the ages of 13 – 15 years, when the ability to understand the long-term consequences of this behaviour is very limited. This is consistent with observations made by Coetzee and Underhay (2003) in South Africa, that adolescents from as early as 13 years participate in health risk behaviours, including smoking.

The rural-urban disparities in smoking prevalence among adolescents have been attributed to a lack of tobacco-related information in the rural schools and the influence of paternal smoking, as observed in an Indonesian tobacco control study by Achadi, Soerojo and Barber (2005).

Researchers in the field of chronic disease epidemiology have identified a number of correlates for the current smoking trend, such as gender, age, level of education and work status. In a recent national multi-level analysis of the predictors of smoking in China, Pan and Hu (2008) found a strong positive correlation between age and smoking prevalence, suggesting that as people age, they become more likely to smoke. Consistent with previous literature, males were reported to be more likely to smoke than females. The Pan and Hu analysis is reliable since it is based on quality data derived from a nationally representative sample of 4,000 households, coupled with a sound methodology.

Locally, a Kenyan national health survey (WHO, 2005c) reported a 21% smoking prevalence among men aged 18 years and over as the highest of all population categories. However, smoking studies conducted among high-school learners in Nairobi, Kenya, (Kwamanga, Adhiambo and Amukoye, 2003) and Kampala, Uganda, (Mpabulungi and Muula, 2004) reported prevalences of 32% and 17% respectively. This corresponds to the findings of a Chinese study by Yang, Fan, Tan, Qi, Zhang and Samet (1999), showing that there has been a rapid lowering in the age of smoking initiation.

A rather higher smoking prevalence regionally is that reported in a demographic health survey by Pampel (2004) among males aged 15 to 59 years in Malawi and Zambia, which recorded 40% and 20% smoking prevalences respectively.

While smoking is becoming increasingly common, especially in the developing countries, data on the prevalence of predictors of smoking and evidence on which to base prevention programs is still inadequate. This paucity seriously challenges the effectiveness of most anti-tobacco interventions. The present study therefore attempts to bridge this knowledge gap in Mombasa, Kenya, as a prerequisite for effective public health action.

2.6.3 Hypertension

According to a report by the American National Joint Committee on Hypertension, raised blood pressure is now a major public health problem, affecting over 50 million individuals in the United States and over 1 billion worldwide (Chobanian, Bakris, Black, Cushman, Green, Izzo, Materson, Oparil, Wright and Roccella, 2003). The authors also indicated that hypertension is a close correlate of Body Mass Index and has continuously and consistently remained as a core intermediate health risk factor for coronary heart diseases as well as ischemic and haemorrhagic stroke, the leading causes of morbidity and mortality worldwide.

Findings from the Strong Heart Study (SHS) by Wang, Lee, Fabsitz, Devereux, Best, Welty and Howard (2006) in America reported a rising hypertension prevalence rate among

American Indians, consistent with the national and global trends. They also found a strong positive correlation between measures of age, alcohol consumption, diabetes mellitus and the risk of developing hypertension. This analysis suggests that population ageing, risky alcohol consumption and being diabetic are combined significant risks of hypertension.

The literature also indicates that, despite the high rate of detection and treatment, hypertension remains a major public health problem in the developed countries

With reference to the Omran epidemiologic transition model, hypertension is an early hallmark of the transformation from the age of pestilence and famine to the age of receding pandemics in the developing countries. According to Huang and Stamler (1996), this probably explains the higher hypertension rates observed in the urban areas compared to the rural areas in most developing countries of northern Asia and sub-saharan Africa where cardiovascular mortality is high due to low detection and poor treatment of hypertension.

This relates to the findings of a risk factor surveillance study by Nawi et al (2006) in Indonesia, which showed that the prevalence of hypertension was higher among the urban population and the richest quintile in the rural areas, compared to the poorest rural quintile. Contrary to this report, however, an earlier review by Popkin (1998) revealed that, as the hypertension epidemic advances, the social gradient also reverses, with the poor becoming the most vulnerable victims in both the developed and the developing countries. According to the literature and as observed in this review, these variations are indicators of a significant direct association between a population's socioeconomic status and hypertension.

2.6.4 Overweight/Obesity

Overweight or obesity, together with hypertension, raised blood glucose and lipids levels, is a major intermediate health risk factor for chronic non-communicable diseases. At least 2.6 million people die each year as a result of overweight and obesity, with mortality rates

increasing as the degrees of overweight increase, as measured by BMI (Dobson, Evans and Ferrario, 1998).

According to Flegal, Carroll, Kuczmarski and Johnson (1998), the mean BMI is rising at an alarming rate across all sectors of the population among the established market economy countries like America and the United Kingdom. However, WHO (2005a) demonstrated that overweight and obesity are not limited to developed countries. In many of the developing countries, it is on the rise as well. In South Africa, the BRISK study by Steyn, Jooste and Bourne (1991) reported a 44% obesity rate among African women living in the Cape Peninsula. WHO (2005a) projects that more than 75% of South African women aged over 30 years will be overweight or obese by 2015.

According to the findings of an Indian study by Reddy, Prabhakaran, Shah and Shah (2002), the apparently high rate of overweight and obesity in South Africa (WHO,2005a) could be attributable to urbanization, improved socioeconomic status, the availability of high-fat and protein foods, and moves towards more sedentary lifestyles.

Overweight and obesity have been known to increase in the late stages of the epidemiologic transition. However, contrary to this long-held notion, the World Health Report (1998) revealed a sharp increase in childhood and adolescent overweight and obesity in both the developed and developing countries. This is suggestive of further increases in the prevalence of overweight and obesity in the future.

The Kenyan overweight and obesity profile is equally worrying. As demonstrated in a National Demographic and Health Survey (1998), an estimated 22% of Kenyan women aged 45 – 49 years were reported overweight and obese. Though not based on up-to-date data, the statistics on the mean BMI are generally alarming and predictive of a future epidemic of weight-related disorders. This situation needs an urgent address by the public health authorities, since the cost of inaction is well understood and highly undesirable.

2.7 The impact of chronic non-communicable diseases and their risk factors.

2.7.1 Health impact.

> *The lives of far too many people are being blighted or cut short by chronic diseases such as heart disease, stroke, cancer, chronic respiratory diseases and diabetes. This is no longer only happening in the high income countries. This is a very serious situation to individuals, societies, public health and economies affected.* (Jong-Wook, 2005).

In 2000, the 53rd World Health Assembly reported that public health advocacy, especially in the developing countries, had been traditionally devoted to infectious diseases. In contrast, it became clear that the impact and profile of non-communicable diseases had generally been insufficiently appreciated.

Due to material deprivation, increased exposure to risks and decreased access to health care services, the non-communicable disease burden is now concentrated among the low- and middle-income countries with a majority of poor people (WHO, 2005a).

The health impact of chronic non-communicable diseases and their risk factors is estimated in terms of mortality rate and the burden of diseases (DALYs) attributable to them. According to the burden of disease study (Ezzati et al, 2002), chronic disease risk factors are the leading cause of death in all countries, regardless of their economic development status.

Figure 2.3 below shows the global annual estimates of deaths attributable to the major risk factors for non-communicable diseases.

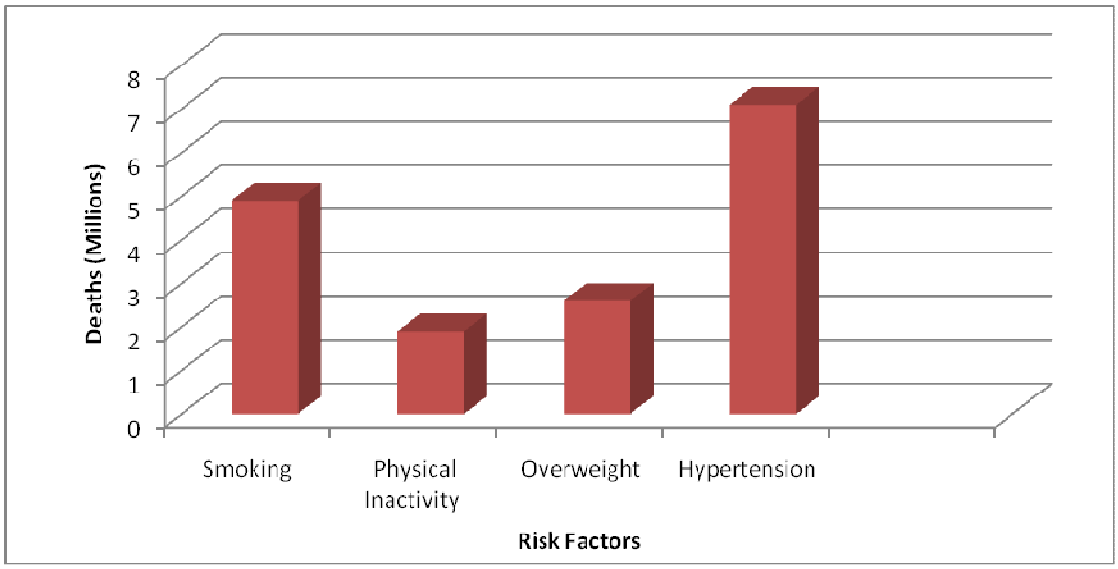

Figure 2.3 Estimated annual global death toll due to major risk factors (WHO, 2005a).

2.7.2 Socioeconomic impact

Chronic diseases and poverty are interconnected in a vicious cycle. The poorest quintile in almost all countries is more vulnerable to chronic diseases for several reasons, including greater exposure to health-risk living conditions and decreased access to good-quality health care services (Sachs, 2005).

Chronic diseases represent a major cost and a profound economic burden to individuals, families, health systems and societies. According to Marmot (2004), chronic diseases may cause poverty or worsen already existing poverty by ruining a family's economic prospects through direct catastrophic expenditure on health care services and prolonged loss of income. This argument is supported by the findings of a case study in Jamaica by Henry-Lee and Yearwood (1999) who found that approximately 59% of people with chronic diseases reported financial difficulties caused by their illness.

A similar consequence was reported by Shobhana, Rama, Lavanya, Williams, Vijay and Ramachandra (2000) in India, where people with diabetes appeared to spend more than 25% of their annual income on medical care. This suggests that the direct cost of non-communicable diseases is high and that the indirect economic impact due to loss of income following disability or premature death warrants serious consideration.

Contrary to this, Hulme and Shepherd (2003) argued that the existing knowledge seems to underestimate both the economic implications of chronic diseases and the potential of chronic disease prevention and health promotion in alleviating poverty, especially in the developing countries. This could be due to the fact that the profile of non-communicable diseases and their risk factors is insufficiently appreciated and not enough efforts have been made at the local, national and even international level regarding prevention and control of chronic non-communicable diseases.

This review has clearly revealed that chronic diseases place a grave economic burden on individuals, families and countries, and that there is sufficient evidence to show that urgent action is required to avoid an adverse impact on national socioeconomic development.

2.8 Models of best practice in the control and prevention of non-communicable diseases

In 2000, the 53rd World Health Assembly passed a resolution on the prevention and control of non-communicable diseases among member states in their efforts to reduce the toll of morbidity, mortality and premature mortality related to non-communicable diseases (WHO, 2005a).

The main objective of this global strategy was to map the emerging epidemic and analyze its social, economic and behavioural determinants in order to provide guidance for policy

making and public health action. It was proposed in the assembly that comprehensive and integrated surveillance of non-communicable disease risk factors would be part of the wider health information system recommended by the World Health Organization as an essential national public health function.

The means of preventing and controlling most non-communicable diseases through comprehensive and integrated action are already established, and have proved applicable and cost-effective even in resource-constrained settings (Jong-Wook, 2005).

The paucity or lack of data on surveillance and monitoring of non-communicable diseases and their risk factors, especially in most African countries, forms a hindrance to the planning and implementation of informed, target-specific and cost-effective interventions.

Successful evidence-based interventions informed by up-to-date data from surveillance systems have been documented in several WHO member countries. In America, for example, using data from the 2001 National Health Interview Survey (NHIS), a workplace health education program by the Johnson & Johnson's Health and Wellness program established in 2002 offered chronic disease prevention and health promotion services to the company's employees (Goetzel et al., 2003). On evaluation a year after the commencement, the authors recorded a significant reduction in the mean number of risk factors for non-communicable diseases among the employees.

Another successful American documentation is a school-based health program dubbed the Child and Adolescents Trial for Cardiovascular Health (CATCH) (Hoelscher et al., 2004). This program, structured using data from the Behavioural Risk Factor Surveillance System (BRFSS), was target-designed and recorded a substantial reduction in cardiovascular risk factors among learners.

In a comparative study to investigate the cost of various public health interventions (World Education Forum, 2000), the World Bank reported that school-based health programs are

highly cost-effective, even in low-income countries. This suggests that adoption and transferability of such programs is highly feasible.

This review has revealed that national legal frameworks are also a fundamental element in public health policy and practice. Other than the proactive workplace- and school-based programs, population-wide policies on tax and price control have also proved effective in enhancing desirable health-related behaviour.

A successful regional intervention was South Africa's 33% reduction in smoking following the introduction of a 50% increase in the retail prices for tobacco products in 1994 (Van Walbeek, 2002). In the long run this will translate to reduced rates of chronic respiratory disorders, cardiovascular diseases and multiple cancers among the entire population.

As seen in the cases of Costa Rica (Sankaranarayanan, 2002) and Mexico (Pan American Health Organization, 2005), clinical prevention interventions are also a key component of comprehensive programs aimed at reducing the risk of chronic disease onset in both developing and developed countries. When based on multiple risk factor assessment and properly delivered, they are highly effective in reducing disease and death and improving the quality of life of people at risk of or living with chronic diseases. Though there is limited documentation of proven clinical programs, the available few are notable exceptions and are of great public health significance.

2.9 Conclusion.

Chronic non-communicable diseases have emerged as a leading cause of death and disability globally. Health risk behaviors, including poor diet, risky alcohol consumption, smoking and physical inactivity, have been closely associated with hypertension, overweight and obesity, high blood sugar and high cholesterol levels, which ultimately lead to the development of

chronic diseases. The literature has attributed this to changes in the social, economic and demographic environments following urbanization.

There is adequate disturbing evidence on the profile of non-communicable diseases, their impact on health, their socioeconomic effect, and their risk factors at individual, family, national and global levels.

As this review has demonstrated, knowledge exists on how to deal with this global threat in order to save millions of lives. Comprehensive on-going surveillance of the major risk factors is fundamental. For the resource-constrained countries of Africa, action is possible through cost-effective interventions that have been proven to work in other WHO-member developing countries.

For the Kenyan Department of Public Health to plan and execute a successful and cost-effective chronic disease prevention program, a baseline starting point must be put in place. This essentially involves up-to-date surveillance data on multiple risk factor analysis. The paucity or absolute lack of such vital public health information motivated the undertaking of this survey in Mombasa, Kenya, where data on chronic disease risk factor surveillance is unavailable.

Chapter Three

Methodology

3.1 Introduction

This chapter describes the study setting and the rationale for its selection, the research design employed, and the sampling techniques utilized. Tools of data collection and methods of data analysis are outlined, as well as a description of the pilot study. The protocol observed to ensure ethical considerations is also stated.

3.2 Research setting

The study was conducted in Mombasa, Kenya. This metropole is located along Kenya's coastline, measuring 83,603 square kilometers off-shore. It is Kenya's second largest city, forming the coastal provincial administrative capital. The population has a diverse multi-ethnic background and is estimated at 828,5000 according to the Kenya National Bureau of Statistics (1999 census).

Mombasa represents one of Kenya's major sources of revenue, owing to its local, regional and global tourism reputation, and to the port of Mombasa, which is a trade and commercial gateway to most parts of the East and Central Africa.

The institutions where the study was conducted included four public high schools, two boarding and two day schools. The participating tertiary institutions were a public university, a university college, and a vocational training college. Workplaces comprised a public referral hospital, a security firm and a sanitation and waste disposal company. A city marketplace, on the other hand, was used as a community setting.

3.3 Study design

The researcher employed a cross-sectional quantitative design. The WHO STEPwise protocol (WHO, 2005b), which provides a framework for the surveillance of non-communicable disease risk factors, was used. This is a sequential process, starting with gathering questionnaire-based data on key risk factors (Step 1), then moving on to taking simple physical measurements (Step 2), followed by biomedical measurements (Step 3). The present study, however, only utilized the first two steps, as advised by WHO for resource-scarce settings like Kenya.

Table 3.1: WHO STEPS framework for non-communicable diseases risk factors surveillance (WHO, 2005b).

Measures	**STEP 1 (Questionnaire-based information)**	**STEP 2 (Physical measurements)**
Core	Self-reported socioeconomic and demographic variables, tobacco and alcohol use, physical inactivity, fruit and vegetable intake.	Measured height, weight, waist circumference, blood pressure.
Expanded core	Educational level, occupation, income, fat consumption, types of physical activities, treatment for hypertension and diabetes.	Hip circumference, pulse rate.

3.4 Study population

The study was targeted at males and females aged between 15 and 70 years living in Mombasa, Kenya. Stratification of the population was done according to age and gender, as

demonstrated by the Kenya National Bureau of Statistics (1999 census). Table 3.2 below describes Mombasa's population for various age categories according to gender.

Table 3.2: Mombasa's population by age category and gender (Kenya National Bureau of Statistics, 1999).

Age-group (Years)	Male	Female	Total
15 – 19	25,899	29, 427	55, 329
20 -35	153, 168	118, 073	271, 241
36 – 50	52, 242	34, 983	87, 225
51 – 70	21, 549	14, 358	35, 907

3.5 Sampling technique

The study sample was determined through convenient stratification of the population according to age, gender and setting.

Table 3.3: Population stratification by age, gender and setting.

Age-group (Years)	Male	Female	Total	Category	Convenient setting
15 – 19	25, 899	29, 427	55, 329	Adolescents	High schools
20 – 35	153, 168	118, 073	271, 241	Young adults	Tertiary institutions
36 -50	52, 242	34, 983	87, 225	Adults	Workplaces
51 – 70	21, 549	14, 358	35, 907	Elderly	Community

The convenient settings of public high schools, colleges, universities and workplaces were listed and randomly sampled. The study participants were then randomly selected from the chosen settings to form the study sample.

Using the Yamane formula $\mathbf{n = \frac{N}{1 + N (e^2)}}$ (Yamane, 1967) to calculate the study sample, (where n = sample size, N = total population and e = level of precision), approximately 500 participants were targeted with a composition of 150 high-school learners, 200 university and college students, 100 from workplaces and 50 from communities. This was meant to ensure proportionate representation of the different population categories in the selected study sample, as recommended by Babbie and Mouton (2006).

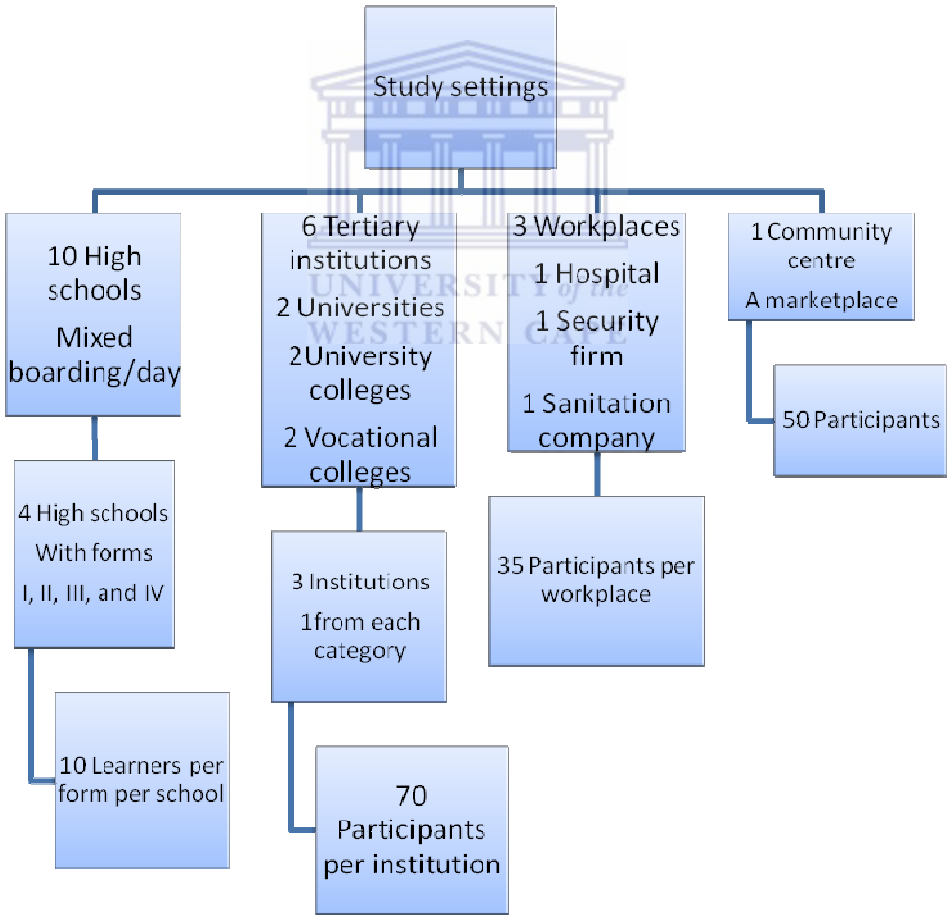

Figure 3.1: Randomized selection of study settings and participants

3.5.1 High schools

From a total of 10 high schools (mixed boarding/day), the researcher randomly selected four high schools. Using a class list as per admission for the 2008 academic year, 10 learners were recruited per class per selected school from Forms I to IV by randomly picking every fifth learner from each class list until the target was reached. In each of the four high schools, all the randomly selected learners were gathered in a common room where they filled in the questionnaires (Appendix I). At each school, a convenient corner of the common room was identified and screened to ensure privacy during the taking of the anthropometrical measurements.

3.5.2 Tertiary institutions

This category was comprised of two universities, two university colleges and two vocational training colleges. The researcher randomly selected one institution from each of the three categories. Stratification was done according to course of study and 70 participants were conveniently recruited from each of the three selected institutions with a proportionate composition per course of study. At every tertiary institution, all the selected participants were asked to gather in a hall where they filled in the questionnaires (Appendix I). Anthropometrical measurements were taken by the researcher and the research assistants at the clinic in each institution.

3.5.3 Workplaces

The three workplaces selected consisted of a public referral hospital, a security firm, and a sanitation and waste disposal company. A total of 35 willing participants from different job categories were recruited in each of the three settings. Jobs were categorized into office

workers such as clerks and managers, station workers doing lifting, carrying or pushing duties, and field workers involved in heavy lifting or digging. Questionnaires (Appendix I) were distributed to the selected participants in their respective departments in each of the workplaces. The taking of the anthropometrical measurements was done by the researcher and the research assistants in convenient screened rooms allocated by the respective authorities.

3.5.4 Community

A city marketplace was conveniently selected by the researcher for this category. The rationale for selecting the marketplace was the likelihood of involving the non-institutionalized Mombasa residents. 50 participants were targeted in this category. Recruitment for the study was based on participants' willingness. A well lit and properly ventilated small room was obtained next to the marketplace and was used as a central base where participants could fill in the questionnaire (Appendix I). Using screens, a corner of the room was isolated for taking the anthropometrical measurements.

3.6 Study instruments

Data were gathered using the WHO STEPS framework questionnaire (V1.4) Core and expanded (Appendix I). This instrument is internationally recommended for surveillance of the risk factors for non-communicable diseases (Bonita et al., 2001). Through close-ended and scaled questions, it requires participants to give information concerning socio-demographics, tobacco use, alcohol consumption, physical activities, diet and any history of diabetes and hypertension (Step 1). The next procedure (Step 2) involved the measurement of systolic and diastolic blood pressure and pulse rate. This was done using a *Mars* automatic digital blood pressure monitor (MS – 700AM) with the participants seated and their left arms supported on a flat surface level with the heart. Height and weight for MBI were measured using a *Bio-*

metric machine (BMS™), with participants standing flat-footed and without headgear. BMI was calculated by dividing the participants' height in square meters (m^2) by their weight in kilograms. A flexible (Oppo Pro-Sport) tape measure was used to measure the participants' waist and hip circumference in an erect position. In particular, the researcher took care to ensure that measurements were not taken on top of loose-fitting or heavy clothing.

3.7 Pilot study

The researcher recruited two research assistants, a physiotherapist and an occupational therapist, and trained them on the protocol of taking the physical measurements and in assisting the participants with filling in the questionnaires. This was followed by a pilot study on 20 participants, composed of five from each of the four age and setting categories, in order to determine the time taken by participants to complete the questionnaire (Appendix I) and to ensure that the research assistants understood the protocol for taking the anthropometric measurements. The piloted participants did not take part in the main study.

3.8 Reliability

Reliability is a fundamental concern in all measurements. It refers to the dependability or consistency of measurements (Redfern and Norman, 1994). The reliability of the instrument (Appendix I) in this study has been proved through previous similar studies done in some WHO member states, such as Thailand in 2001 (WHO, 2005a) and Indonesia (Nawi et al., 2006).

The anthropometric measurements were tested for intra-rater and inter-rater reliability and re-tested in a pilot study before the main study to check reliability. The reliability testing outcome was satisfactory, since repeated measurements by the researcher and research

assistants showed negligible differences. Similarly, the differences in the measurements taken on the same participants by the researcher and the two research assistants were not significant. The reliability of the anthropometric measurements was further ensured by taking an average of two measurements for each variable.

3.9 Validity

This refers to the degree to which an account truthfully represents the social phenomena to which it refers (Silverman, 2000). The adopted WHO STEPS instrument (Appendix I) was tailored to suit different settings; its content has been proven valid in similar risk factor surveillance studies across WHO member states, such as in Indonesia (Nawi et al., 2006), and it uses the same standardized questions and protocol.

3.10 Procedure

3.10.1. Permission

Permission was obtained from the University of the Western Cape, Higher Degrees Committee (Appendix A). Permission to undertake the study in Mombasa was sought from the Ministry of Education, Science and Technology (Appendix B), through a written request after submitting a letter of introduction and a copy of the research proposal.

High schools

The researcher obtained permission from the heads of the four selected high schools by introducing himself, giving a brief explanation of the study and submitting the approval letters from the University of the Western Cape, Higher Degrees Committee (Appendix A), the

Ministry of Education, Science and Technology (Appendix B), and the Mombasa District Education Officer (Appendix D).

Tertiary institutions

Permission from these institutions was obtained after a meeting between the researcher and the respective principals. The researcher introducted himself, before giving a brief description of the study. Letters of approval from the University of the Western Cape, Higher Degrees Committee (Appendix A), Ministry of Education, Science and Technology (Appendix B), as well as from the Mombasa District Education Officer (Appendix D), were submitted to the principals.

Workplaces

To obtain access to each of the selected organizations, the researcher went through the administrators and departmental heads in each organization. At both levels, the researcher introduced himself and gave a brief description of the study before being given access to the participants. The university and ministerial approval letters (Appendices A and B) were only submitted to the administrators.

Community

At the marketplace, the researcher met individuals and small groups. He introduced himself as a student of the University of the Western Cape, using the student identification card (Appendix J) and the research clearance permit from the National Research Council (Appendix C). Together with the research assistants, the researcher gave brief descriptions of the study, after which willing individuals were asked to go to a central place set for completing the questionnaires (Appendix I) and taking the anthropometrical measurements.

3.10.2. Recruitment

Four high schools and three tertiary institutions were randomly selected from the total of 10 and six respectively. 10 high school learners per form per school were randomly selected and 70 participants were conveniently selected from each of the three randomly selected tertiary institutions, with a proportionate composition per course of study. In the three randomly selected workplaces, 35 participants were conveniently recruited from each organization, with a proportionate composition per job category. A total of 50 participants from the city marketplace were conveniently and willingly recruited. Using the participants' information sheet (Appendix E), participants were informed of the study at the various venues and were asked to voluntarily participate in the study. Written consent was obtained from participants and guardians (Appendix F) where necessary. Participants completed the self-administered questionnaire (Appendix I) first and at each venue a central place was set up for the taking of the various anthropometric measurements. The completed questionnaires (Appendix I) were then compiled by the principal researcher.

3.11 Data analysis

Data were captured using the Statistical Package for Social Sciences (SPSS V13.0). Data cleaning and analysis were done using the Statistical Analysis System (SAS). Descriptive analysis was done using frequencies and percentages to describe the participants and their health-related behavioral patterns and socio-demographic characteristics. Inferential statistical analysis was employed to explore the correlation and association between socio-demographic information and the prevalence of the risk factors among the participants.

3.12 Ethical considerations

Approval for the implementation of this study was sought from the Senate Higher Degrees Committee of the University of the Western Cape. Permission to conduct the study in Mombasa was obtained from the Ministry of Research and Higher Education and the governing bodies of the selected high schools, tertiary institutions and workplaces, after the researcher had submitted a letter of introduction and a copy of the research proposal. The study purpose, issues of confidentiality, anonymity and participants' rights to withdraw from the study at any stage without notice were explained to all the participants using the participants' information sheet before they completed a written informed consent form.

School heads, parents or guardians were requested to give consent for participants aged below 18 years. Participants were also informed of any health centres which could be consulted if any queries were encountered. Completed questionnaires were compiled and stored in a locked place by the principal researcher.

Chapter Four

Results

4.1 Introduction

This chapter presents the descriptive and inferential statistic results of the study. The descriptive results mainly present the demographic characteristics of the study sample, while the inferential statistic results highlight the observed correlations and associations between various demographic variables and the risk factors for non-communicable diseases.

4.2 Descriptive characteristics of the sample

A total of 500 questionnaires were distributed to participants in the various settings. Three hundred and five (305) questionnaires were completed and returned to the researcher, yielding a response rate of 61%. One hundred and ninety-five (195) participants did not complete the questionnaires and were withdrawn from the study. The participants were aged between 15 and 63 years, with a mean age of 22.8 years and a standard deviation of 8.6. In this survey, 181 of the participants were male and 124 were female. Table 4.1 below presents the socio-demographic data of the respondents.

Table 4.1: Socio-demographic information of the study participants.

Variables **Gender**	*Frequency*	*Proportion*	*Number of participants*
Male	181	59.3	305
Female	124	40.7	
Age (years)			
15- 19	117	38.6	
20 – 24	126	41.3	303
25 -29	22	7.2	
30 and above	38	12.5	
Missing	2	0.7	
Level of education			
No formal education	1	0.34	
Primary education	1	0.34	
Primary school completed	101	34.24	295
High school completed	130	44.07	
College/university completed	59	20.00	
Postgraduate	3	1.02	
Missing	10	3.3	
Work status			
Government employees	18	6.10	
NGO employees	17	5.76	
Self-employed	13	4.41	
Non-paid	4	1.36	
Student	221	74.92	295
Home-makers	7	2.37	
Retired	4	1.36	
Unemployed (able to work)	11	3.73	
Missing	10	3.3	
Participants setting category		**Mean age**	
High school	93	17.45	
College/university	124	21.14	291
Work places and community	74	33.21	
Missing	14	4.6	

4.3 Analysis of risk factors among study participants

The studied risk factors for non-communicable diseases, which included tobacco use, risky alcohol consumption, physical inactivity, overweight/obesity and hypertension, were used to categorize the respondents into those who were considered to be at risk for developing a non-communicable disease and those who did not possess the risk factor. Table 4.2 below illustrates the observed proportions of participants under each risk factor.

Table 4.2: Risk factors according to participants' age-groups.

Risk Factor	Age-groups (years)				
	15-19	**20-24**	**25-29**	**30 and above**	**Total**
Tobacco use (N=297)					
Smokers	12 (10%)	6 (5%)	4 (18%)	6 (16%)	28 (9%)
Non-smokers	105 (90%)	114 (95%)	18 (82%)	32 (84%)	269 (91%)
Alcohol consumption (N=296)					
Risky drinkers	29 (25%)	54 (45%)	15 (68%)	29 (81%)	127 (43%)
Non-drinkers	87 (75%)	66 (55%)	7 (32%)	9 (19%)	169 (57%)
Physical Activity (N=303)					
Sedentary	92 (79%)	67 (53%)	7 (32%)	11 (29%)	177 (58%)
Active	25 (21%)	59 (47%)	15 (68%)	27 (71%)	126 (42%)
Body Mass Index (N=303)					
Overweight/obese	15 (13%)	18 (14%)	3 (14%)	19 (50%)	55 (19%)
Normal weight	102 (87%)	108 (86%)	19 (86%)	19 (50%)	248 (81%)
Blood Pressure (N=303)					
Hypertensive	7 (6%)	12 (10%)	2 (9%)	20 (53%)	41 (24%)
Normal	110 (94%)	114 (90%)	20 (91%)	18 (47%)	262 (76%)

4.3.1 Smoking

Participants were defined as smokers if they used any tobacco products (cigarettes, cigars or pipes) either daily or on some days. In our study, 9% (n=28) of the respondents were smokers, with an equal representation of 50% for both male and female participants. The mean age at which participants started smoking was 22 years. Manufactured cigarettes were the only type reported to be used by all smokers, with a majority of 68% (n=19) smoking an average of 12 cigarettes per day.

The majority of the smokers, 34% (n=10), were aged 25 years and above; however, the association between smoking risk and age was not statistically significant (p=2.47). Similarly, participants who had only attained primary education formed the majority, 36% (n=10), of those who smoked within the level of education category. Further analysis on the work status category indicated that most of the smokers, 61% (n=17), were students. However, using the Mantel Haenszel Chi-square test, the observed associations were not statistically significant (p = 4.08).

4.3.2 Alcohol consumption

Male participants were regarded as risky drinkers if they had an average weekly consumption of ≥ 14 alcoholic drinks or five or more drinks per day on most days of the week; for women, it was an average of ≥ 7 alcoholic drinks per week or four or more drinks per day on most days of the week. In this study, 43% (n=127) of the respondents were risky alcohol drinkers, with a statistically significant male dominance of 78% (n=99) (p = 0.03). Participants aged 30 years and above comprised a majority of 81% (n=103) of the risky alcohol drinkers. Those who had attained only up to high school education formed 50% (n=127) according to the level of education category, while a majority of 62% (n=127) were students as per the work status

category. However, the associations observed between risky alcohol consumption and the different socio-demographic variables were not statistically significant (p= 3.45).

4.3.3 Physical inactivity

Physical inactivity was defined as less than 30 minutes of light or moderate physical activities at a time for five or more times a week, or less than 20 minutes of vigorous activities at a time for three or more times a week. Heavy lifting and brisk walking represent vigorous and moderate physical activities respectively.

In our present study, 58% (n=177) of the participants were found to be physically inactive, with a male and female composition of 59% (n = 104) and 41% (n =73) respectively. However, further analysis to explore possible associations between physical inactivity and gender demonstrated that there was no statistical significance between the two variables. Using the Pearson Chi-square test for independence (p=0.05), a statistically significant association was found between physical inactivity and the participants' ages (p=0.03). The majority, 79% (n=140), of the physically inactive participants were aged between 15 and 19 years. Figure 4.1 below shows the proportions of physically inactive participants according to age.

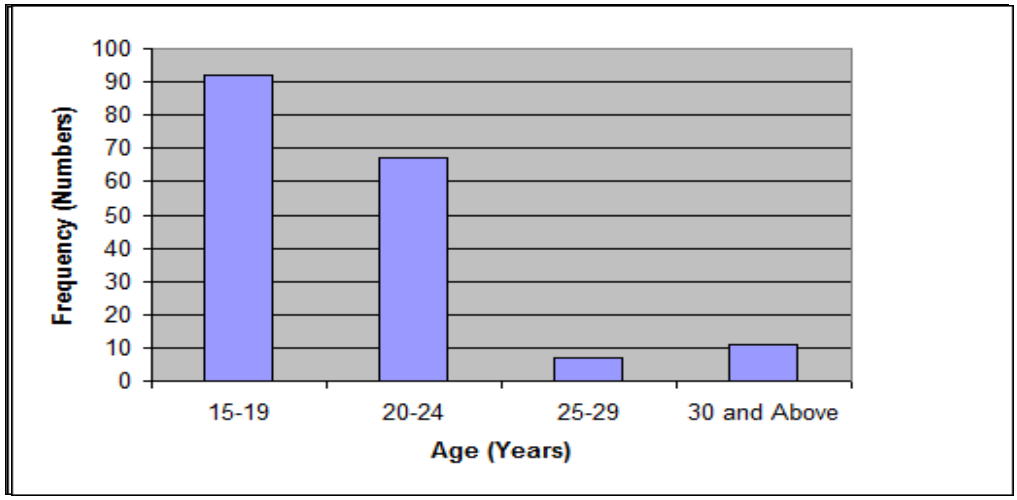

Figure 4.1: Frequency of physical inactivity according to age (n=175).

The participants' level of education was also proved to be closely associated (p=0.05) with their patterns of physical activity, with those who had attained only up to primary education being the most inactive group, representing 49% (n=87) of the study participants within the level of education category. Figure 4.2 below shows the frequencies of physically inactive participants according to the level of education attained.

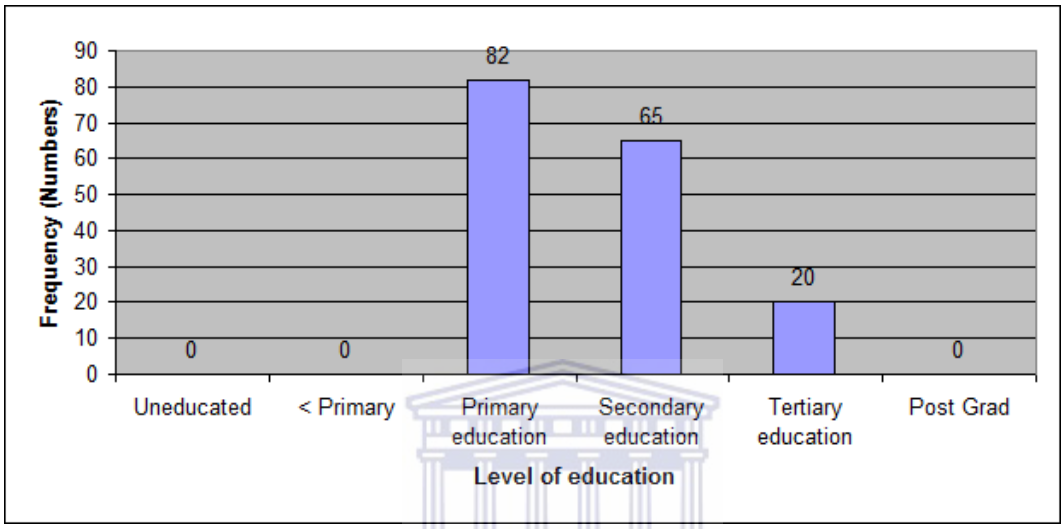

Figure 4.2: Physical inactivity according to participants' level of education (n=175).

Using the Pearson's Chi-square test (p=0.05), a statistically significant association was found between participants' patterns of physical activity and their work status, with students being the most sedentary group, at 63% (n=110), within the work status category. It was, however, revealed that the majority, at 66% (n=83), of the physically active participants indulged in physical activities during their leisure time, as opposed to during their time of work.

4.4: Analysis of the anthropometrical measurements

4.4.1 Blood pressure

Blood pressure is one of the known intermediate risk factors for non-communicable diseases. In our current study, participants were classified into hypertensive and normal under various socio-demographic categories, as illustrated in Table 4.3 below.

Table 4.3: Blood pressure according to socio-demographic characteristics.

Category	Blood pressure		
	Hypertensive	**Normal**	**Total**
Gender			
Male	17 (9%)	164 (91%)	181
Female	24 (19%)	100 (81%)	124
Level of Education			
No formal schooling	_	1 (100%)	1
Primary education	_	1 (100%)	1
Primary school completed	11 (11%)	90 (89%)	101
High school completed	15 (12%)	115 (88%)	130
College/University	11 (19%)	48 (81%)	59
Postgraduates	3 (100%)	_	3
Work status			
Government employees	8 (44%)	10 (56%)	18
NGO employees	4 (24%)	13 (76%)	17
Self-employed	6 (46%)	7 (54%)	13
Non-paid	_	4 (100%)	4
Students	15 (7%)	206 (93%)	221
Home-makers	4 (57%)	3 (43%)	7
Retirees	3 (75%)	1 (25%)	4
Unemployed (able to work)	_	11 (100%)	11

4.4.1.2: Hypertension

Participants were classified as having elevated blood pressure if the systolic pressure was > 140mmHg and/or diastolic pressure was > 90mmHg, or if they were taking anti-hypertensive medication or had been diagnosed as hypertensive by a medical practitioner in the previous 12 months. A proportion of 28% (N=305) had had their blood pressure measured by a doctor or health care worker in the past 12 months, with 24% (n=84) diagnosed as hypertensive; all of these were on prescribed anti-hypertensive medication. Inferential statistics indicated a significant association (p=0.05) between hypertension and participants' age, gender and level of education. A proportion of 19% (n=24) of females were hypertensive within the gender category, with the attainment of an increasing level of education observed to be directly proportional to high blood pressure. Similarly, participants' increasing age also proved to be a statistically significant positive predictor for hypertension, with most of the hypertensive participants, 53% (n=41), aged 30 years and above. Figure 4.3 below illustrates the observed association between hypertension and the participants' ages.

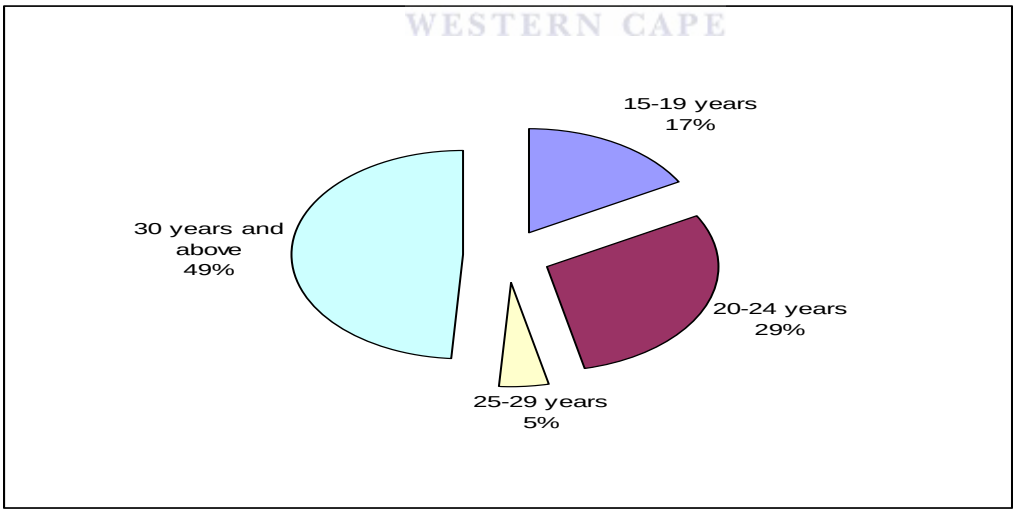

Figure 4.3: Hypertension according to participants' age-groups (n=41).

4.4.2: Body Mass Index (BMI)

Body Mass Index (BMI) was used in this study as a standard measure for weight. Participants were therefore classified as overweight/obese or normal and further categorized under their various socio-demographic characteristics.

Table 4.4: BMI according to socio-demographic characteristics

Category	BMI		
	Overweight/obese	**Normal**	**Total**
Gender			
Male	16 (9%)	165 (91%)	181
Female	40 (32%)	84 (68%)	124
Level of Education			
No formal schooling	_	1 (100%)	1
Primary education	_	1 (100%)	1
Primary school completed	9 (9%)	92 (91%)	101
High school completed	36 (28%)	104 (72%)	130
College/University	16 (27%)	43 (73%)	59
Postgraduates	3 (100%)	_	3
Work status			
Government employees	9 (50%)	9 (50%)	18
NGO employees	4 (24%)	13 (76%)	17
Self-employed	4 (31%)	9(69%)	13
Non paid	_	4 (100%)	4
Students	31 (14%)	190 (86%)	221
Home-makers	3(43%)	4 (57%)	7
Retirees	3 (75%)	1 (25%)	4
Unemployed (able to work)	_	11 (100%)	11

4.4.2.1: Overweight/obesity

The average BMI was 22.5 kg/m^2 with a standard deviation of 4.6. The inferential analysis indicated that 19% of the study participants were overweight/obese and that the variations in participants' body mass index (p=0.02) were significantly associated with their gender. Using the Pearson Chi-square test (p=0.05), female gender was seen to be a positive predictor for overweight/obesity, with a 71% majority compared to a 29% male composition (p=0.01). Although statistically insignificant, attainment of a low level of education, increasing age and being a student were observed to be predictors for being overweight or obese. A majority of 58% of participants with only up to high school education were obese/overweight, as were 50% of those aged 30 years and above, and 57% of student participants. Figure 4.4 below illustrates the observed relationships between overweight/obesity and participants' ages.

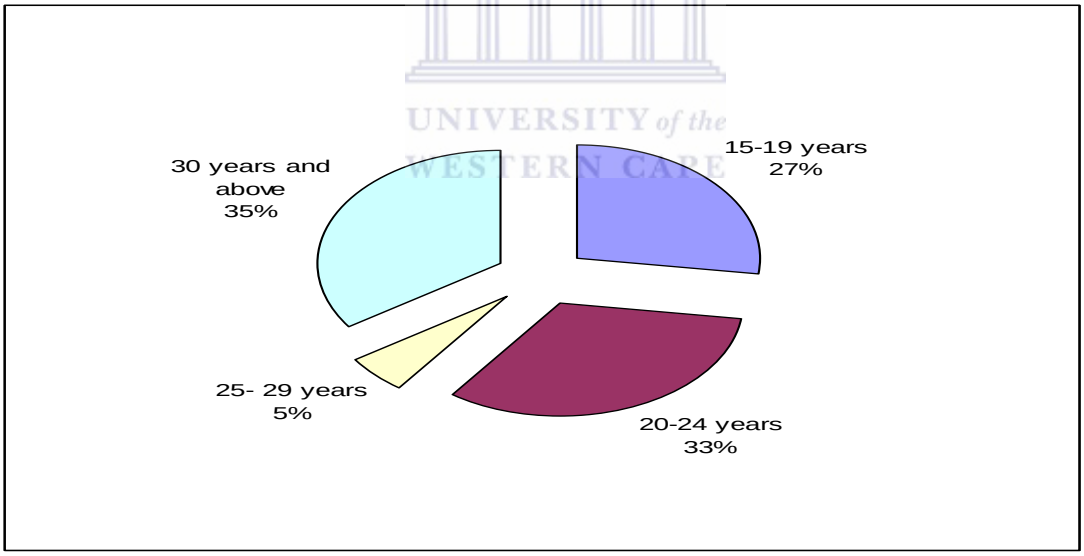

Figure 4.4: Overweight/obesity according to participants' age-group (n=55)

4.5 Diet

Diet as one of the known determinants for non-communicable disease was also investigated in this study. In our analysis, fruit and vegetable consumption, together with cholesterol-free vegetable cooking oil, were used as indicators of proper diet. The results indicated that 42% (n=114) of the participants ate fruits on most days of the week, with a majority of 34% (n=39) eating at least two servings in each of the days. Daily vegetable consumption was reported by 36% (n=110) of the respondents, the majority of whom, 44% (n=48), consumed only one vegetable serving daily. Vegetable oil was reportedly the cooking oil of choice for the majority of the participants, with 66% (n=201) using it in their daily household cooking. Using the Pearson's Chi-square test for independence, a statistically significant association (p=0.01) was found between level of education and fruit and vegetable consumption, with 60% (n=86) of the participants who ate fruits on most days of the week and 56% (n=61) of those who reported eating vegetables possessing more than high school education.

4.6 Blood sugar

Raised blood sugar or metabolic syndrome is equally a major risk factor for non-communicable diseases globally. Total prevention or early detection has always been advocated by most public health stakeholders in the drive to control the non-communicable diseases pandemic. In our analysis, 13% (n=40) of the participants had had their blood sugar measured by a health care professional in the previous 12 months, 30% (n=12) of them being diagnosed as diabetic. Of these, 40% (n=16) were on injectable insulin, while the rest were on oral drugs and a specially prescribed diet. Increasing age, male gender and high level of educational attainment were found to be directly proportional to elevated blood sugars.

4.7 Analysis of risk factors by participants' gender

The risk factors included under this analysis were smoking, risky alcohol consumption, poor diet, physical inactivity, hypertension and overweight/obesity. In our inferential analysis, a significant association was demonstrated between gender and the mean number of risk factors possessed by participants. A comparative analysis was performed to observe the variations in the total number of risk factors possessed by the subjects across gender. The findings indicated that more females (62%) had at least one risk factor, as opposed to 51% of their male counterparts. The prevalence of multiple risk factors among both male and female study participants was 14% (n=37).

The intra-gender analysis of the profile of risk factors among female participants indicated that a majority of 48% (n=124) of the females had one risk factor for non-communicable diseases, followed by 31% who possessed none of the risk factors, 19% who had two of the risk factors, and 2% who had three or more. Figure 4.5 below presents the risk factors profile of the female participants.

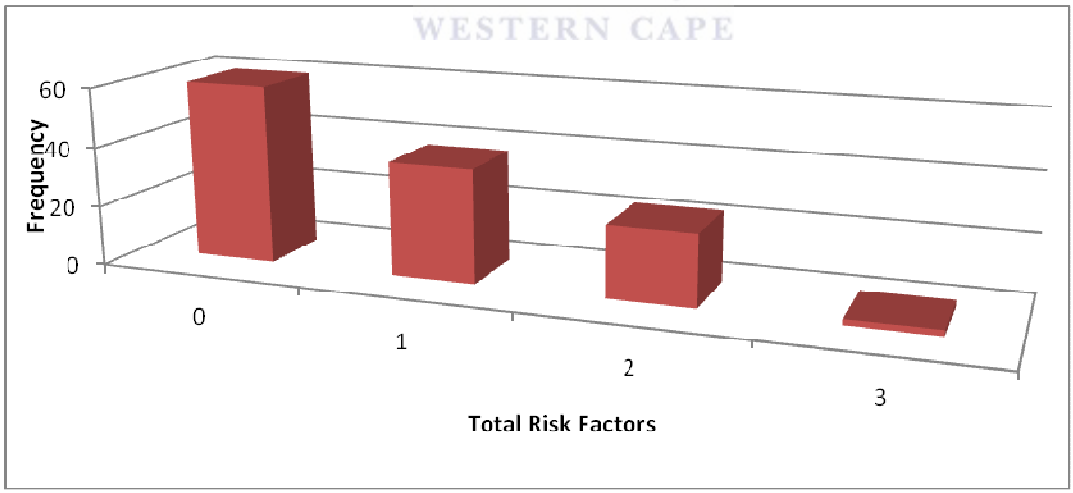

Figure 4.5: Total risk factors and frequencies among female participants (n=124).

The risk factor profile for the male participants, however, diverged from that of the females. The majority of the male subjects, 49% (n=181), was composed of those who showed none of the risk factors for non-communicable diseases, followed by 40% with one risk factor, 10% with two, and 1% who had three or more risk factors. Figure 4.6 below presents the profile of risk factors among male participants.

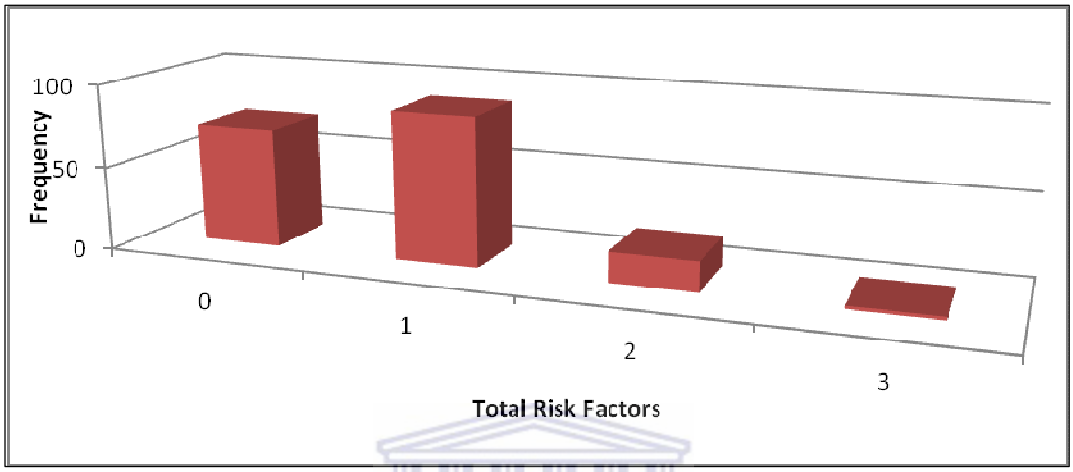

Figure 4.6: Total risk factors and frequencies among male participants (n=181).

Using the Mantel–Haenszel Chi–square test (p= 0.03) for the association between gender and the mean number of risk factors, no significant statistical difference was observed between males and females (p=4.88).

4.8 Clustering of risk factors according to participants' setting

Total risk factor analysis was performed among the study participants according to different categories, namely high-school learners, university/college students, and adults. Using the Chi-square independence test ($x^2 = 8.3507$, $p = 0.4$), no significant difference was found in the mean number of risk factors between high-school learners, university/college students and adults. Table 4.5 below shows the observed frequencies and percentages of participants under different settings according to the number of risk factors they possessed.

Table 4.5: Total risk factors according to setting among participants (N = 254)

Participants' category	Number of risk factors				
	0	1	2	3	4
High-school learners (n=88)	39 (44.3)	37 (42.0)	12 (13.6)	0	0
University/college students (n=99)	44 (44.4)	44 (44.4)	10 (10.1)	1 (1.0)	0
Adults (n=67)	30 (44.8)	24 (35.8)	10 (14.9)	1 (1.5)	2 (3.0)

4.9 Clustering of risk factors by age among adult participants

This category comprised 25% (N=295) of the study participants. Among them, 55% had none of the risk factors and were aged 45 years and below. Those who possessed at least one risk factor accounted for 45%; the majority of these (32%) had one risk factor, with an average age of 37 years. Further analysis of possible relationships between age and the total number of risk factors possessed by the adult participants indicated that there was no statistically significant association (Spearman's correlation coefficient = 0.3251, p=0.008) among the adult participants.

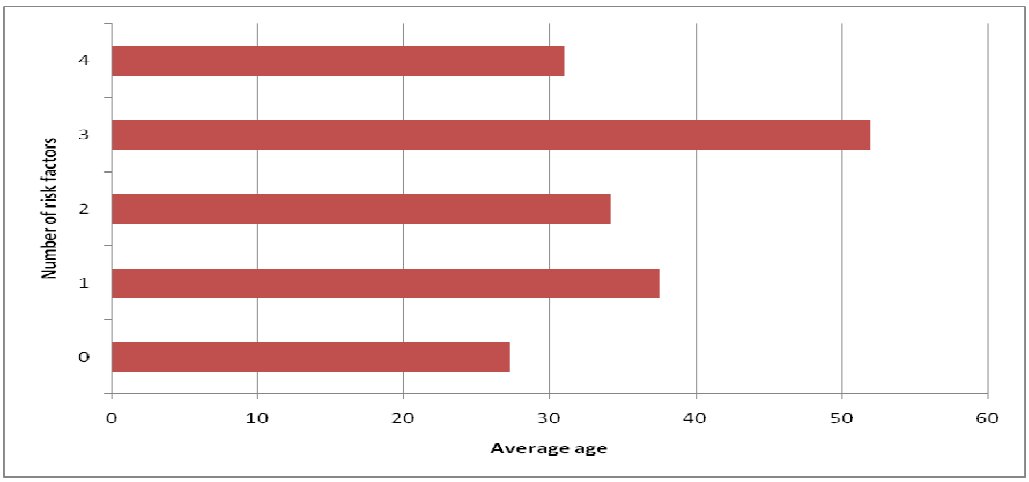

Figure 4.7: Total risk factors according to mean age among adults (n =74)

4.10 Analysis of multiple risk factors

In this study, 44% (N=305) of the subjects possessed none of the investigated risk factors for non-communicable diseases. Those who had one risk factor accounted for 42% (N=305).

Apart from the participants with either none or one risk factor profile, some participants possessed multiple risk factors, co-occurring in clusters and varying in their combinations. Those with two risk factors were 13% (N=305), while those with three risk factors or more comprised 4%. Figure 4.8 below presents the frequencies of participants according to the total number of risk factors they possessed.

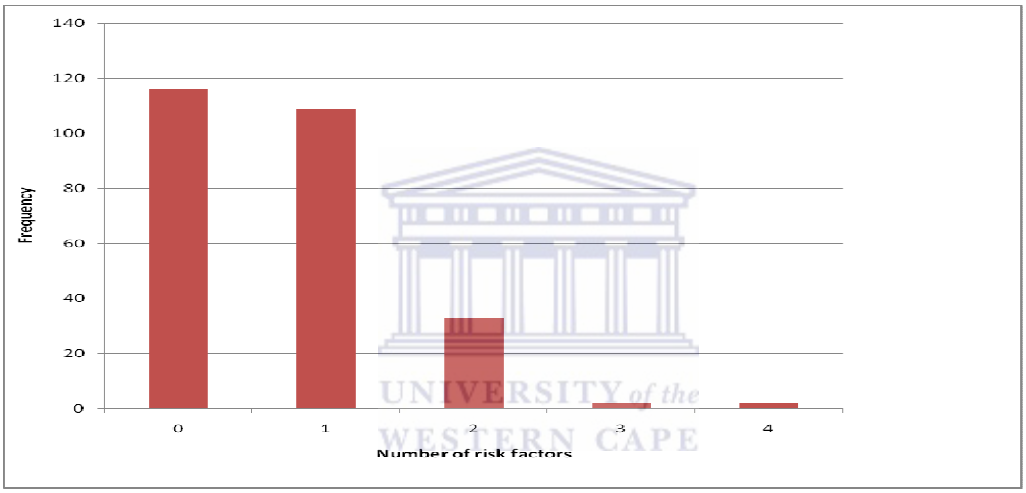

Figure 4.8: Total number of risk factors among study participants (N=305)

4.11 Analysis of individual risk factors

The inferential analysis in this study presented physical inactivity as the most prevalent risk factor for non-communicable diseases among the participants, accounting for approximately 42% (N=305) of the sample. The other risk factors were registered among participants in the following percentages: 24% hypertension (high blood pressure), 11% overweight/obesity, 9% tobacco use (smoking), and 5% risky alcohol consumption.

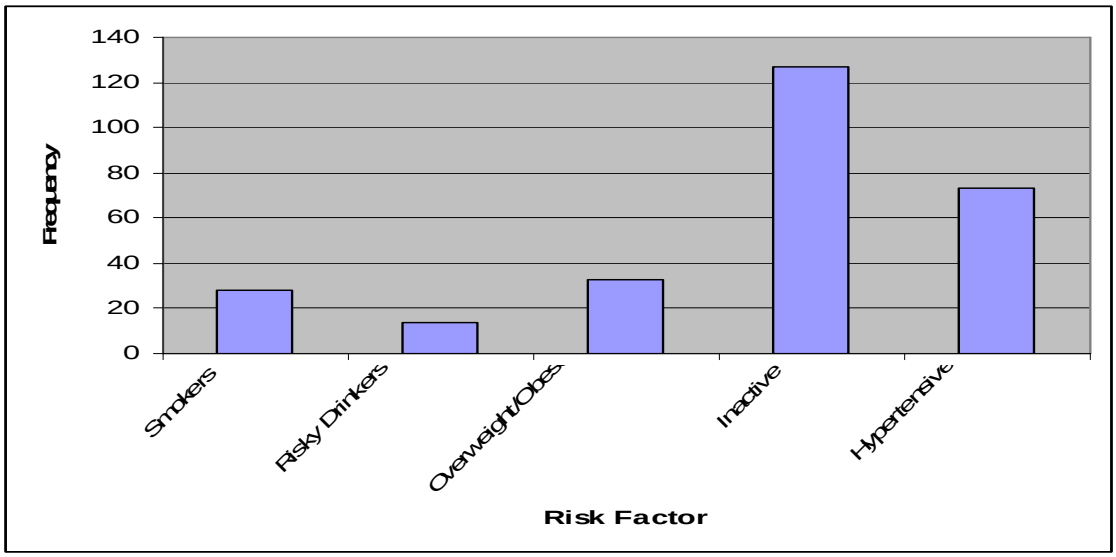

Figure 4.9: Frequencies of individual risk factors among study participants (N=305).

Table 4.6: Patterns of multiple risk factors among study participants (N= 305).

Number of risk factors	Smoker	Drinker	Obese	Hypertensive	Inactive	Frequency	%
4	Y	Y	X	Y	Y	2	0.7
3	Y	Y	X	Y	X	1	0.3
3	X	X	Y	Y	Y	1	0.3
2	Y	Y	X	X	X	1	0.3
2	Y	X	X	Y	X	2	0.7
2	Y	X	X	X	Y	2	0.7
2	X	Y	X	Y	X	1	0.3
2	X	Y	X	X	Y	1	0.3
2	X	X	Y	Y	X	2	0.7
2	X	X	Y	X	Y	2	0.7
2	X	X	X	Y	Y	23	7.5
1	Y	X	X	X	X	5	1.6
1	X	Y	X	X	X	10	3.3
1	X	X	Y	X	X	11	3.6
1	X	X	X	Y	X	38	12.5
1	X	X	X	X	Y	87	28.5
0	X	X	X	X	X	118	38.7

Y indicates the presence of a risk factor, X the absence of a risk factor.

The most common risk-factor combination among study participants was hypertension and physical inactivity, at 8% (N=305).

Chapter Five

Discussion

5.1: Introduction

The aim of this study was to establish the prevalence of risk factors for non-communicable diseases among males and females aged between 15 and 70 years living in Mombasa, Kenya. In order to realize the specific objectives of the study, a total of three hundred and five (305) participants were investigated using the WHO STEPwise questionnaire (Appendix I), which involved gathering self-reported data on socio-demographics and health-related behaviour (Step 1), and taking anthropometrical measurements (Step 2). This chapter will discuss the individual prevalence of the investigated risk factors for non-communicable diseases, and the clustering of multiple risk factors, as well as associations and correlations between risk factors and various socio-demographics. Consistencies and disparities between the findings of the current study and other previous related studies will be established. The chapter will conclude by highlighting the limitations of the study.

5.2: Findings on Socio-demographic characteristics

Socio-demographic characteristics observed in this study, such as age, gender, level of education and work status, are known to be substantial determinants for non-communicable diseases risk factors. The distribution of non-communicable diseases in a population can therefore be analyzed on the basis of these variables.

The current study produced a response rate of 61%. Participants were aged between 15 and 63 years, with an average age of 22.8 years and a standard deviation of 8.6. Approximately 80% of the participants were under the age of 25 years, and this explains the

large standard deviation. This could however be attributed to the fact that most of the participants were drawn from tertiary institution settings with no household representation. In contrast to our study, a similar non-communicable diseases risk factor surveillance study in Indonesia by Nawi et al (2006), which employed the WHO STEPwise approach, investigated a sample of 2963 institutionalized and household participants aged 15 to 74 years from both rural and urban settings. In our present study, males formed the majority of the study sample, compared to their female counterparts. In the light of the documented literature on the association between male gender and health-risk behaviour, this may translate into a relatively higher likelihood of indulgence among the Mombasa residents.

Previous non-communicable disease risk factor studies globally and regionally by Fine et al (2004) and Pampel (2004) unanimously demonstrated that some socio-demographic characteristics, including gender and level of education, are indicators of an individual's health profile. A study in China by Pan and Hu (2008) reported a significant association between male gender and smoking, while a similar study by Chande and Salum (2007) in the United Republic of Tanzania linked males with risky alcohol consumption.

In this study, the level of education was used as an indicator of an individual's socio-economic position. With the majority of participants, 44% (N=295), having attained only up to high school education, the represented population may be expected to possess a higher risk factor mean score, thus adversely exposing them to the development of chronic diseases. This relates to reports by Nawi et al (2006) in the Indonesian study that socioeconomic position is inversely proportional to the mean number of risk factors for non-communicable diseases, and populations with low socioeconomic status, determined either by income or level of education, are therefore relatively at higher risk of developing non-communicable diseases. The socio-demographic characteristics of the Mombasa population as observed in this study seem to make them vulnerable to the known major risk factors for non-communicable

diseases, given that male gender, low level of educational attainment and low socioeconomic status were dominant.

Epidemiological studies for non-communicable diseases risk factors have demonstrated that identification and description of risk factors guarantees better understanding of the health transition facing most of the world's populations. Using participants' attained level of education as an indicator for their socioeconomic position (SEP), the results of this study revealed that the burden of non-communicable diseases risk factors is unequally distributed among different SEP classes within the population of Mombasa. Disease prevention and control strategies should therefore be target-specific if any desirable outcome is to be achieved. Our analysis is however in agreement with the findings of Fine et al (2004) in America and Nawi et al (2006) in Indonesia. Consistent with Nawi et al's (2006) suggestions, this study further shows that risk factor surveillance offers a comprehensive picture of the overall non-communicable disease burden, one which is vital to public health authorities addressing health inequities.

5.3 Risk factors among study participants

5.3.1: Smoking

Tobacco use or smoking is largely acknowledged as one of the common major risk factors consistently associated with chronic non-communicable diseases, including cancer and chronic obstructive pulmonary diseases (World Health Report, 2002). The literature has attributed health risk behaviours like smoking to the adoption of western lifestyles among populations in the developing countries. In our analysis, we revealed a 9% prevalence of smoking among the participants who were aged between 15 and 63 years. The minimal rate recorded could in part be due to the small proportion of adult participants investigated.

A regional nationally representative survey in South Africa by Walbeek (2002) indicated a current smoking prevalence of 27% among the adult population, despite a drastic decline in tobacco consumption following a legislatively imposed increase in excise tax on all tobacco products. A rather higher smoking prevalence rate among males aged 15 to 59 years was documented in regional studies carried out by Pampel (2004) in Malawi and Zambia, recording 40% and 20% respectively. Similarly, nationally representative studies by Guindon and Boisclair (2003) and Levenson, Skerrett and Gaziano (2002) in the United States indicated high and ever increasing smoking trends in developing countries.

However, age-related similarities exist between this present study and Pampel's (2004) survey, with participants aged below 30 years as the majority of the smokers in both studies. This implies that initiation of smoking behaviour now starts at an early age.

A recent Chinese study by Pan and Hu (2008) reported that socio-demographic characteristics, including male gender and labour-intensive occupations, were significantly associated with smoking behaviour. This is consistent with previous findings by Anthonisen et al (2005). Contrary to these reports, our study found no significant associations between smoking and gender or work status. However, in agreement with the Pan and Hu (2008) analysis, our findings contradict those of research by Gong et al (2005) which maintained that level of education, which was used in this study as an indicator for participants' socioeconomic position, is not a statistically significant predictor of smoking behaviour. Although our analysis revealed a relatively lower rate of smoking behaviour compared to similar regional studies, it is expected that a nationally representative sample would yield a higher rate. It is clear, however, that the age of initiation into smoking behaviour and the mean age of smokers are alarmingly lower than they were in the past.

5.3.2: Risky alcohol consumption

Alcoholic disorder or risky alcohol consumption is one of the common major risk factors known to predispose individuals to the development of chronic non-communicable diseases such as type 2 diabetes, hypertension and chronic liver and pancreatic cancers. In this study, a relatively higher prevalence rate of 43% was recorded, compared to a previous regional rate of 22% reported by Chande and Salum (2002) in the United Republic of Tanzania and a 21% nation-wide prevalence reported by Fine et al (2004) in the United States of America.

Our current study was markedly similar to the Tanzanian survey in terms of sample size and the participants' socio-demographics. However, our analysis indicated that participants aged between 20 and 24 years drank more than any other age group, a finding that supports the conclusion drawn by most authors, including Walbeek (2002) in South Africa, that there is a rapid decline in the average age at which people start indulging in health-risk behaviours.

Contrary to the Tanzanian survey by Chande and Salum (2002), our results indicated that students were the majority drinkers under the work status category. In both studies, however, lower level of educational attainment and male gender were seen as indicators for alcoholic disorder. These variations reflect the complexity and variability of the interactions between health-related behaviours and socio-demographic characteristics among different populations, communities and even socioeconomic classes.

5.3.3: Physical inactivity

According to statistics by WHO (2008), physical inactivity or sedentarism has become a major public health concern, making a significant contribution to the global non-communicable disease morbidity and mortality rates.

This has largely been attributed to urbanization and global socioeconomic transitions. The results of this study indicated that 58% of the respondents recorded inadequate levels of physical activity, with an observed positive correlation trend between a participant's age and the level of physical activity. The majority of the physically inactive participants were aged between 15 and 19 years. This is mostly the age of people in secondary and tertiary institutions, and according to Murenzi (2001), people in Rwanda at this stage in life adopt sedentary lifestyles. Bray and Born (2004) argued that this could be as a result of the physical and psycho-social changes they undergo during the transition from high school to college or university. Illustrations that physical activity is influenced by psychological, social, cultural and environmental factors (Sallis et al, 1999) allowed this researcher to agree with the consistencies observed between the current study and the Murenzi (2001) and Bray and Born (2004) studies.

The literature has consistently shown that patterns of physical activity are worsening globally. Similar to the findings of this study, a National Health Survey in the United States by Fine et al (2004), which investigated multiple risk factors among a nationally representative sample of 29,183 participants, reported a 66% prevalence of physical inactivity. Though based on high school learners, regional studies by Phillips (2001) in the Western Cape, South Africa, and Tumuusime and Frantz (2006) in Rwanda are consistent with the rates of physical inactivity reported in this study. The observed consistencies could however be associated with similarities in the underlying determinants faced by these populations.

Gender has been reported as a predictor for participation in physical activities. In a recent American comparative study on physical activity and physical fitness between rural and urban children by Joens-Matre et al, (2008), it was reported that boys were more active than girls at all ages in both rural and urban settings. This present study, however, did not discover any statistically significant gender disparities among the physically inactive participants.

Socioeconomic status, which in our study was determined by the participants' level of education, has in many epidemiological studies been regarded as the major predictor for non-communicable diseases. Results from the present study indicated that participants who attained a rather lower level of education, such as primary education, were more inactive than those who attained university or post-graduate education. The rate of physical inactivity declined with an improved level of education, signifying a positive correlation between physical activity and level of education or socioeconomic status. These findings complement a previous comprehensive analysis by Galobardes et al, (2003). In a longitudinal study to reveal the trends of risk factors among various socioeconomic groups in Switzerland, the authors investigated a nationally representative sample of 8194 adult participants from 1993 to 2000. Their findings illustrated that physical inactivity was high, especially among the low socioeconomic status group. This present study found a higher prevalence of physical inactivity which is significantly associated with low socioeconomic status and young age; this implies that the young and the poor in Mombasa are more prone to inactivity-related diseases.

5.3.4 Hypertension

High blood pressure or hypertension, together with obesity and overweight, raised blood glucose and abnormal blood lipids, are generally recognized as the intermediate risk factors for non-communicable diseases. Hypertension is closely associated with most cardiovascular diseases, including ischemic and haemorrhagic stroke. Analysis of our results indicated that 24% of the investigated participants had raised blood pressure. Further inferential analyses revealed that the prevalence of hypertension increased with old age. These findings were consistent with the outcome of a similar cross-sectional epidemiologic study by Leenen et al, (2008) which employed similar measures in determining the prevalence of hypertension among 2551 participants in Ontario, Canada.

The results indicated a 21% prevalence of hypertension, with the rate increasing with age. However, contrary to the male gender predominance in hypertension reported in Leenen et al's study, our analysis demonstrated that more women (59%) were hypertensive compared to their male counterparts (41%).

Studies have indicated that low levels of educational attainment are a predictor of an individual's socioeconomic status, which in turn is linked with the prevalence of hypertension. Contrary to previous findings by Yusuf et al (2001), our analysis revealed that an increased level of education attained was closely associated with the risk of developing hypertension. This suggests that residents of Mombasa who possess higher levels of education, as well as females and people of middle age and above, are more at risk of developing cardiovascular diseases compared to the other population sub-groups.

5.3.5: Overweight/Obesity

The literature has portrayed overweight and obesity as a by-product of poor diet and inadequate physical activities following modernization. It is recognized as one of the common intermediate risk factors for most of the weight-related non-communicable diseases, including type 2 diabetes and cardiovascular diseases. In our study, however, the results presented a relatively lower rate of 19%. Similarly, in an Indonesian study by Nawiet et al (2006), which employed the WHO STEPwise protocol for the surveillance of risk factors for non-communicable diseases, findings indicated that women had a higher mean BMI compared to men. Similarly, this present study showed a female predominance of 71% among participants who were overweight and obese; this presents females in Mombasa as more at risk of developing weight-related chronic diseases.

Our results also showed that factors related to age act in moderating the mean BMI. This was proved by the higher prevalence of overweight and obesity among participants aged 30 years and above compared to the younger age groups.

Obesity and overweight trends are high and are increasing at an alarming rate across gender and age groups globally. This is evidenced by Gregg et al's (2005) findings in the United States where a 31% prevalence of overweight and obesity was documented among participants aged 20 to 74 years. This was a comprehensive analysis of five cross-sectional surveys composed of nationally representative samples.

With overweight/obesity evidently common among adults and females in Mombasa, target-specific strategies should be embraced if desirable outcomes are to be achieved in alleviating the emerging chronic disease pandemic.

5.3.6 Diet

High-fat foods, lack of fruits and vegetables, together with the use of low-density cholesterol cooking oil are all classified as poor dietary practices and have been closely linked to the development of chronic diseases.

Our study revealed a substantial consumption of fruits and vegetables among the participants, at 42% and 36% respectively. This rate is seen as significant when compared to the nation-wide reports by (WHO, 2005) on Kenya. Combining fruits and vegetables with a 66% majority choice for the use of vegetable cooking oil, Mombasa residents can be considered in this respect to be embracing health-promoting dietary practices.

5.3.7 Blood sugar

Elevated blood sugar is another well-known risk factor for non-communicable diseases. With morbidity and mortality rates attributable to type 2 diabetes on an alarming increase regionally and globally, early detection remains the health-promoting practice of choice.

Analysis in our study indicated that 13% of the participants had had their blood sugar tested for type 2 diabetes in the previous 12 months; 3% of those who were tested were diagnosed as having elevated blood sugar levels and were put on different medications. Compared to reports by WHO (2008) on the prevalence of diabetes in sub-saharan African countries, the revealed rates in this study are relatively low. However, the low proportion of participants who had been tested for diabetes reflects a lack of public sensitization towards early detection in Mombasa.

5.4: Clustering of multiple risk factors

According to the literature, there are adequate data on the prevalence and profiles of individual risk factors for non-communicable diseases. Recent studies have however revealed that there exist quite considerable knowledge gaps on the clustering of these risk factors, which are known often to co-occur. The WHO (2005a) report indicated that for any desirable outcome to be achieved in the prevention and control of non-communicable diseases, governments and public health departments must incorporate identification of the most common clusters of multiple risk factors in their surveillance systems. In this study, 13% of both male and female participants had multiple risk factors. This is consistent with the findings of an American multiple risk factor study by Fine et al (2001) which reported a 17% multiple risk factor prevalence among a nationally representative sample of 29,183

participants. Further analysis revealed inconsistencies in the associations between the subjects' demographic characteristics and the mean number of risk factors possessed. Unlike Fine et al's (2001) findings, the present study indicated that gender was significantly associated (p=0.05) with participants' mean number of risk factors. More females (54%) in this study had two or more of the risk factors, compared to 46% of their male counterparts.

In our study, the Spearman's correlation coefficient was not statistically significant (0.3251) at (p=0.008), showing no correlation between age and the participants' risk factor mean score.

The Fine et al (2001) analysis, however, indicated that individuals aged 40 years and above and those who had attained only up to secondary school education or below possessed a higher risk factor mean score compared to other age groups and education level categories respectively.

Using the Chi-square independence test ($x^2 = 8.3507$, $p = 0.4$), the results in this study showed no significant association between level of education and participants' risk factor mean score. This is also contrary to the findings of the comprehensive Galobardes et al survey (2003) in Geneva, Switzerland. Using level of education as an indicator for socioeconomic position, the authors reported that individuals with a low socioeconomic position had the worst risk factor profiles.

5.5: Trends of individual risk factors

This study employed the WHO STEPwise protocol in the surveillance of risk factors for non-communicable diseases (WHO, 2005a). In line with the findings of the Fine et al (2001)

survey, our results indicated that physical inactivity was the most prevalent among the investigated risk factors for non-communicable diseases, accounting for approximately 42% of the entire study sample.

The other risk factors were registered among study participants in the following percentages: 24% hypertension (high blood pressure), 11% overweight/obesity, 9% tobacco use (smoking), and 5% risky alcohol consumption.

5.6: Patterns of multiple risk factors

It has been demonstrated by most leading authors in the field of risk factor surveillance that identification of the most common patterns of risk factors remains an essential fundamental starting point in the planning and implementation of target-specific and cost-effective intervention programs. According to WHO (2005a), identification of these patterns could assist in predicting the future epidemiology of non-communicable diseases among a given population, community or group at risk.

Nawi et al (2006) and Yusuf et al (2001) indicated that different populations or socioeconomic classes may possess multiple risk factors in patterns or combinations varying from one another. Complementing these observations, results in our study indicated that the investigated risk factors co-occurred in combinations of two, three and four, with variations in proportions among the participants. Subjects with two risk factors composed the majority 89% (n=38) among those who possessed multiple risk factors. Of these, 68% comprised those who were both hypertensive and physically inactive. However, as observed in the Fine et al (2001) study, our results showed that physical inactivity and obesity co-occured among participants; in the reseacher's opinion this is a result of the mutual influence between these two risk factors.

Participants in this study with three of the investigated risk factors accounted for 5% of those who possessed multiple risk factors. The pattern of risk factor combination among these participants included overweight/obesity, hypertension and physical inactivity among 2.5% of the subjects; the other 2.5% who possessed three risk factors were smokers, risky drinkers of alcohol, and hypertensive. Four of the investigated risk factors for non-communicable diseases were revealed to co-occur among 5% of the participants who possessed multiple risk factors. There were however no variations in the patterns among this group; instead they were all smokers, risky drinkers of alcohol, hypertensive and had inadequate levels of physical activities.

5.7: Limitations of the study

Step one of the WHO STEPwise protocol employed in this study involved gathering self-reported information on the participants' socioeconomic and demographic characteristics. Such subjective information may lack representativeness as well as transferability across the population.

The sampling method used was purposive and convenient. The majority of the participants were young institutionalized individuals and this could have compromised the quality of the data collected.

A further limitation in this study was the relatively low average age of the participants; this could have facilitated over-reporting or under-reporting among most of the respondents.

Chapter Six

Summary, conclusion and recommendations

6.1: Introduction

This chapter emphasizes the key findings of the study. A concise summary as well as conclusion are highlighted. Finally, recommendations based on the main study outcomes are given.

6.2: Summary

The aim of the study was to determine the prevalence of risk factors for non-communicable diseases among males and females aged between 15 and 70 years living in Mombasa, Kenya. To realize this aim, identification and description of individual risk factors was done. Clusters of multiple risk factors as well as possible socio-demographic facilitators were investigated. Overall, 61% of the study participants possessed at least one of the investigated risk factors for non-communicable diseases. However, there were proportional variations according to the risk factor profiles of the participants. Those who had one risk factor accounted for 42%, while 13% proved to possess two risk factors, and 4% had three or more risk factors .

The investigated risk factors, which included physical inactivity, hypertension, overweight/obesity, smoking and risky alcohol consumption, were prevalent among participants in different proportions. The most common risk factor recorded was physical inactivity, which accounted for 42% of the entire study sample. This revelation indicates that most of the participants were living more sedentary lifestyles characterized by inadequate levels of appropriate physical activities.

Hypertension or elevated blood pressure was the second most common risk factor, and was possessed by 24% of the participants. Overweight/obesity, smoking and risky alcohol consumption accounted for 11%, 9% and 5% of the participants respectively.

Physical inactivity, hypertension and overweight/obesity were the three most common risk factors among the participants; this is typically the negative effect of urbanization which is characterized by poor diet and the adoption of more sedentary lifestyles.

Risk factors were also seen to co-occur in different numbers and in varying patterns of combinations. Double risk factor clusters were the most common (89%) among those with multiple risks. Participants who were both physically inactive and hypertensive composed a majority of 68% of those who had a total risk factor score of two. This observation suggests a possible relationship between physical inactivity and hypertension which could necessitate a future study in order to explore the dynamics facilitating their co-occurrence.

Socio-demographic characteristics such as age, gender and level of education or socioeconomic status were proved to influence health behaviour. Physical inactivity, which was the most common risk factor among participants, was seen to be influenced by age. The physical activity profiles of participants aged 25 years and under were the worst. This is the age of individuals in tertiary learning institutions. The situation could be improved were these institutions to promote physical activity through adapted facilities and targeted health education. Likewise, the study showed that increasing age was an indicator for hypertension.

The prevalence of hypertension was seen to vary across gender. Females were more hypertensive (59%) compared to their male counterparts (41%). Since hypertension is one of the intermediate risk factors for non-communicable diseases, the variations between male and female participants who were hypertensive suggests differences in their exposure to the underlying socioeconomic determinants of non-communicable diseases.

Apparently, there exists an intricate relationship between the underlying determinants and the behavioral health risk factors which in the researcher's opinion warrants further exploratory studies in future.

6.3: Conclusion

As revealed in our current study, behavioral risk factors for non-communicable diseases, mainly physical inactivity, hypertension, overweight/obesity and smoking, are common among Mombasa residents. The prevalence rates are high and show some increasing trends suggestive of likely future epidemics of non-communicable diseases. Identification and description of the most common patterns of multiple risk factor clusters gave a comprehensive picture of the future epidemiology of non-communicable diseases in Mombasa. This is undoubtedly an essential component of the national health information system.

The unequal distribution of these risk factors among the people of Mombasa has been attributed to the influence of various socio-demographic factors, including age, gender, level of education and economic status. This suggests that for any preventive and control interventions to be effective, public health authorities and other relevant stakeholders must exercise targeting in their planning and implementation of health promotion programmes.

6.4: Recommendations.

On the basis of the findings of this study, the following recommendations are suggested to the various stakeholders:

1. Further risk factor surveillance studies incorporating Step 3 of the WHO STEPwise protocol should be done to give a more comprehensive profile.

2. A continuous national surveillance system on risk factors should be instituted by the Centre for Diseases Control and Prevention to offer up-to-date analysis of the national risk factor profile.
3. Data on multiple risk factors should be used as the baseline foundation for legislation and intervention by the public health authorities and policy planners.
4. Clinicians, including medical doctors, physiotherapists and nurses in both public and private health care sectors, should incorporate enquiries on modifiable health risk behaviours in order to ensure early detection at the primary health care level.
5. The Education Department, in collaboration with the Ministry of Health, should introduce health-promoting schools, to make healthy behaviour an easier option among students.
6. Institutions, organizations and all workplaces in Mombasa should be advised to uphold the strategy of health-promoting settings to ensure prevention and control of non-communicable diseases.

References

Achadi, A., Soerojo, W. and Barber, S. (2005). The relevance and prospects of advancing tobacco control in Indonesia. *Health Policy*, 72, 333-349.

Adjuik, M., Smith, T., Clark, S., Todd, J., Garrib, A., Kinfu, Y., Kahn, K., Mola, M., Ashraf, A., Masanja, H., Adazu, K., Sacarlal, J., Alam, N., Marra, A., Gbangou, A., Mwageni, E., and Binka, F. (2006). Cause-specific mortality rates in Sub-saharan Africa and Bangladesh. *Bulletin of the World Health Organization*, 84, 181-188.

Anthonisen, N. R., Skeans, M. A., Wise, R. A., Manfreda, J., Kanner, R.E. and Connet, J. E. (2005). The effects of a smoking cessation intervention on 14.5-year mortality. A randomized clinical trial. *Annals of Internal Medicine, 142*(4), 233-239

Babbie, E. and Mouton, J. (2006). The practice of social research. Cape Town, South Africa. Oxford University Press.

Bauman, A. and Campbell, T. (2001). Heart Week 2001: Get Active! A call to action. *Medical Journal of Australia* 174: 381-382.

Berrigan, D., Dodd, K., Troiano, R. P., Krebs-Smith, S. M. and Barbash, R. B. (2003). Patterns of Health Behaviour in U.S Adults. *Preventive Medicine,* 36, 615-623.

Bonita, R., de Courten, M., Dwyer, T., Jamrozik, K. and Winkelmann, R. (2001). Surveillance of risk factors for noncommunicable diseases: The WHO STEPwise approach. Summary. Geneva, *World Health Organization*, 2001.

Boutayeb, A. and Botayeb, S. (2005). The burden of non-communicable diseases in developing countries. *International Journal for Equity in Health, 4*(2), 1186-1475.

Bray, R. S. and Born, A. H. (2004). Transition to University and Vigorous Physical Activity: Implications for Health and Psychological Well-Being. *Journal of American College Health,* 52, 181-187.

Capewell, S., Beaglehole, R., Seddon, M. and McMurray, J. (2000). Explanation to the decline in coronary heart disease mortality rates in Auckland, New Zealand between 1982 and 1993. *Circulation*, 102, 1511-1516.

Centre for Chronic Disease Control and Prevention (2003). International Activities. www.hc.sc.gc.ca/international e html

Center for Disease Control and Prevention (1996). Report for the Surgeon General. Physical Activity and Health. *US Department of Health and Human Services*.

Center for Disease Control and Prevention (2001). Increasing Physical Activity. A report on the recommendations of the Task Force on Community Preventive Services. *Morbidity and Mortality Weekly Report*. 50: 1-16.

Chande, H. and Salum, I. (2007). Prevalence of and factors associated with alcohol consumption in Temeke. *East African Journal of Public Health, 4*(2), 64-66.

Chobanian, A. V., Bakris, G. L., Black, H. R., Cushman, W. C., Green, L. A., Izzo, J. L., Materson, B. J., Oparil, S., Wright, J. T. Jr. and Roccella, E. J.(2003). The seventh report of the joint national committee on prevention, detection, evaluation and treatment of high blood pressure: the JNC report. *Journal of American Medical Association*, 289, 2560-2572.

Chockalingam, A. and Balaguero-Vinto, I. (1999). Eds. Impending Global Pandemic of Cardiovascular Diseases: Challenges and Opportunities for the Prevention and Control of Cardiovascular Diseases Developing Countries and Economies in transition. *World Heart Federation.* Barcelona: Prous Science.

Coetzee, M. and Underhay, C. (2003). Gesondheidsrisikogedrag by adolessente van verskillende ouderdomme. *South African Journal for Research in Sport, Physical Education and Recreation, 25*(2), 27-36.

Colagiuri, R., Colagiuri, S., Yach, D. and Praming, S. (2006). The Answer to Diabetes Prevention: Science, Surgery, Service Delivery, or Social Policy? *American Journal of Public Health, 96*(9), 1562-1569.

Coulson N, Goldstein S and Ntuli, A (2002). Promoting health in South Africa. An action manual. Heinemann Higher and Further Education (Pty) Ltd, Cape Town-South Africa.

Daar AS, Singer PA, Persad DL, Pramming SK, and Matthews DR. (2007). Grand challenges in chronic non-communicable diseases. *Nature* 450: 494–496. doi:10.1038/450494a.

Dobson, A. J., Evans, A. and Ferrario, M. (1998). Changes in estimated coronary risk in the 1980s: data from 38 populations in the WHO MONICA Project. World Health Organization. Monitoring trends and determinants in cardiovascular diseases. *Annals of Medicine,* 30, 199-205.

Ezzati, M., Lopez, A. D., Rodgers, A., Vander Hoorn, S., Murray, C. J. L. and The comparative risk assessment collaborating group (2002). Selected major risk factors and global and regional burden of disease. *The Lancet, 360,* 1347-1360.

Fine, L. J., Philogene, S., Gramling, R., Coups, E. J. and Sinha, S. (2004). Prevalence of multiple chronic disease risk factors, 2001 National Health survey. *American Journal of Preventive Medicine. 27*(2s), 18 – 24.

Flegal, K. M., Carroll, M. D., Kuczmarski, R. J. and Johnson, C. L. (1998). Overweight and Obesity in the United States: Prevalence and Trends, 1960 -1994. *International Journal of Obesity and Related Metabolic Disorders*, 22, 39-47.

Forrester, T., Cooper, R. S. and Weatherall, D. (1998). Emergence of Western diseases in the tropical world: The experience with chronic cardiovascular diseases. *British Medical Bulletin, 54*(2), 463-473.

Fourie J (2001). Definition of chronic diseases of lifestyle.
http://www.mrc.ac.za/chronic/cdloverview.pdf Accessed: May 31, 2005.

Frantz, J. M. (2006). Physical inactivity as one of the chronic disease risk factors among high school learners in public schools in a local community in South Africa. *South African Journal for Research in Sport, Physical Education and Recreation, 28*(2), 73-80.

Galobardez, B., Coatsnza, M. C., Bernstein, M. S., Delhumeau, C. and Morabia, A. (2003). Trends in Risk Factors for Lifestyle-related Diseases by Socio-economic Position in Geneva, Switzerland, 1993-2000: Health Inequalities Persist. *American Journal of Public Health, 93*(8), 1302-1309.

Goetzel, R. Z., Ozminkowski, R. J., Bruno, J. A., Rutter, K. R., Isaac, F., and Wang, S. (2002). The long-term impact of Johnson & Johnson's Health and Wellness Program on employee health risks. *Journal of Occupational and Environmental Medicine, 44*: 417- 424.

Gregg, E. W., Cheng, Y. J., Cadwell, B. L., Imperatore, G., Williams, D. E., Flegal, K. M., Venkat Narayan, K. M. and Williamson, D. F. (2005). Secular Trends in Cardiovascular Disease Risk Factors According to Body Mass Index in US Adults. *Journal of American Medical Association, 293*(15), 1861-1918.

Grundy, S. M., Bazzarre, T., Cleeman, J., D'Agostino, R. B. Sr., Hill, M. and Houston-Miller, N. (2000). Prevention conference V: Beyond secondary prevention: identifying the high-risk patient for primary prevention: medical office assessment: Writing Group 1. *Circulation;* 101:e3. Available from: http://circ.ahajournals.org/cgi/content/full/101/1/e3

Guindon, G. E. and Boisclair, D. (2003). Past, Current and Future Trends in Tobacco use. Economics of Tobacco control paper No. 6. *Health, Nutrition and Population discussion paper*.

Health and the Millennium Development Goals. Geneva., World Health Organization, (2005b).

Health Education Authority (1998). Young and active. A policy framework for young and health enhancing physical activity. London. Health Education Authority.

Henry-Lee, A. and Yearwood, A. (1999). Protecting the poor and the medically indigent under health insurance: A case study in Jamaica. Bethesda, MD, Partnership for Health Reform Project and Abi Associates.

Hoelscher, D. M., Feldmam, H. A., Johnson, C. C., Lytle, L. A., Osganian, S. K. and Parcel, G. S. (2004). School-based health education programes can be maintained over time: Results from the CATCH institutionalization study. *Preventive Medicine, 38*, 594- 604.

Hornby A S (2000). Oxford Advanced Learner's Dictionary. 6th Ed, Oxford University Press, UK.

Hulme, D. and Shepherd, A. (2003). Conceptualizing chronic poverty. World Development, 31, 403-423.

Institute of Medicine (2001). Health and Behaviour: The interplay of biological, behavioural and societal influences. Washington DC: National Academy press.

Joens-Matre, R. R., Welk, G. J., Calabro, M. A., Russel, D. W., Nicklay, E. and Hensley, L. D. (2008). Rural-urban Differences in Physical Activity, Physical Fitness, and Overweight prevalence of Children. *National Rural Health Association, 24*(1), 49-54.

Jong-Wook, L. (2005). World Health Organization Global Report. Preventing chronic diseases: A vital investment.

Jong-Wook, L. (2005). In: Preventing Chronic Diseases: A Vital Investment. World Health Organization Global Report.

Katzmarzyk P, Gledhill N and Shepherd R (2000). The economic burden of physical inactivity in Canada. *Canadian Medical Association Journal 163*(11): 1435-1440.

Kenya National Bureau of Statistics (2001). The 1999 Population and Housing Census. Counting our People for Development.

Kwamanga, D. H., Odhiambo, J. A. and Amukoye, E. L. (2003). Prevalence and risk factors of smoking among secondary school students in Nairobi. *East African Medical Journal*, 80, 207-212.

Lazcano-Ponce, E. C., Hernandez, B., Cruz-Valdez, A., Allen, B., Diaz, R., Hernandez, R., Anaya, R. and Hernandez-Avila, M. (2003). Chronic Disease Risk Factors Among Adolescents Attending Public Schools in the State of Morelos, Mexico. *Archives of Medical Research*, 34, 222-236.

Leenen, F. H. H., Dumais, J., Mclnnis, N. H., Turton, P., Stratychuc, L., Nemeth, K., Lum-Kwong, M. M. and Fodor, G. (2008). Results of the Ontario Survey on the Prevalence and Control of Hypertension. *Canadian Medical Association Journal, 178*(11), 1441-1449.

Levenson, J. W., Skerret, P. and Gaziano, M. (2003). Reducing the global burden of cardiovascular disease: The role of risk factors. *Preventive cardiology, 5*(4), 188-199.

Marmot, M. (2004). Status Syndrome. London, Bloomsbury.

McPherson K (2001). Public health does not need to be led by doctors. *British Medical Journal* 322:1593-1596.

Mendes, S., Fukino, K., Cameron, A., Laing, R., Filipe Jr., A, Khatib, O., Leowski, J. and Ewen, M. (2007). The availability and affordability of selected essential medicines for chronic diseases in low- and middle-income countries. *Bulletin of WHO 2007*, 85:279-288.

Mokdad, A. H., Marks, J. S., Stroup, D. S. F. and Gerberding, J. L. (2001). Actual causes of deaths in the United States. *Journal of the American Medical Association*, 291, 1238-1245.

Morrow, J., Jackson, A., Bazzarre, T., Milne, D. and Blair, S. (1999). A One-Year Follow-up to Physical Activity and Health. A Report of the Surgeon General. *American Journal of Preventive Medicine, (17)*1, 24 – 30.

Mpabulungi, L. and Muula, A. S. (2004). Tobacco use among High School Students in Kampala, Uganda: Questionnaire Study. *Croatian Medical Journal, 45*(1), 80-83.

Murray, C. J. L. and Lopez, A. D. (1996). The Global Burden of Disease. Cambridge, MA: Harvard School of Public Health.

Murenzi, J. G. (2001). Habitual activity patterns among adolescent learners in Rwanda. Unpublished Master of Science thesis. Physiotherapy department, University of the Western Cape.

National Council for Population and Development (1998). Kenya Demographic and Health Survey. Calverton, Maryland, NDPD, CBS and Macro International Inc.

Nawi, N., Stenlund, H., Bonita, R.,Hakimi, M.,Wall, S. and Weinehall, L. (2006). Preventable risk factors for non-communicable diseases in rural Indonesia: Prevalence study using the WHO STEPS approach. *Bulletin of the World Health Organization*, 84, 305-313.

Omran, A. R. (1971).The epidemiologic transition. A theory of the epidemiology of population change. Milbank Mem Fund Q.; 49:509-538.

Pampel, F. C. (2005). Patterns of Tobacco Use in the Early Epidemic Stages: Malawi and Zambia, 2000-2002. *American Journal of Public Health, 95(*6), 1009-1015.

Pan American Health Organization (2005). (http://www.paho.org.common.Display.asp.?Lang=S&RECID=7157,accessed, 14, July 2009.

Pan, Z. and Hu, D. (2008). Multi-level analysis of individual and community predictors of smoking prevalence and frequency in China: 1991-2004. *Journal of Public Health Policy, 29*(1), 72-84.

Perel, P., Casas, J. P. Ortiz, Z. and Miranda, J. J. (2006). Non-communicable diseases and injuries in Latin America and the Caribbean: Time for Action. *Plos Medicine, 3*(9), 1448-1451.

Phillips, J (2001). Recreational activities of high school learners in the Strand. Unpublished Masters Thesis. University of the Western Cape.

Popkin, B. M. (1998). The nutrition transition and its health implications in lower-income countries. *Public Health Nutrition,* 1, 5-21.

Reddy, K. S., Prabhakaran, D., Shah, P. and Shah, B. (2002). Differences in body mass index and waist: hip ratios in north Indian rural and urban populations. *Obesity Reviews,* 3, 197-202.

Redfern, S. and Norman, I. (1994). Validity through triangulation. *Nursing Researcher* 2: 41-56.

Sachs,J. D. (2005). The end of poverty. New York, NY, Penguin Press.

Sallis, J. F., Calfas, K. J., Nichols, J. F., Sarkin, A. J., Marilyn, F. J., Caparosa, S., Thompson, S. and Alcaraz, E. J. (1999). Evaluation of a University Course to Promote Physical Activity: Project GRAD, *Research Quarterly for Exercise and Sport,* 70, 1-10.

Sankaranarayanan, R. (2002). Effective screening programs for cervical cancer in low- and middle-income developing countries. *Bulletin of the World Health Organization,* 79, 954-962.

Sen, A. (1998). Non-communicable diseases and achieving the Millennium Development Goals. Available. www.unescap.org/esid/hds.

Shobhana, R., Rama, R. P., Lavanya, A., Williams, R., Vijay, V. and Ramachandran, A. (2000). Expenditure on health care incurred by diabetic subjects in a developing country - a study from southern India. *Diabetes Research and Clinical Practice,* 48, 37-42.

Silverman, D. (2000). Doing Qualitative Research: A practical handbook. London Sage Publications.

Steyn, K., Jooste, P. L. and Bourne, L. (1991). Risk factors for coronary heart diseases in the black population of the Cape Peninsula. The BRISK study. *South African Medical Journal*, 79, 480-485.

The World Health Report (1999). Making a difference. Geneva: World Health Organization.

The World Health Report (2002) – Reducing risks, promoting healthy life. Geneva, World Health Organization.

Tumuusime, D. K. and Frantz, J. M. (2006). Influence of previous participation in physical activity on its perceptions among tertiary institution students. *African Journal for Physical, Health Education, Recreation and Dance (AJPHERD), 12*(3), 287-297.

Unal, B., Critchley, J. L. and Capewell, S. (2005). Modelling the decline in coronary heart disease in England and Wales, 1982-2000: Comparing contribution from primary prevention and secondary prevention. *British Medical Journal*, doi: 10.1136/bmj.38561.633345.8F.

UNESCO/UNICEF/WHO/World Bank (2000). Focusing resources on effective school health: A fresh start to enhancing the equality and equity of education. World Education Forum. Final Report. (http://portal.unesco.org/, accessed, 14, July 2009.

Unwin, N., Setel, P., Rashid, S., Mugusi, F., Mbanya, J., Kitange, H., Hayes, L., Edwards, R., Aspray, T. and Alberti, N. (2001). Non-communicable diseases in sub-saharan Africa: Where do they feature in the health research agenda? *Bulletin of the World Health Organization*, 79, 947-953.

Van Walbeek, C. (2002). Recent trends in smoking prevalence in South Africa – Some evidence from AMPS data. *South African Medical Journal, 92*(6), 468 – 472.

Wang, W., Lee, E. T., Fabsitz, R. R., Devereux, R., Best, L., Welty, T. K. and Howard, B. V. (2006). A Longitudinal Study of Hypertension Risk Factors and their Relation to Cardiovascular Disease: The Strong Heart Study. *Hypertension*, 47, 403-409.

WHO (2005a). Preventing Chronic Diseases: A Vital Investment. *World Health Organization Global Report.*

WHO (2005b). WHO STEPS Instrument. Department of Chronic Diseases and Health Promotion. *World Health Organization*. Geneva, Switzerland.

World Health Organization (2001a). Physical Activity. Department of Non-communicable Disease Prevention and Health Promotion. *World Health Organization*: Geneva.

World Health Organization (2002). Reducing Risks: Promoting Healthy Life. *World Health Organization*. Geneva.

World Health Organization (2003). Physical inactivity: Direct and indirect health benefits. Non-communicable diseases and prevention and health promotion. *World Health Organization*, Geneva.

World Health Organization (2004). World Health Survey, Kenya.

World Health Organization (2005c). World Health Survey, Kenya.

World Health Organization (2008). Preventing Chronic Diseases: A vital investment. Available: http://www.who.int/chp/chronic=disease=report/en/. Accessed 30 June 2009.

World Health Organization (200b1). Summary. Surveillance of risk factors for noncommunicable diseases. *The WHO STEPwise approach*. Noncommunicable diseases and Mental Health.

World Health Report (1998). Obesity: Preventing and Managing the Global Epidemic. Geneva, Switzerland: *World Health Organization*. WHO/NUT/NCD/98.1.

World Health Report (2004). Building blocks for tobacco control, A handbook. Geneva.

Wu, X. and Stamler, Z. (1996). Changes in average blood pressure and incidence of high blood pressure 1983-1984 to 1987-1988 in four population cohorts in the people's Republic of China. The PRC-USA Cardiovascular and Cardiopulmonary Epidemiology Research Group. *Journal of Hypertension, 14*(11), 1267-1274.

Yamane, T. (1967). Statistics, An Introductory Analysis, 2nd Edition, New York: Harper and Row.

Yang, G., Fan, L., Tan, J., Qi, G., Zhang, Y. and Samet, J. M. (1999). Smoking in China: Findings of the 1996 National Prevalence Survey. *Journal of American Medical Association, 33*(4), 478-480.

Yusuf, S., Reddy, S., Ounpuu, S. and Anand, S. (2001). Global burden of cardiovascular diseases. Part 1: General considerations, the epidemiologic transition, risk factors and impact of urbanization. *Clinical cardiology: New Frontiers*, *104*, 2746-2753.
Retrieved March 26, 2008, from http://www.circulationaha.org.