The prevalence of certain risk factors of non-communicable diseases in a rural community: a physiotherapeutic perspective

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Declaration

I declare that the study:

"The prevalence of certain risk factors of non-communicable diseases in a rural South African village: a physiotherapeutic perspective",

that I am submitting for the M PhysT (Management) degree, at the University of Pretoria, is my own work, and has not been submitted for a degree to any other university before.

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Commissioner of oaths

Date 3 April 2001

This study is dedicated

to

Cizelle and Magdalena

and

Whom they represent

"When therefore a physician comes to a District previously unknown, its situation previously unknown, its situation and its aspect to the winds must be considered. Similarly the nature of the water supply must be considered; …. Lastly consider the life of the inhabitants themselves; are they heavy drinkers and eaters and consequently unable to withstand fatigue or, being fond of work and exercise, eat wisely and drink sparsely."

Hippocrates: *Airs, Waters, Places*[1]

[1] In: Amanoo-Lartson R, Ebrahim GJ, Lovel HJ and Ranken JP. District Health Care 2nd ed. London: Macmillan; 1996. p.33

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Abstract

Introduction

Tobacco addiction, obesity, hypertension and physical inactivity are common risk factors of non-communicable diseases. Information on the prevalence of risk factors is needed for *inter alia* planning of services.

Sample

A community-based sample of 99 subjects of both genders, aged 20 to 59 years, was randomly selected.

Method

Smoking status and physical activity levels were determined using a questionnaire. Hypertension (systolic blood pressure >160mmHg / diastolic blood pressure >90mmHg) and obesity (body mass index (BMI) >30kg/m^2, waist-hip ratio (WHR) >1(males), >0.84 (females)) were measured.

Results

Of the sample, 25% smoked, 6% were hypertensive, 19%(BMI) and 12%(WHR) were obese, 23% inactive at work and 25% inactive during leisure time. Seventy-eight percent did not participate in sport. Each subject had at least one risk factor.

Conclusion

Socio-economical, behavioural, psychological and cultural factors appear to influence the prevalence rates. Despite relatively low prevalence rates, high-risk groups were identified such as male smokers and obese females. Promoting physical activity by physiotherapists as part of comprehensive intervention programmes appears especially appropriate due to its inter-

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relationship with other risk factors. Prevention and treatment of risk factors should be a health priority.

Key words. Physiotherapy, physical therapy, risk factors, hypertension, smoking, obesity, physical activity, non-communicable disease, rural, epidemiology

Abstrak

Inleiding

Tabakverslawing, obesiteit, hypertensie en fisiese onaktiwiteit is algemene risiko faktore van nie-oordraagbare siektes. Inligting oor die voorkoms van risiko faktore word benodig vir *inter alia* beplanning van dienste.

Steekproef

'n Gemeenskapsgebaseerde steekproef van 99 proefpersone van beide geslagte, ouderdom 20 tot 59 jaar, is ewekansig gekies.

Metode

Rook-status and fisiese aktiwiteitsvlakke is bepaal deur die gebruik van 'n vraelys. Hipertensie (sistoliese bloeddruk >160mmHg / diastoliese bloed= druk >90mmHg) en obesiteit (liggaams-massa indeks (LMI) >30kg/m2, middel-heup verhouding (MHV) >1 (mans), >0.84 (dames)) is gemeet.

Resultate

Van die steekproef het 25% gerook, 6% was hipertensief, 19%(LMI) en 12%(MHV) was obees, 23% onaktief by die werk en 25% onaktief tydens ontspanning. Agt en sewentig persent het nie aan sport deelgeneem nie. Elke proefpersoon het ten minste een risiko faktor gehad.

Samevatting

Sosio-ekonomiese, gedrags-, sielkundige en kulturele faktore blyk die voorkoms-syfers te beïnvloed. Ten spyte van lae voorkoms-syfers, is hoë-risiko groepe, soos manlike rokers en obees dames, geïdentifiseer. Bevordering van fisiese aktiwiteit deur fisioterapeute as deel van omvattende

intervensie progamme, blyk veral van toepassing te wees weens die interverwantskap daarvan met ander risiko faktore. Voorkoming en behandeling van risiko faktore behoort 'n gesondheids-prioriteit te wees.

Sleutelwoorde. Fisioterapie, risiko faktore, rook, obesiteit, fisiese aktiwiteit, nie-oordraagbare siektes, landelik, epidemiologie

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List of Abbreviations

ACSM	American College of Sports Medicine
AIDS	Acquired immunodeficiency syndrome
ANC	African National Congress
BF	Body fat
BMI	Body mass index
CBE	Community-based Education
CHD	Coronary heart disease
COPD	Chronic Obstructive Pulmonary Disease
DBP	Diastolic blood pressure
FFM	Fat free mass
HIV	Human immunodeficiency virus
HSRC	Human Sciences Research Council
NIDDM	Non-insulin dependent diabetes mellitus
RDP	Reconstruction and Development Programme
SA	South Africa
SANCO	South African National Civic Organisation
SBP	Systolic blood pressure
UP	University of Pretoria
WHO	World Health Organization
WHR	Waist hip ratio

Chapter 1

Perspectives and problem statement

1.1 Introduction

"*The health needs in developing regions are undergoing radical change from predominantly communicable, maternal and perinatal diseases to predominantly non-communicable diseases.*"[1]

The consequence of the situation explained in the above comment, is an increase in life expectancy and in exposure to risk factors of non-communicable diseases. As soon as a population's life expectancy exceeds 60 years, chronic diseases occur in all strata of society, including those of a low socio-economic standing, even in developed countries. Coronary disease for example, is increasing more rapidly among people living in the poorer sectors of society.[2] Parallel to the general decrease in infectious diseases, is a growing urbanisation of the world-population, going hand in hand with an increase in diseases due to unhealthy lifestyles.[3,4] Epidemics of ever increasing non-communicable diseases are a major challenge facing global health,[5] especially in middle and low-income countries such as those in sub-Saharan Africa.[6]

In South Africa (SA), infectious diseases - apart from the human immunodeficiency virus/ acquired immunodeficiency syndrome (HIV/AIDS)[7] - are also controlled more effectively, with chronic diseases subsequently taking a more prominent place in health care needs. According to statistics on degenerative disease mortality in South Africa, cerebrovascular, ischaemic heart and chronic respiratory diseases are the most frequent causes of death in all population groups, accounting for more than 24% of deaths, with an upward trend since 1990.[8] The country is suffering *"a minor epidemic of stroke".*[9]

Moreover, in South Africa the estimated impact of cardiovascular diseases alone - in all population groups - is enormous. Pestana *et al.*[10] estimated the cost between R4 135 billion and R5 035 billion in 1991. This does not include the cost of

rehabilitation and follow-up of patients. Direct costs such as consultation fees, hospital expenditures and laboratory tests, as well as indirect costs such as lost earnings as a result of premature morbidity and mortality should be considered.

Aptly, the South African Medical Research Council (MRC) predicts that infectious diseases (apart from HIV/AIDS) may soon be overtaken by life-style induced chronic diseases, especially in African communities.[11] This may be due to socio-economic changes, rapid urbanisation and improvements in immunisation and access to medical care.[12] Common risk factors leading to the major non-communicable diseases include tobacco addiction, hypertension, obesity and a sedentary lifestyle.[13] It is better to keep these factors under control than to try to reverse negative lifestyle behaviour.[14]

1.2 Rationale for the research

An established principle in primary health care is the advantage of preventing diseases instead of treating them.[15,16] This shift in emphasis from curative services to disease prevention and health promotion has become indispensable for the achievement of health for all.[17]The movement in South Africa towards managed health care further highlights the importance of disease prevention.[18]

The first level of prevention is preventing the disease from occurring; in other words, an effort is made to attempt to eliminate the risk factors, which could lead to disease.[19] Preventing a few common risk factors could have a positive impact on preventing a number of chronic diseases, thus addressing them simultaneously rather than separately.[20]

Eksteen describes Physiotherapy as a health care profession encompassing all the basic primary health care factors, with the aim of maintaining, curing, where indicated, and optimising the bodily functions of patients in the context of their socio-economic and geographic environment.[21] She also emphasises that the potential of physiotherapy in the prevention of dysfunction from occurring in the first place, is also increasingly emphasised.

The four major groups of non-communicable diseases are neurological conditions, cardiovascular diseases, cancers and non-communicable respiratory diseases. The major risk factors contributing to these diseases can be narrowed down, globally and in South Africa,[22] to:

- tobacco and alcohol addiction
- obesity
- hypertension and
- physical inactivity or a sedentary lifestyle.

The primary health care and community health approaches emphasise primary prevention of diseases, thus focusing on these risk factors. There is a need for epidemiological studies to identify the real health needs of communities, particularly in the rural areas.[23]

In 1995 the Department of Physiotherapy of the University of Pretoria initiated a community physiotherapy block for student education, research and community service. This emphasis towards community-based education was done to comply with requirements of the National Department of Health[24] to provide relevantly trained health personnel for the South African context.[25] The University also increasingly emphasises community service, in addition to its student training and research functions.[26]

The physiotherapy programme should, however, be relevant to its consumers, namely the graduates, patients and clients, as well as to the South African government, who funds the training, as well as local, provincial and national health departments. Therefore, the international and national approaches to health, based on primary health care and public health, should be adhered to.

In the opinion of the author, preventing or at least containing the risk factors previously identified, should be a priority in the service, as they fall within the realm of physiotherapy. However, the prevalence of these risk factors in the Moretele District, a mainly Tswana community, could not be found in the recent literature.[27] Indications are that ethnic differences exist for these risk factors,[28,29,30] for example, the prevalence rate of hypertension is different for urban Xhosa-speaking (12%) and

urban Sesotho-speaking groups (30%).[31] Walker[32] also commented on the interethnic physiological and pathological diversities in Southern African populations, for example, with regard to the occurrence of cancer and coronary heart disease. Currier emphasises the role of informative studies such as surveys to establish baseline data.[33]

Chronic diseases, that are not covered by the present physiotherapy outreach programme, are one of the Reconstruction and Development Programme (RDP) priorities.[34] Priorities that are covered are mother and child health, adolescent health, care of the elderly and disability care.[35] Increasing the focus of the programme to include non-communicable disease risk factor management is essential in the South African context.

1.3 The research question

The burden and cost of non-communicable diseases internationally and nationally, the scope of physiotherapy, and the nature of community–based services already rendered by the Department of Physiotherapy, UP, emphasise the importance of focusing on the four risk factors of non-communicable diseases, that is, tobacco addiction, obesity, hypertension and physical inactivity. The lack of scientific knowledge with regard to the prevalence of these factors in a specific Tswana community in the North West province is particularly pertinent. The question that needs to be researched is therefore: What are the prevalence rates of the specific risk factors, the risk profile of the community, as well as the inter-relationships between smoking, hypertension, obesity and physical inactivity in the Bosplaas community, the Moretele district, North West Province, South Africa?

1.4 Definition of terms

- Prevalence rate: the rate of existing disease in a population at risk at a given time.[36]

- Risk factors: factors associated with an increased risk of acquiring disease. These factors may be environmental (physical or social), behavioural or inherited.[37]

- Non-communicable disease: diseases, the causative agent of which may not be passed or carried from one person to another directly or indirectly, usually of a chronic nature, that is slow in its progress and of long continuance.[38]

1.5 Organisation of the dissertation

In chapter two a theoretical background, based on a review of the literature is presented, providing a conceptual framework for the study. The methodology of the investigation will be described in chapter three; the results presented and discussed respectively in chapters four and five, based on the aims set out in chapter three. The study concludes with chapter six, in which the conclusion and recommendations from the study will be given.

1.6 Summary

In this chapter an outline of the increasing health and economic burden of non-communicable diseases and their common risk factors was given. The importance of incorporating the prevention of these risk factors into a university community service, as well as the lack of information of the prevalence of these risk factors in a specific Tswana community were discussed. The subsequent research question was included.

Chapter 2

Common risk factors of non-communicable diseases

2.1 Introduction

Smoking, obesity, hypertension and physical inactivity were identified as common risk factors for the development of chronic non-communicable diseases.[39,40,41] A broad base of knowledge related to these risk factors already exists. However, the prevalence of these risk factors in rural South African Setswana speaking communities in particular has as yet not been investigated.

In this chapter operational definitions for each risk factor are introduced, as well as the possible effects they may have on health status. Knowledge about the prevalence of these risk factors in other previously researched communities is necessary for comparing the prevalence rates in this study population in a meaningful way. An attempt is made to understand the relationship between the risk factors. Methods used in previous studies served as guidelines for developing the investigative methodology.[42]

For the purpose of this theoretical investigation an overview of relevant concepts will be covered. The following aspects are important in the field of non-communicable disease risk factors, but are not relevant to this prevalence study: associated physiology (including hormonal aspects), pathophysiology, biochemistry, pathogenesis, toxicology (for example, related to smoking) and pharmacology. Certain risk factors for cardiovascular diseases, for example Type A behaviour, emotional stress[43] and elevated levels of serum cholesterol, triglyceride and levels of low-density lipoproteins will also not be discussed.[44] This information would not contribute to the understanding of this study.

A description of the method followed to obtain the relevant information is set out in **Appendix 2.1**.

2.2 Non-communicable diseases

As life expectancy increases and fertility rates decline, there is a steady decline in infectious diseases (apart from HIV/AIDS) and an increase in non-communicable diseases.[45] Non-communicable diseases include cardiovascular diseases such as hypertension, coronary heart disease (CHD), rheumatic heart diseases and stroke, diabetes; respiratory diseases, such as chronic obstructive airway disease; cancers, including lung and cervical cancer; musculoskeletal diseases such as osteo-arthrosis and genetic disorders. These diseases are not contagious and are mainly associated with old age and economic development, including urbanisation and/or the unhealthy lifestyle which people follow. If diseases are more specifically related to an absence of sufficient physical activity, they are also referred to as hypokinetic diseases.[46]

In epidemiology, 'lifestyle' is defined as the way in which people respond to their conditions by selecting what they will eat and drink, deciding whether or not they will smoke and what kind of sexual /reproductive behaviour they will follow.[47] Whilst some aspects of lifestyle can enhance health, others have been identified as major causes of premature death and disability, with both high tangible and intangible costs.[48]

The term "chronic diseases of lifestyle" is used for a group of diseases, which have similar risk factors as a result of exposure to various external factors, usually over many decades. Some of the factors are diets, high in kilojoule and saturated fats, and low in dietary fibre, cigarette smoking, physical inactivity, psychological stress as well as stress of urbanisation and work conditions.[49] This 'lifestyle complex" is obviously only one of many found in the modern world with its north-south polarisation, its many cultures and diverse climatic regions. The isolation of this lifestyle complex for special study and characterisation in South Africa is justified because of its preponderance among middle- and upper-income people and especially, because of its idealisation by the majority of poor people.[46] The World Health Organization (WHO) predicts an explosion of non-communicable diseases in developing countries from the present time to the year 2015. By then, the ratio of deaths from non-communicable diseases versus deaths from infectious and parasitic diseases is predicted to be 1:1 in Africa.[50]

2.3 Smoking

2.3.1 Introduction

Concern over the effect of tobacco on the health of man led to the banning of the "stinking weed' in England in 1604. In 1623 the Sultan of Turkey decreed that smokers be put to death and in 1634 the noses of Russian smokers were disfigured by order of the Tsar. In 1638 Chinese smokers were beheaded as a punishment for smoking. Despite these stringent actions, smoking became more widespread and the habit became firmly established. Today smoking is a worldwide health problem.[33]

Nicotine produces chemical reactions in the body similar to those produced by heroin or cocaine. The relapse rate of dependent persons trying to quit using nicotine, alcohol, cocaine and heroin are roughly the same.[51,52] In some countries tobacco is used because it is thought to have medicinal effects.[53]

Indigenous tobacco production and consumption are major problems in many developing countries. Of particular concern, is the penetration of these markets by the transnational tobacco companies, because many developing countries have little experience in counteracting the transnational tobacco companies.[54,55,56]

2.3.2 Types of smoking

Tobacco can be inhaled in various ways, for example, using a pipe, a cigarette or home-rolled cigar. Tobacco is also chewed. The smoking of cigarettes is a convenient delivery system for nicotine, recognised as the major inducer of tobacco dependence,[57] but all forms of tobacco, including smokeless tobacco use, cigar smoking and pipe smoking are detrimental to health.[58]

There is no safe type of cigarette, nor a safe level of consumption: the single most effective way to reduce hazards of smoking is quitting entirely.[59]

2.3.3 Risks of smoking

Risk is closely related to smoke dose, as measured by the number of cigarettes consumed. A clear dose-response relationship has been established between cigarette smoking and a number of disease states.[60] The major prospective studies show that the risk of coronary heart disease (CHD) and lung cancer increases in a roughly linear manner with the increasing number of cigarettes smoked per day.[61] See **Table 2.1**.

Table 2.1: Risk for developing coronary heart disease (CHD) according to dosage of smoking[64]

CHD Risk	Number of cigarettes smoked per day
Low	5
Moderate	20
High	30-40
Very high	50

Risk also increases with increasing depth of cigarette smoke inhalation and longer duration of the smoking habit. The earlier the age at which regular smoking was initiated, the higher the risk for developing CHD.[53]

Switching to lower yield cigarettes does not necessarily decrease the risk, as compensatory behaviour, e.g., inhaling more deeply may negate any advantage of the lower yield product. Lower yield cigarettes may even increase the health risk as smokers may increase the number of cigarettes they smoke.[33]

2.3.4 Effects of smoking

The association between tobacco use and detrimental health effects has been proven more than thirty years ago, in many separate investigations.[62] Research indicates that cigarette smoking may cause cancer of the lung, larynx, oral cavity and oesophagus and is significantly associated with pancreatic, urinary bladder and kidney cancer in both males and females.[63,64,65,66,67]

Causes of smoking related deaths in SA include mainly:

- lung cancer
- ischaemic heart disease
- chronic obstructive airways disease (such as chronic bronchitis and chronic obstructive pulmonary emphysema)
- aortic aneurysm
- other cardiovascular conditions due to atherosclerosis, hyaline thickening of the arterioles in the heart and coronary heart disease following a myocardial infarction, and peripheral vascular disease.[66]

Lung cancer is the most obvious cancer related to lifestyle, being strongly associated with smoking.[68] The percentage of cancer occurrence associated with smoking in the age group of 15 to 65 years is as follows:

Male - 41%
Female - 16%.[47]

Other detrimental effects of smoking vary from hearing sensitivity[69] to tooth loss and dental caries,[70] increased risk of developing nuclear lens opacities[71] and developing Dupuytren's contracture.[72] Cigarette smoking also promotes the progression of diabetic nephropathy in patients with both type II and type I diabetes[73] and stroke in young adults.[74]

Of the three major cardiovascular risk factors - cigarette smoking, hypertension and hypercholesterolaemia - cigarette smoking is extremely noxious, highly prevalent and yet, a reversible habit. It therefore deserves special priority as a preventive measure to control atherosclerotic cardiovascular disease.[20] An ordered relationship between increasing exposure to cigarette smoke and the presence of silent cerebral infarction and acute brain infarction has also been reported.[75,

In addition, there is a considerable body of epidemiological, clinical and laboratory evidence concerning the detrimental role of cigarette smoking in the pregnant woman, possibly causing complications in the foetus, new-born infant and child.[76] Prescott *et al.*[77] postulate that females may be more sensitive than males to some of

the harmful effects of smoking. Interactions between components of smoke and hormonal factors may be involved in the development of ischaemic heart disease in female smokers. There is a 20 to 25 year lag phase between an increase in smoking and an increase in tobacco-related death.[78]

Jenkins *et al.*[79] argue further that money spent on cigarettes is money not spent to meet vital, life sustaining needs. In Vietnam, also a developing country, the mean expenditure for cigarettes could have bought almost enough food for one person for a year. As smoking declines in the West, per capita cigarette consumption rates are increasing in the developing world.[80] Unless steps are taken to reduce smoking, it is anticipated that by the year 2025, the death toll due to smoking in the developing world, will climb to seven million.[81] In addition, the financial burden of smoking on the people of South Africa, on industry and on medical services is enormous.[82]

2.3.5 Prevalence of smoking

Facts on smoking prevalence for South Africa, a middle-income country, are limited. In most developed countries data are more easily availble.[33]

Yach[62] compared trends in smoking prevalence in South Africa from 1976 to 1990 and found an increase of approximately 320 000 new African smokers. One can assume that these new smokers are men, as smoking rates among African females remained under 10% for the same period of time. By 1990 the highest smoking rates were reported among coloureds (49%), followed by whites (34%), blacks (28%) and Asians (28%).[62] The prevalence rate among rural whites, on the other hand, declined between 1979 and 1991. Addressing the smoking habit amongst black South African men thus already came to the fore almost a decade ago.

The lack of data on the prevalence of risk factors among urban blacks prompted Steyn *et al*[83,84] to do a survey on smoking rates in the Cape Peninsula (the BRISK study). Data on blood chemistry, blood pressure, number of cigarettes smoked and BMI of an adult population 15 to 64 years of age, of both genders, were collected. A stratified proportional sample of 986 subjects was taken from the black population of the Cape Peninsula based on a Human Sciences Research Council (HSRC) census. The process of randomisation was not described in the article, neither how the

census data were obtained. The age/sex distribution was adjusted to an international standard. The non-response rate was not indicated in the article. The extent to which the data from this study could be generalised to the population and other populations in South Africa is therefore doubtful. Ethical factors of concern are that no mention is made of ethical clearance to do the study, whether informed consent was obtained from participants, nor to any follow-up measures of subjects with harmful profiles. Steyn *et al*[85,86] reported that the fieldworkers were trained in order to ensure uniform interview techniques. It cannot be deducted from the article whether the subjects knew that the fieldworkers were nursing sisters. Being from the health sector could have introduced bias to the smoking data, as subjects could under report smoking habits, to please the interviewers. The fact that 8% of females and 52% of males reported smoking, probably is an underestimate of the real smoking rates. Other forms of tobacco intake were smoking pipes (6% of males and 3 % of females), using snuff (less than 1% of males and 23% of females), as well as chewing tobacco (less than 1% of both genders). Knowledge about the detrimental effects of smoking did not deter this population from smoking, as 82% of the male smokers and 92% of female smokers did perceive the smoking habit as harmful to health. It is not clear from the study whether this conclusion was based solely on perception, or on subjects accepting the harmful nature of smoking as a fact. Factors that correlated with smoking cigarettes were low levels of education amongst women, and earning an income amongst males. As more men enter the employment market, and attain managerial ranks with its increasing stress levels, this is disturbing information. A positive finding was that both sexes in the youngest groups, aged 15 to 19, smoked the least. Having spent less than a third of their lives in the city, thus being mainly from a rural background, was a deterring factor, in Steyn *et al.*'s study[85,86], for females to smoke. Nevertheless, smoking emerged as an important public health issue in the Cape Peninsula.

In the same year a similar study was conducted in the Orange Free State,[87] on the indigenous populations (Sesotho-speaking) of QwaQwa (853 respondents), a rural area, and Mangaung (758 respondents), an urban area. The rural part of the study was conducted in collaboration with tribal leaders. The sample selection was adequately described to prove its random nature. Subjects from 24 years and older were selected, and age-sex adjustments were made to the target population. Therefore direct comparison with the BRISK study,[83] discussed in the previous

paragraph cannot be made. The average response rate for both areas was 65%. The authors suspected that the response and non-response groups were socio-demographically comparable. No mention is made as to whether the two fieldworkers were trained. One of them was a registered nurse raising the same concerns as in the BRISK study.[83] The study found that dangerous levels of smoking (smoking more than ten cigarettes a day) were mostly confined to male subjects. The prevalence of smoking for males declined over the age deciles from 25% to 6% in a rural area and from 46% to 10% in an urban area. The urban group clearly comprised heavier smokers than the rural group.

Another study from the Western Cape (the Coronary Risk Factor Study (CORIS)) reported smoking rates for 1620 white South Africans,[88] in a similar risk profile study to the BRISK[83] and Orange Free State studies. In the western Cape the population was from three rural towns, one where a low intensity coronary risk programme was previously implemented, one which was exposed to a high intensity programme and a control town. Only results from the control town will be reported here, as they compare to the previously discussed studies, which also did not have active intervention programmes. Although the sample is referred to as random, 50 subjects were selected per sex- and age-specific decile. This suggests that the selection design was a simple *stratified* random sampling. Reference is made of ethical clearance, informed consent, and follow-up of patients at risk, ensuring the reader of a high ethical standard while conducting this study. In the control town 34% of males and 13% of females were current smokers. Unfortunately the number of cigarettes smoked were not reported. This study shows lower smoking rates amongst white males than black males, but comparative results for females.

2.3.6 Measurement of smoking

In field studies, data on smoking habits are usually collected via interviews, and thus reflects reported information only.

There are wide variations in how smoking is defined. Willems *et al*[89]. defined smokers as those who smoked at least one cigarette per day for the last seven days. They stratified the smoking category further into three categories: zero cigarettes per day, between zero and ten cigarettes per day, and more than ten cigarettes per day. The

Fragerstrom test, on the other hand, has the following categories: less than 16 cigarettes per day, 16 to 25 and more than 26.[90] A series of South African studies[91] paid particular attention to collecting data in comparable ways. These studies calculated prevalence rates for high and moderate levels of risks, defining a high level risk of smoking as smoking ten or more cigarettes per day. A moderate level of risk was attributed to smoking less than ten cigarettes per day.[91] It would therefore be useful to use the same information in a study of a Tswana population group.

2.3.7 Conclusion

Tobacco addiction is a proven risk factor for numerous diseases. The prevalence of cigarette smoking is increasing in developing countries, particularly amongst black smokers in South Africa. Measuring the dose of cigarette smoking has been standardised in South African studies for high and moderate risk.

2.4 Hypertension

2.4.1 Introduction

The WHO classification of hypertension[92] (see **Table 2.2**) is widely accepted as the norm in categorising blood pressure levels. Using the same operational definition as in international scientific literature, facilitates communication between researchers, as well as the comparison of research findings.

Table 2.2: Classification of hypertension by blood pressure level

Classification of hyper-tension and initial coding	**Systolic blood pressure (SBP) (mmHg)**	**Diastolic blood pressure (DBP)(mmHg)**
Normotensive (3)	< 140	< 90
Mild Subgroup(2) borderline	140 – 180 or 140 – 160 or	90 – 105 90 – 95
Moderate and severen(1)	> 180 or	> 105
Isolated systolic:(4) **Subgroup: borderline**	> 140 and 140 – 160 and	< 90 < 90

Hypertension includes both primary and secondary hypertension.[93] Primary hypertension, that is, essential hypertension, is characterised by high blood pressure of unknown cause. This category includes well over 95% of hypertensive patients identified during community screening.[94] Secondary hypertension describes raised blood pressure caused by an underlying renal or adrenal disease, or linked to an external factor such as the taking of certain types of medication. The exact mechanism is often obscure.[95] However, distinguishing between the two types of hypertension is not indicated in a community survey.

Pseudohypertension is inaccurately measured blood pressure (for example, when using normal cuffs on patients with an arm circumference of 33cm or more) leading to the incorrect diagnosis of high blood pressure.[96] Researchers should prevent over reporting hypertension rates, by using valid and reliable measures of blood pressure.

Another phenomenon responsible for bias in hypertension prevalence rates is "white-coat induced hypertension;" recently called "isolated clinic hypertension."[97] These are terms used to describe usually mild elevations in blood pressure during clinical consultations, but where pressures are documented to be normal when the patient goes about his normal daily life.[97] There is evidence that patients with white-coat hypertension develop renal impairment and are thus at risk for heart disease.[98,99] Including cases of white coat induced hypertension in a community survey should be acceptable, because these patients also need intervention.

2.4.2 Effects of hypertension

Hypertension is among the most common and most important of the risk factors for cardiovascular-renal disease.[100] High blood pressure is also associated with an increased risk of developing CHD, including coronary artery disease,[101] stroke,[102,103,104] congestive cardiac failure, renal insufficiency, peripheral vascular disease and retinopathy.[105] The risk has been noted in both sexes and throughout the entire adult age range.[106] Even mild elevations of blood pressure (i.e. DBP>90 and <110) yield increased risk.[107]

The importance of elevations in SBP is also receiving more attention.[107] Baseline systolic blood pressure is, for example, an independent risk predictor for amputations

(p=0004).[108] Preventing elevations of SBP is therefore indicated even in some musculoskeletal conditions, not traditionally related to hypertension.

In sub-Saharan Africa the effects of hypertension are even more detrimental, as most hypertensive clients are only diagnosed after one of the major complications has already developed.[109]

2.4.3 Prevalence of hypertension

Consistent findings in communities world-wide are that hypertension in blacks is under diagnosed. It is also poorly controlled in many of those who do receive treatment.[110] One in three African-Americans has hypertension compared to one in four whites. Although it is known that obesity increases the risk of hypertension, it was found that the prevalence of hypertension in non-obese blacks in America is higher than in non-obese whites in America.[111]

Gorey and Trevisan,[112] however, came to an interesting conclusion after analysing 25 studies on hypertension prevalence amongst black and white adults (1960-1991). They made the following inferences:

1) both female and male, black and white hypertension prevalence ratios have diminished by approximately one third over the past three decades,
2) response rates were significantly lower amongst the more recent surveys (i.e. after 1976), and
3) these two trends are directly associated. Thus, response rates may account for a third to nearly a half of the variability in black-white hypertension differentials.

The WHO MONICA project[113] aimed to monitor trends and determinants of cardiovascular diseases. The prevalence of hypertension in the majority of the study's centres is over 20%, and that is true for all centres from Europe to Yugoslavia.

Hypertension was one of the risk factors measured in the BRISK study.[83] The same limitations discussed in **Paragraph 2.3.5** apply to determining hypertension in the

BRISK study. A mercury manometer was used to determine blood pressure according to a standardised, unbiased procedure. Inter-rator reliability was ascertained during the five day training session of the fieldworkers. A correlation coefficient of above 0.95 between the fieldworkers and an experienced reference person had to be achieved. Using the WHO definition 9% of males and 12% of females were hypertensive.

The QwaQwa study[87] (refer to **Paragraph 2.3.5**) reported hypertension rates of 35% for females and 22% for males. Blood pressure measurements were done according to a "standardised clinical examination;" however, no reference or explanation were given for this standard procedure. Measures were taken to ensure correct readings in obese patients. Inter-rator reliability was not recorded. For both the rural and the urban Orange Free State groups, blood pressure increased with age, with increases more marked in the urban group. In the urban area 23% of males and 36% of females were hypertensive, using the WHO definition. The corresponding figures in the rural area were 21% and 35%.

The same procedures and definitions were used in the CORIS study as in the BRISK study[83]. Inter-rator reliability was tested using a double headed stethoscope, however, the coefficient rate was not reported. Twenty percent of males and 16% of females were hypertensive.[88]

It appears that the apparatus to measure blood pressure in the South African studies were not calibrated. Results should therefore be interpreted with care.

2.4.4 Measurement of hypertension

Blood pressure can be measured directly or indirectly. Direct blood pressure measurement is done via catheterisation and is a valuable research tool,[114] but not easily accessible to all researchers.

Resting blood pressures can be measured indirectly by auscultation using a sphygmomanometer[115] or automatic blood pressure monitors.[116] However, readings taken using a sphygmomanometer frequently lack inter-observer reliability because of systematic error, terminal digit preference for the terminal numbers zero and five,

and observer prejudice. Musso *et al.*[117] warned that caution should be paid when interpreting the results of sphygmomanometry, as the error level in single patients can be as high as +/- 40mmHg. Measurements with automatic devices on the other hand, tend to be higher for systolic and lower for diastolic measurements, than the manual method. The WHO recommends that if a patient's systolic and diastolic blood pressure falls into different levels of hypertension, the higher category should be selected to classify his or her blood pressure status. Therefore, the fact that electronic devices give opposite deviations in terms of systolic and diastolic measurements when compared to the manual method, should not affect the diagnosis of hypertensive patients negatively.[118] If having a choice in terms of indirectly measured methods, researchers should give preference to automatic blood pressure monitors.

Blood pressure is subject to variation as a result of certain factors. These factors may be of two general types:[114]

a) Cyclical changes with differing time courses. Short-term variability occurs as a result of respiratory fluctuations and oscillations of sympathetic activity. There is a diurnal rhythm of blood pressure with the highest values generally occurring in the morning hours, and the lowest during sleep. In some climates there is a seasonal rhythm with higher levels during the winter.

b) Changes occurring as a result of physical and mental activity. During exercise, systolic pressure can exceed 200mmHg in a normotensive individual, whilst during sleep it may drop to as low as 70mmHg. Anxiety and anger may both raise blood pressure.

The implication for researchers is that surveys should not be done over long time periods covering different seasons. Ideally blood pressure should be taken at roughly the same time of the day and not directly after physical or mental activity.

Accurate assessment of an individual's 'true' blood pressure thus requires multiple measurements. Self- and ambulatory monitoring may be helpful in this regard:

a) Self-monitoring of blood pressure can easily be performed using mercury or aneroid sphygmomanometers with specially designed cuffs or with semi-automatic devices.

b) Twenty-four hour ambulatory recording of blood pressure may provide important additional information and may be a useful adjunct for making therapeutic decisions.[119]

Although self-measurement is beginning to be used satisfactorily in clinical trials, De Gaudemairs *et al.*[120] are of the opinion that numerous studies are still necessary to clearly define its place. In the opinion of the researcher, the extra effort entailed in these two measures would not make a significant difference in prevalence rates in community surveys.

2.4.5 Conclusion

There is broad consensus in terms of what is meant by the term hypertension, as well as how it can be measured. Factors to be taken into account when measuring blood pressure were discussed. The prevalence of hypertension among Africans is of great concern.

2.5 Obesity

2.5.1 Introduction

Obesity can be defined as body weight that is above published acceptable standards, usually in relation to height.[121] See **Appendix 2.3**.[122] The most widely used height-weight index is the Quetelet Index, more commonly known as the BMI.[156] BMI is calculated by dividing body mass in kilograms by the square of the individual's height in metres.[162]

The WHO accepts Garrow's definition of obesity,[123,124] seen in **Table 2.3**.

Table 2.3 WHO/Garrow's classification of body mass using the Quetelet Index[125]

Quetelet Index (kg/m^2)	Classification
20-25	Desirable
25-29,9	Grade 1 obesity
30-40	Grade 2 obesity
>40	Grade 3 obesity

Cut-off points suggested by Bray,[126] (**Table 2.4**), coincide with other South African and international studies and could facilitate comparison between the studies.[83,87,88]

Table 2.4 Bray's classification of body mass, using the Quetelet Index[166]

Level	Quetelet Index	
	Male	Female
Obese	>30	>30
Overweight	25-30	24-30
Normal	21-24	20-23
Underweight	<20	<19

2.5.2 The effects of obesity

Excess body weight and fatness pose a great risk to both the quality and quantity of one's life. Obese individuals have a shorter life expectancy and greater risks for the development of CHD,[127] hypertension[128], hypercholesterolaemia, diabetes mellitus,[129] chronic obstructive pulmonary disease and osteoarthritis of the spine, hips, and knees,[130,131] arteriosclerosis[131] and gastric cardia cancer.[132] Obesity also favours the development of hypertensive related diseases, gallbladder disease[133] and certain cancers (breast,[134] colon[135]), dislipidaemias.[136,137] and obstructive sleep apnoea.[138] Shephard adds respiratory conditions and reproductive abnormalities to the list of adverse effects of obesity.[139] In addition obesity is linked to hormonal abnormalities that are associated with infertility and polycystic ovarian syndrome, menstrual irregularities and an increased risk of miscarriage.[140,141] Leboeuf-Yde *et al.*[142] found in a cross-sectional postal survey of 29,424 twin subjects aged 12 to 41 years that

obesity is associated with low back pain, in particular with chronic or recurrent low back pain. Furthermore, greater adiposity is associated with decreased every day physical functioning, such as climbing stairs or other moderate activities, as well as lower feelings of well-being.[143]

Although Fritz and Penn[144] list obesity as a risk factor for stroke, obesity has not been established as an independent risk factor for stroke, apart from its association with other risk factors.[145] Most studies of the association between obesity and stroke have found little if any adverse effect. The close association between obesity and other risk factors for stroke confounds the search for causality, although the Framingham Study has suggested that obesity may be an independent risk factor if present for a long enough period.[144] Therefore, a lifelong history of obesity may be more important in the assessment of stroke risk than current body mass in middle age.[140]

The waist to hip ratio is a predictor of cardiovascular disease and diabetes in both sexes.[146] Truncal-abdominal obesity is an independent risk factor that carries an even higher risk than excess body fat *per se* in males. Fat distribution is therefore a better predictor of cardiovascular morbidity and mortality than the body mass index (BMI).[147] It is more prevalent in individuals habitually exposed to stress. Abdominal or android ('apple') obesity, found more in men, is thus more noxious than gynoid ('pear') obesity, found more commonly in females.[148,149]

One should note that obesity might vary in its noxiousness; for example, African-American females have high prevalence rates of obesity but appear to be at lower risk than may expected.[150]

2.5.3 Prevalence of obesity

The World Health Organization recognises obesity as a global epidemic.[151,152] One example is in the United States where obesity has reached epidemic levels. The age-adjusted prevalence for females was 36% in 1998. Females of minority groups experience an even greater problem, with nearly 50% of Mexican-American and African-American females exceeding a BMI of 27kg/m^2.[141] The prevalence rate found in a national probability sample in Belgium,[153] on the other hand, was only 8% in males and 9% in females.

The BRISK[83] and CORIS[88] studies previously discussed (**Paragraphs 2.3.5** and **2.4.3**) reported on obesity rates in South Africa. In these studies obesity was defined as a BMI of greater than 30 kg/m^2. In both studies care was taken that the good quality bathroom scale, used to determine body mass, consistently gave standardised measures and standard procedures were maintained. Eight percent and 45% respectively of the black males and females in the BRISK sample[83] were obese. On the contrary in the CORIS sample, more males than females were obese, that is 34% of males and 18% of females. In neither of these studies was an indication of the distribution of adipose tissue, such as waist circumferences, given.

Researchers in the QwaQwa study[87] also obtained reliable data, using a Seca beam scale for height and weight measurements and duplicating anthropometric readings on every tenth subject. However, how this quality control measure was implemented was not described, for example, no predetermined correlation coefficient between raters was given. Mollentze *et al.*[87] did not report obesity rates, only overweight. (BMI>25kg/m^2). Thirty one percent of males and 58% of females were overweight. No study for a rural Tswana population could be found.

2.5.4 Measurement of obesity

Anthropometry provides a quick and easy way to assess a person's body composition. It is concerned with the systematised measurement and quantification of the dimensions of the human body.[154] Anthropometric techniques (measuring body mass, stature, skinfold fat, body circumference and diameter) are popular for predicting body composition in the field setting. They are inexpensive, require little space, and are easy[155]and quick to perform and can be applied generally to adults.[156] Application of these techniques is indicated in field surveys.

2.5.4.1 Height-weight indices

The disadvantages of using relative weight, or height/weight tables are:[157]

- The data on which height-weight tables are based are not representative of the entire population.

- Quality of the data is variable.
- There is substantial diurnal variation of body mass, partially linked to cycles of eating, urination and defaecation.
- There is inadequate control of potentially confounding variables, especially smoking.
- It is not always clear how frame size was determined.
- Tables do not provide information on body composition. In any given individual, a heavy body mass may reflect not only an accumulation of body fat, but also a heavy frame or well-developed muscles.
- BMI could give a false impression of the state of obesity, as only about 50% of the variation in body fat is explained.[158]
- At different ages the same levels of BMI correspond to different amounts of fat and fat-free mass.[159]

The above factors should be taken into account when interpreting results using the Quetelet Index.

Fortunately, when considering a population, some of these difficulties diminish, and these indices may accurately reflect obesity.[160] The above-mentioned factors should be taken into account when interpreting results using the Quetelet Index. Advantages of these tables include:[157]

- Weight is an important distinguishing feature of identification of body fat.
- Weight and height can be measured accurately.
- Height-weight tables are easily understood and used.
- Height-weight tables are generally used by the lay population.
- It serves as a rough guide in helping persons determine in what range their weight should fall.[161]
- BMI as an index of heaviness is not characterised by a significant hereditary component.
- BMI has a relatively high correlation with estimates of body fat and a low correlation with stature.

- BMI correlates well with other measurements to establish body fat such as body density, total body water and total body potassium.[162]
- BMI is both a reliable and convenient indicator of obesity.

Neville and Holder[163] proposed a lean body mass index, as the square of height divided by weight. This was shown to be an accurate measure of percentage lean body mass, and, as such, a better predictor of percentage body fat than BMI. However, the latter is generally used in population-based studies.[164,165]

The Quetelet Index is an appropriate tool for use in determining obesity for researchers. On the other hand, it can also facilitate the study population's understanding of the research finding, and could subsequently increase compliance to intervention pogrammes following a survey of obesity prevalence rates.

2.5.4.2 Skinfold measures

Another widely used field method is the skinfold technique. Skinfold measures at various sites of the body can be used to estimate the amount of subcutaneous fat. Subcutaneous fat is independent of genotype and is associated with the determinants of energy balance, it is habitual energy intake and total habitual energy expenditures.[166] Generalised skinfold equations for the prediction of body density are reliable and valid for a wide range of individuals.[167] Heitman differs, stating measurements of skinfold have been reported to have a large inter-observer variance and seem very unreliable on obese people.[170] Howie *et al.*[166] also proved the prediction of percent fat to be unreliable. He refuted the assumptions on which skinfold calliper prediction of percent fat relies for the following reasons:

- Constant compressibility of skinfold.
- Skin thickness being negligible or a constant fraction of skinfold.
- Fixed adipose tissue patterning.
- Constant fat fractionation of adipose tissue.
- Fixed proportion of internal to external fat.

2.5.4.3 Body circumference measurement

The site of obesity, apart from the scale of obesity, is also important. Determining the ratio of the waist or abdominal circumference to the hip or gluteal circumference is an easy way to assess body fat distribution.[169] The waist-hip ratio provides an index of regional body fat distribution and is a valuable guide to assess health risk, as it is a good indicator of coronary heart disease risk status.[170,171] It is calculated by dividing the waist circumference by the hip circumference. The high-risk cut-off point for males is a waist circumference greater than 102cm and for females greater than 88cm.

Investigators have, therefore, suggested combining the Quetelet Index with the easily obtained waist-to-hip ratio as an improved means of assessing risk for heart disease, stroke, diabetes mellitus and premature death.[172]

Bouchardt therefore, distinguishes between different types of obesity from a health perspective.[173] See **Appendix 2.2** for obesity phenotypes.

2.5.4.4 Body composition measurement

Body composition measurement is a measure of the quality of an individual's body weight. A percentage of 'normal' weight can be 'overfat'. Percentage body fat is thus a relative measure of body composition. Age-gender equations, based on multicomponent models of body composition, can be used to convert body density into percent body fat.[174] The two-compartment model assumes that body composition is made up of fat and fat-free body compartments.[174]

The availability of technology to measure different compartments includes methods such as total-body dual-energy X-ray absorptiometery (DEXSA), computerised tomography and magnetic resonance imaging, hydrostatic weighing and CT-scans.[175,]However, the cost of these technologies limits their use to few researchers.[176] Bio-electrical impedance analysis[177] appears to be a satisfactory alternative, although ultrasound and near-infrared interactance methods need further validation and development.[178] Measurements of total body potassium, total body water and underwater weighing are usually considered to be gold standard methods

for the estimation of fat free mass (FFM) and body fat (BF).[179] The electrical impedance method seems to be the most accurate for field research.[179]

In **Appendix 2.4** is a summary of different methods of determining body composition and in **Appendix 2.5** a table with the pros and cons of the different measuring options.

2.5.5 Conclusion

In this section the concept of obesity and its effects were discussed. It was seen that there are various ways in which to measure obesity, with the Quetelet Index, also called the BMI, a popular field method. South African females have relatively high rates of obesity, but there is a gap in terms of data on obesity rates in Tswana populations.

2.6 Physical activity

2.6.1 Introduction

Caspersen[180] defined physical activity as any movement of the body that is produced by the muscles and results in a significant expenditure of energy. However, other factors such as the basal metabolic rate and the thermal effects of food also affect total energy expenditure.[181] Physical activity is the most variable component of total energy expenditure and comprises activities of daily living, sport and leisure, as well as occupational activities.[182]

Exercise is in essence a subset of physical activity, and implies the undertaking of planned, structured and repetitive movements with the aim to maintain or improve physical condition.[193] However, certain occupational and domestic activities also fall within the same parameters as physical exercise such as hanging washing or carrying bricks.

2.6.2 The effects of physical activity

There is increasing research supporting the argument for a beneficial link between physical activity and health maintenance.[183,184,185] Methodologically well-designed studies tend to show a larger benefit of physical activity than those less well-planned studies.[186] Those who engage in physical activity three or more times per week appear to have the least coronary risk factors. However, even those engaged in physical activity once per week had fewer CHD risk factors than sedentary individuals.[187]

The lack of physical activity has emerged as an important risk factor for many chronic diseases, such as coronary heart disease,[188,189,190,191] hypertension, non-insulin dependent diabetes mellitus (NIDDM),[192,193] stroke, obesity, fibromyalgia[194] and cancer,[195] especially of the colon, prostate, breast[196] and endometrium,[197] as well as conditions such as premenstrual syndrome.[198]

Additional benefits of exercise include the ability to improve psychosocial health[199] by reducing anxiety and depression and by improving mood,[200] self-esteem[201] and other indices of psychological well-being.[202,203] Physical activity is beneficial as part of the treatment of alcoholism, substance abuse and other forms of addictive behaviour.[204]

In addition, the diminishing muscle power and strength that occur with age, are due more to reduced levels of physical activity than to the ageing process *per se*.[205,206] In a sample of older patients with Chronic Obstructive Pulmonary Disease (COPD), aerobic fitness was predictive of cognitive performance of various tasks. In particular, aerobic fitness is predictive of speed of thought processing, which is a cognitive variable that may itself underlie performance of a majority of cognitive tasks.[207] Studies indicate that physical activity is effective in postponing mortality and enhancing longevity.[208] Physically active persons also report less circulatory strain during routine household tasks and less functional limitation than unfit or sedentary participants.[209,210]

Other forms of hypokinetic disease which correlate with decreased physical activity, are musculoskeletal disorders, such as osteo-arthritis, osteoporosis, bone fractures, connective tissue tears, neck and shoulder pain and the low back pain

syndrome.[211,212] Muscular weakness or imbalance contributes to more than 80% of all low back problems caused by a lack of physical activity.[213] If the muscles are not strong enough to support the vertebral column in a good alignment, poor posture results and low-back pain may develop.[214] People, who remain physically active throughout life, retain more bone, ligament and tendon strength, and are therefore, less prone to fractures and connective tissue injuries.[215] However, it is important that participants are progressively prepared for intense fitness programmes, as these may have adverse effects such as pain and soft tissue injuries.[216] Similarly, the least aerobically fit British Army officer cadets, sustained more injuries than their fitter counterparts.[217] The important factor is a programme which provides sufficient physical activity to attain maximal benefit and the lowest risk of injury.[218] Furthermore, findings indicate that persons with rheumatoid arthritis, who participate in appropriate exercises, may lessen fatigue levels and experience other positive effects, such as increased hand grip strength and decreased pain, without aggravating their arthritis.[219]

2.6.3 Prevalence of physical activity

The first study to determine the level of physical activity in a representative South African sample was published in 1986.[220] The study formed part of the CORIS study (refer to **Paragraphs 2.3.5**, **2.4.3** and **2.5.3**). The subjects, 7188 rural Afrikaners, were categorised into three groups according to activity at work (sedentary, moderate and vigorous) and during leisure time (light, moderate and vigorous). Unfortunately only a few examples in each category were given, and it is unclear whether respondents had a choice of activities or whether open-ended questions were asked. If a list was given, the question is whether the list was sufficiently detailed, and if not, what process was followed to categorize activities. Similarly if respondents had to list their activities, they did not explain how they were categorised. It is therefore not possible to comment on the validity of the questionnaire. Noakes *et al.*[220] converted the time spent on different activities into energy expenditure (corrected for by body weight). Again no indication is given how data on time spent per activity were obtained. One would have, for example, preferred that measures were taken to ensure that total time spent on activities did not amount to more than real time available per week. Obsequious bias could have led to over-reporting of activity levels. However, because only broad categories were used, one may assume that

the data reflects he trends of physical activity levels of the population. The results were that less than 1% of males and females, irrespective of age, performed workday activities requiring high-energy output. From 24 years onwards, there was a dramatic fall in the percentage of both males and females participating in either moderate or vigorous leisure time activity. Only 26% of males and 16% of females over the age of 24 participated in moderate or vigorous leisure-time activities. Less than 2% of males and less than 1% of females of all ages, expended more energy than the required threshold level per week associated with lower risk of CHD is of concern.

The BRISK study[83,221] also reported on levels of physical activity. In this case the population was employed blacks from the Cape Peninsula, addressing the gap in literature on activity levels in non-whites in South Africa. Unfortunately only 41% of females in the original sample were employed, and female data across age strata were not adequate for analysis. Therefore only the data of the male subjects were analyzed. Two hundred and two employed, middle-class men took part in the study. Participants gave informed consent to take part in the study. The physical activity questions were given in full, and had face validity. Working activity was categorized into three categories based on whether respondents' work mainly involved sitting and standing, a lot of walking or hard physical work (sweat work). If subjects took part in regular (defined as more than twice a week) exercise (muscle work), outside working hours, they were asked whether it was light or strenuous. The authors acknowledged that the data were subjective self-reports, and that they obtained no data on the intensity or duration of activities. Fifty nine percent of the sample exercised outside of working hours, 18% of those strenuously. Twenty-five percent of the subjects performed moderate amounts of exercise at work and 18% did hard physical work. This group were more active than the white group of the CORIS study.

Noakes and Lambert[222] are of the opinion that South African researchers could make a unique contribution by studying groups other than middle-aged, predominantly affluent upwardly mobile, white males. The latter population was studied in the majority of the reported studies in this field.

2.6.4 Measurement of physical activity

Many survey instruments to measure physical activity are available; they range from lengthy questionnaires that are completed by a trained observer, taking several hours per subject, to simple retrospective or prospective reports. Methods used to gather data include personal or telephonic interviews, as well as self-administered and mail questionnaires.

Questionnaires are suitable for epidemiological studies. They require no technical equipment, are relatively cheap and do not interfere with the subjects' usual activity.[223] A disadvantage of questionnaires is that they may necessitate translation and adaptation.

Physical activity questionnaires vary with regard to the detail requested. Activity levels at work, during leisure time, and / or sporting activities can be included in questionnaires about physical activity levels.

Job classification was frequently used as an epidemiological tool until the mid-1970's. Although job classification is simple, cheap and does not interfere with the behaviour of the subjects, it has certain drawbacks. Classification of jobs lacks precision as some people have two or more jobs, and others change occupations frequently. The intensity of activity associated with any given occupation, especially outdoor work may be gauged differently by different investigators. Outdoor work may vary according to the seasons, leading to variations of energy expenditure. Only "heavy" occupational activities are considered beneficial. Heavy activity was defined as the continual climbing of stairs or inclines, lifting loads of 20 pounds or more each hour, or carrying loads of any size continuously throughout the day.[139] No consideration is given to activity performed by the unemployed and/or retired. Currently more emphasis is placed on leisure and non-occupational physical activities.[183]

Physical activity questionnaires can *inter alia* be classified in terms of the period of activities that they measure. Periods range from diaries of up to 24 hours duration, recall surveys over periods of several days, to quantitative histories, covering from one year to a lifetime.[224]

Generally, the more accurate a method, the greater the degree of respondent co-operation that is required and the lower the response rate that is obtained. It also appears as if the respondent's quality of recall is affected negatively by the length of time that has elapsed, a low educational level and inability to communicate.[225] Therefore, because of linguistic diversity and low literacy levels, the following questionnaires were regarded by the researcher as being inappropriate for use in a rural disadvantaged South African community: the CARDIA Physical Activity History[226] (12-month recall), the Tecumseh Occupational Physical Activity Questionnaire[227] (past year recall), the KIHD Seven-Day Physical Activity Recall[228] (one week recall) and the Framingham Physical Activity Index.[229]

The researcher was also of the opinion that other existing questionnaires may not be appropriate in the South African context, because they focus on culturally foreign factors such as kayaking, snow skiing and berry-picking. Examples are the Aerobics Center Longitudinal Study Physical Activity Questionnaire,[230] the Kuopio Ischemic Heart Disease Study (KIHD),[231] Canada Fitness Survey,[232] the Stanford Usual Activity Questionnaire[233] the Behavioral Risk Factor Surveillance System[180] and the Minnesota Leisure Time Physical Activity Questionnaire.[234,235] Some questionnaires, for example, the Aerobics Center Longitudinal Study Physical Activity Questionnaire,[236] focus on sport, which has as yet not been established in many disadvantaged communities.

Historically, physical activity has been oriented around the types of leisure and occupational activities, typically performed by men. Females engage in a substantial amount of child care and household activities, and the physical activity involved is difficult to assess. Therefore, many of the questionnaires currently in use may be less sensitive to differences in physical activity levels in populations of females.

One method that can give an accurate picture of energy expenditure is the use of diaries. However, diaries are quite costly to administer; for example, the Bouchard three-day physical activity record,[237] needs to be delivered and then collected after three days. Moreover, some people are unwilling to record every activity. The pattern of activity the respondent habitually participates in, may be modified to simplify recording. Furthermore, only a small part of any year is sampled by the diary, and the actual energy cost of the various activities that the subject reports may differ widely

from the figures available in published tables. Respondents also tend not to record events as they happen, and depend on memory which is not ideal,[238] as already mentioned.

Although the available questionnaires investigated, appeared to be unsuitable for South African communities, some had useful items, which could be modified for this study; for example, the Baecke Questionnaire of Habitual Physical Activity.[239] The Godin leisure-time exercise questionnaire[240] provides a useful guide for coding participation in exercises, the Modifiable Activity Questionnaire[241] for coding job categories and the MONICA Optional Study of Physical Activity (MOSPA)[242, 243] for coding transport to and from work. The Pfaffenbarger Physical Activity Questionnaire[244] uses the pace of walking as an indication of cardiorespiratory conditioning during physical activities.

The pedometers and accelerometers also proved to be useful in assessing physical activity in a large, free living population.[245,246] A pedometer and accelerometer are mechanical motion sensors that record the acceleration and deceleration of movement in one direction. Pedometers have the advantage of avoiding the self-report bias of physical activity questionnaires, diaries and logs. It is an objective measure of physical activity in large population studies with different linguistic cultural groups. However, the pedometer's limitations include its inability to measure physical activity of a static nature, such as lifting heavy objects, and activity involved in water sports and cycling.

In terms of physical activity levels in sport there are a few parameters which researchers should consider. They are the mode, frequency, duration and intensity of the exercise. The definition of these parameters in terms of what is beneficial for health is as yet inconclusive.[247] **Table 2.5** provides a summary of the exercise parameters for health benefits.[248,249]

A questionnaire to determine activity levels during sport should include these parameters.

Table 2.5: Summary of parameters of physical activity for health and fitness

Parameter	American College of Sports Medicine (ACSM) (1978)	ACSM (1990)	Centre for Disease Control, ACSM (1998)[250]
Type of activity	Large muscle groups in dynamic movements	Large muscle groups, continuous and rhyth-mical (aerobic) Resistance training[251] one set of 8-12 repetitions of 8-10 exercises	Exercise or activities of daily living including walking up stairs, gardening, dancing and walking part or all of the way to and from work.
Duration (minutes)	15 or longer, continuous	20-60 continuous	30 accumulated
Frequency (days per week)	3 or more	Aerobic: 3-5 Resistance[252]: 2-3	Over the course of most days
Intensity	60% of cardiorespiratory capacity	60-90% of maximum heart rate or 50-85% of maximal oxygen consumption	Moderate intensity (e.g. walking briskly)

2.6.5 Conclusion

There is strong evidence that regular physical activity provides people of all ages, male and female, with substantial physical, social and mental health benefits and general well-being. It reduces the risk of premature mortality in general, and to a large extent, protects against the development of major non-communicable diseases.

Because physical activity can be defined in several ways, there is no single standard for measuring physical activity. Moreover, time considerations often require the researcher to select a brief survey that measures the most common physical activities of a population. Short bouts of activity, which are linked principally to the total amount of physical activity and less to the specified characteristics of the activity (such as mode or duration of the activity) are an appropriate approach to achieve health benefits. However, the characteristics of the population being studied (such as

culture, gender and age) and the outcome of interest to the researcher are critical considerations in the choice of a physical activity assessment tool. Therefore, the measurement of physical activity still depends greatly upon the aims of the investigator.

No information could be found on prevalence rates of physical activity levels for rural black South Africans.

2.7 Inter-relationships between the four common risk factors

It would be an oversimplification to interpret the prevalence of any of these risk factors in isolation, as correlations between them have been established, and recorded in the literature.

2.7.1 Smoking

Smoking and hypertension

Smoking is related to a higher prevalence of hypertension[253] and is significantly correlated with a lower BMI.[254]

Smoking and obesity

BMI was found to be lower in persons who smoke 25 or more cigarettes a day, when compared to non-smokers irrespective of sex.[255,256]

Smoking and physical activity

Narayan *et al.*[257] found (amongst both males and females), that the prevalence of smoking was associated with leisure inactivity and high levels of physical activity at work and at home. In their study people in manual occupations were more likely to smoke than those in professional or supervisory occupations. Brisson *et al.*[258] also found that the prevalence of smoking was highest in both males and females who had physically demanding jobs.

2.7.2 Hypertension

Hypertension and physical activity

Blood pressure can be lowered by means of low to moderately intense physical activity (40-60% of maximal oxygen consumption),[259] such as 30 to 45 minutes of brisk walking most days of the week.[260,261] Not all large epidemiological studies have reported this inverse relationship between blood pressure and level of physical activity.[262] However, the "American Family Physician" reported a study done by Kokkinos *et al.* Forty-six black males participated in an exercise programme of stationary cycling at 60 to 80% of predicted maximal heart rate for an average of 45 minutes three times per week for 16 weeks.[263] The males who exercised, had an average decrease of 5mmHg in diastolic blood pressure, compared with a 2mmHg increase among the subjects who did not exercise.

2.7.3 Obesity

Obesity, age and gender

Statistically significant age dependencies were observed in the total body fat compared with younger persons with comparable BMI's. Females have significantly greater amounts of total body fat and larger mean waist circumferences than do males throughout the entire adult life span.[264,265] Gupta and Merishi[266] showed that in males there is a significant risk in terms of weight, BMI, SBP and DBP with increasing waist-hip ratio.

Obesity and hypertension

Increases in body mass are associated with elevated blood pressure.[267,268,269,270,271] On average, a weight loss of one kilogram is associated with a decrease of 1,2 to 1,6mmHg in systolic and 1,0 to 1,3mmHg in diastolic pressure.[272] The prevalence of central obesity is significantly higher among male and female hypertensives compared to non-hypertensive subjects.[273]

Martinez-Gonzalez *et al.*[274] collected data on physical inactivity and BMI from a mixed gender group of 15 239 people aged 15 years upward. Sedentary lifestyle was assessed by means of self-reported hours spent sitting down during leisure time. The results were consistent with the current view that a reduction in energy expenditure during leisure time, may be the main determinant of the current epidemic of obesity in the Western world. Rippe and Hess,[275] Fitzgerald *et al.*[276] and Seidell[277] confirm that physical activity plays multiple roles in the prevention and treatment of obesity. BMI showed stronger associations with frequency of physical activity than with intensity or duration.[278]

2.7.4 Physical activity

Physical activity and age

A linear and inverse association between the mean intensity of physical activity and age, as well as between the maximal oxygen consumption and age has been shown in middle-aged men.[279] There is an inverse association between leisure time and occupational physical activity in the same group.

Physical activity and smoking

Results from a study by Albrecht *et al.*[280] suggest that exercise training improves short-term smoking quit rates. Various authors found smoking habits to be negatively related to physical fitness level.[281,282]

Physical activity and hypertension

Kingwell and Jennings[283] proved a dose-effect relationship between physical activity and blood pressure. Moderate intensity cycling produced the greatest blood pressure reduction. Walking at low-intensity induced lower blood pressure reductions and high-intensity walking did not change blood pressure. Various epidemiological studies also suggest an inverse relationship between physical activity and blood pressure.[284,285]

Cox *et al.*[286] on the other hand, found the effects of a vigorous exercise programme on blood pressure inconsistent, with no influence on clinic blood pressure

measurements, but a reduction in day time ambulatory blood pressure. However, when combined with caloric intake restriction, regular vigorous exercise exhibits a synergistic effect in reducing ambulatory blood pressure throughout a 24 hour period.

Physical activity and obesity

Currently, reduced physical activity may be the most important factor explaining the rising prevalence of obesity,[287] even with increasing age.[288] The inverse association between physical activity and weight has been reported in several cross-sectional epidemiologic studies, which consistently report lower body weight, or more favourable distribution of body fat, with higher categorical levels of self-reported physical activity.[289,290]

Kumagai[291] found the same significant negative correlation between waist-hip ratio and physical fitness, evaluated by the oxygen uptake at the onset of blood lactate accumulation, which is an indicator of muscle oxidative capacity. The results of Tomeo *et al.*[292] support the finding that intra-abdominal adipose tissue is negatively related to physical activity, indicating that more physically active females have relatively small intra-abdominal adipose tissue deposits, compared to other fat deposits.

Moderate and light self-reported physical activity do not relate to fitness measures.[293] However, subjects reporting more total and heavy activity, have higher aerobic capacity and lower body fat.

2.8 Conclusion

The concept of non-communicable diseases, as well as four common risk factors, were discussed. Each risk factor was described in terms of what it entails and what impact it could have health-wise and economically. Prevalence rates as well as methods to measure the risk factors, found in other studies, were presented. Finally it was explained that there are general relationships between the common risk factors, which are apparently fairly similar in different communities.

In the next chapter, the method used in this study to determine the prevalence of these risk factors, and their inter-relationships with each other in a rural disadvantaged community, will be discussed.

Chapter 3

Methodology

3.1 Introduction

In **Chapter 2** certain risk factors of non-communicable diseases were identified as having detrimental effects in terms of the health status of communities. A need identified from the literature is that the prevalence of these risk factors has not been determined in a Tswana community.[83,87,88] Knowledge of the prevalence rates of tobacco addiction, hypertension, obesity, and low levels of physical activity may assist health authorities and service providers in setting health priorities, and tailoring interventions,[294] in Tswana communities, accordingly. Prevalence rates are accepted as a guide to planning medical services.[295]

The aim of this chapter is to describe the aims, research design, study population and sample selection procedures for this study. The material and apparatus, as well as the collection, recording and analysis of the data are covered. A diagrammatic representation of the research methodology used in this study is given in **Figure 3.1**

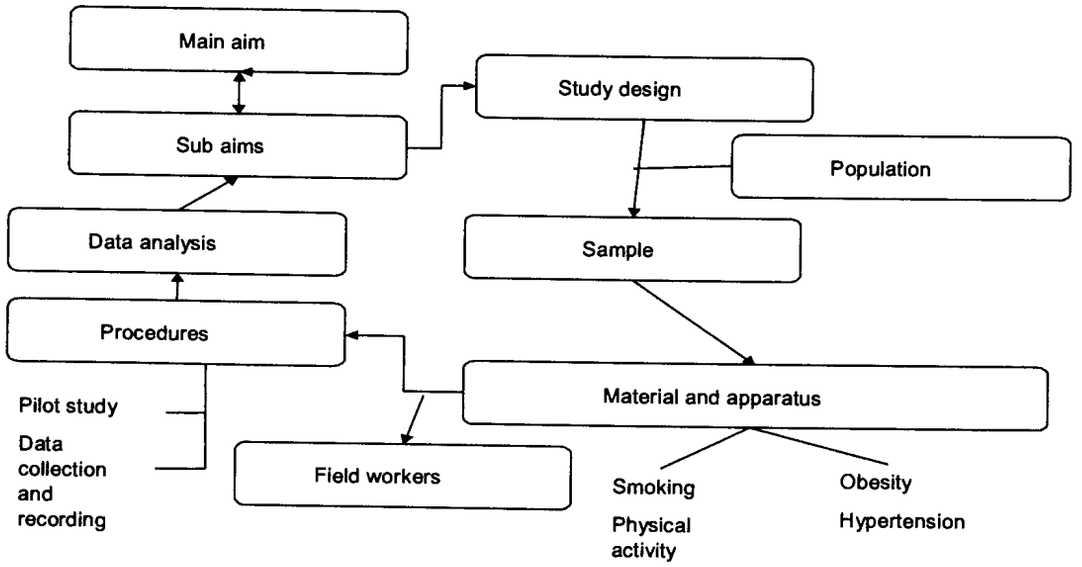

Figure 3.1 Diagrammatic presentation of the research methodology used in this study

3.2 Aim of the study

Based on the needs identified in the literature, the aims of the study were formulated.

3.2.1 Main aim

The main aim of this study was to investigate the prevalence of tobacco addiction, hypertension, obesity and physical inactivity in a Tswana population.

3.2.2 Sub aims

Sub aims had to be formulated, covering different variables involved in arriving at an answer for the main aim.

The prevalence of each of the above mentioned risk factors were determined as follows:

- in the total sample,
- for both genders, and
- for three age categories (thirty years and below, 31 to 45 years and over 45 years of age).

3.2.2.1 Sub aim 1

To determine the prevalence of tobacco addiction.

3.2.2.2 Sub aim 2

To determine the prevalence of hypertension.

3.2.2.3 Sub aim 3

To determine the prevalence of obesity.

3.2.2.4 Sub aim 4

To determine the prevalence of low levels of physical activity.

The levels of physical activity were determined according to

- occupational activity,
- non-participation in sport and
- activity during leisure time.

3.2.2.5 Sub aim 5

To compile a risk profile of the four risk factors for the sample.

3.2.2.6 Sub aim 6

To determine if there is a relationship between the different risk factors.

3.3 Study design

A cross-sectional descriptive epidemiological survey,[296] with some analytical elements,[297] was conducted.

A survey was the method of choice, because surveys can provide information to measure risk factors.[298] A survey is therefore an appropriate tool to collect data to achieve the main aim of this study. It is a very useful method of collecting information that is not available from the routine health investigations or surveillance systems.[299,300]

Cross-sectional surveys, furthermore, have the following advantages:[301302,303]

- Costs are low in comparison to health examination surveys.
- They are fairly quick and easy to organise.
- A representative sample of the population can be studied.
- Summation of data is possible according to a variety of descriptive techniques.

The frequency and occurrence of risk factors can be measured in terms of incidence or prevalence, both of which are important concepts in epidemiology. Incidence expresses the occurrence of new cases or episodes of a disease during a defined period.[304] The prevalence, on the other hand, expresses the frequency of a disease including old cases, at a given point in time (point prevalence) or during a defined period (period prevalence).

Although the data in this study were collected over a few weeks, the prevalence rates determined are regarded as point prevalence, because the incidence of the conditions being investigated, did not change much during this time span.[305]

A population based approach was used, as household surveys are useful for providing information for calculating prevalence rates for a representative sample of the population, rather than, on community members who attend particular types of clinics.[306]

3.4 Sample

It is impractical and costly to question and examine all the members of a fairly large community. Furthermore, the size of a very large study may introduce errors.[307]

Therefore, a representative sample had to be selected from the study population.

3.4.1 Population

The study population was the inhabitants of the Bosplaas village, an area with distinct geographical borders in the Moretele district in the North West Province, South Africa. The village has a population of approximately 8 000 people.[308] As they are mainly Tswanas, it was a suitable population to fulfil this study's research aim.

3.4.2 Criteria for selection

Male and female subjects from 20 to 59 years were included in the study.

To enhance the validity and reliability of the results of the study, the following exclusion criteria were established:

a) The inability of the subject to be interviewed due the influence of alcohol, drugs, medication or being in a state of emotional shock.
b) Subjects being intellectually or mentally impaired.[309]
c) The inability of the subject to speak English, Tswana, Sotho, Pedi, Zulu or Xhosa.
d) Pregnancy.

3.4.3 Selection procedure

The following procedures were employed to select the sample:

- The study protocol was submitted to the Bosplaas local community authority, and the local branch of the South African National Civic Organisation (SANCO) via the chairperson, Mr Makoe, as well as to the District Health Authority via the district manager, Mr Baloy. All three groups gave their approval for the study.

- Approval was also obtained from the Human Ethics and Protocol committee of the University of Pretoria and the Pretoria Academic Hospital, protocol number 147/97.

- Stand numbers from a map of Bosplaas, obtained from the local community forum office, provided the sampling frame.

  A two-stage sampling technique was used, because the sample was taken in two steps, selecting different units in each stage.[310] In stage one the units of selection were stands with a household with residents, from clusters of 10

stands (primary units). The second stage was a simple random selection of one person (matching the selection criteria) (secondary unit) from each stand selected in the first stage. According to Cochran[311] the principle advantage of two-stage sampling is that it is more flexible than one-stage sampling. It also has a good balance between cost of sampling and statistical precision.

First stage

The Department of Statistics, University of Pretoria, provided a table of random numbers. Corresponding stand numbers were selected according to the numbers in the table, starting at the top of the first column of numbers moving to the bottom and subsequently moving one column to the right. The stand numbers were highlighted on the map for easy reference.

Although Bosplaas is systematically divided into street blocks and stands, a large proportion of stands is undeveloped. The distribution of houses in Bosplaas resembles a natural population, such as trees in a forest. Therefore, the process used in agricultural trials, namely a "square grid," was used.[312] Ten stands formed a cluster unit from which the first eligible stand was selected in the following way:

a) If the stand was undeveloped, or obviously deserted, the next eligible stand was selected, in the numerical order presented in **Figure 3.2**, where number one is the number of the stand, which coincided with the random number. This process did not introduce bias.

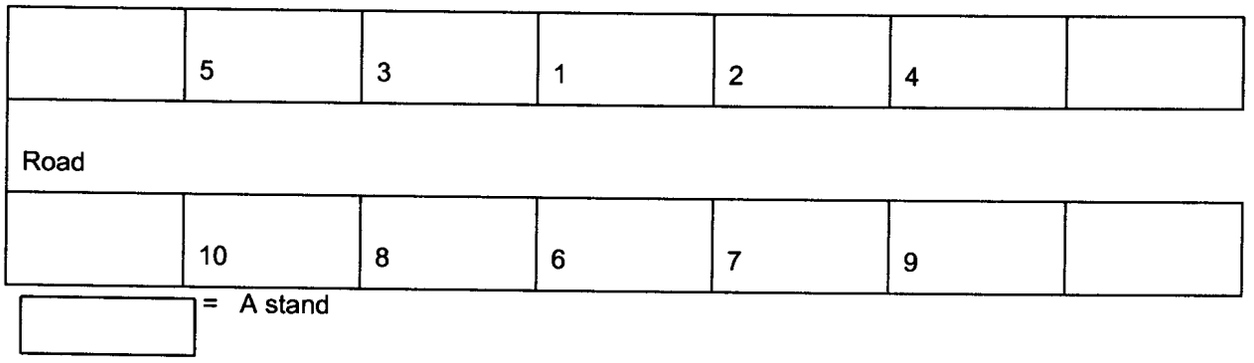

Figure 3.2 Diagrammatic presentation of sequence of selecting an eligible stand

This type of sample is called an unaligned sample, because the position of the selected unit, the stand with a household with residents, is not the same in the different cluster units.

Milne as quoted by Cochran[312] found that using a square grid cluster unit, performed better than simple random sampling, and slightly better than stratified random sampling, although this difference was not statistically significant.

b) If the whole cluster unit was without a single household, a new stand number was chosen from the table of random numbers to select a new cluster unit.

c) If nobody was at home, but it appeared that the stand was occupied, the researcher returned a second time, having previously consulted with a neighbour, as to what may be the most suitable time. If there was still nobody at home, a new stand was randomly selected.

For more detail on the selection of stands refer to **Appendix 3.1**.

The owners of the selected stands were identified from a list at the Tribal Authority's Office, to facilitate locating the stands.

The second stage was to randomly select a subject.

Second stage

The aim of the study was briefly explained to the people living in the household on the selected stand. They were also informed that not everybody could participate, but everyone had an even chance to be drawn.

Fourteen identical cards that were numbered from one to fourteen on the one side, with the opposite sides identical in appearance, were available.

a) If all eligible subjects were present, the researcher fanned out the same number of cards as participants present, with the identical sides facing up. The household members, one after the other, drew a card. The sequence was in an anti-clockwise direction, starting with the person to the far left of the researcher. The first person to draw the card with the number one on it was included in the study.

b) If some eligible, prospective subjects were not at home, all eligible subjects were listed, and each allocated a different number. The cards were again fanned out and a volunteer from the household drew one card. The person, whose allocated number coincided with the number on the card that was drawn, was the first choice for inclusion in the study. If this subject was not at home, the researcher returned at a later stage, having consulted with other members of the household, as to when it would be a suitable time. If the subject was not at home at the second visit, a new subject was randomly selected from those present, in the same way as described in (a) and it was recorded as such.

3.4.4 Sample size

The sample size was calculated on EpiInfo 6 on Statcalc, using the formula:

$$S = Z^*Z\ (P\ (1-P)/(D^*D)$$

in which D is one half the width of the desired sample confidence interval. Z is a percentile of the standard normal distribution determined by the specific confidence level. It is 1.96 for a 95% confidence level. S is then adjusted by a finite population correction factor, to obtain the final estimate of sample size, as follows:

$$\text{Sample size} = S/(1+(S/\text{population})^{313}$$

The sample size for each risk factor based on prevalence figures in other studies was determined.[314,315,316,317,318] The minimum sample size was calculated as 96 persons.

On completion of the survey, 103 households were used. The non-response rate[319] was 4 out of 103, namely 4%. Reasons for non-response were:

- withdrawal due to embarrassment, when the blood pressure measurements were to be taken, and a larger cuff was selected due to obesity
- non-participation due to possible fear that the tests would reveal that one subject smoked an illegal drug, marijuana
- withdrawal due to responsibilities in the family business
- refusal to open the door.

The exclusion criteria did not apply to any of the selected subjects.

Therefore data of 99 subjects were analysed.

Data for two items on the questionnaire were missing:

- Body weight for one female – it was not transferred to the form and on the next call, the person had left on vacation (n = 98).
- One person who did participate in sport, did not complete the other sport related questions (n = 21).

3.5 Material and apparatus

A questionnaire to collect data on tobacco addiction and levels of physical activity was developed for this study. (See **Appendix 3.2**).

3.5.1 Development of the questionnaire

Some general guidelines that were followed in developing the questionnaire[320] are as follows:

- Simple language was used.

- Responses, wherever possible, were pre-coded, so that the information could be transferred easily for computer analysis.
- Simpler questions were asked first, moving on to the ones that were more sensitive or difficult to answer. This gave the subject an opportunity to become accustomed to the interview situation.

Questions on socio-demographic data, smoking and physical activity were covered in separate sections of the questionnaire, and will be discussed next.

3.5.1.1 Socio-demographic data

Questions on the socio-economic data covered the following factors:

- Information on the respondent such as gender, age, relationship to the owner of the stand, level of education, occupation and limited medical history.
- Information on the household such as the number of living units on the stand, the material of the outer walls of the house, the number of rooms and bedrooms, the number of persons in the household and the availability of water and electricity.
- A socio-demographic index was compiled by adding the following variables together: the relationship to the owner of the stand, educational level, type of house, availability of water and electricity. This could be done, because the new ordinal categories for these variables were set, with the order corresponding with an increasing level of socio-economic development.

Data from the socio-demographic questionnaire provided descriptive information on the respondents and the relevant household in a rural South African village. This information served to contextualise the risk factor data.

It was also used to investigate possible relationships with the risk factors, to indicate possible intervening variables that may require closer examination in future studies. The relationship between risk factors is complex, as indicated in **Chapter 2**.

3.5.1.2 Tobacco addiction

Smoking data were obtained using the questionnaire (**Appendix 3.2** Questions). **Chapter 2** indicated that the risk of smoking is related to the type of tobacco used by smokers, the duration of the habit and the dosage. Apart from indicating their smoking status, smokers therefore had to answer questions on the type of smoking, when they had started to smoke and the number of cigarettes/pipes consumed per day.

3.5.1.3 Physical activity

From **Chapter 2** it became apparent that there is much controversy on how physical activity should be measured. The material available in the literature is mostly culturally inappropriate for this study's sample, and a more suitable questionnaire had to be developed.

Each dimension of physical activity and the aspects addressed, in the specially compiled questionnaire, are summarised in **Table 3.1**.

Table 3.1 Summary of factors covered in the physical activity questionnaire

Occupational activity

Parameter
Type (choice between seven categories, if employed, probed to specify)
Full time/part-time (days per week)
Indication of ratio of time spent sitting, standing, walking and lifting heavy weights[321] (Likert scale)
Indication of an intensity high enough to condition the cardiovascular system (sweating, heavy breathing)[322]
Mode of transport used to and from work, If by bicycle/walking, the intensity in terms of pace and distance

Sporting activity

Type (up to two sports)
Formal/informal
Number of seasons of the year
Frequency (days per week)

Leisure time activity

Type of activities (five most common) (open question)
Indication of an intensity high enough to condition the cardiovascular system (sweating, heavy breathing)

The three dimensions covered in the questionnaire were occupational (Questions 31-41), sporting (Questions 42-48) and leisure time activity (Questions 49 and 50). These dimensions of physical activity (used in other studies in the literature)[239,,240,242,244] were modified for the Bosplaas community.

3.5.2 Apparatus

Specific apparatus was needed for the measurement of hypertension and obesity.

3.5.2.1 Hypertension

Blood pressure was taken with a calibrated[323] non-invasive, automatic oscillometric blood pressure monitor, Omron model HEM-705CP.[324] The Technical Department of the Pretoria Academic Hospital calibrated the monitor, as studies have shown differences of up to 60mmHg using some devices.[325]

3.5.2.2 Obesity

A light weight electronic platform scale, the Ngata scale, model FAT-601 was used to measure body mass. It has a capacity of three hundred kilograms with intervals of twenty grams. The scale was calibrated according to instructions in the operation manual, number FAT-6-S. Electronic scales are presently considered the most reliable field method of measuring body mass.[78]

A custom-made stadiometer adapted for fieldwork and built according to reliable plans[326] was used to measure stature (standing height). The vertical scale of the stadiometer can be broken down into components that can be carried in a firm wooden case, which is also used as a platform for the stadiometer. The vertical scale is two metres long with intervals of one millimetre.

The same inelastic tape measure was used for all subjects to measure waist and hip circumference. It is calibrated in centimetres with millimetre graduations, two metres long and enclosed in a case with an automatic retraction mechanism.

3.6 Translators and fieldworkers

3.6.1 Translators of the material

A home-language speaker of Setswana translated the questionnaire into Setswana. (See **Appendix 3.4**) He was a fourth year medical student, familiar with the terminology used in the questionnaire, as well as with the culture and language of the subjects.

The primary fieldworker, whose mother-tongue is Setswana, verbally translated the questions back into English, so that the researcher could ensure that the original meaning was not changed during translation.

3.6.2 Fieldworkers

Fieldworkers were needed to assist in carrying and setting up the apparatus at subjects' homes. The next sections cover their selection, role and training.

3.6.2.1 Selection

The first fieldworker was the messenger from the tribal community forum office. The researcher met the other two fieldworkers during the initial fieldwork. All three were respected in the community, lived in and knew the community, were conversant at least in English and Setswana, were helpful and trustworthy.

3.6.2.2 Role

The fieldworkers' presence acted as a safety measure.[327] They facilitated the co-operation of the community members and assisted in carrying and setting up material such as the scale and stadiometer.

3.6.2.3 Training

Thorough training was provided to the fieldworkers on an individual basis. They were familiarised with the intent and meaning of the questions and role-played interview situations. At first they conducted the interview in English with the researcher observing and helping where necessary. Role-playing by the interviewers, and interviews done under the critical eye of colleagues, are two very useful means of obtaining a standardised technique by all the interviewers.[328] When the researcher was satisfied that their procedure was reliable, they started to conduct interviews with non-English speaking subjects.

Interviewers were made aware of how they could influence the answers to questions. Asking questions in a neutral, and non-threatening way, and without any indication that certain answers are 'correct', was emphasised. The interviewers were asked not to show agreement, disagreement, distaste or pleasure at the replies.

3.6.2.4 Principal fieldworker

The researcher performed all the physical measurements. She has training and experience in the administration of all of the physical tests. Inter-rater reliability was not applicable as the researcher did all the physical tests.

Intra-observer reliability[329] was not tested, as it was unlikely to be significant, because:

- The measurements were objective; no subjective observations or judgements had to be made.
- The time-period of the study was limited and therefore it was unlikely that the observer would vary her observation significantly.

- The assessment and physical examinations were done in a routine, standardised way, as described in this chapter.

3.7 Procedures

In this section the pilot study, as well the procedures that were followed to collect the relevant data, record the data and analyse the data statistically, will be described.

3.7.1 Pilot study

A pilot study was necessary, for the following reasons:

- to pre-test the sample selection procedure
- to pre-test the different sections of the specially compiled questionnaire: the socio-demographic, the smoking and physical activity sections
- to establish if the logistics of the interview were practical for the field-testing and for collection of the relevant data
- to determine the duration of an interview.

The procedure for the pilot study was as follows: The pilot study was conducted over two days. On day one, ten subjects were selected, the purpose of the study explained. Subsequently the blood pressure was measured. An appointment was made to pick these subjects up the following day at a few central points, and transport them to the local clinic (Bosplaas), where the questionnaires and physical tests were completed (following the procedure set out in the following sections). They were then dropped off at central points close to their homes.

The results of the pre-testing were:

Locating the selected household

Household members were unfamiliar with the stand numbers on the initial map, (obtained from Eskom) which was used. The stand numbers did not coincide with those used by the residents.

Duration

It took about half an hour to locate a selected household, explain the purpose of the study, randomly select the subject, and to take a preliminary blood pressure measurement. The completion of the questionnaires and physical measurements and tests took another half-hour.

Logistics

- The travel arrangements and expecting subjects to spend at least three hours at the clinic were impractical and not time effective.
    - It was also expensive and time consuming to make three visits to the same household.

Questionnaire, physical measurements and tests

- All the data were obtained fairly easily. However, it was clear that some subjects did not have the command of English as claimed in a previous study, in the same area.[330]
- Some households did not have a table on which to support the subject's arm at the level of the heart for blood pressure measurements. Pillows were used to comply with the prescribed method.
- Provision to record the blood pressure readings from the other arm had not been made on the anthropometric form.
- It appeared that the questionnaires had the advantage of establishing rapport with the subjects.
- Time was lost collecting material such as the tape measure.

The following adaptations were made after the pilot study:

- A map, with the same stand numbers as those used by the residents, was obtained from the local community forum office.[331]
- It was decided to complete and carry out all sections of the questionnaire and physical tests at the subjects' homes, in one session.
- Provision on the form was made to record all blood pressure readings.
- Two pillows protected in plastic bags were added to the materials.

- The cards used for the random selection and the tape measure were carried in a moonbag around the researcher's waist.
- The questionnaire was translated into Setswana. (See **Appendix 3.3**)

3.7.2 Data collection and recording

A subject was selected as explained in **Paragraph 3.4.3**.

Each participant was informed by the researcher (or if necessary the interpreter), about the content of the voluntary informed consent form (**Appendix 3.4**) and requested to sign the form. If the prospective participant was illiterate, he/she gave verbal consent and a cross instead of a signature was drawn on the consent form. In both cases two witnesses signed the form. No undue influence was placed on the prospective participant to consent or refuse to participate.

Data were collected in the following order:

- Smoking data
- Physical activity data
- Blood pressure measurement
- Anthropometric measurements

As an interviewer administered questionnaire was used,[332] special attention was paid to the interviewing technique to limit bias and to prevent the interview from becoming ponderous and irritating for both the participant and the interviewer. The following guidelines were followed:[333]

- The interviewer established rapport during the introductory phase, exchanging a few pleasantries, as subjects were likely to be somewhat apprehensive, and perhaps even suspicious, during the first few minutes.
- Every effort was made to isolate the subject during the interview, because the presence of other people may have influenced the subject's answers.
- Instructions were given in a slow, clear manner. The interviewer maintained the pace in a matter of fact way.[334]

- Each question was asked to every subject in exactly the same way.
- Extraneous talk was avoided.
- Any answer that appeared exaggerated or incongruous was challenged; for example, if a patient said that he/she never sits at work, but his/her occupational title suggested that to be highly unlikely.
- The interviewer remained neutral to comments made by the interviewee. He/she tried not to reply or, if he/she did, he/she used a neutral word such as "OK."
- He/she did not encourage or praise the interviewee.[335]

The physical procedure for the physical tests and measurements will be discussed in the next sections.

Obesity

The anthropometric measurements used were weight, standing height (stature), waist and hip circumferences, because they are amongst the most easily obtained.[336] The privacy of subjects was taken into consideration by only allowing other people into the room, if the subject requested his/her presence.[337]

The measurement of body mass, stature, as well as waist and hip circumferences need to be discussed in further detail:

Body mass

A standard valid method, allowing for little observer error,[78] was used to measure body mass.

- The scale was placed on a flat, hard surface with the display on 00.00, indicating that the scale was level.
- The subject was asked to remove shoes and excess clothing, such as jerseys. The measurement was therefore taken with bare feet and light summer clothing.
- The subject was then asked to step onto the scale and stood in the centre of the scale platform.

- The weight was recorded to the nearest tenth kilogram on the anthropometric data form.

Stature

- The stadiometer was placed on an even surface.
- The subject was barefoot and wore the same minimal clothing, as described for measuring mass, to facilitate correct positioning of the body. Feet were parallel, heels together, arms to the sides, legs straight; shoulders relaxed and head in the horizontal plane.[78] The request was "to look straight ahead". Heels, buttocks, scapulae and the back of the head were as far as possible against the vertical board of the stadiometer.
- Just before the measurement was taken, the subject was given the instruction to "breathe in deeply and stand tall". While the subject inhaled deeply, held the breath, and maintained an erect posture, the headboard was lowered to the highest point of the head, with enough pressure to compress the hair.
- The measurement was read to the nearest tenth centimetre with the researcher's eye level with the headboard, to avoid errors due to parallax.

Waist circumference

- The subject stood erect, abdominal muscles relaxed, arms relaxed at the side, and feet together.
- The researcher faced the subject and made sure that the tape measure was placed in a horizontal plane to measure the area of least circumference. The waist circumference was measured at the narrowest area below the rib cage and above the umbilicus as viewed from the front.[338] If there was no apparent area of least circumference, the measurement was taken at the level of the umbilicus.[78]

The measurement was taken at the end of a normal expiration and recorded on the data form.

Hip circumference:

- The researcher squatted beside the subject to see the maximum extension of the buttocks.
- The tape measure was placed in a horizontal plane around the hips at the point of greatest circumference.
- The measurement was taken with the tape in close contact with the skin.[339]

Blood pressure

The method that was used was based on a previous protocol using the above-mentioned device,[340] according to the guidelines of the South African Department of Health,[341] *inter alia* the South African Medical Research Council (MRC), the Medical Association of South Africa (MASA) and the Hypertension Society of South Africa[342] contributed to these guidelines.

There is increasing evidence that the anxiety associated with a clinical examination, inflates blood pressure by an average of 5 to10mmHg, relative to the values that are recorded during ordinary daily life. The fact that these readings were obtained in the homes of the subjects under relaxed conditions may have reduced the anxiety factor.[343]

- Blood pressure was measured in a sitting position. Since the interview preceded the measuring of blood pressure, the subject was in a resting position for at least half an hour before the readings were taken.
- The subject was seated in a quiet, comfortable environment with the back supported. If a subject did not own a chair with a backrest, a stool or object such as an oil tin, was placed next to a wall, and the wall was used as a backrest.
- The subject's arm was supported at heart level at an angle of 45 degrees away from the trunk, on a table or on pillows on the subject's lap, so that the level of the cuff would be at heart level. The elbow was slightly flexed.
- The procedure was explained to the subject and he/she was requested not to talk or move during the procedure.
- Restrictive clothing was removed from the arm to expose the area of the brachial artery.

- The appropriate sized cuff[344] was chosen, i.e. a standard cuff (12cm) for normal arm size, and a larger cuff (15cm) for arms with a mid-upper arm circumference above 33cm. The latter was used to control possible over-estimates[345] by 10 to 25mmHg, if a normal size cuff had been used.
- The blood pressure monitor was positioned so that the researcher could see the reading.
- She palpated the brachial artery and centred the bladder over the brachial artery in line with the subject's middle finger. The cuff was fitted snugly around the arm so that the edge of the cuff was one to two centimetres above the elbow crease.
- The cuff end protruding from the fitting was gripped and wrapped tightly around the arm, and fixed by Velcro strips.
- The centre of the cuff was therefore at heart level.
- The pressure value was pre-set at the automatic level so that the cuff pressurised to 170mmHg when the start button was depressed.
- When the pressure increased to the set value, pressurising automatically stopped. If the subject's pressure was higher than 170mmHg, the start button was continuously depressed until a pressure of about 30 to 40mmHg higher than the pre-set pressure was reached.
- Measurements were done automatically, and the cuff also deflated automatically. Once the cuff was completely deflated, the monitor gave an auditory signal, and the blood pressure and the heart rate were displayed alternatively.
- Blood pressure was measured on both arms and recorded on the data form. The arm with the higher mean pressure was used for further readings. This arm was more likely to reflect systemic arterial blood pressure.[346]
- Both systolic blood pressure (SBP) and diastolic blood pressure (DBP) were recorded on the anthropometric form. The reading was repeated and the lowest DBP with its matching SBP were used to determine blood pressure.
- If a subject was hypertensive, he/she was referred to the local primary health care clinic. In this way some service was delivered as part of the survey.[347]

General

The survey was planned to be completed within one month, to exclude seasonal variation in physical activity, humidity, temperature and interviewer fatigue.

Fieldwork was conducted from as early as possible after eight o' clock in the morning, until between 17:00 and 20:00 on weekdays and Saturdays, as well as on Sunday afternoons, between 14:00 and 16:00. In this way, working people were also incorporated in the study.

Each subject who participated in the study received a poster from the Wheat Board as a token of appreciation.

3.7.3 Data recording procedures

It is easy to err in transferring the pre-coded information from the questions to the appropriate coding box in the coding column. The coding column was therefore completed in the evenings, when the coding could be done at a more leisurely pace. The researcher did the coding, and each coding was double-checked by another person to make sure it was correct.[348] The field editing comprised all the data being checked and reviewed for completeness, and obvious inconsistencies, such as a male with a female name. The few queries that were encountered were sorted out.

3.7.4. Data analysis procedures

The process followed to manipulate the data in order to answer the study aim will now be discussed.

3.7.4.1 Introduction

The Bureau for Statistical Processing and Analysis at the University of Pretoria assisted in analysing the data, using a mainframe computer with Statistical Application Software (SAS).[349]

The processing of the data, including coding, editing and reducing thereof is described in detail in **Appendix 3.5**.

3.7.4.2 Statistical methods

The specific data analysis procedure followed to achieve each sub aim set out at the beginning of **Chapter 3** is presented in **Table 3.2**. Details on the cut-off points for new categories (merging of original variables into global variables)[350] and the formulae used, are provided in **Appendix 3.6** and **Appendix 3.7**.

Table 3.2 Statistical methods and techniques per sub aim

Sub aim	Method	Test
One to four: To determine the prevalence of the risk factors (smoking, obesity, hypertension and physical activity)	Determine the proportion of the sample with the risk factor[351] Description of those at risk for different sub groups e.g. based on gender, age and educational level	Percentages * Cumulative frequencies per sub group
Five: To compile a risk profile of the four risk factors for the sample	Description of the number of risk factors per subject for the sample	Discrete frequency distribution[352]
Six: To determine the relationship between the risk factors	Determination of the association between different risk factors	Two way contingency tables* Chi-square test**[353] Loglinear regressions*[354] (In those instances where the probabilities of the Chi-square was less or equal to 0,01)

* If the original categories as indicated by the coding on the questionnaire resulted in some empty cells, categories were combined, and the procedure was repeated. (**Appendix 3.7**)

** For all tests, critical values at either the one or five- percent level of significance were required for significance. Significance was reported when

the ratio of the log-linear parameter estimate to its standard error (z) was equal or exceeded 1,96.[355]

3.8 Summary

This chapter outlined the study design and the methodology that was followed in order to collect the data necessary to answer the research question. The method of processing and analysing the data was also described. The results are presented in the **Chapter 4**.

Chapter 4

Results

4.1 Introduction

It has become clear that non-communicable diseases are an increasing threat, even in developing countries.[1] Different studies have determined the prevalence rates of certain risk factors in several and varied communities.[20] However, a gap still exists to determine the prevalence rates of certain risk factors of chronic diseases in different South African ethnic groups, and specifically a rural Tswana community. Several sub aims were formulated in **Chapter 3**, to endeavour to fill this gap in scientific knowledge. In this chapter the results of the study, necessary to fulfil the main aim of the study, are presented.

4.1.1 Structure of the presentation

A schematic diagram of the study aims is given in **Figure 4.1**, which forms the basis of the systematic discussion of the results.

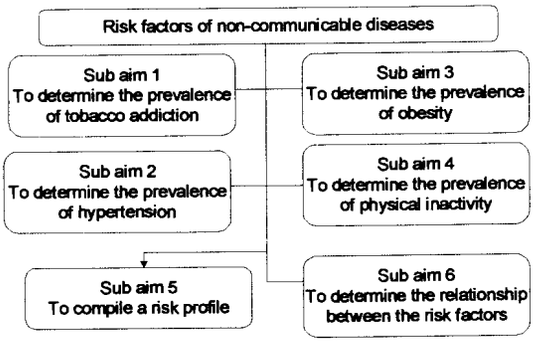

Figure 4.1: Study aims that form the basis of the presentation of the results

4.1.2 Method of presentation

Results are presented almost exclusively in graphic form and will be interpreted in the next chapter.

In cases where the sample size for calculations was 99, real percentages are not reported, because if rounded off, frequencies and percentages are the same.

Additional data that could be used for interpretation of the data are presented in **Appendix 4.1**.

4.2 Results

4.2.1 Sample

The characteristics of the selected sample are reflected in **Table 4.1**, referring to gender and age. Information on gender and age is important, as prevalence rates are used in conjunction with age- and gender-specific distribution.[297]

Table 4.1 Summary of the characteristics of the sample. (n=99)

Characteristics/subgroup	**Frequency**		
Gender			
Male	40		
Female	59		
Age (Mean = 35, SD= 11,45, Range: 20-59)	**Male**	**Female**	**Total**
20-24	15	8	23
25-34	9	20	29
35-44	6	18	24
45-54	9	9	18
55-59	1	4	5

4.2.1.1 Gender

There were 40% males and 59% females in this sample.

4.2.1.2 Age

In the younger subgroup (44 years and under), there were relatively more subjects, and in the oldest subgroup less subjects.

4.2.1.3 Socio-demographic data

On average, the adults of the village do not have a high level of education. Thirty-one percent had grade VII as highest level of education, of which 7% had no formal education. Thirty-nine percent passed grade VIII or IX, and 20% had matriculated. Nine percent acquired a tertiary qualification.

Of the households in Bosplaas, only 33% had easy access to water, that is a tap in the house, or a tap or bore hole on the stand. The majority of the people (67%) got water from communal taps, or bought it in containers from the few people who had bore holes on their stands. Only 17% of the households had electricity, either from Eskom or from their own generators.

The walls of 52% of the houses in the area were built with bricks. The rest of the houses were not permanent structures, but built from corrugated iron and asbestos panels (38%) or mud bricks (10%). Eleven percent of the houses consisted of only one room, 29% had three to four rooms each and 60% five or more rooms. Thirty- one percent of households comprised four or less people per bedroom. Six percent of households were crowded with more than four people per household.

4.2.2 *Prevalence of risk factors*

All results are given for the total sample, as well as according to gender and age groups.

4.2.2.1 *Prevalence of tobacco addiction*

Tobacco addiction was determined by whether the subjects smoked any form of tobacco or not. For cigarette smokers the questionnaire distinguished between moderate (less than 10 cigarettes per day) and high levels (ten or more cigarettes per day) of addiction.

4.2.2.1.1 *Prevalence for the total sample*

Figure 4.2 presents the smoking habits of the sample.

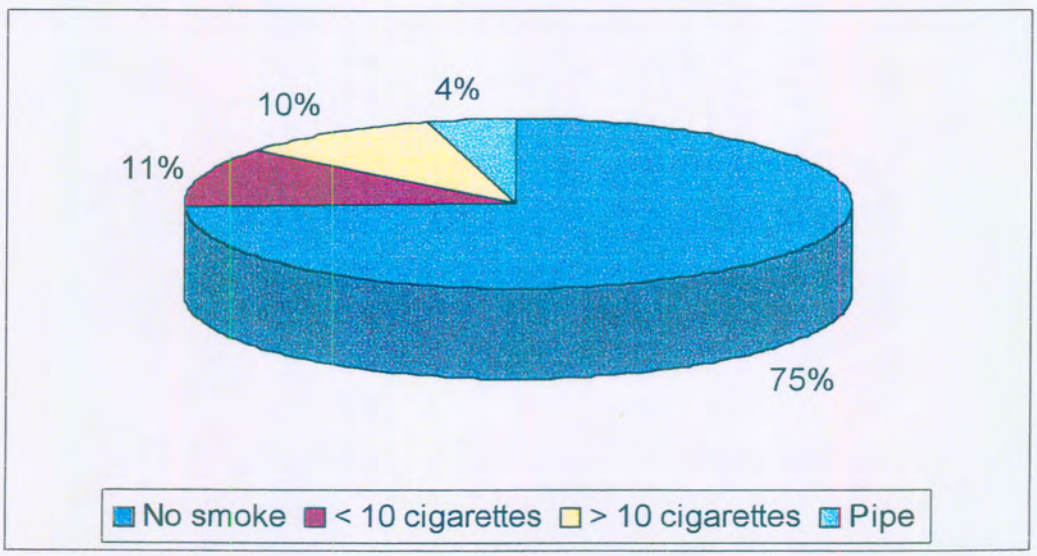

Figure 4.2: Smoking habits of the total sample

Twenty-five percent of the sample smoked and of those who smoked cigarettes, almost an equal number, 11% and 10%, smoked more, or less than 10 cigarettes respectively per day. A minority (4%) smoked pipes.

4.2.2.1.2 Prevalence according to gender

In **Figure 4.3** the prevalence of tobacco addiction is given for males and females, as well as for the total sample.

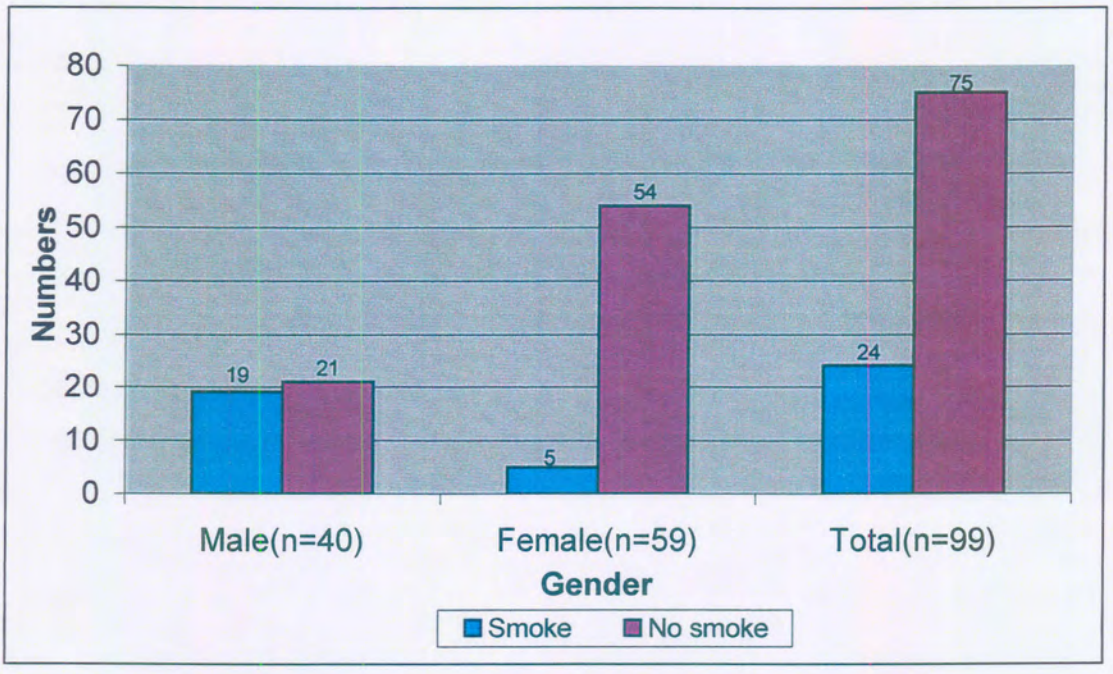

Figure 4.3: Tobacco addiction according to gender

The majority of males (19/40 i.e. 48%) smoked. In comparison to this, 92% of the females (54/59) did not smoke. This brought the prevalence of smokers in the total sample to 24%.

4.2.2.1.3 *Tobacco addiction prevalence according to age groups*

The prevalence of tobacco addiction in different age groups may also be important. These results are given in ***Figure 4.4.***

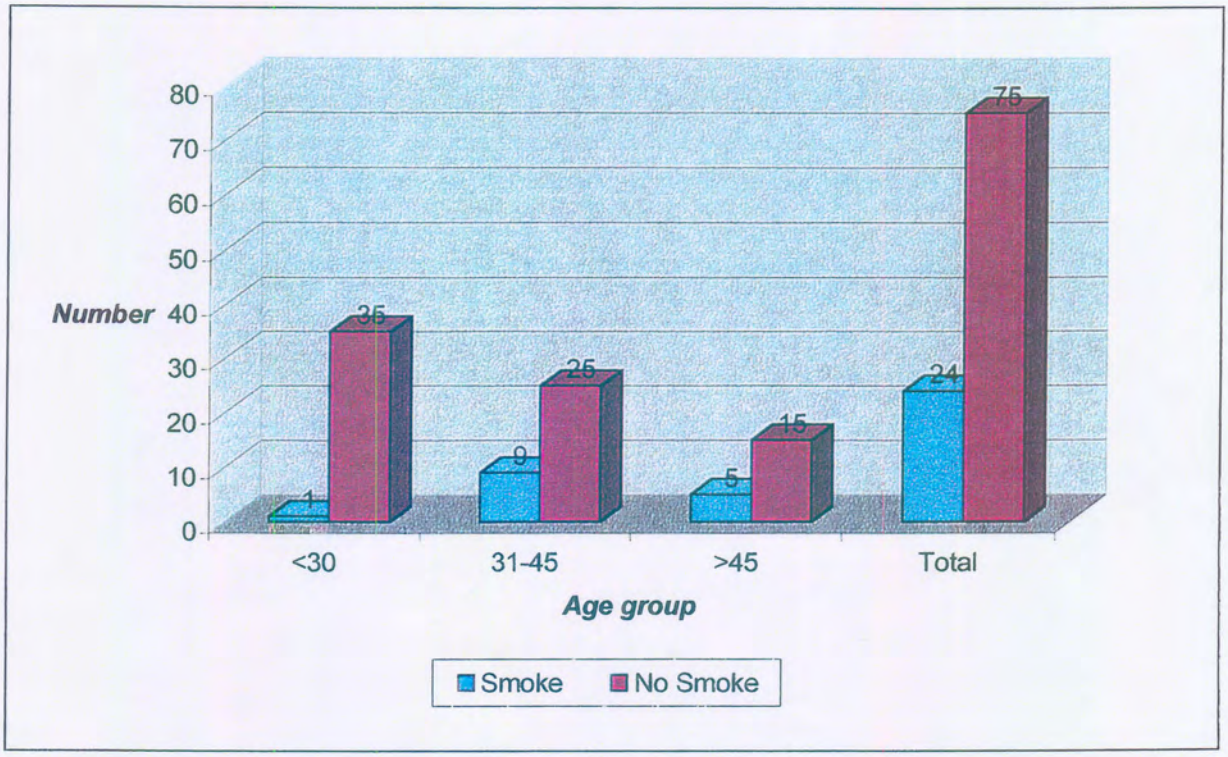

Figure 4.4: Tobacco addiction according to age groups

Smokers were represented in all three age groups, decreasing in frequency with age, from 28%(10/35) to 25%(5/20) in each age group. A positive factor is that the number of non-smokers indicates an inversely proportional tendency with increasing age, with the highest number in subjects under 45 years (35/45 i.e. 78%).

4.2.2.2 *Prevalence of hypertension*

Hypertension is reflected by data obtained from the blood pressure measurements.

4.2.2.2.1 *Prevalence of hypertension for the sample*

In the next figure the prevalence of hypertension for the sample is presented. Only 6% of the sample are hypertensive.

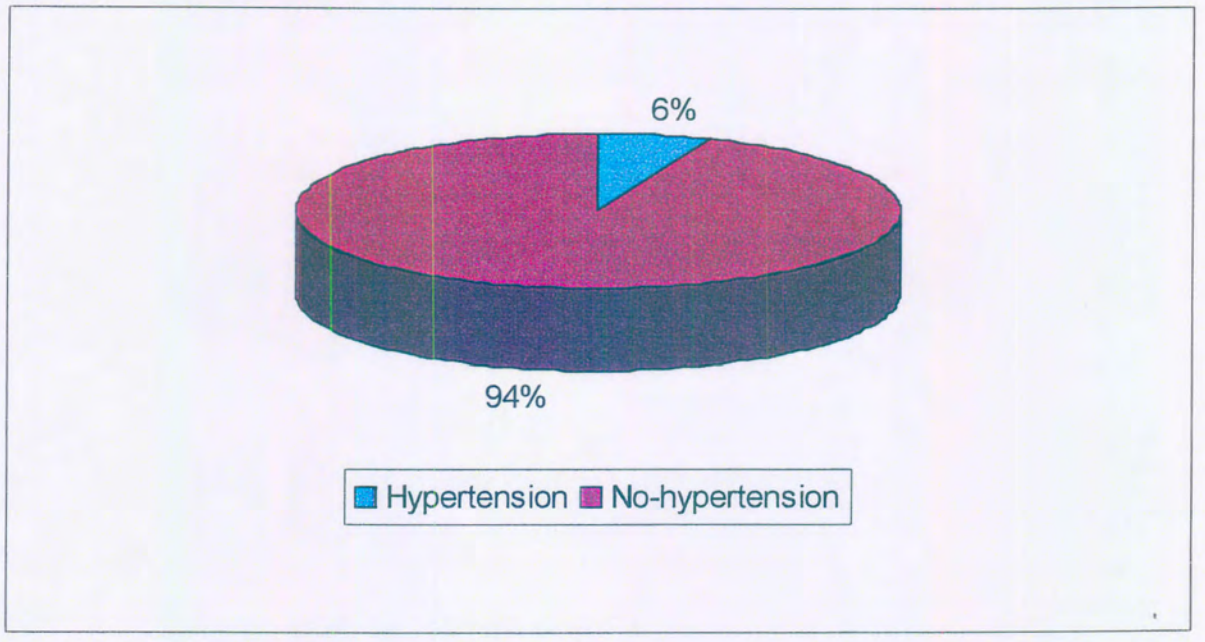

Figure 4.5: Hypertension for the sample

In the next section the number of hypertensives according to gender is given.

4.2.2.2.2 *Prevalence of hypertension according to gender*

The proportion of hypertensive subjects in the study sample is presented in ***Figure 4.6***.

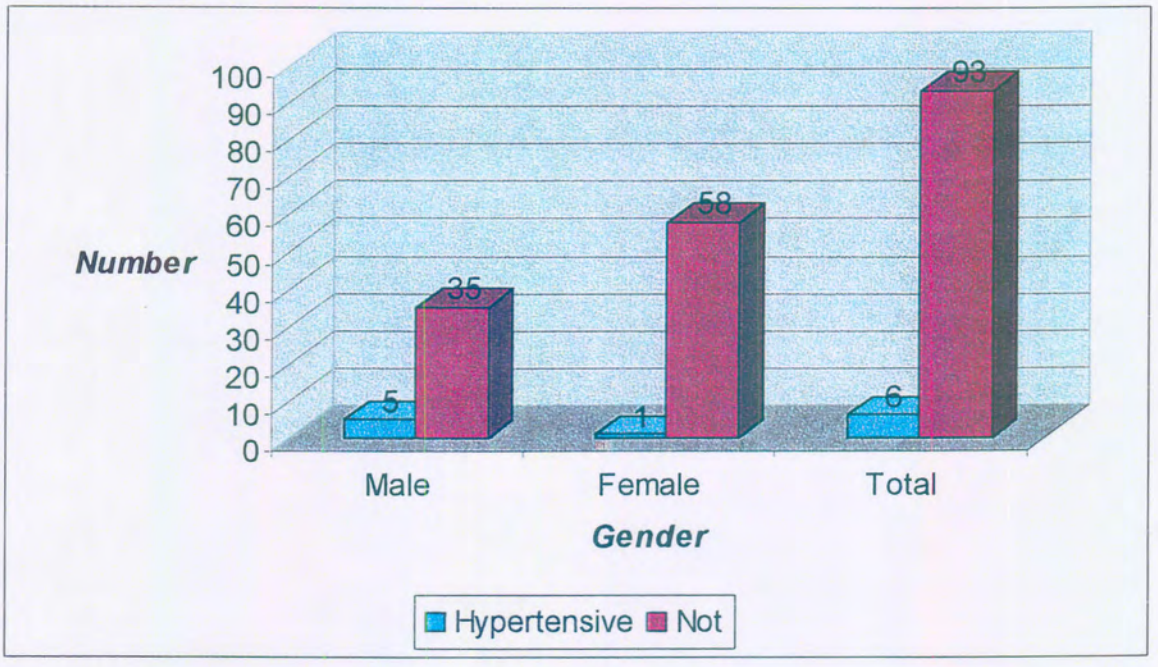

Figure 4.6: ***Hypertension according to gender***

Significantly more (p=0,038) males (5/40 i.e. 13%) were hypertensive than females (1/59 i.e. 2%). Blood pressure findings in the three age groups are depicted in ***Figure 4.6***.

4.2.2.2.3 Prevalence of hypertension according to age groups

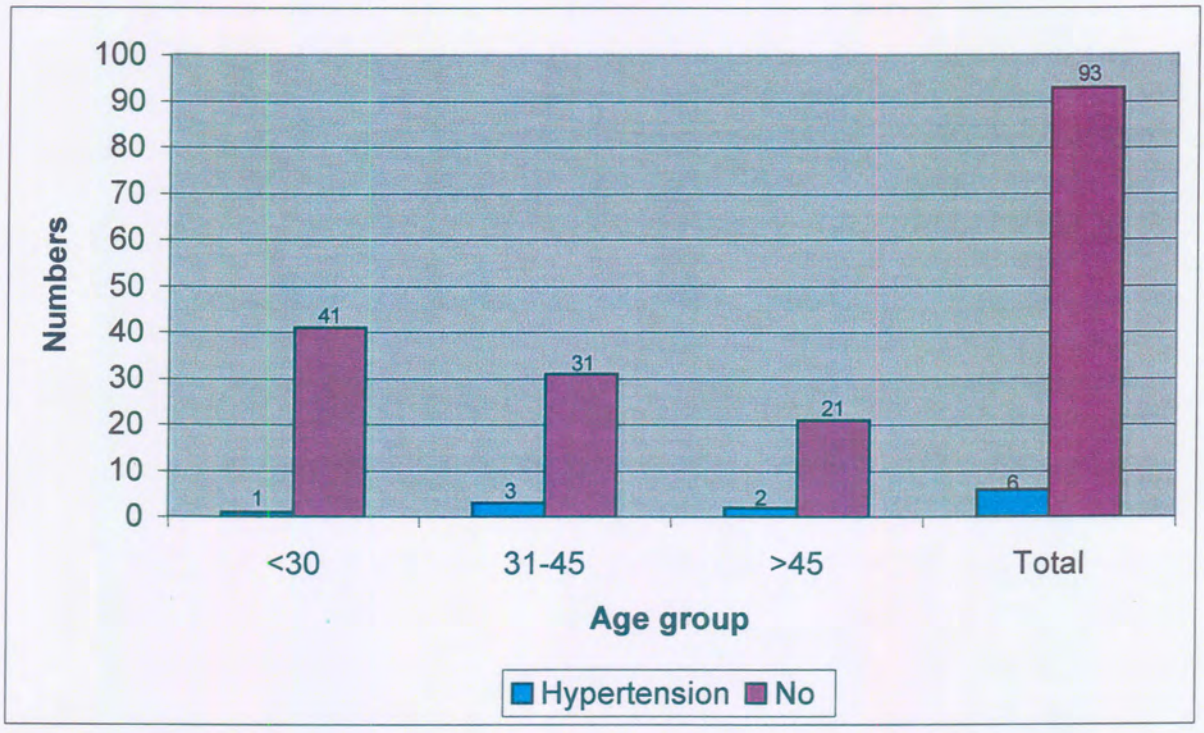

Figure 4.7: Hypertension according to age groups

The prevalence of hypertension in all three age groups as well as in the total sample was low: 2%, 9%, 9%, and 6% for the increasing age groups and the sample respectively. It is interesting that although the prevalence of hypertension did not show a positive correlation with age, the prevalence of those without hypertension is inversely correlated with age.

4.2.2.3 *Prevalence of obesity*

Two variables, based on anthropometric data, were used to investigate the prevalence of obesity: the Quetelet Index and the waist-hip ratio. Information will firstly be given on data using the Quetelet Index, and thereafter the waist-hip ratio. In both cases histograms are used.

4.2.2.3.1 *Prevalence of obesity for the sample*

- ***Quetelet Index***

Obesity was first calculated by dividing body mass of the subject by the square of the height. The results are reflected in ***Figure 4.8***.

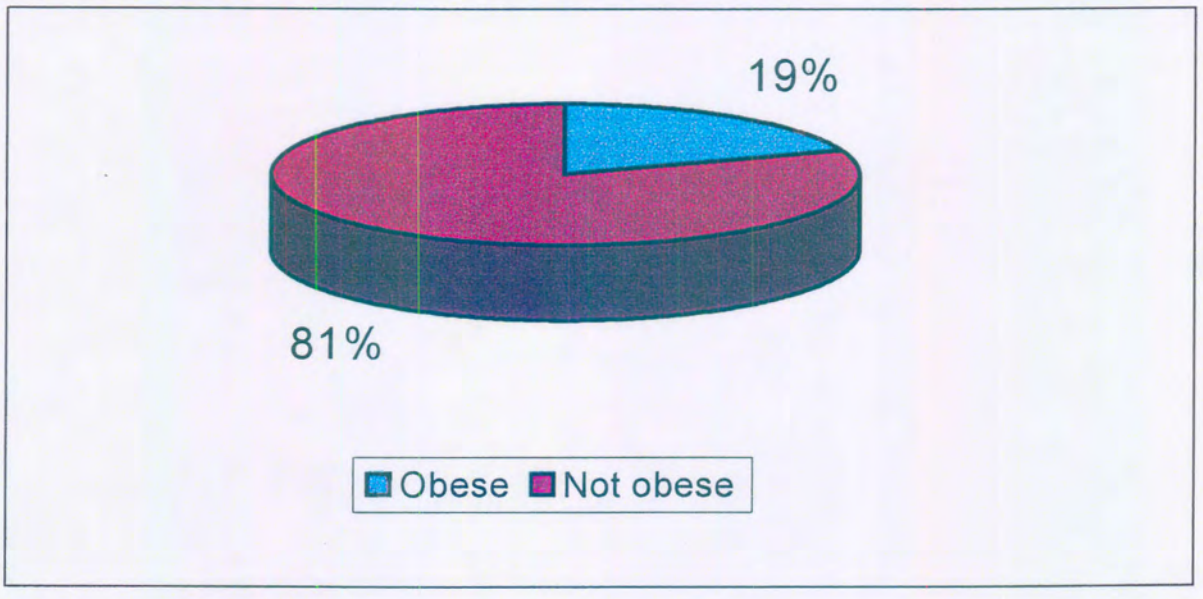

Figure 4.8: Prevalence of obesity of the sample identified by the Quetelet Index

Waist-hip ratio

The risk for CHD was calculated by dividing the waist circumference with that of the hip for each subject.

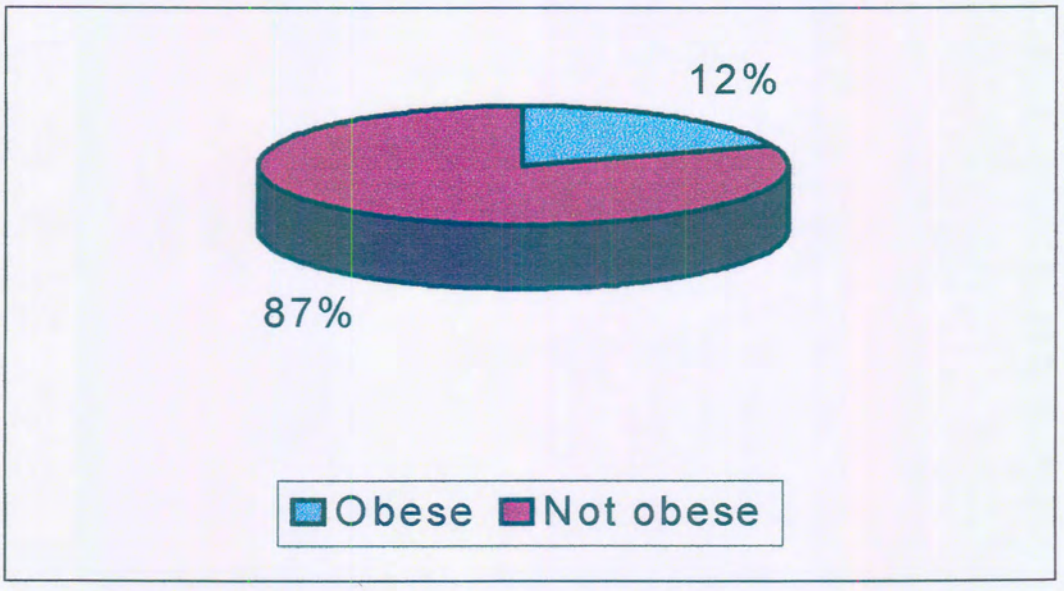

Figure 4.9: Prevalence of obesity of the sample identified by the waist-hip ratio

In **Figure 4.9**: it can be seen that the minority of the sample was obese identified by this measurement.

4.2.2.3.2 Prevalence of obesity according to gender

- **Quetelet**

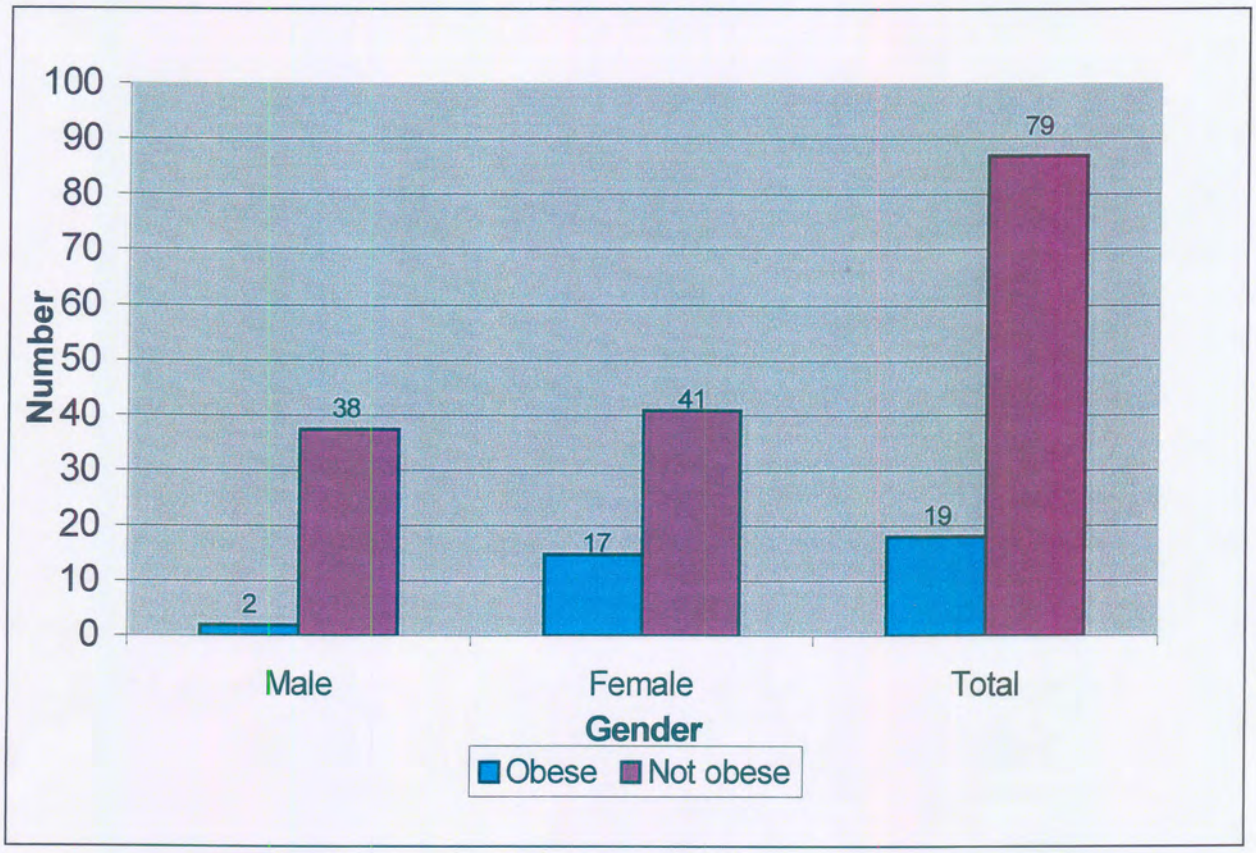

Figure 4.10: Obesity identified by the Quetelet Index according to gender

Not surprisingly, it is noted that obesity was more prevalent amongst females (12/59 i.e. 20%) than males (0/40 i.e. 0%). Therefore significantly less males than females were obese (p=0.003).

- **Waist-hip ratio**

Accepted norms explained in **Chapter 2** were used to classify subjects as either at risk or not at risk for CHD, as indicated in **Figure 4.11** based on the gender distribution.

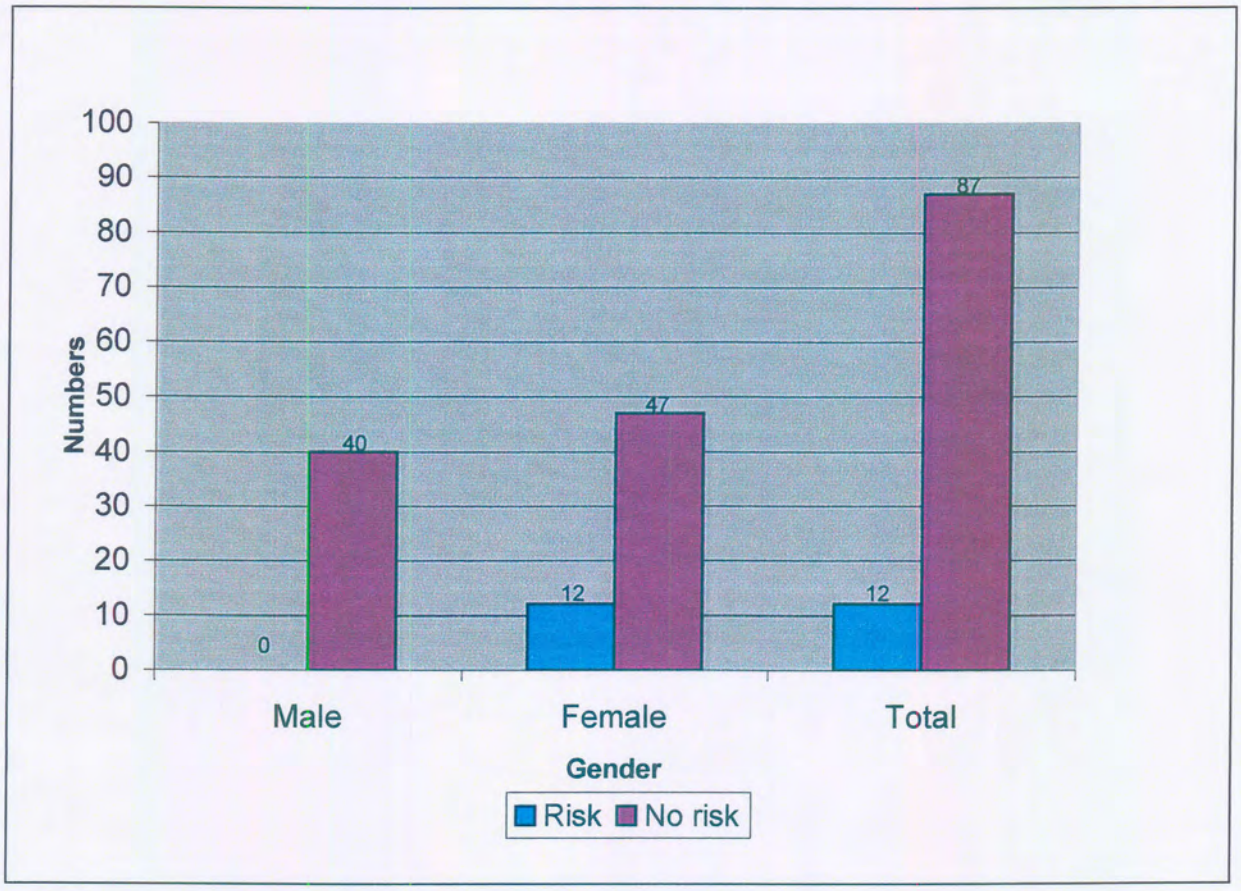

Figure 4.11: Obesity using the waist-hip ratio according to gender

It is evident that significantly more females (p=0.002) are at risk (12/59 i.e. 20%) for developing CHD. No males (0/40) were found to be at risk using the waist-hip ratio. Twelve percent of the total sample is at risk.

4.2.2.3.3 Prevalence of obesity according to age groups

- **Quetelet**

The number of subjects, who were obese in each age group, is reflected in **Figure 4.12**.

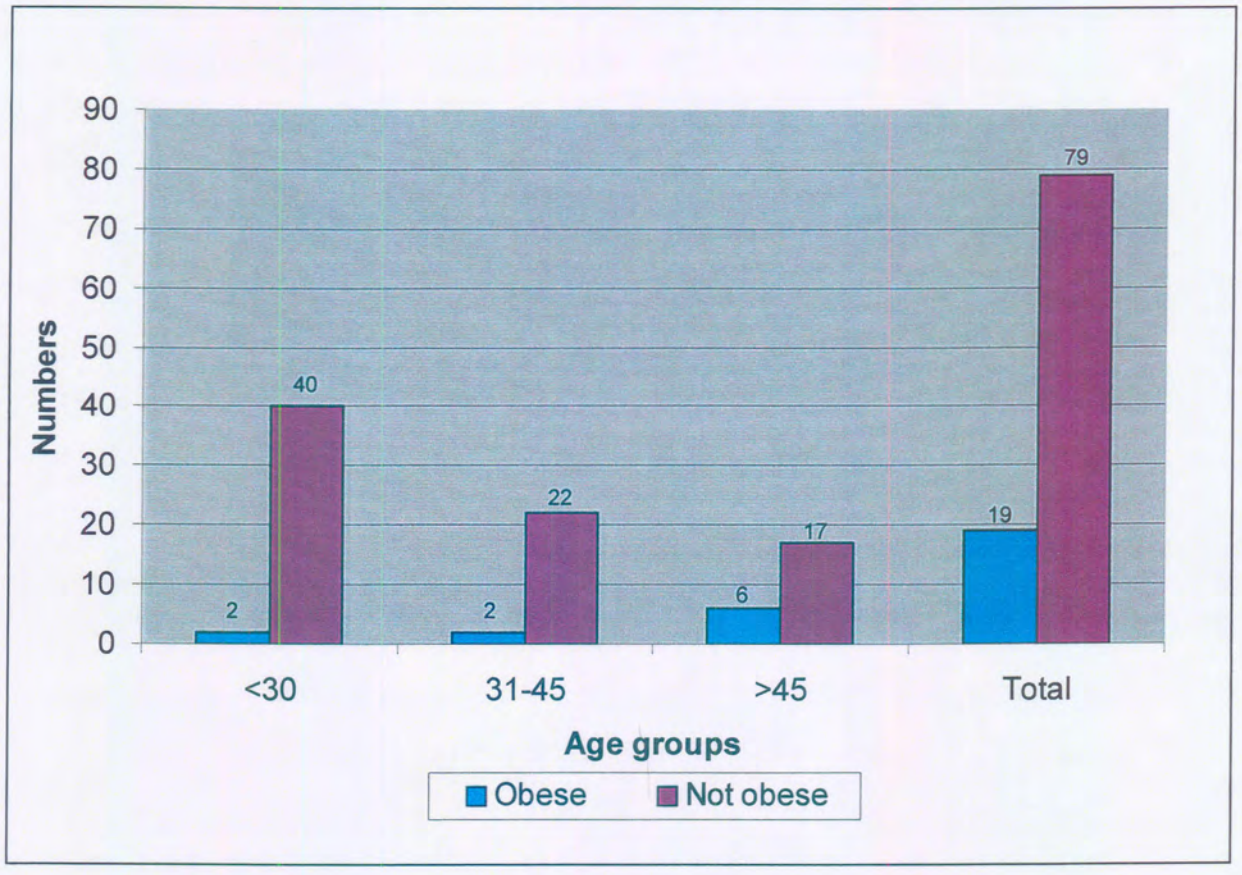

Figure 4.12: Obesity identified by the Quetelet Index according to age groups

As expected, age and obesity in the sample are associated with the prevalence in the older group being significantly higher than in the youngest group (p=0,005).

- ***Waist-hip ratio***

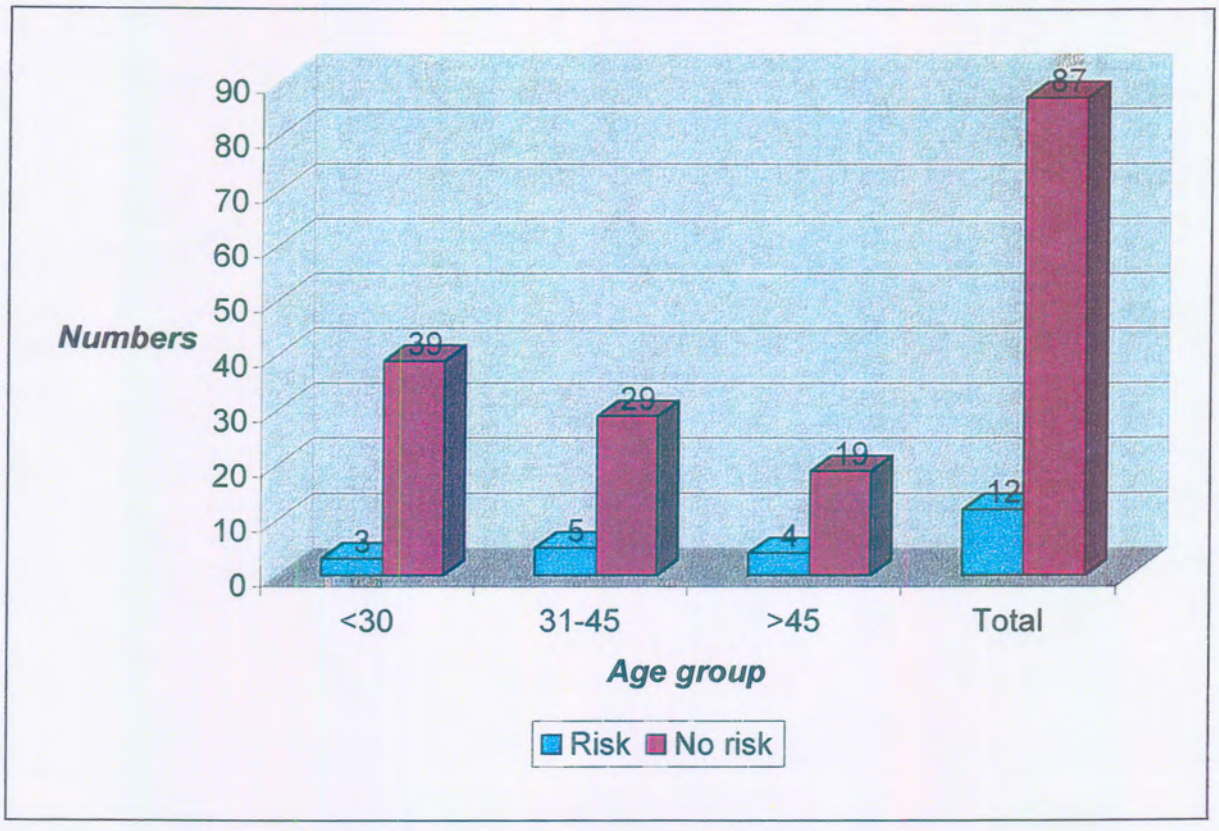

Figure 4.13: Obesity identified by the waist-hip ratio according to age groups

The prevalence for the at risk group is slightly lower (12%) than that found by means of using the Quetelet Index (19%) The frequency of obesity amongst the different age groups is almost equal.

4.2.2.4 *Prevalence of physical activity*

This section starts with three pi charts indicating the proportion of the sample that was inactive in terms of occupational, sport and leisure time physical activity. The section continues with more detailed descriptive data on each of these variables.

4.2.2.4.1 *Prevalence of physical activity for the sample*

- ***Occupational physical activity***

Subjects were probed as to whether they were employed or not, based on the six categories in ***Figure 4.14***. The specific job title for those who were formally or informally employed or self-employed was noted. Note that housewives and males who attended to household tasks were grouped under the legend "housewife."

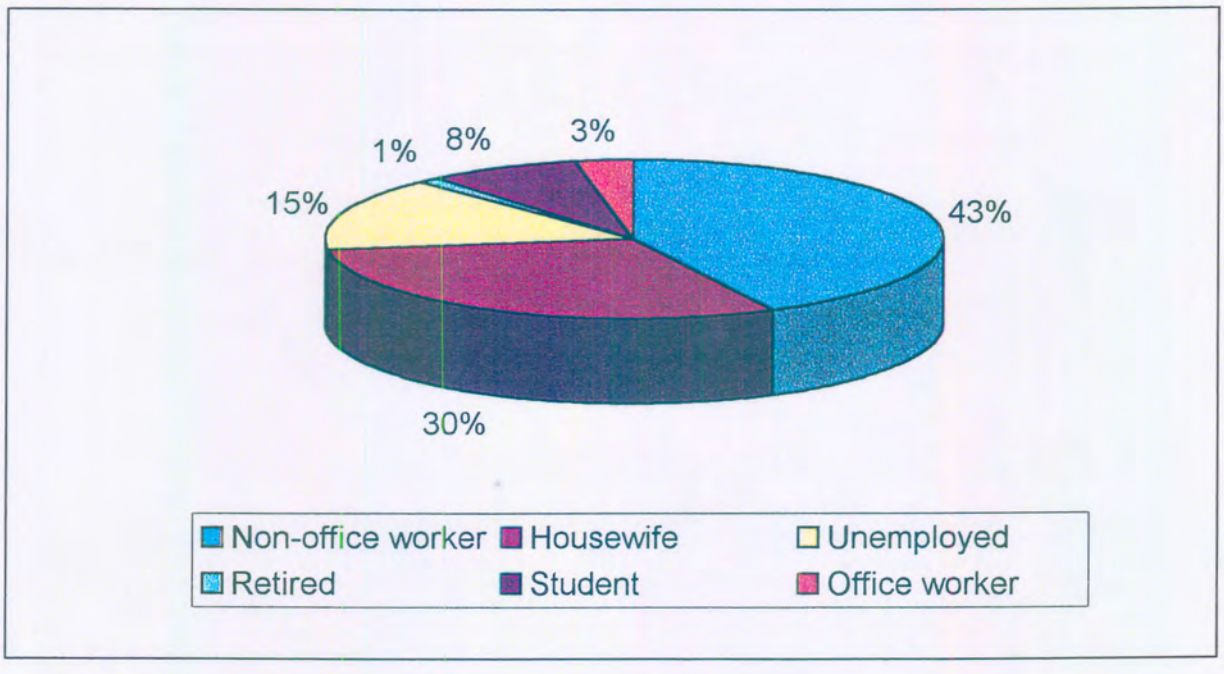

Figure 4.14: Occupational status

The unemployed, retired and student subjects constituted 24% of the sample. Of the employed, only 3% were in office jobs, which implies less physical activity at work. Seventy-three percent fell into a seemingly more active sub group of housewives and non-office workers.

Based on this initial classification, the employed and housewives were probed on the nature of their activities, as well as the mode of transport that they use to get to and from work. The mode of transport is presented in ***Figure 4.15***.

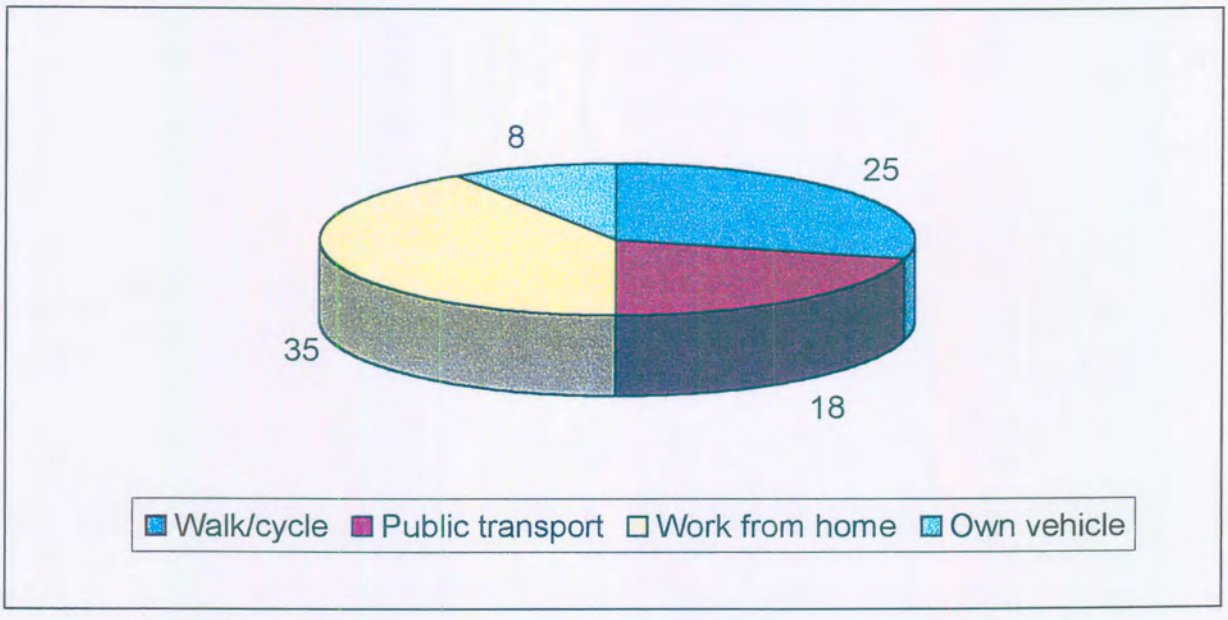

Figure 4.15: Mode of transport used to and from work

Fifty percent of the sample was in some way physically active with regard to getting to and from work: either cycling or walking, or having to walk to a point where they got public transport.

Based on the above information, subjects were subsequently classified as either relatively inactive, moderately or very active. This was done by calculating an

Occupational Index score, based on factors such as the amount of time the subject spent sitting, standing or walking at work. Lifting heavy weights contributed to a higher score.

Participation in sport

Similar to the occupational index, a sport index was calculated for each subject based on whether they took part in sport or not. The specific type of sport was noted and classified in terms of how vigorous it is. Higher scores were also obtained by subjects who were active for more days per week, and more seasons per year. The final outcome of the calculations is illustrated in ***Figure 4.16***.

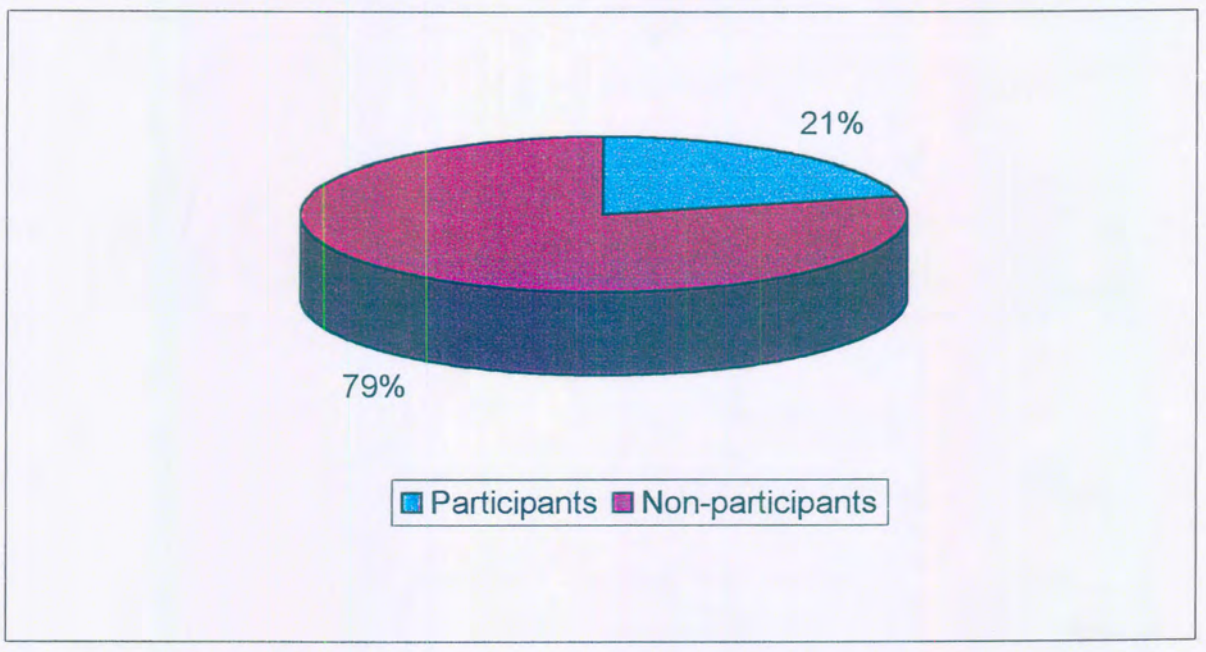

Figure 4.16: Participation in sport for the sample

Leisure time physical activity

Based on the questions that investigated the type and intensity of leisure time activities that the subjects mainly took part in after work, a leisure time index was calculated. Activities were divided into sedentary and moderately active.

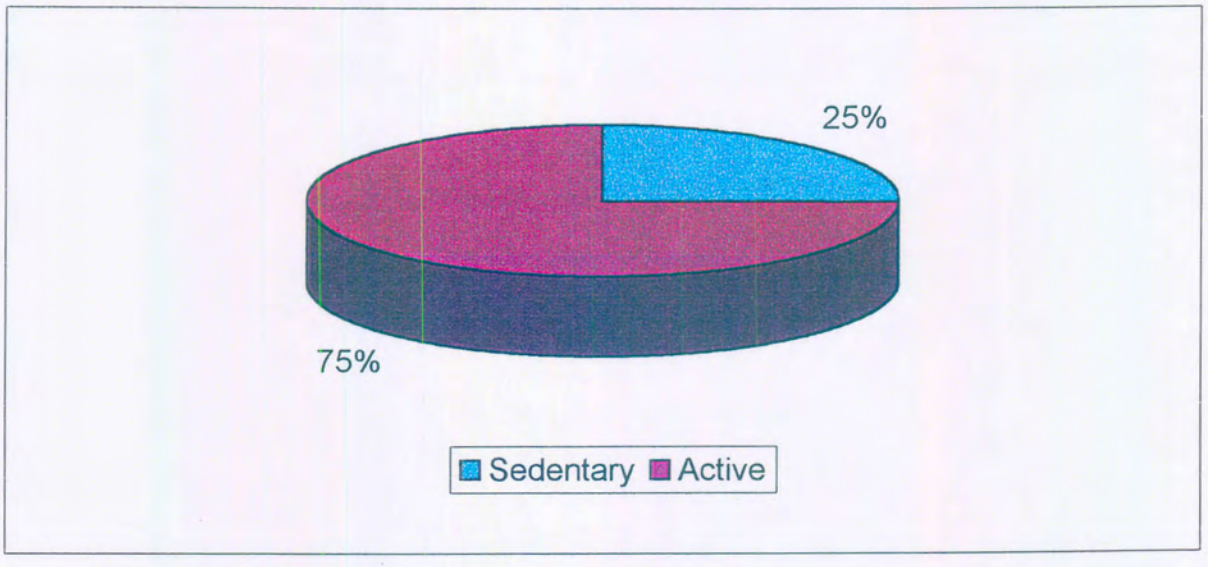

Figure 4.17: Physical activity based on leisure time activity

4.2.2.4.2 Physical activity in terms of gender

- ***Occupational activity***

The distribution of the two genders for each of the categories is depicted in ***Figure 4.18***.

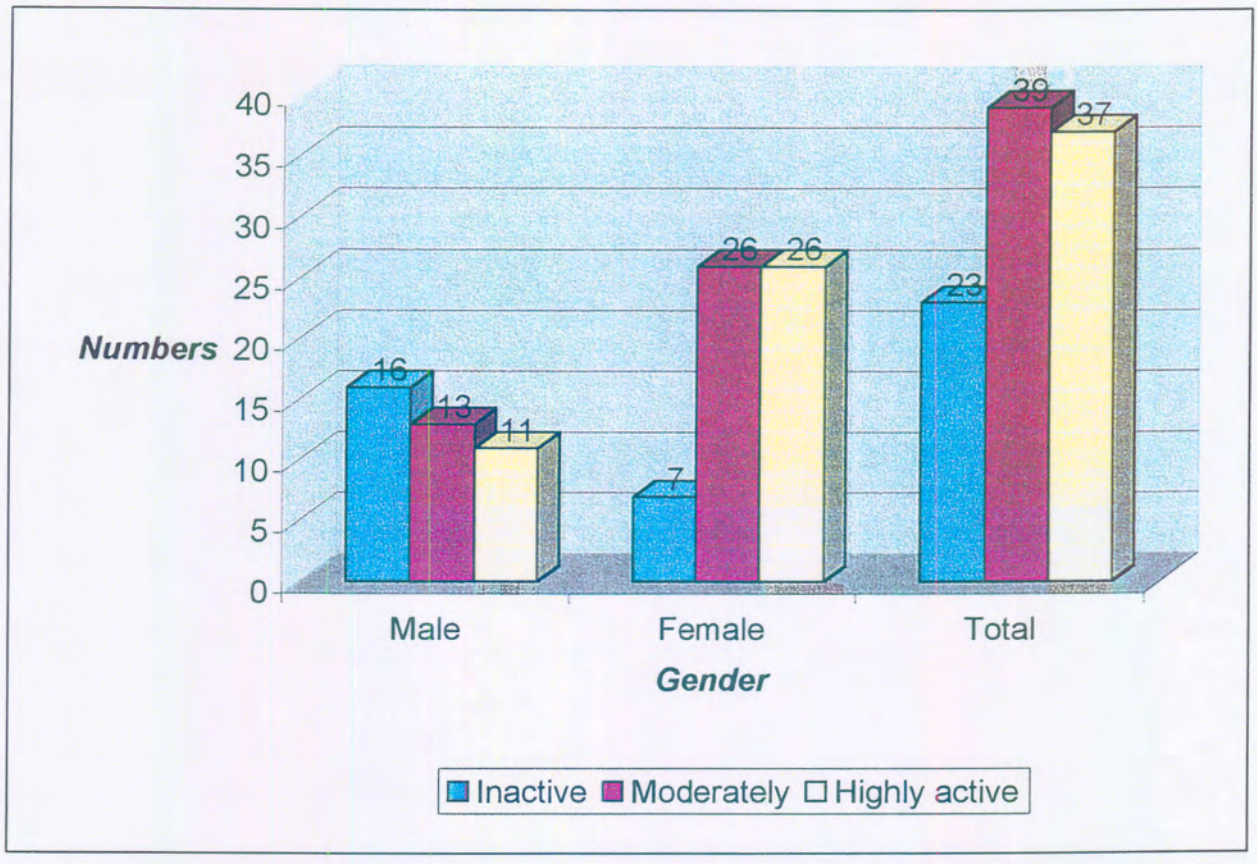

Figure 4.18: Levels of occupational activity according to gender

Interestingly enough, significantly more males (p=0,005) (16/40 i.e. 40%) than females (7/59 i.e. 12%) are relatively inactive during their workday.

Analyses were done, starting with participation in sport according to gender.

- **Participation in sport**

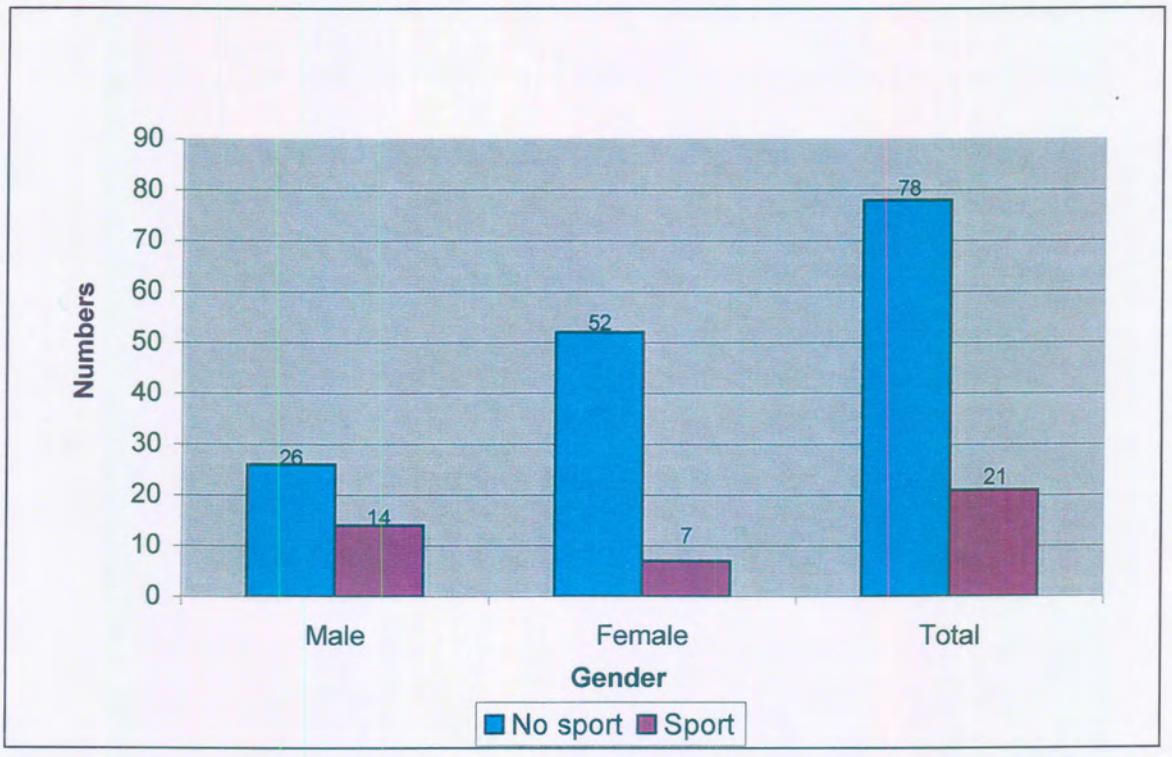

Figure 4.19 Participation in sport according to gender

The findings reflect that significantly (p=0,006) more males (14/40 i.e. 35%) are active in sport than females (7/59 i.e. 12%). Seventy-eight percent of both sexes do not take part in any form of sport, formally or informally.

- **Leisure time**

Levels of leisure time activity are depicted according to gender in **Figure 4.20**.

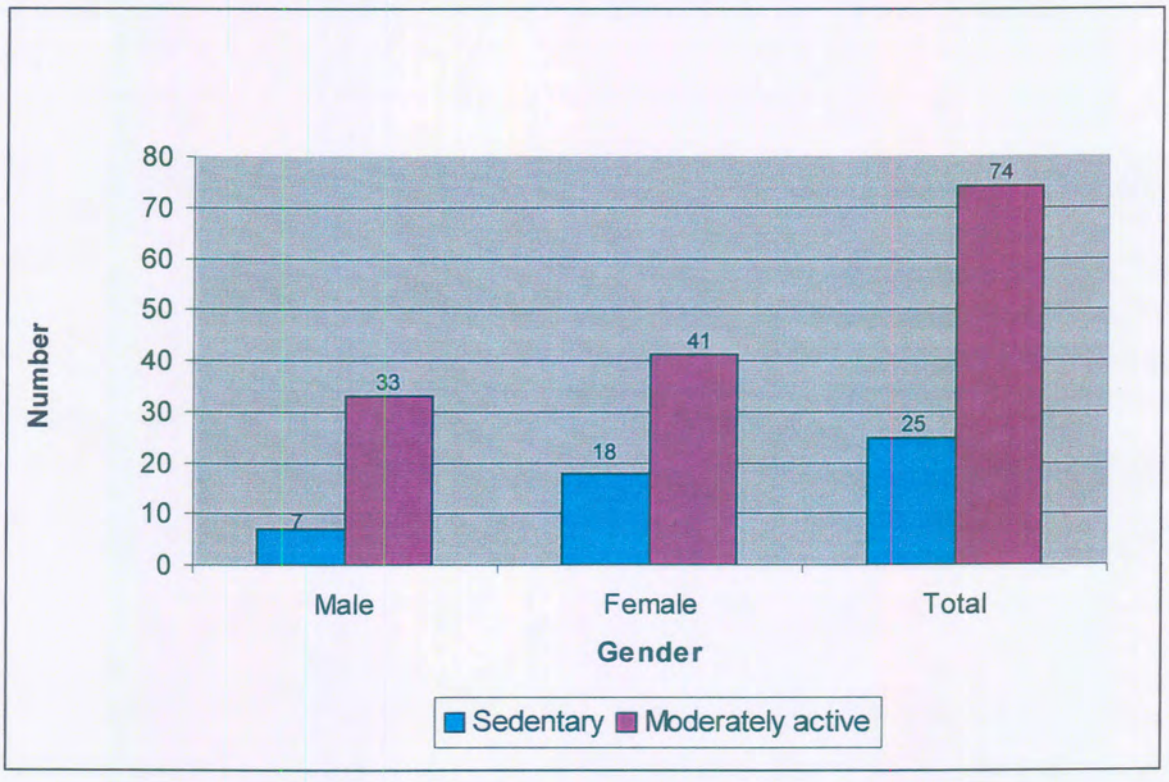

Figure 4.20: Levels of leisure time physical activity according to gender

The levels of leisure time physical activity do not differ significantly (p=0,144) for males and females. Twenty five percent of the sample is physically sedentary during leisure hours.

4.2.2.4.3 Prevalence of physical activity according to age groups

- **Occupational activity**

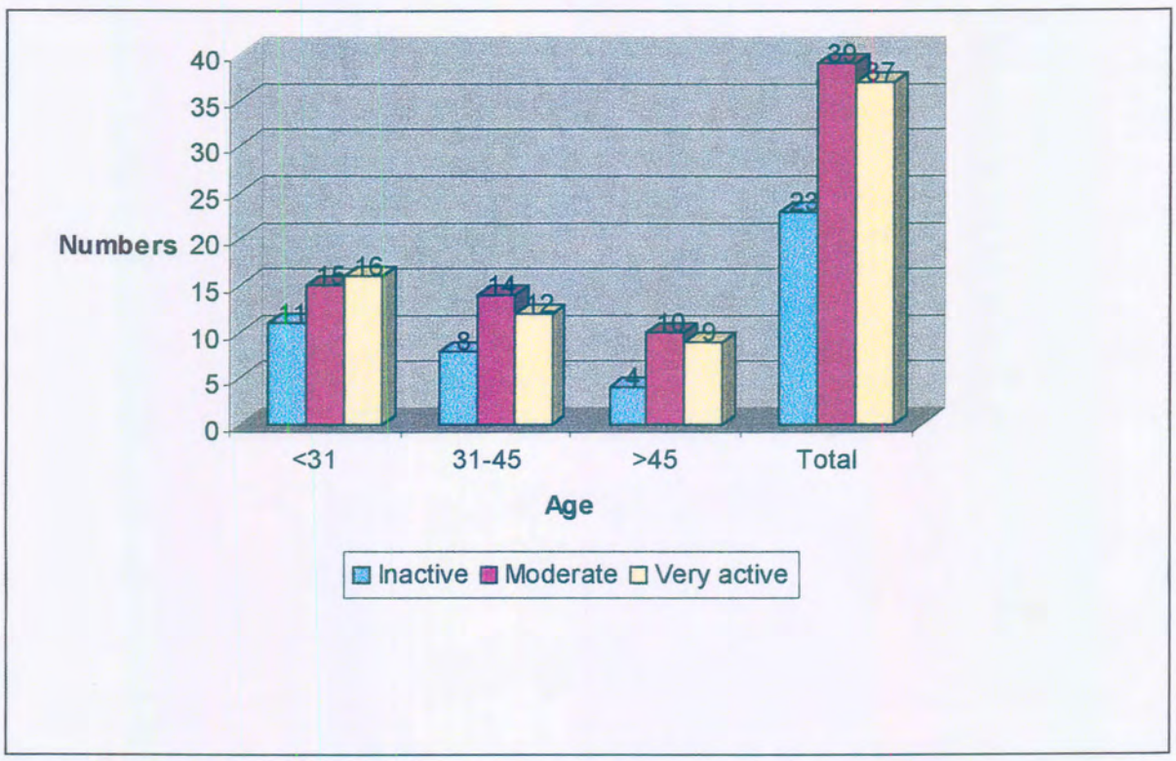

Figure 4.21: Levels of occupational activity in different age groups

The number of inactive workers is inversely related to increasing age, but the highest number of moderately to physically active (31) are, as expected, in the youngest age group. However, these findings were non-significant (p=0,934). Over 80% of the sample is moderately to very active as a result of their occupations, and mode of transport to and from the work place.

- **Participation in sport**

Figure 4.22 is a presentation of the distribution of participation in sports for subjects in the different age groups.

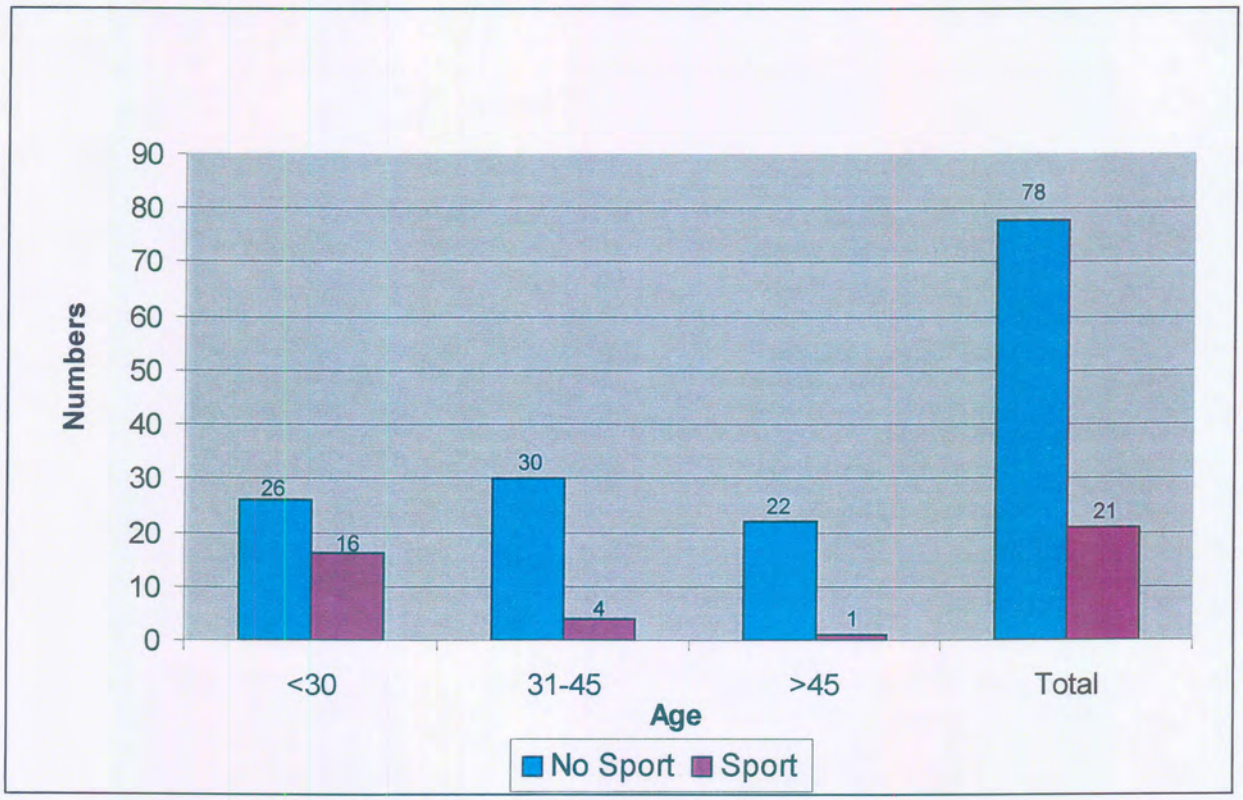

Figure 4.22: Participation in sport according to age groups

The above diagram illustrates that participation in sport decreases steadily with increasing age, with only one subject over the age of 45 being active. Participation in sport is therefore significantly associated with the younger age group (p=0,002).

The frequencies of sedentary and moderately active leisure activities according to age groups are given ***Figure 4.23***.

- ***Leisure time***

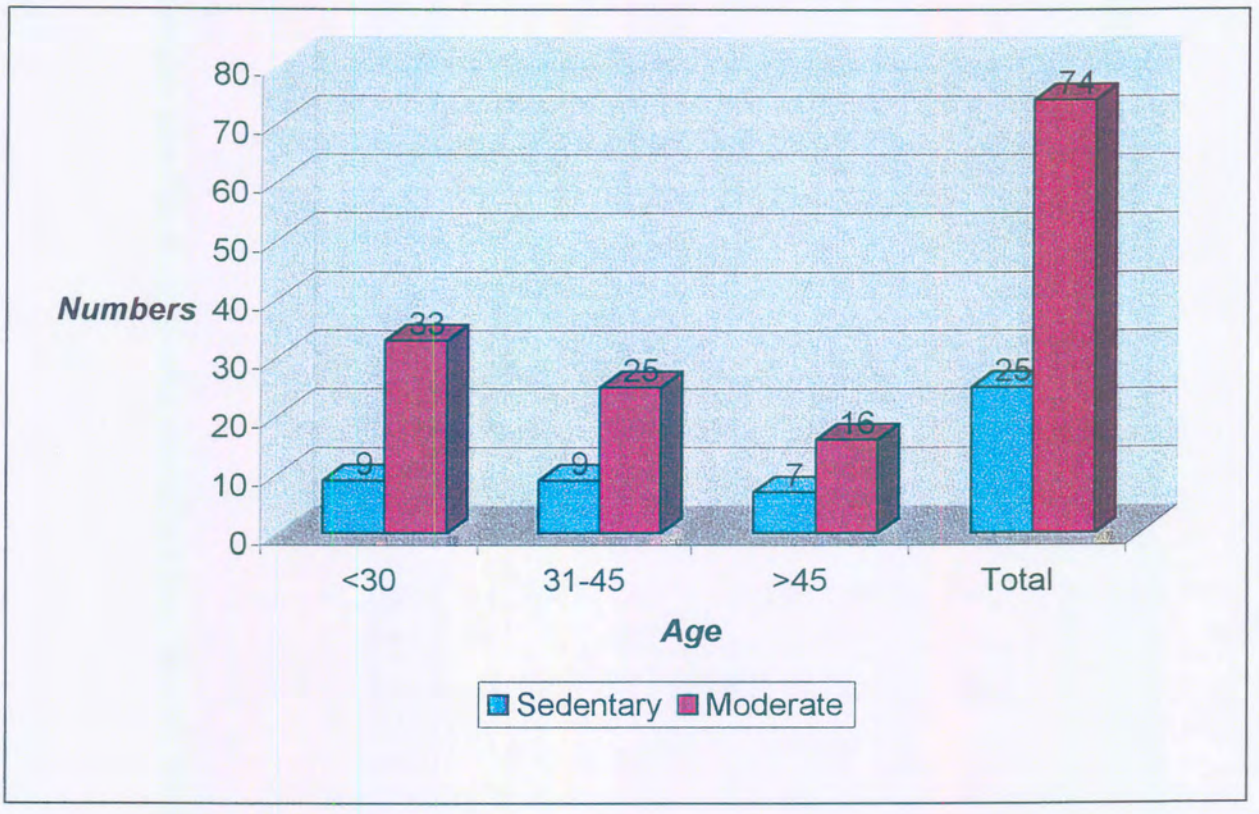

Figure 4.23: ***Levels of leisure time physical activity according to age groups***

The data reveals that there is a non-significant difference (p=0.712) in the intensity of leisure time activities amongst the three age groups.

4.2.3 Summary of prevalence rates

Tobacco addiction, obesity, hypertension and low levels of physical activity were prevalent in the minority of the sample. However, the majority of the sample was physically inactive according to all three criteria measured.

4.2.4 Description of the risk profile of the sample

Subjects were classified as being at high absolute risk if they had three or more of the risk factors.[162] The risk profile in terms of number of risk factors per subjects is presented in **Figure 4.24**.

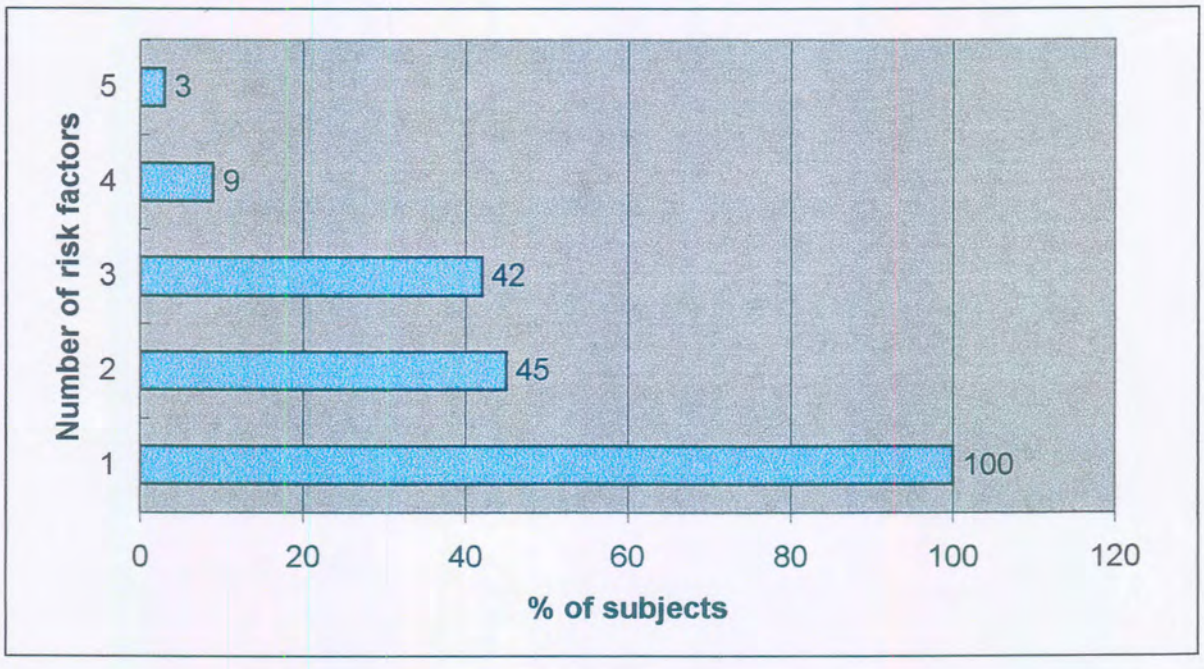

Figure 4.24: Number of risk factors per subject

Fifty four percent of the sample falls in the high-risk category of three or more risk factors. Forty-five percent have at least two risk factors and, of concern, is that every subject in the sample had at least one risk factor.

In the next section, the relationship between the different risk factors will be given.

4.2.5 Relationships between the different risk factors

The levels of significance according to the Chi-square tests are given in Table 4.1.

Table 4.1: **Results from the two-way contingency tables: Chi-square: test p values**

	Age	Gender	Smoking	Hypertension	Quetelet	WHR	Occupation	Sport	Leisure
Age	—	0.109	0.425	0.42	0.005##	0.409	0.934	0.002##	0.712
Gender		—	0.000##	0.002##	0.003##	0.027##	0.005##	0.006##	0.144
Smoking			—	0.066 *	0.184	0.084 *	0.047##	0.524	0.044##
Hypertension				—		0.725	0.798	0.779	0.016##
Quetelet					—	0.329	0.667	0.234	0.163
WHR						—	0.844	0.681	0.983
Occupation							—	0.012##	0.563
Sport								—	0.193
Leisure									—

$p<0,05$

* $p<0,1$

As described in **Table 3.2** the results in **Table 4.1** were used as a basis for the log linear regressions. A description of the nature of the relationships, based on the z-values obtained with the log linear regressions, is given:

- All non-smokers are sedentary at work.
- Non-smokers do not take part in vigorous sports.
- Non-smokers score low on the leisure index, and more smokers are active at work than non-smokers.

- Those without hypertension, score higher on the leisure index.
- The non-obese are not hypertensive, but the obese tend to be hypertensive.
- The majority of those who are not obese tend not to have central fat distribution. There is a trend for the obese identified by the Quetelet Index, to also be at risk in terms of the waist-hip ratio.
- More males than females tend to be smokers and tend to smoke more than ten cigarettes per day. There was a non-significant difference between genders with respect to those who reported smoking zero to ten cigarettes per day.
- All the obese are women (identified by the waist-hip ration), and there is a tendency for men to be underweight.
- Females are more at risk for CHD in terms of their waist-hip ratio than males.

In order to get a clearer understanding of the meaning of these associations, **Figure 4.25** gives a visual presentation of the factors that relate in a significant way. The results will be interpreted in the next chapter.

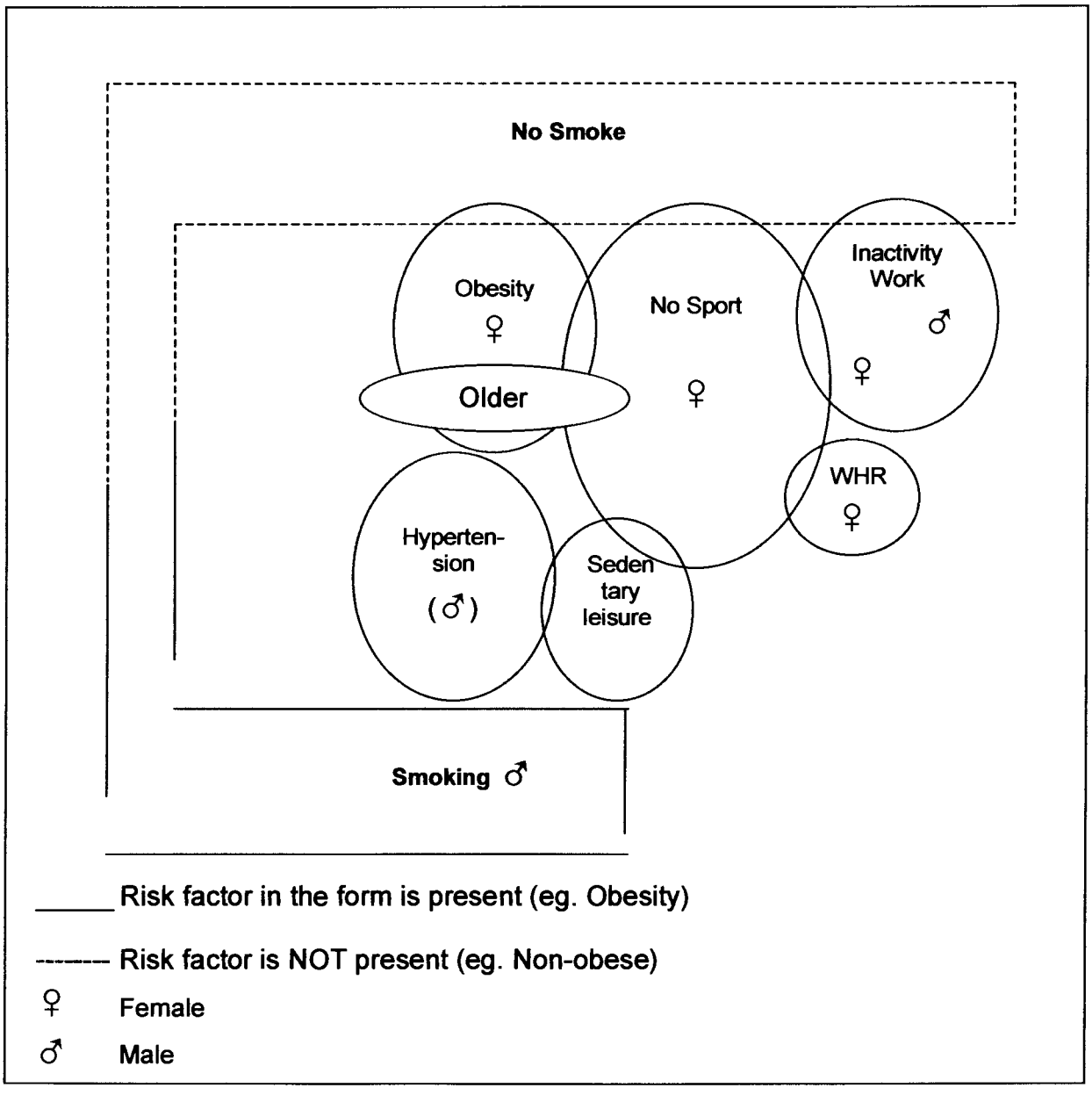

Figure 4.25: Diagrammatic presentation of the inter-relationships between the biographic and risk factors

4.3 Summary

In this chapter, the results derived from the statistical analyses were systematically given.

A discussion of the results follows in **Chapter 5**

Chapter 5

Discussion

5.1 Introduction

In this chapter the results given in **Chapter 4** will be interpreted and possible reasons for the findings, and the implications thereof, discussed. This study, to date, is the first investigation, to determine the prevalence of certain common risk factors of non-communicable diseases in a Tswana community. Traditionally, physiotherapists were more involved in the treatment of the diseases that developed as a result of the risk factors. The results of this study may give physiotherapists, working in the community, more insight into the risk factors investigated. They may, therefore, re-prioritise their involvement, giving more attention to primary prevention of risk factors by means of health education and promotion. Primary prevention of diseases is one of the fundamental principles of primary health care.[14]

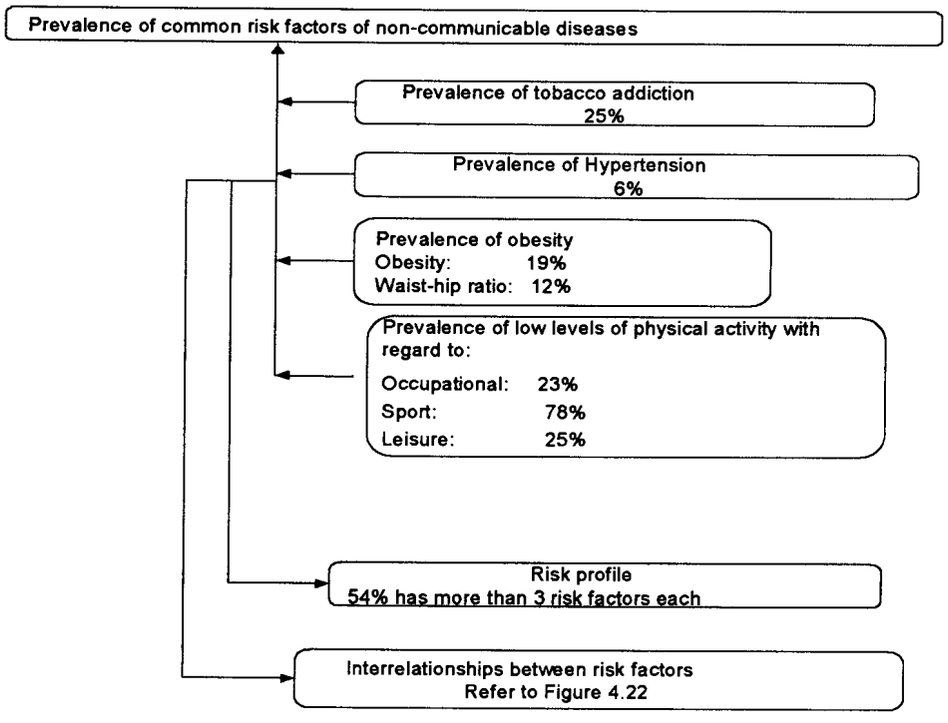

Figure 5.1 Results forming the basis of the discussion

See **Appendix 5.1** for tables, with summaries of prevalence rates of the common risk factors in different communities, set out for easy reference. All South African statistics found in the literature, as well as results since 1998 from other countries, are given.

5.2 The prevalence of common risk factors of non-communicable diseases

In order to answer the main question posed in this study, it was necessary to analyse the results of each sub aim.

5.2.1 The prevalence of tobacco addiction

Total sample

The prevalence rate of tobacco addiction (25%) for the sample supports the literature. A previous study showed that the North West Province (where Bosplaas is situated) has the lowest prevalence of tobacco addiction (38%) compared to other South African provinces. This rate is also lower than any other report (1990) for a South African ethnic group,[62] as well as recent international population sample prevalence results.

One should keep in mind that the prevalence rate of 25% is self-reported and may be a conservative estimate, in the light of a possible Hawthorne effect.[356] It is a possibility that subjects gave answers, indicating lower than real rates, because they thought that was the expected answer by a white health professional, who conducted the interviews.

It is speculated that the low prevalence rate of tobacco addiction in Bosplaas may be due to the success of continued national anti-smoking programmes, and anti-tobacco legislation since 1993.[88]

Gender

The overall low rate in the sample is attributed to the low prevalence rate of smoking for females (8%), which is significantly lower than that of the males in this sample, and lower than any other reported South African smoking rate for females. The

female smoking prevalence rates in the sample are higher than that found in Zimbabwe[357] (1%),Vietnam (4%),[79] China[438] (4%),[358] Saudi-Arabia[359] (1%), but lower than European (21%)[360] and Jamaican rates[441] (28%). The male smoking prevalence rate (45%) compares less favourably with Zimbabwe[359] (37%), but favourably with Vietnam[79] (73%), China[438] (63%) and America[440] (56%). Lower smoking rates of females could be attributed to the fact that smoking is not culturally acceptable for females. Present lower rates amongst females could have a positive influence in preventing future generations from smoking, as they may encourage anti-tobacco socialisation in the home.[361]

Low socio-economic levels are related to higher prevalence rates of smoking;[65] however, no significant correlation was found with the socio-economic index (p=0.366), or with the level of education in this sample (p=0.518). This may be because of the relative homogeneity of the sample, as they were all from a disadvantaged, rural community. Weiss and Lonnquist,[362] in contrast, found lack of education to be the strongest predictor of smoking. They found that uneducated subjects of either gender were more likely to smoke, than those with college education. On the other hand Spangler *et al.*'s[363] results indicate an association between cigarette smoking and higher education. Perhaps this study sample was too small to reflect these associations.

Adapting to an increasing westernised lifestyle, and being exposed to television, may be a contributing factor for higher rates of tobacco use than in other African countries. Coonrod *et al.*[364] proved that there are high rates of smoking (44%) amongst Mexican-American women, especially those born in the USA, with high levels of American acculturation and those from families with low family cohesion. A study that assessed the prevalence of tobacco and alcohol use in top-grossing American films, from 1985 to 1995, found that 98% of the films had references supporting tobacco use, and discouragement of its use was uncommon.[365] At least one lead character used tobacco in 46% of the films, but the hazards of smoking were not reflected. Kerner *et al.*[366] warn that the relationship between smoking behaviour and acculturation appears to be complex. King *et al.*[367] support the view that socio-demographic factors may affect smoking behaviour patterns in different communities. One can therefore only speculate that the same factors increasing tobacco addiction in other communities also influence the Bosplaas community.

Age categories

The youngest group of the three age categories had the lowest level of smoking (22%), which is in agreement with other studies.[368,362] The results in Bosplaas may be due to a greater awareness in terms of the health benefits of not smoking, as well as significantly higher (p=0.001) education levels amongst the younger subjects. The increasing cost of cigarettes may also explain the lower rate of smoking in the younger group, as it was previously found that younger populations are more likely to reduce or quit smoking in response to a price increase in cigarettes.[369]

Conclusion

The implication of the findings is that there is an opportunity for the health sector to attempt to maintain the relatively low rate and even decrease the rate of tobacco addiction for the sample. The high rate of smoking found in men, signals a need for prevention and cessation efforts. An active attempt in this direction appears to be necessary because the trend of prevalence rates for the sample is similar to that of nations with higher rates. Younger age groups smoke less, and may be the best group to target with anti-smoking campaigns. According to Flint and Novotney,[370] further understanding of the relationship between poverty and smoking is also essential to develop effective programmes for disadvantaged groups. The women are a resource that can be utilised to influence a decrease in smoking.

5.2.2 The prevalence of hypertension

A low hypertension prevalence rate of 6% was found, with males (13%) having a higher prevalence rate than females (2%).

Total sample

This finding was substantially lower than the prevalence of hypertension identified in a Free State Sesotho-speaking group (29%),[87] and is also lower than that found in a Xhosa-speaking population of the Cape Peninsula (9% for males and 13% for females).[88] In the latter study hypertensives reported using alcohol more frequently than normotensive. Furthermore, Mollentze *et al.*[87] found that the increase in blood

pressure with increasing age amongst people, who had spent less than 40% of their lives in the city, was less than amongst those who had spent more than 40% of their lives in the city. Unfortunately, data on alcohol consumption and the migratory patterns in Bosplaas were not collected. However, the fact that the majority of subjects were related to the owner of the stand, where they are living, suggests that they are permanent inhabitants of the area, and supposedly did not spent more than 40% of their lives in the city.

It can also be speculated that the rural lifestyle *per se* may be a contributing factor to lower hypertension levels. Christodolou[43] proved that psychological stress is seen as the most important factor in the symptom-organ-selection interplay in hypertensives. Psychological stress symptoms are often due to a failure to adjust to change. Cultural changes in the South African black population give rise to confusion of role identity, tribal security and tribal-philosophical beliefs, producing anxiety and psychosomatic illness. Hypertensive blacks in Christodolou's study, furthermore, experienced the environment as restricting and were emotionally insecure. It can only be postulated that these factors may be present in a limited way in Bosplaas. It appears to be a peaceful community, with large stands and little traffic. Donkey carts are still used by many families to collect water from the communal taps. The community, also, appear to maintain tribal customs such as traditional funerals. The tribal authority in the village is also functional and active, for example, a community forum was organised during the time of the fieldwork. The chief is often the guest of honour at community celebrations such as the opening ceremony of a private crèche.

The proportion of obese subjects in the study sample is also lower than in other samples with higher levels of hypertension. The leaner mean BMI may be another contributing factor to lower levels of blood pressure.

Gender

One possible cause that could be put forward as an explanation for the higher rate of hypertension for males than for females could be the higher unemployment rate amongst males. Unemployed females tend to become housewives. This speculation is based on results from a finding on raised blood pressure in young unemployed people.[371]

Age categories

Unexpectedly, age did not correlate significantly with hypertension in the sample, but the number of non-hypertensive patients per age group decreased with increasing age. This may be because the sample did not include persons over 60 years of age, as well as the low prevalence of hypertension found in this sample.

Conclusion

Brownley *et al.*[372] aptly reminds the reader that "*blood pressure regulation is a complex, dynamic process influenced by psychosocial, behavioral (sic), and cultural factors. Integrative theories of cross-population differences in the prevalence of hypertension and response to treatment include physiological, social, and genetic perspectives.*"

The low rate of hypertension in the sample is a favourable finding.

5.2.3 The prevalence of obesity

There is a moderately significant correlation (p=0,037) between the Quetelet Index and the waist-hip ratio used to measure obesity. Nineteen percent of the sample is obese, according to the Quetelet Index. This rate compares favourably with populations from the Cape Peninsula (28%), Eastern-Europe (23%) and America[440] (64%). Twelve percent of the sample is at risk in Bosplaas, according to the waist-hip ratio, for CHD, and this finding is less than that for samples from the USA (56%),[373] the Cameroons[377] (39%) and Jamaica[441] (34%).

Total sample

The prevalence rate of obesity for the total sample, according to the Quetelet Index, is lower when compared to all other studies found in the literature, using the BMI, as the criterium. There is a proven positive relationship between age and the Quetelet Index; and therefore, not surprisingly, a significant association (p=0.01) between obesity and increasing age was found in this study. The reason for the overall low rate in this study may therefore be because only people under 60 years of age were

included in the sample. No evidence has as yet been found in the literature to explain the differences in obesity between populations. Flegal[374] states that even within one population *"the economic, social, and cultural factors that influence the distribution of body mass index are not well understood."* Similarly, Okosun *et al.*[375] emphasise that "*an important public health challenge is to clarify how lifestyle factors influence risks of abdominal adiposity."*

Gender

No males were at risk according to the Quetelet Index or the waist-hip ratio. In contrast, rates of obesity for males using the Quetelet Index, found in the recent literature, was found to be higher. This could also be because Thulstrup *et al.*[376] suggest that there is a difference in the accumulation of intra-abdominal adipose tissue amongst males and females with the same degree of obesity. One can speculate that the high level of underweight is associated with chronic energy deficiency due to lack of sufficient food,[377] which is possible in a disadvantaged community. Darntoll-Hill and Coyne[378] reported that many countries have significant pockets of malnutrition, but despite this, obesity prevalence is increasing. They emphasise that social inequality is an important factor in differential mortality in both developed and developing countries. Attending to the health risk factors cannot be done without the collaboration of other sectors such as, for example, Trade and Industry, which should play a role in increasing job opportunities and therefore earnings.

The females in the study sample had a higher rate of obesity of 19% compared to white females from the Cape[88] (16%), and subjects from European countries, for example, France (7%). However, they had a lower rate of obesity than that found amongst a black group from the Cape Peninsula (44%) and ethnic mixed subjects from the USA and Germany (24%). It can only be speculated that socio-economic, behavioural or cultural factors,[379] which were not measured in this study, are responsible for these differences.

Factors which may influence obesity rates, are the desire to be slim, and how women relate to their body mass. In many African cultures fatness is a symbol of womanhood, marriageability and a primary criterium of female beauty. Being fat

when getting married, means that a woman starts her reproductive years with an energy surplus in the form of peripheral fat. In economically developed societies, and possibly Bosplaas, women have fewer pregnancies, which means that they have less opportunity to mobilise peripheral fat stores and suffer greater risk of obesity.[179]

It has been suggested that the prevalence of obesity in black women is high, partly because self-image in black women is not highly dependent on body size. However, a study by Riley *et al.*[380] contradicts this viewpoint: a higher body mass index is associated with poorer self-image, as well as with lower levels of body size satisfaction amongst American blacks. Thus some American blacks are unhappy to be obese which leads to poor self-image in this group. Compared to European women, for example, South Asian and Afro-Caribbean women are more likely to be obese, but less likely to rate themselves as overweight.[57] The nature of the association between fatness and self-worth and sexuality[179] is not constant. In mainstream American culture obesity is stigmatised. For many cultures, however, fatness is viewed as a welcome sign of health and prosperity.[179] Probably the Bosplaas females' views lie somewhere between these extremes. It is important that cultural factors need to be considered in developing intervention programmes to combat obesity. As a result of the AIDS epidemic, thinness is now stigmatised as a sign of AIDS in contemporary central Africa.[179]

Another possible confounding factor for the high prevalence rates of obesity amongst black females compared to white samples, could be that on average, blacks have a larger amount of muscle (heavier than fat) and more dense bones than whites.[381] It is speculated that genetic factors play a role in the obesity prevalence in Bosplaas females. Mesomorphs, people with a muscular composition, have a lean body weight, but are overweight according to height-weight tables, yet their body fat content may be lower than average. This example confirms again that body-weight tables alone can lead to invalid conclusions.[179]

Other factors, contributing to higher obesity levels in this study sample, could be due to an increasing westernised way of living.[382,383] Secular trends in fast food availability (for example, at work places) contribute to increasing obesity rates in the United States,[384] and possibly in South Africa as well. In Bosplaas-East there are a few local shops selling high-fat foods such as "vetkoek." Hawkers at food stalls, also sell high-

fat home-made maize snacks. The Bosplaas community is therefore exposed to a local variant of high-fat "fast-food."

It is important to bear in mind that all the results from other communities cannot be generalised to the Bosplaas community, but give an indication of factors that need further research and attention, for health intervention programmes to be successful.

As mentioned earlier, only the females in the Bosplaas sample were found to be obese and this finding correlates with data from other African,[385] American[440] and Caribbean studies. However, the situation is the opposite in countries such as Canada.[386] In the latter the higher prevalence of obesity for males compared to females, may be attributed to lack of exercise, poor diet and smoking. This accentuates the fact that intervention programmes should incorporate cultural factors in order to be successful, because when a developing country progresses to a developed country, new risk factors may emerge.

Risk for CHD, based on the waist-hip ratio was similar to ratios based on abdominal adiposity measured in Nigerian females, but lower than rates for females from the Cameroons[377], the Caribbean[441] and the United States[440]. This may be due to the same scale of difference in terms of obesity for the different communities. One can speculate that a reason for higher levels of obesity, is the change from traditional diets to western eating habits with an over-consumption of high-fat diets.[387]

Age categories

In terms of increasing age, the results were surprising. Obesity, according to the Quetelet Index, shows a positive association with increasing age; however, the waist-hip ratio did not indicate an association of obesity and increase in age. A study, conducted in India, found that central obesity did not increase with age,[388] supporting the present study. Opposing results come from Sweden, where BMI was stable in three representative cohorts, but waist-hip ratios increased significantly in those aged 38 to 50 years.[389] There appeared to be a combination of increasing waist circumferences and decreasing hip circumferences. The authors could not explain the changes in body shape and composition, resulting in increased centralised fat deposit. There is a likelihood that the centralised fat composition is influenced by

genetic factors and the former by environmental factors. However, both BMI and android fat distribution were greater amongst first-degree relatives than amongst spouses in a Canadian population, supporting the importance of genetic factors.[390] Molarius *et al.*[391] are of the opinion that waist-hip ratio and waist circumference alone, measure different aspects of the human body: waist circumference probably reflects mainly the degree of overweight whereas waist-hip ratio does not.

5.2.4 The prevalence of physical activity

Twenty-seven percent of this sample, according to occupation, lead an inactive life, 71% do not walk/cycle to and from work, and 23% are inactive in terms of occupational activity. Interestingly, males are more inactive during working hours than females. Seventy eight percent of the sample does not take part in sport, with the females significantly in the majority as non-participants, and the younger age group was found to be significantly the most active group. Pertaining to leisure time activity, 25% of the sample is sedentary after hours, with gender and age sub groups not differing significantly.

The great majority of the sample does not take part in sport. Comparing genders, males are significantly less active at work, but significantly more active in sport than females, with a non-significant difference between genders for the leisure time index. There is a significantly positive association between increasing age and inactivity for all the above-mentioned activities.

No reports on physical activity in terms of occupation, walking or cycling to and from work were found in recent literature. It is clear that public transport in Bosplaas is accessible and that the sample need not walk far to catch either a bus or a taxi. Other activities or sport will have to be utilised in programmes aimed at increasing the levels of activity in the Bosplaas community.

Those in Bosplaas with a zero score on the occupational index (not working) were mostly men. Those with scores of three (highly active at work) were mainly women. Those with moderate activity levels (1 and 2) were fairly evenly distributed according to gender. One explanation for these results may be found in the methodology. Questions on the level of activity were completed for all housewives, and therefore

also for "unemployed" women, who assisted with or took over household activities. Men on the other hand, were not involved in household tasks when unemployed, and scored zero on the occupational activity index.

Participation in sport

The non-participation rate in sport for the total sample is almost the same as that found for a Caribbean sample,[392] a developing country. However, both males and females of this sample participated less in sport compared to black subjects from the Cape Peninsula,[83] Metropolitan Cape[220] and the USA.[393] Although educational level was not measured in the other studies, a difference in levels of education could be speculated as a possible explanatory factor. In this study, the majority of those with Grade VII as a highest level of education did not participate in sport, whereas those with tertiary education did take part. There was thus a positive correlation between participation in sport and level of education. Furthermore, those who scored 8 on the demographic index (excluding those who scored 9 and higher) participated in sport more than any other group, indicating a positive association between socio-demographic status and participation in sport. This was further confirmed by a low score on the sport index, which incorporated the number of seasons that subjects were involved in sport, the vigour of the type of sport, as well as the number of days per week that the subject participated in sport. This finding was associated with a low score on the demographic index which was a summation of different factors indicating the socio-demographic status, for example, access to water, electricity availability and the type of material that the house was built from. Another reason for the low participatory rate could also be the lack of sports facilities. Apart from facilities at the school, there are two soccer fields in Bosplaas, possibly explaining higher participation levels in sport by men. Informally, the women interviewed indicated to the researcher that they would be interested in playing netball if there were facilities. Another possible reason for lower participation by women is their dual role of being employed, as well as being responsible for caring for the household.[394]

Leisure time activity

The only other group that was investigated in a previous study, in terms of leisure time physical activity was from the rural Cape.[88] Both genders were much more

sedentary than the Bosplaas sample. A possible explanation for this is the fact that the infrastructure in the Cape communities is better than in Bosplaas. In Bosplaas, the majority of households do not have access to electricity or water on the stand, necessitating physical activity in terms of household chores.

As with obesity prevalence rates, environmental and cultural factors are known to influence particular characteristics of an ethnic group, and as such, can be partially responsible for distinguishing one ethnic group from others.[395]

Conclusions

Occupational leisure time activity is modifiable only in a very limited way. Compared to other populations, the Bosplaas sample has a satisfactory level of leisure time physical activity. As the Bosplaas village is becoming increasingly modernised, for example, the provision of electricity, the challenge to health providers is to maintain this favourable activity profile. One approach could be the promotion of sporting activities as a multi-sectoral endeavour, with specific emphasis on targeting the females. Another challenge is to maintain activity levels, as community members grow older.

5.2.5 The risk profile of the sample

Each subject in the sample had at least one risk factor, with 54% falling in the high-risk category of having three or more risk factors. The literature search revealed no other study that analysed the risk profile of a sample in this manner. Although the prevalence rate for each risk factor in individuals is relatively low, the spread of risk factors in the sample is high. This emphasises the importance of intervention programmes in Bosplaas. The high level of subjects with more than three risk factors is a concern, as clustering of risk factors appears to increase the risk of detrimental effects more, than when considering risk factors in isolation.[396]

5.2.6 The inter-relationships between the risk factors

A high correlation of prevalence rates of risk factors in this study compared to other similar studies, was found. It is therefore not surprising that relationships between risk factors identified in this study coincide to a great extent with the literature. Refer

to **Paragraph 2.8.** For example, a non-smoking status is associated with obesity[205] and participation in sport.[237] It was found, in this study as well as in the literature that hypertensives, tend to be smokers,[196] obese,[210] and physically more active[222] than the normotensives. Non-participation in sport correlates with sedentary leisure time activity[279] and cardiovascular risk in terms of the waist-hip ratio.[273,397]

Hellersted and Jeffery[398] found that job demands are positively associated with smoking. Brissons *et al.* found that smoking is associated with high levels of physical activity at work and at home, but with inactivity during leisure time. In Bosplaas the opposite in terms of occupational activity was found. The females, who are the non-smokers, were found to be more active at work. It was explained that this relationship may be the result of the fact that unemployed males reported no occupational activity, whereas unemployed females were involved in household tasks.

Cognisance should be taken of the fact that improving a subject's health status in terms of one risk factor, could have a negative impact on another, e.g. the inverse relationship between the Quetelet Index and smoking. Coakly *et al.*[399] confirm that quitting smoking was consistently related to weight increase in their study with health professionals. Stopping smoking could have other negative health effects, such as post-cessation depression.[400]

In summary it can be observed, that the factor most amenable to intervention appears to be physical activity outside of the work place. Activity at work is to a very limited extent modifiable. Participation in sport, and higher levels of physical activity during leisure time are negatively associated with obesity (Quetelet and waist-hip ratio), and positively associated with non-smoking. Other studies, already quoted, proved an inverse relationship between physical activity and hypertension, and a positive correlation between hypertension and smoking.

The interpretation of the inter-relationships of the four risk factors requires caution, because of the cross-sectional design used. However, the findings are consistent with similar studies found in current literature.

5.3 Conclusion

The prevalence rate of all four risk factors was found to be fairly low in the Bosplaas sample. However, rates were high for subgroups such as smoking in males and obesity in females. Socio-economic and cultural factors appear to play a major role in the prevalence of the risk factors. In support of the literature obesity was speculated to have a major genetic component, as well. Although the sample was fairly active, sport is not as yet an established past time in Bosplaas. Despite the relatively low prevalence rates of risk factors, their spread in the sample is wide, indicating a need for intervention and health promoting programmes. No new inter-relationships between the risk factors were found. The study emphasises "*the necessity of community-based preventive interventions in deprived areas.*"[401]

5.4 Summary

In this chapter, the results of the study were interpreted and the implications thereof given. It appears that Bosplaas is a relative healthy community in terms of the four risk factors that were investigated, and that inter-relationships between the risk factors comply to a large extent with findings from the literature. In the next chapter the conclusion, a critical evaluation of the study and recommendations for clinical practice and further research are given.

Chapter 6

Conclusions and Recommendations

6.1 Introduction

In this chapter the conclusions, as well as the relevance of the findings of the study, in terms of the contribution to basic knowledge and applied practice is presented. The implications of the results discussed in the previous chapter are clarified and the merit of the research is critically assessed. In essence, the conclusion to the research question, with regard to the prevalence of certain common risk factors of non-communicable diseases in a disadvantaged, rural South African community, postulated in **Chapter 1,** is presented.

6.2 Common risk factors of non-communicable diseases in a rural community

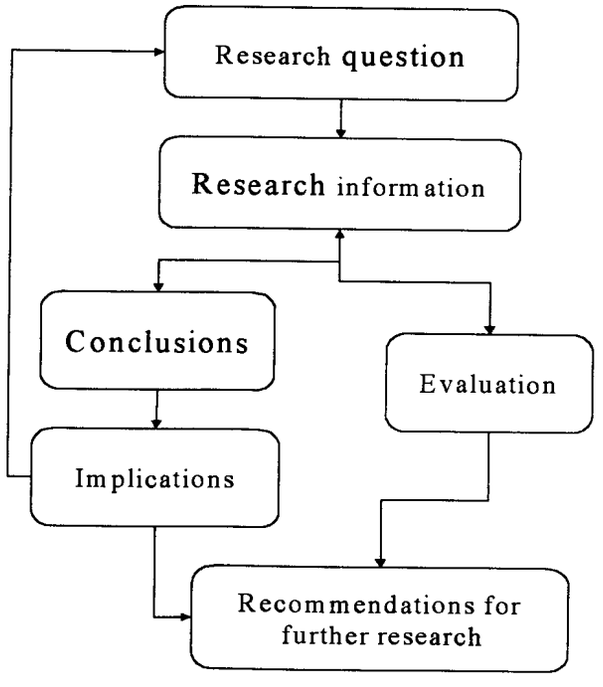

Figure 6.1 Diagrammatic presentation of the basis of the discussion

Figure 6.1 illustrates how, by drawing conclusions from the research information, an answer to the research question, and thus the main aim of the study, is acquired. From these implications and the critical evaluation of the study, recommendations for further research can be postulated.

6.2.1 Conclusions

In this section, the conclusions from the study are presented, as well as a brief summary of the interpretation that was given in the discussion in the previous chapter. Conclusions of the sub aims are presented in the same order as in **Chapter 3**.

- A relatively low smoking rate of 25% was found, with men smoking significantly more than the females. Subjects over the age of 30 years smoke significantly more than the younger groups. Progressively increasing western lifestyle and exposure to American films, also via television, may be related to increasingly higher levels of smoking in Bosplaas. Smoking fewer cigarettes per day, not only cessation, relates to improved quality of life. The cost of cigarettes and higher levels of education may explain the lower rates of smoking amongst the younger age groups. Acknowledging a possible Hawthorne effect implies that the smoking rate is conservative. The low smoking rate of females could be a positive factor influencing non-smoking behaviour in households.

- The prevalence rate for hypertension was also relatively low (6%) compared to other South African communities, with men in a less favourable situation than females. The probable low migratory level in Bosplaas, the presence of traditional customs and the rural lifestyle with relatively little psychological stress, may be possible explanatory factors. There also appears to be an association between the level of hypertension and BMI.

- Obesity prevalence rates were found to be low in comparison to rates found in other studies (19% according to the Quetelet Index and 12% according to the waist-hip ratio). Factors such as a possible larger proportion of muscle tissue

and denser bone than that in whites, and genetic factors, may explain differences between different populations. Differences in the accumulation of intra-abdominal adipose tissue amongst females may further explain the difference in waist-hip ratio between the genders in this study. The rate of obesity for females is between that of white South African and European communities, and those of American[440] and Caribbean samples. Again, cultural and socio-economic factors, not measured in this study, could explain the results. Fatness in many African societies is a symbol of feminity, maturity and wealth, and obesity may be desirable for females in Bosplaas. However, there is no conclusive evidence about the relationship between self-image and body size in black women. It is speculated that the degree of overweight is probably better reflected by waist circumference only, rather than by waist-hip ratio. The aetiology of obesity is complex and multi-faceted, and research to understand these factors is necessary before the initiation of weight-loss programmes.

- The minority of the sample is physically inactive with regard to occupational requirements (23%) and leisure time activities (25%); and the majority in terms of occupational titles (70%) and non-participation in sport (78%). Differences in occupational activity between males and females may be attributed to the methodology of this trial. The fact that the majority of the sample does not walk or cycle to and from work, could be because public transport is easily accessible. Women participated significantly less in sport, and this may be due to their dual role of housekeeping and working. The overall low level of participation in sport could partially be due to the lack of sport facilities in Bosplaas. Leisure time physical activity levels may also be influenced by socio-economical factors such as sparse or no access to electricity and / or water on the stand of households, necessitating manual activity in household chores. There therefore is a possibility that improved socio-economic status could increase the prevalence rate of obesity for females, and poses a challenge to health promotional programmes as the infra-structure in Bosplaas improves.

- The fact that each subject in the sample presented with at least one risk factor, and more than half of the sample are at particular risk for cardio-

vascular diseases due to a clustering of three or more risk factors, is of concern.

- A summary of the inter-relationships between the risk factors, which were found to be statistically significant, were given in the previous chapter.

Participation in sport and physical activity outside of the workplace seem to be most amenable as an intervention entry point. Participation in sport is associated with all three other risk factors namely non-smoking, lower levels of hypertension and less obesity. The inter-relationships indicate that smoking cessation programmes should not be carried out without concomitant weight-management programmes. The physiotherapist is an appropriate team member to facilitate intervention programmes. However, it should be emphasised, that the inter-relationships are complex, and an interdisciplinary, and even intersectoral approach is indicated.

In conclusion, the research question was successfully anwered. The prevalence rates of all four risk factors in isolation were relatively low, but some sub groups were found to be at high risk, for example, men who smoked and women who were obese. Increasing age correlates with increases in obesity and physical inactivity. Participation in sport is not yet established in the Bosplaas community. Calculating the risk of the sample with regards to the number of risk factors per individual, proved valuable, indicating that each subject in the sample had at least one risk factor. A cluster of risk factors, which increase susceptibility for developing CHD, was found in more than 54% of the sample. It appears that there is a definite need for health promotion and prevention programmes in the Bosplaas community, regarding the four risk factors examined in this study.

6.2.2 Critical evaluation of the research

It is necessary to evaluate the research critically in order to determine whether valuable contributions to basic knowledge and clinical practice can be made.

- From **Chapters 1 and 2** it is clear that the research question addressed is highly topical and important in an international, national and local context. The risk factors investigated contribute extensively to the increasing prevalence of

non-communicable diseases, in developing countries including South Africa. The financial implications and detrimental health effects are notable. Having determined the prevalence levels in Bosplaas in particular, can assist the local health care team, and particularly the Department of Physiotherapy to plan and implement meaningful interventions. Preventative programmes for chronic non-communicable diseases are one of the health priorities of the RDP.

- From the comprehensive literature overview, a gap in the literature on information regarding prevalence rates of the risk factors, and their relationship to each other in the Bosplaas community, became evident. It highlighted the need for this study.

- Methods to measure the variables were chosen according to an extensive literature overview. This ensured that the methods used in the study were reliable and valid. However, the US Expert Panel on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults[156] recommends that waist circumference alone should be used to assess abdominal fat content. Evidence from epidemiological studies has shown that waist circumference is a better marker of abdominal fat content than WHR[162] and should rather be used in further studies.

- Using the same definitions for the risk factors as in other studies facilitated comparisons of the results with information in the literature.

- The study methodology was pre-tested in a pilot-study and the questionnaire and procedures were subsequently modified.

- The representative community-based sample increases the possibility of generalisation of results to populations aged between 20 and 59 years of age.

- Studies that use clinic-based or hospital-based samples often comprise mainly females, children, and the unemployed. Males and the employed are therefore often under-represented in epidemiological studies based at clinics. This

study, especially because fieldwork was also carried out over weekends, included a more representative sample of the population.

- A limitation of the study is that only subjects aged 20 to 60 years were included in the study. However, in other South African studies subjects aged 15 to 65 years were included.

- The high level of correlation between the results and information from other studies indicate that the questionnaires measuring tobacco addiction and physical activity levels had internal validity. The levels measured may be conservative due to the previously mentioned possible Hawthorne effect that may take place during self-reporting.[402] However, Manwell *et al.*[403] reported that patients do complete screening tests accurately.

- Using only one person to take all measurements, and the meticulous, standardised way, described in **Chapter** 3 in which physical tests and the interviews were carried out, ensured a high level of reliability.

- The fact that blood pressure and anthropometrical measurement were done objectively, and that the researcher did not rely on self-reported data or data from health files, is another factor increasing the validity of the results. Misclassification using self-report as a selection instrument in screening for risk may be considerable.[404,405]

- The socio-demographic data, collected in the study, proved useful in interpreting the results.

- A high response rate was obtained.

6.2.3 Implications for clinical practice

This study was conducted due to a gap in existing literature, as well as a practical need of the health providers in the Bosplaas community. The results, apart from the contribution to basic knowledge, have implications for clinical practice, to be discussed in this section.

- The complexity of the inter-relationships between risk factors, as well as associations with socio-economic factors will necessitate a multidisciplinary approach in the intended programmes. No single discipline can address any one of the risk factors comprehensively and satisfactorily.

- The results isolated groups according to gender and age, which are at particular risk for certain risk factors. These results are useful in prioritising plans for services in the village. The following target groups in the Bosplaas community, which are relatively more at risk, and in need of intervention programmes were identified:

  - Males who smoke and are underweight.
  - Obese females.
  - The unemployed with hypertension.
  - The total sample, in particular females, who do not participate in sport.
  - The sample as a whole, in terms of leisure time physical activity, should the infrastructure of Bosplaas improve.
  - Older groups with regards to obesity, possible hypertension, and a sedentary life style.

- The approach in planning health services in Bosplaas is participatory.[23] The results from the study can be used as a starting point in the next needs assessment with the community leaders. It should be presented at a community forum organised by the tribal authority and/or a planning meeting of the Bosplaas clinic committee. It is essential that the following are also present: the district and ward health care providers and their University of Pretoria counterparts represented by the Community-based Education (CBE) Group of the Faculty of Health Sciences. The CBE group comprises lecturers who co-ordinate services rendered by students in the Moretele district and therefore the Bosplaas village.

- A summary of the report should be presented to the district health manager and Bosplaas clinic staff, or presentations should be made to them by the researcher to familiarise them with the findings of the study, and the

implications thereof. Descriptive epidemiology is the starting point for planning health services as it describes health needs.[406]

- Provincial and national departments of health, as well as the Medical Research Council are continuously involved in revising health policies and guidelines for priority health services, particularly the departments dealing with non-communicable diseases and health promotion. These departments, in addition have a role in monitoring the health status of the South African population. Results from this study can assist them in their task and improve knowledge on the health status in a rural village. It is thus recommended that these departments also be provided with an executive summary of the results from the study.

- Vaughan and Morrow[299] confirm that information from health surveys can be communicated in three main ways:

    # Disseminating reports
    # Meetings and discussions with local organisations.
    # Local and mass media.

    It is therefore further recommended that the researcher endeavour to obtain an interview on a radio station, which broadcasts in the Bosplaas area. The information on the detrimental effects of the four risk factors should be included in such an interview, to raise awareness amongst the community.

    A press release could also be sent to the local newspaper.

- Health promotion with regard to smoking cessation, weight loss and increasing physical activity can start immediately, by sharing information by health professionals during patient consultations.[407] Counselling has been shown to motivate patients to seek more help in their attempts to improve their health behaviour.[408]

- Physical activity appears to be a pivotal factor that may influence all four other risk factors. Health care teams, including a physiotherapist, can assist the

public by promoting physical activity and describing the type, quantity and quality of activity that improves health.[409]

- A suggested plan of action, based on the process of community development[410,411,412] is as follows:

Phase 1: Analysing the situation

Have a community meeting organised by the tribal authority to give feedback on the research findings and to negotiate the entry of Physiotherapy into the community - starting with intervention programmes.

Invite representatives from various groups in the community e.g. the African National Congress (ANC) Women's League, the churches, schools, known leaders, the soccer club chairperson, the health portfolio-holder of SANCO and the chairperson of the Electricity Forum. The health sector should be well-represented e.g. invitations should be sent to the District Health Forum's committee, the Bosplaas Clinic staff, the Bosplaas School of Traditional Healers, the superintendent of the Jubilee Hospital, the District Health Manager and the Directors of Rehabilitation in the North West Department of Health. Other sectors that could be included are the Department of Education in Temba and business leaders from the Babalegi area.

At this meeting the community's perception with regard to what they see as the priority areas, can be gauged. Those who would be interested in taking part in the suggested programmes should be identified. A follow-up meeting should be scheduled.

Phase 2: Clarifying and prioritising the problems that the community wishes to address

Phase 3: Getting representation from the community

This meeting is very important for motivating the community to participate. Specific objectives need to be identified e.g. improving opportunities for organised sport for females in Bosplaas.

An action-committee should be elected. It should comprise community members, and members from the health fraternity. The UP physiotherapy representative should initially be a "default" member and not the chairperson.

Phase 4: Planning

The action committee subsequently needs to plan how to implement a project. See **Appendix 6.1** for a possible schedule. Different action committee members could chair subcommittees for different objectives.

Phase 5: Implementing projects

Phase 6: Monitoring and evaluating

This should be an intrinsic part of each subcommittee's actions. Public monitoring should however not be neglected. The action team could e.g. report back to the next community meeting.

6.2.4 Suggestions for further research

- The cross-sectional design of the study emphasised inter-relationships between the risk factors. However, to understand the causal relationship between them, and other factors, would necessitate studies of a different design, for example, longitudinal studies. Previous findings that need further investigation are, for example, the properties of skeletal muscle and their relation to CHD risk factors.[413]

- A study that simultaneously measures the prevalence of the related non-communicable diseases and their risk factors, would be useful in determining the odds ratios of specific risk factors causing specific diseases.[414] This could assist in further refining the health priorities and quantifying the specific contribution of each risk factor to specific non-communicable diseases in the Bosplaas community. In such cases it is recommended that objective

measures for measuring smoking (by means of urinary continine excretion levels),[415] is suggested

- **Chapter 5** emphasised the possible role of psychological, socio-economic and cultural factors related to all four risk factors that were investigated. These factors need to be investigated, and qualitative methodology may be particularly appropriate to complement quantitative data. For example, the psychology of exercise initiation and adherence to exercise, especially in the overweight, is seriously under-researched.[416] Programmes may not be successful without paying attention to these factors.

- The complexity of the risk factor inter-relationships requires that they not only be examined in relationship to the individual in his/her local context, but also in relation to the macro-environmental influences on him/her. Allan advocates that findings from this body of research need to be translated into models,[417] which could facilitate effective programmes.

- Concurrent assessment of the nutritional status of subjects[164] in studies such as this one, is recommended, because many of the males were underweight.

- For intervention and health promotion programmes to be successful, aetiological factors for the risk factors, as well as factors that would facilitate compliance to programmes also need to be investigated.[418] Baranowski *et al.*[419] for example, recommend that changing the focus to basic behavioural and social sciences, and mediator change research should provide a more systematic and cost-effective approach to increasing the effectiveness of physical activity interventions. Basic dose-response studies in controlled settings are also needed to increase understanding of the health effects of accumulated moderate intensity physical activity.[420,421]

- Further refinement of the physical activity questionnaire. Objectively analysing the health status and needs of communities are a continuous need of district health managers and service providers.

- The specific parameters of activities of daily living and exercise in this community in terms of their nature, intensity, duration and frequency, which contribute to health need to be further clarified.[422] This information is needed before large-scale community interventions are begun, in order to choose the correct intervention for the desired effect.[423]

- A participatory action research approach in implementing intervention and health promotional programmes is suggested. Community participation is a cornerstone of primary health care, the philosophy behind current health care.[14] A shift towards a developmental approach in health care, further necessitates a participatory approach in research.

- A similar, longitudinal study in approximately a decade's time could provide useful information on the influence of possible changing socio-economical status on the health status, of the same population.

- The data from this study could serve as a baseline for planning and evaluating the expected benefit of future interventions.[424,425]

6.3 Summary

This study emphasises the importance of common risk factors of non-communicable diseases in a disadvantaged community. Some of the factors that contributed to the relatively low prevalence rates, in general, may change with improved socio-economic conditions, which is being strived for by national, provincial and district authorities from different sectors. Targeting high-risk groups, identified in this study by means of intervention programmes and maintaining low rates in other groups, are the exciting challenges facing *inter alia* the health care professionals. Effective, pro-active population-based health improvement efforts may have significant potential, even for a positive economic impact. Physiotherapists in particular have an opportunity to fully establish their role in preventative medicine, within a multidisciplinary, developmental approach. Prevention and treatment of modifiable risk factors are an important health priority.

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Appendix 2.1

The methodology of the literature search

These approaches were followed to collect relevant literature (Appendix 2.1) for the search outlines:

a) A Medline search (1993-1998) was conducted on two occasions. The initial search was carried out in order to obtain a broad overview of the concepts by reading the abstracts. Articles of specific interest were identified and relevant references arising from these articles were also perused. The second search, approximately a year after the initial search, was to identify additional relevant information published since the original search.

b) An erudite search was conducted to find all textbooks available in the Pretoria Academic Information Centre, related to the four risk factors.

c) A SABINET search of all South African dissertations and theses was carried out

d) A list of all publications, related to smoking, obesity, hypertension, and physical inactivity, supported by the MNR was scrutinised, and appropriate articles and reports ordered.

e) Related documents from the web pages of the WHO were extracted from the Internet.

f) The overview is introduced by a discussion on non-communicable diseases to contextualise the four risk factors.

Appendix 2.2

Obesity phenotypes[426]

Type	Description
Type I	Excess total or percent fat (Generally attributed to non-genetic factors. It is a multifactorial trait determined by genetic and non-genetic effects)
Type II	Excess subcutaneous truncal-abdominal fat (android)
Type III	Excess abdominal visceral fat (Increases with age in both genders. It is moderately correlated with total body fat)
Type IV	Excess gluteofemoral fat (gynoid)

Appendix 2.3

Types of height/weight indices and their formulae

Type of index	**Calculation (weight in kilograms and height in meters)**
Weight/height ratio	Weight / height
Quetelet's index	Weight / $(height)^2$
Khosia-Lowe index	Weight / $(height)^3$
Ponderal index	Weight / $(height)^{1/3}$
Benn's index	Weight / $(height)^p$

Appendix 2.4

Summary of methods to determine body composition

Type of method	Examples
Laboratory methods	Total body water measurements Deuterium, Oxygen-18, tritium Total body potassium count Densitometry (Underwater weighing) Immersion, Plethysmography Creatinine Neutron activation Photon absorptiometry Electrical conductivity Computed tomography Infrared interactance Magnetic resonance
Field methods	Skinfold thickness Height/weight indices Circumference measurements Electrical impedance

Appendix 2.5

Benefits and limitations of different options (adapted from Maud[155])

Type of measurement	Cost	Ease	Accuracy of use	Regional fat
Height and weight	+	Easy	High	No
Skinfolds	+	Easy	Low[427]	Yes
Circumferences	+	Easy	Moderate	Yes
Water($^{3}H_2$,D_{20},H_2,^{18}O)	++	Moderate	High	No
Bioelectric impedance	++	Easy	High	No
Computed tomography	++++	Difficult	High	Yes
Ultrasound	+++	Moderate	Moderate	Yes
Neutron activation	++++	Difficult	High	No
Magnetic resonance	++++	Difficult	High	Yes[428]

Appendix 3.1

Description of the action that was taken if a stand corresponding to the random number drawn, could not be included in the study, as well as the stand number each action referred to

Event	Action	Stand numbers
Opposite the street was another village	New number selected	One
Adjoining the river and surrounded by empty stands	New number selected	Thirty-two
Stand empty, and surrounded by empty stands	New number selected	Three
Empty stand	Second house to the left or right was selected	Two
Only inhabitant mentally challenged and lived on his own with no one to do proxy reporting, next to and opposite empty stands and opposite another village	New number	One
Inhabitants twice not at home	New number	Four

Event	Action	Stand
The members of the household on the selected stand functioned as a unit with the stand next door.	Everybody from the two stands were included in the selection process, and the subject lived on the stand next to the selected one	One
House was deserted	The neighbouring stand was selected	Two
The inhabitants both older than 60 years	The neighbouring stand was selected	One
One stand with people older than 60	Second stand to the right was included	One
Inhabitants older than 60 years and surrounded by empty stands	New number	One
Empty stands surrounded by stands already included in the study	New number	Three
Empty house	House next to the selected house was included	Seventeen
Cases where the initially selected stand was included in the study		Sixty-nine

Appendix 3.2

Questionnaire

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Demographic information

Resp 1- 3 | | | | Card | | 4

1. Name
2. Address: .....
.....

(Stand/plot) no: ..... Tel: ..... A1 | | | | 5-7

3. Date today: A2 | | | | | | 8-13

Y	Y	M	M	D	D

4. Gender:
   1 Male
   2 Female A3 | | 14

5. Date of birth:

Y	Y	M	M	D	D

A4 | | | | | | 15-20

6. What is your relationship to the owner of the stand?
   1 Self
   2 Wife
   3 Son/daughter/son-in-law/daughter-in-law
   4 Grandson-/daughter
   5 Mother/father
   6 Aunt/uncle
   7 Nephew/niece
   8 Other: specify..... A5 | | 21

7. What is your highest qualification? (Circle the applicable option)
   0 No schooling
   1 Standard 5 (class/grade 7) or less A6 | | 22
   2 Secondary school without matric
   3 Secondary school with matric
   4 Certificate, diploma or degree

Specify: .....

8. How many separate houses/living units are on your stand/plot? ..... A7 ☐ 23

9. What type of house do you live in? Indicate the material of the outer walls of the house in which you sleep.

1 Mud
2 (Face) brick
3 Big cement blocks
4 Corrugated iron
5 Panels A8 ☐ 24
6 Other: specify: .....

10. How many rooms does your house have?

☐ Number of bedrooms A9 ☐ 25
☐ Number of other rooms A10 ☐ 26

11. How many people are you in your household/eat together?

☐ Number of children ≤ 5 years A11 ☐ 27
☐ Number of children > 5 years, < 18 years A12 ☐ 28
☐ Number of adults (≥ 18, ≤ 60) A13 ☐ 29
☐ Number of adults over 60 A14 ☐ 30

12. How do you get water?

1 Tap(s) in house
2 Tap on stand (outside house)
3 Communal tap (free water)
4 Own bore hole
5 Buy in containers
6 Others: specify ..... A15 ☐ 31

13. Do you have electricity in your house?

0 No
1 Yes A16 ☐ 32

Please indicate whether any of the following diseases ☐

apply to you.
(Circle the applicable option or complete)

A17 33 ☐
A18 ☐☐ 34
A19 35, 36 ☐

		Hyperten-sion		Stroke		Heart disease		Diabetes mellitus			
		Yes 1	No 0	Yes 1	No 0	Yes 1	No 0	Yes 1	No 0	A20	37
										A21 ☐	38
										A22 ☐	39
										A23 ☐☐	40 – 41
Diagnosis by:	Medical 1									A24 ☐	42
	Self 2									A25 ☐	43
	Traditional 3									A26 ☐	44
Year of diagnosis (YY)										A27 ☐☐	45-46
										A28 ☐	47
Treatment? (Currently)	Yes 1 Specify									A29 ☐	48
										A30 ☐	49
										A31 ☐☐	50-51
	No 2									A32 ☐	52

Bosplaas Community healtlth Assessment (BoCHA)

1 Respondent nr 2 Card nr	V33 ☐☐☐ V34 ☐☐02	1-3 4-5
3 Blood pressure on arrival ..... /	V35 ☐☐☐ V36 ☐☐☐ V37 ☐☐☐	6-8 9-11 12-14
Anthropometry 4 Height: ..... Weight:..... 5 Waist: ..... Hips:.....	V38 ☐☐☐☐☐ V39 ☐☐☐☐☐ V40 ☐☐☐☐☐ V41 ☐☐☐☐☐	15-19 20-23 24-28 29-33

Smoking		
	V47 ☐	39
6 Do you smoke? 1 Yes 0 No		
7 If yes: what do you smoke?	V48 ☐	40
1 Pipe	V49 ☐	41
2 Cigarette	V50 ☐	42
3 Rolled cigar		
8 How much do you smoke on an average day?		
If pipe: ..... g per day	V51 ☐☐☐	43-45
If cigarettes: ..... per day	V52 ☐☐☐	46-48
If rolled cigars/zol: .....nr per day	V53 ☐☐	49-51
9 When did you start smoking?		
Year:..... or	V54 ☐☐	52,53
Age when started smoking	V55 ☐☐	54,55
10 If no: Have you smoked before?		
1 Yes 0 No	V56 ☐	56
11 If yes: for how many years:	V57 ☐☐	57,58
12 Respondent nr	V58 ☐☐☐	1-3
13 Card nr	V59 ☐☐0 3	4,5
Physical activity		
14 What is your main occupation?		
1. Student/ Scholar		
2. Home maker	V74 ☐	7
3. Retired	V75 ☐☐	8,9
4. Disabled and not employed outside the house		
5. Unemployed		
6. Employed / volunteer: office worker: Specify _____		
7. Employed / volunteer: non-office worker. Specify _____		

15	1 Fulltime 2 Part-time	V76 ☐	10
16	If part-time: How many days per week: 1 2 3 4 5 6 7	V77 ☐	11
17	At work/school I sit (Use chart #) 1 Never 2 Seldom 3 Sometimes 4 Often 5 Always	V78 ☐	12
18	At work/school I stand 1 Never 2 Seldom 3 Sometimes 4 Often 5 Always	V79 ☐	13
19	At work/school I walk 1 Never 2 Seldom 3 Sometimes 4 Often 5 Always	☐	
20	At work/school I lift heavy loads 1 Never 2 Seldom 3 Sometimes 4 Often 5 Always	V81 ☐	15
21	At work/school do you sweat: 0 No 1 Some 3 A lot Get out of breath: 1 Yes 0 No	V82 ☐ V83 ☐	16 17
22	How do you get to work/school? 1 Walk/cycle 2 Taxi 3 Public transport 4 other	V84 ☐	18
23	If 2/3: how far do you walk:	V85 ☐☐☐☐☐	19-23
24	If walking/cycling: what is your usual pace of walking? 1 Casual/strolling	☐	

	2 In between 3 Brisk	V86	24
25 26 27	Do you regularly do sport? 1 Yes 0 No If yes: which sport do you play most frequently? Specify ..... 1 Formal 2 informal: Specify.....	V87 ☐ V88 ☐ V89 ☐	25 26 27
28	If yes: How many times per week? 1 2 3 4 5 6 7	V90 ☐	28
29	During which seasons do you do it? 1 summer 2 autumn 3 winter 4 spring 5 through the year	V91 ☐	29
30	Do you take part in a second sport 1 Yes 0 No Specify..... If yes: How many times per week? 1 2 3 4 5 6 7	V92 ☐ V93 ☐	30 31
31	During which seasons do you do it? 1 summer 2 autumn 3 winter 4 spring 5 throughout the year	V94 ☐	32
32	What do you do when you are not working/ at school / playing sport: (prompt for five) _____ _____ _____ _____ _____ How far do your walk on the average day?	V95 ☐ V96 ☐ V97 ☐ V98 ☐ V99 ☐ V100 ☐	33,34 35,36 37,38 39,40 41,42 43-47

33	When you are not working/ at school / playing sport, do you sweat: 0 No 2 Some 3 A lot Get out of breath: 1 Yes 0 No If yes: How many days per week? 1 2 3 4 5 6 7	V101 ☐ V102 ☐ V103 ☐	48 49 50
Physical tests			
34	Resting blood pressure and heart rate ...../..... ..... rates per minute	V104 ☐☐☐ V105 ☐☐☐ V106 ☐☐☐	51-53 54-56 57-59
35	Post-test blood pressure and heart rate ...../.....	V108 ☐☐☐☐ V109 ☐☐☐☐ V110 ☐☐☐	65-67 68-70 71-73

Thank you for your cooperation

Please note:

Questions missing from the above questionnaire did not form part of this study. They were however asked during the fieldwork of this study for other purposes.

Appendix 3.3

Setswana Questionnaire

DEMOGRAPHIC

1. Leina:

.....

2. Aterese ya ntlo:
.....

.....

Namoro ja mogala:

3. Letsats: La Gompieno:

Ngwaga
Kgwedi
Letsatsi
La gumpieno

4. A O?
I. Monna kapa II. Mosadi

5. Letsatsi La Matsalo:

Ngwaga
Wa Tsalo
Kgwedi
Ya Tsalo
Letsats
La Tsalo

6. O Tsalana katsela efe le moo nnany?

i. Ke mo ga gago
ii. Ke mo ga mosadi wa gago
iii. Ke ntlo ya ngwana wa gago
iv. Ke ntlo ya motlogolo wa gago
v. Ke ntlo ya batsadi ba gago
vi. Ke ntlo ya ntate mogolo kapa mmemogolo wa

7. Ka thuto - le rutegile jang/go fitlha kae? O ga o aka wa tsena sekolo

i. Mophato wa bo tlhano kapp tlhase. Ga mophatho wa bot tlhano.
ii. Go fitlha ka junior setifi kate (Mophato wa borobed:)
iii. Go fi tlha ka mophato wa bolesome
iv. Diploma kapa degree ya universiti

8. Go nale dintlwana tse kae mo jarateny ya gago.

9. Ntlo ya gago e ruletswe ka eng?

i. Motoro
ii. Ditena
iii. Ditena tsa semente
iv. Kadtshipi
v. Ka mokgwa o mongwe: ke eng mokgwa oo?

10. Ntlo ya gago e nale di ka more tse kae?

11. Go nna batho ba bakae mo ntlong ena?

Ba tlase ga mengwaga e tihano ba ba kae?

Ba godimo ga mengwaga e tihano mme tihase ga somerobedi ba ba kae

Ba godimo ga some robedi mme

Ba godimo ga some a marataro ba ba kae?

12. Metsi a fumanwa jang/kapa a bonwa ka tsila efe?

i. Ka tepe ya montlong
ii. Ka tepe ya kontle
iii. Ka tepe ya mo motseng
iv. Ka go epa le khuti
v. Ka go a reka ka diemere
vi. Ka tsela ennywe: tsela e jang?

13. A o nale motlhakase mo ntlong?
O nyaa

1. EE

14. A O nale malwetsi/bofokodi a latelang?

Bolwetsi ba
High blood
(Madi)
Bolwetsi

ba gowela
mofatshe?
Bolwetsi
ba pelo
Bolwetsi
ba sukere

EE ?
Nyaa ?
- O
1. EE
?
O Nyaa ?
1. EE
?
O. Nyaa ?
1. EE
?
O.
Nyaa ?

O Tseble ka
Eng kapa jang
1. Ka Ngaka ya
2. Ka bowena
3. Ka Ngaka
Ya Setswana

Wgwaga o boneng
bolwetsi ka one

Bolwetsi bona
O bo Tihokometse
1. EE
Ka tsela efe

2. Nyaa

BOCHA

3. A OA goga/tsuba 1. EE O Nyaa

4. Fa O goga/tsuba: O goga eng?

i. Giyarete
ii. Peep:
iii. Zolo kapa B.B/boxer

5. O goga/tsuba ga kae ka letsats: le
Tihwae leg: leng?

Fa O goga/tsuba peepe - ke tse kae?
Sigarete tse kae ka letsats:?
Motsko wa boxer/BB tse kae
Ka letsatsi?

6. O simolotse go goga.tsuba ka Ngwa ga mang?
Mengwaga ya gago eng e le kae fa O simolola go goga/tsuba?

7. Fa O sa goge/tsubi: A O kile wa goga/tsuba pejana?
1. EE O Nyaa

8. Nomoro ya mmuiwa
9. Nomoro ya karata

10. A O kgona go itlhokome ia ka
Bowena ke gore A O kgona

Go ijesa dijo
Go ikapesa diaparo
Go itihapisa mmele ka bo wena
Go ikisa Ntlwaneng ya biothotelo

11. A O kgona go itsamaisa mo jarateng?

12. A O kgona go Tsamaya mo setarateng?
13. A O kgona go namela ditepise kapa felo go namelang?

14. A O kgona go siana?

15. A O kgona go dira tiro e bofefo jaaka go tihatswa dijana kapa go kolomaka

16. A O kgona go dira tiro e nnyane jaaka go fiela mo ntlong kapa go rwala dilo

17. A O kgona go dira tiro e thata mo ntlong jaaka go Rwala finitshara?

18. A O kgona go dira mo temong jaaka go lema?

19. A O kgona go robala kapa go utlwana le mosadi?

20. A O kgona go tshame ka dipapadi jaaka kgwele ya maoto, golofo,tenese? Bolo ya matsogo kgotsa bolo ma? maoto

21. A O kgona go tshameka dipapadi tse bioma jaaka go thuma, kgwele ya mao to le tse dingwe? Whole game

22. Nomoro ya mmiwa

23. Nomoro ya karata

24. Mobophelong O dira eng?

A O i. Ngwana wa sekolo
ii. Nna mo gae
iii. O febitse go dira/bereka - O mo pensin
iv. Ga O kgone go dira ka baka la go gobala
v. Ga O dire/bereke
vi. Wa bereka - O berekela lefela kapa go thusa batho
vii. O bereke/dira tiro ya O fisi

25. Mmerekong/tirong kapa sekolong
O phela O ntse mo fatshe/O eme ka maoto kapa wa tshamaya?

i. Nyaa
ii. Nako ella fela
iii. Ka maka engwe
iv. Ga ntsi

26. Tirong/sekolong O phela O ntse ka mao to

i. Nyaa
ii. Nako ela fela
iii. Ka nako enngwe
iv. Ka metla
v. Ka metiha gotlhe

27. Tirong/sekolong O phela O tsamaya

i. Nyaa
ii. Nako eia fela
iii. Ka mako enngwe
iv. Ka nako yo tihe

28. Ko tirong O phela O tsholetsa dilo tse thata

i. Nyaa
ii. Nako ela fela
iii. Ka nako enngwe
iv. Gants

29. Ko tirong O dira ka thata gore ebile O tshwe mofufutso?

O Nyaa I. Bo nnyane fela

3. Bongata fa O hema

1. EE
O. Nyaa

30. O ya ka eng tirong?

1. Ka tekisi
2. Ka bese kapa terena
3. Ka go tsamaya ka ma o to kapa baesekele

31 Fa O tsamaya ka maoto kapa ba ese ke la: O tsamaya jang

1. O tsamaya O iketlile
2. O tsamaya O ikhutsa

32. A O nale go ikwetlisa ka metiha/mako yo tlhe?

1. EE
O Nyaa

Fa O male go ikwetlisa - ke papadi efe eoe tshame kang ka gale?
Fa O nale go ikwetlisa

33. O ikwetlisa ga kae ka beke

1. Tlase ga tharo
2. Ga raro le kogodimo

34. Fa O male go ikwetlisa O ikwetlisa neng

1. Ka selemo
2. Fela morago ga selemo mme pele ga mariga
3. Mariga
4. Fela moragy ga mariga mme pele ga selemo

35. A gonale papadi: enngwe e O e Tshamekang

1. EE
O Nyaa

Fa ele teng? O E Tshameka gakae ka beke

1. Tlase ya tharo
2. Thanks kapa godimo

36. Papadi E ya bobedi E O E Tshamekang O E Tshameka neng?

1. Selemo
2. Morago ga selemo mme pele ga mariga
3. Mariga
4. Marago ga mariga mme pele ga selemo

37. Ka nako e O sa direng tiro kapa O sa Tshameke papadi - A O nale Go fufulelwa?

O Nyaa
1. EE mme gannyane fe ia + O dira eng

3. Gamgata fa O hema 1. EE
O. Nyaa

38. O dira eng Fa O Sa bereke/F A ose Tirong kapa O Sa Tshameke papadi?

39. Same as 37 in Tswana (It?s 1 Question) One and the same

40-45 Not translated

46. A gowale lebaka le dirang gore O SA kgona go Tsamaya ka go. Tlhwaelegileng?

1. EE
O Nyaa

Ke lefe le baka mo go A latelang

01 Peine ya maoto
02. Peine ya maoto
03. Botihko ba maoto
04. Maoto A lapile
05. Mabaka a mangwe jaaka eng?

Appendix 3.4

Informed Consent Form

Bosplaas Community Health Assessment

I, _____ willingly agree to participate in the study which has been explained to me by _____. The Department of Physiotherapy, University of Pretoria, is conducting this research. All the people in Bosplaas have an equal chance to be included in the study, but approximately 120 people will be chosen at random.

Purpose of the study

You have been invited to participate in this research study. The purpose is to determine the number of people in Bosplaas who a) are physically active, b) smoke cigarettes c) are not overweight and d) have high blood pressure and other some other factors.

Description of procedures

This study, therefore, involves research. To ensure your well being and to ensure that the results of the study could be meaningfully utilised in making decisions on intervention measures in the future, it is important that no exceptions should be made to the standard procedure to be followed by the field worker.

The researcher will ask you for some information by means of a questionnaire. A measurement of your weight, height, circumference of your waist and hip will then be carried out. For the latter test you will be required to remove your shoes and bulky clothes. Your pulse rate and blood pressure will be taken, whereafter you will have to walk for 6 minutes between two pre-determined marks. During this test the field worker will closely monitor your condition, eg if you do become exceptionally breathless
or sweaty. If necessary he/she will stop the test. Subsequently your pulse rate and blood pressure will again be determined.

Foreseeable risks and discomfort

The questionnaire and physical examinations should take approximately 40 minutes of your time. Despite protecting your integrity, you might feel a bit self-conscious during the anthropological measurements.

Should an injury occur during participation in the study, the researcher will transport you to the Bosplaas clinic. If your condition renders it necessary, you will be referred to higher levels of care, in accordance with routine referral protocols.

Potential benefit

A further stage of the research comprises a health promotional intervention programme. People taking part in the initial programmes will be chosen at random, so that **no guarantee can be given for your inclusion in such an initial study.** However, if the intervention deems positive, continuation of the programme will be announced publicly.

Contact persons

Miss Karien Mostert, Lecturer: Department of Physiotherapy or Mrs AJ van Rooijen, study leader and head of the Department (tel (012) 354 1100, Fax: 354 1888, e-mail: kmostert@medic.up.ac.za) will provide the questionnaires and the blood pressure apparatus.

Alternatives

Instead of this study using only a sample from the community, a door-to-door survey is an alternative. The latter method, however, is very expensive and time-consuming. The added accuracy would not justify the extra utilisation of resources.

Voluntary participation

Participation in this study is voluntary. No financial compensation will be given. You are free to withdraw your consent to participate in this investigation at any time without prejudice to your subsequent care. Refusing to participate will involve no penalty or loss of benefits. You are free to seek care from a physician of your choice at any time. If you do

not take part in or withdraw from the study, you will continue to have access to the health facilities in Bosplaas.

Confidentiality

A record of the result of this interview will be kept in a confidential form at the University of Pretoria and also on computer files in the office and on the personal computer of the researchers. During the analysis of the data the researchers will have access to the records which contain your identity. However, no information by which you can be identified will be released or published.

All of the above has been explained to me, I had time to ask questions, received answers concerning areas I did not understand, and I willingly give my consent to participate in this study. Upon signing this form, I will receive a copy.

_____ _____

Subject Signature Date

_____ _____

Witness 1 Signature Date

_____ _____

Field worker Signature Date

Appendix 3.5

Discussion of the initial phase of analysing the data

a) Processing of data

In the following section the procedure to process the data will be discussed.

b) Editing of data

Office editing was done, checking again for completeness and consistency within the questionnaire and the coding.[429] Doing this manually had the advantage that the researcher became even more familiar with the data. Data were checked question by question, to ensure that each was treated uniformly.

c) Coding

Data were manually transferred from their raw form to a form that was better suited for tabulation, in a column to the right of the questionnaire. The typed, coded data were read back and checked by a second person. For computer use, all data were coded and checked by the researcher and entered into the computer by a data typist.

The initial computer printouts were checked and corrected by the author. The coded data were edited primarily by searching for the types of errors illustrated with examples in the following table.

Examples of data checks that were done by type of possible error

Type of error	Example(s)
Illegal codes:	Gender A3 A value other than 1 or 2 Date of birth after 1937-12-10 or before 1979-12-10 (inclusion criteria ages): A4 Only specified codes at the following: A5 - 8, 10 - 16, 18, V50, V 76 –83, V111, V74, 77 Total of Duke scale more than 57,7
Omissions	V47 = 1 and V 48 - 57, 54,55 without data, where V 47 = 0 and " has data V 87 = 1 and V88-91 is empty V101 of V 102 = 1 / 3 en V103 is without data
Logical inconsistencies	V54 later than date of birth A4 Year that started smoking later than date of birth A4 Systolic blood pressure > as diastolic blood pressure: V35, 36, V 104, 105, V 116, 117, V 105 > V 104, V 109 > as V108 V41 > as V40 Waist circumference< hip circumference V 39 > V 38 Height>waist
Improbabilities	V35 (SB) Range between 70 and 170 V36 (DB) Range between 53 and 110 PR V 37 Range between 42 and 119 Height V38 Weight V39 Waist V40 Hips V41 V112 = 01 then V113 must have a value

Computer editing

The computer was used to apply some of the editing rules explained in the previous section, because some errors remained after the manual edit. These were detected when starting to analyse the data. For example, the printout had more missing observations, than the non-response rate. Computer editing, at this stage was quicker, cheaper, more exact, and more uniform that manual editing.

e) Data reduction

The three separate stages of analysis in epidemiological studies[299] were followed.

Each variable was analysed separately, using frequency tables
The range was then divided into intervals and the number of units falling into each interval was tabulated

The following rules were considered[430]

- when grouped, the different categories were mutually exclusive as well as exhaustive
- the tabulation had internal logic
- was consistent and ordered and intervals were of uniform size
- when dealing with scores of whole units. intervals were not so small that they could not be summarised, nor so large that they could conceal the most important characteristics of the distribution
- Where possible data coincided with the categories as indicated by the code on the questionnaire.

Pairs of variables were analysed using two-way tabulations. Summary statistics appropriate means, percentages and standard deviations were calculated[431]

The notion fundamental to data reduction is that certain observations in a set of data are equivalent and it is easier to deal with equivalent observations after they have been summarised.[432]

Appendix 3.6

Combination of categories for classes that were used in the final analysis

Variable	Combined categories	New category
Age oudjr	Those younger than 30 years of age	1
	Those 30 to 39 years of age	2
	Those older than 40 years of age	3
Oud_kat		
	20-24	1
	25-34	2
	35-44	3
	45-54	4
	55-59	5
Age	<31	1
	31-45	2
	>45	3
Level of education	0 and 1	1= Highest qualification grade VII (2 = matric)
	3 and 4	3= a tertiary qualification
Type of house	1,4,5,6	=1Non-permanent walls
	3 (change from a nominal to an ordinal scale)	=2Big cement brick walls
	2 (change from a nominal to an ordinal scale)	=3Face brick walls
Availability of water	1,2,4	Water available on the stand
	3,5,6	Water not available on the stand

Variable	Combined categories	New categories
Hypertension	3	0 = normotension 1 = hypertension
Occupation	Recorded using categories from the Modifiable Activity Questionnaire and the Baecke Questionnaire of Habitual Physical Activity as guidelines.	1 = Low intensity 2 = Moderate intensity 3 = High level

Appendix 3.7

Formulae used in the analysis of the data

Variable	Formula	Cut-off points
Demographic index	(Educational level + type of housing + availability of water)	Less than 3 = low score
Quetelet Index	Weight / (Length)^2 V39 / V38*0.01**2	Standard reference Cut-off points suggested by Bray were used as this co-coincides with other South African studies and facilitate comparison between the studies.[433]
Waist-hip ratio	V40/V41	Standard reference.
Occupational index	5*(VV78+V79+V80+V81)	<45 = 1 >45 and < 65 = 2 > 64 = 3
Sport index	(VV88*V90*VV91) + (VV91*V93*VV94)	< 600 = moderate >=600 = active
Leisure index	Mean (of VV95-VV99)	1= 1 >1 = 2
Intensity of leisure time activities	(V101*V102)*V103	

V = the appropriate variable as number on the Questionnaire (**Appendix 3.2**)

Appendix 4.1

Additional results

Hypertension

Blood pressure values (in mmHg)

Parameter	Mean (SD)	Range
Systolic blood pressure	121(19)	78 – 170
Diastolic blood pressure	75 (10)	55 – 112

Occupational physical activity

Frequency distribution according to level of occupational physical activity (n=85, 14 was not employed)

Parameter	Frequency
Intensity to stimulate the cardio-vascular system	
Sweat :	
Adequate	16 (20%)
Inadequate	69 (80%)
Get out of breath:	
Yes	19 (23%)
No	**67 (77%)**
Distance walked/cycled to work (in metres)(mean = 1 900 (SD 2 800), **range:** 0 – 12 000)	
Using other modes of transport, or work from home	58
Less than one kilometre	22
Between 1.5 and 12 kilometres	19
Pace of walking/cycling	
Slow or in between	61
Brisk	38

Participation in sport

Frequency distribution of certain parameters of participation in sport (n=22)

Parameter	Frequency
Type of participation (n=22)	
Formal participation	11
Informal participation	11
Frequency (n=21)	
Less than three times per week	7(33%)
Three or more times per week	14(66%)
Seasonal participation in sport (n=21)	
Part of the year	(33%)
All year round	14 (66%)
Participation in a second sport (n=99)	
Yes (all four quarters, but less than 3 times per week)	4
No	95

Leisure time activity

Levels of leisure time physical activity in terms of stimulation of the cardiorespiratory system (n=99)

Level	Frequency
Neither intense, nor frequent enough	40
Intense, but not frequent enough	30
Adequate intensity and frequency	29

Appendix 5.1

Prevalence rates for the common risk factors in different communities

Tobacco addiction

Country	Males	Females	Total
This study	45	8.47	23.23
SA: Provinces[62] Northern Cape Western Cape North West Province			 55 48 31
Whites, Cape Province[88]	34.2	12.8	
Zimbabwe[359]	36.1	1.3	
Vietnam[79]	72.8	4.3	
Louisiana USA[434] (low income)			26.2
Baltic Republics[435] Estonia Latvia Lithuania	 53.9 56. 53.2	 24.1 10.9 7.6	
China[436]	63.0	3.8	
Saudi-Arabia[361]	21.1	0.9	
Cambodia[437]			Rural:86 Urban:65
USA[438]: Black White Hispanic	56.0 43.2 55.4	20.2 27.1 21.4	
Denmark[362]	38	21	

Hypertension

Country	Males	Females	Total
Brisk Study, Cape Peninsula: Blacks[83]	9.2	12.9	
CORIS-study[88] White towns	19.7	15.8	
Orange Free State[87]			
Rural			29.0
Urban			30.3
Jamaica[439]	19.1	28.2	
America[440]			24
Paraguay[441]			17.1
MONICA studies[113]	>30 in 12 centres	>30% in 10 centres	

Obesity: according to the BMI

Country	Males	Females	Total
This study	5.0	29.41	19.0
SA: CORIS study, Cape Peninsula,			
Whites	14.7	18	
Coloureds	6.1	25.9	
SA Brisk study, Cape Peninsula: Blacks[83]	7.9	44.4	28.0
Bulgaria[442]			23.1
Germany[268]	25.9	23.8	
Louisiana[436], USA Low-income Clinic patients			63.5
Belgium[443]	12.1	18.4	

Abdominal adiposity (waist circumference > 102 for males and >88cm for females)

Country	Males	Females
USA[440]		
White	27.1	43.2
Black	20.2	56.0
Hispanic	21.4	55.4
Nigeria	1.6	12.3
Cameroon[377]	5.1	38.9
Jamaica[441]	5.5	34.0
Barbados[441]	7.8	44.7
USA[440]	21.7	54.1

Physical inactivity

Country/ City	How measured	Males	Females	Total
This study: Physical inactivity in terms of:				
Occupation	Occupational title			27.0
	Occupational index	40	11.86	23.0
	Cycling or walking to and from work			71.0
Sport	Non-participation	65	88.14	73.0
Leisure	Leisure time index			25.0
SA: rural whites[220]	Sedentary leisure time activity group(index)	74	84	
Brisk study[83]: Cape Peninsula, blacks	Unemployed	41.4	59.3	
	Non-participation in sport	>30	>30	
Metropolitan Cape Town: Black men	Sedentary at work	57		
Curacao, Caribbean[394]	Non-participation in sport			75
Louisiana, USA[436] Low-income clinic patients	Behavioural Risk Factor Surveillance			47.1
Greenland[444]	Inactive (index)	14	30	
Denmark[444]	Inactive (index)	14	17	

West London[445] South-Asians Europeans Afro-Caribbeans	Walking at least 2,5 km/d		(22.0) (44.0) (40)	
West-London South-Asians] Europeans Afro-Caribbeans	Inactive at work (Index)		37 56 60	
Urban America[446] African-American Mexican-American White	Not moderately or vigorously activity most days of the weak for at least 30 minutes		92 89 87	
Washington State, USA	Non-participation in regular recreational Exercise		50.0	

Appendix 6.1

An example of a core planning document for Bosplaas

Objective	Resources	Action
Facilitating organised sport e.g. netbal	**Facilities:** - Netbal fields at the two primary schools in Bosplaas East - An open stand in Bosplaas West	Negotiate with the schools' principal and the tribal authority
	Apparatus: Balls and shoes	- Approach businesses in the Temba and Babalegi areas for donations - Organise a fund raising event such as a fun-walk
	Coaches: Volunteers e.g. local teachers or athletes.	Recruitment, training and support
	Physiotherapy students on could be involved in different aspects of this projects	- save stretching - recruiting players - fund raising - facilitating games between teams from Bosplaas East and West.

Objective	**Resources**	**Action**
Health education on smoking obesity, hypertension and physical activity This should include information *inter alia* on the four risk factors, as well as guidelines on a healthy life style.	**Posters and pamphlets** - Obtained from the National Department of Health, the Anti-Tobacco League, the Cancer Association, Nestlè and Weight Watchers - Developed by various experts working in the community (see next paragraph) **Experts with knowledge related to the four risk factors** e.g. - Students from the various departments of the Faculty of Health Sciences e.g. physiotherapy and human nutrition - Staff from the clinic and Jubilee Hospital - Traditional healers	Distribute and display e.g. -- at community events (such as organised by the Electricity Forum) - at different places (e.g. at the local shop, where television is being watched) - Give talks and presentations s - Screening tests e.g. • at the local clinic, • at meetings of various groups, such as the ANC Women's League, • at schools.

Appendix 6.2

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