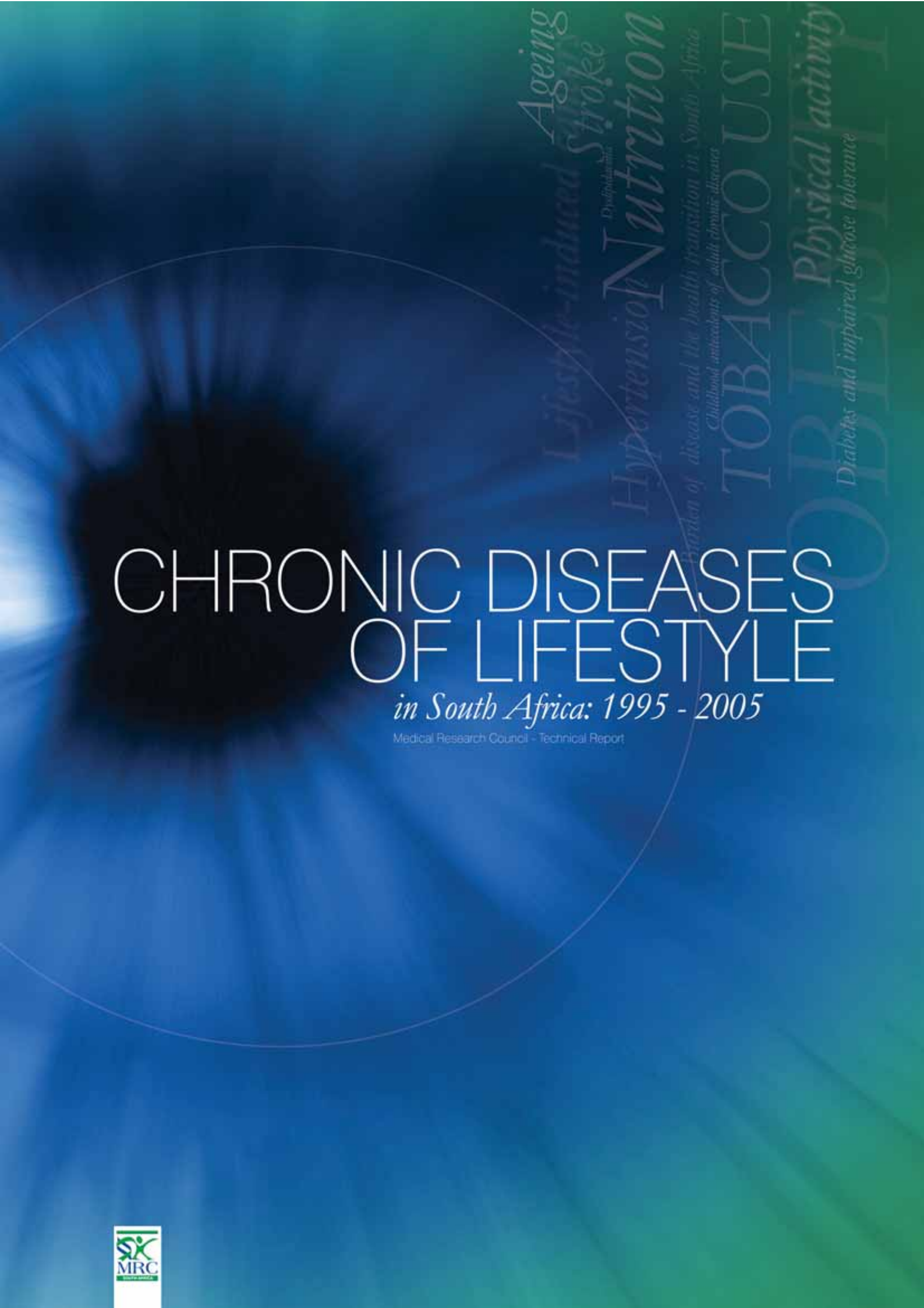

CHRONIC DISEASES OF LIFESTYLE

in South Africa: 1995 - 2005

Medical Research Council - Technical Report

MRC

CHRONIC DISEASES OF LIFESTYLE IN SOUTH AFRICA:
1995-2005

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DEFINITION OF CHRONIC DISEASES OF LIFESTYLE

Chronic diseases of lifestyle (CDL) are a group of diseases that share similar risk factors as a result of exposure, over many decades, to unhealthy diets, smoking, lack of regular exercise, and possibly stress. The major risk factors are high blood pressure, tobacco addiction, high blood cholesterol, diabetes, and obesity. These result in various long-term disease processes, culminating in high mortality rates attributable to strokes, heart attacks, tobacco- and nutrition-induced cancers, chronic bronchitis, emphysema, renal failure, and many others.

PREFACE

Chronic diseases are a growing cause of death and disability in South Africa. The pattern of chronic disease is changing as the determinants and risk factors for chronic diseases develop in this society in transition – a process dubbed 'the epidemiological transition' by Omran.[1] This epidemiological transition, therefore, is predicated upon demographic and nutritional transitions as socioeconomic development and increasing globalisation alter the patterns of chronic diseases in South Africa.

Though the classical risk factors for chronic diseases seem to operate in much the same way in all South African races as they do in high income countries, their manifestations differ somewhat. For example, stroke supervenes at a younger age and haemorrhagic stroke is more common than thrombotic stroke.

This MRC Technical Report catalogues the epidemiology of chronic diseases of lifestyle in South Africa, providing an excellent basis upon which evidence-based health promotion policies can be formulated. Prevention is of course the key, in terms of both likely efficacy and cost-effectiveness. These themes are broadly outlined in the pages of this report.

The intersectoral nature of the required responses to this epidemic are outlined, as well as the multidisciplinary approach required to do research and provide care in this field. Building upon a wealth of local and international data on the causation, epidemiology and management of chronic diseases, the report provides a state-of-the-art analysis of chronic diseases in South Africa.

As with the Technical Report of 1995, this document is likely to take its place as essential reading for both health care workers and policy makers concerned about preventing, monitoring, treating and rehabilitating chronic diseases of lifestyle in South Africa. The authors are to be commended on a job well done, in playing their part to stem the growing tide of chronic diseases in South Africa.

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[1] *Omran AR. The epidemiologic transition theory: A preliminary update. J Trop Pediatr 1983: 29: 305-316.*

INTRODUCTORY COMMENTS

Krisela Steyn and her colleagues have produced the MRC's second Technical Report on Chronic Diseases. Like the first, it is an exemplary example of how best to integrate evolving epidemiological, clinical and basic science with public health policy and health service issues. Over the last decade, the epidemiological challenges have increased in South Africa. HIV/AIDS has now ballooned to become the major cause of death, while injuries and violence remain important, and chronic diseases, especially cardiovascular disease (CVD), diabetes, chronic respiratory disease and certain cancers, have steadily emerged as major threats to health across the spectrum of South Africa's diverse racial and social class groupings.

The report draws heavily on the nationwide Demographic and Health Survey of 10 000 households to provide some of the best data on risks driving the increases in disease incidence available anywhere in the world. As Executive Director of the cluster responsible for chronic diseases at the World Health Organization (WHO) until 2003, I was acutely aware of how the lack of high-quality country-specific data frustrated our efforts to give priority to tackling the seedbed of epidemics we knew were being fuelled by tobacco, unhealthy dietary changes, a collapse of physical activity and high levels of alcohol consumption. This report fills such a gap for South Africa and provides a template for other low-middle income countries to emulate. It comes at a time when academics and the WHO have recognised the urgent need for action.[1,2]

The authors are drawn from many disciplines and have cited the most current research produced by South Africans over the last decade. They have not done so in a parochial way, rather they have interpreted trends in South Africa and the state of science within the context of global trends and knowledge. They are acknowledged international experts, and many of them are actively sought to provide high level policy advice by major international agencies, including WHO and international heart, diabetes, tobacco control, sports and cancer organisations.

Several unique features of the report deserve wider debate within South Africa. First, a number of authors highlight the reality of how infectious diseases and chronic disease risks interact in deadly ways. For example, chronic bronchitis is caused by tobacco, past tuberculosis (TB), exposure to domestic fuel and occupational exposures. All require attention. Yet there are few places in the world where a truly integrated approach to chronic bronchitis exists. Moreover, studies in South Africa, China and India indicate that smokers are at considerably greater risk of death from TB, yet no TB clinic anywhere integrates tobacco cessation with TB treatment. Authors indicate how the significant success being achieved in extending the lives of those with HIV/AIDS through use of antiretrovirals may be limited if the atherogenic consequences of the drugs are not considered in long-term users. And with increasing levels of obesity being reported, the possible effects on TB will need greater attention. The report calls implicitly for the arbitrary infectious-noninfectious disease divide to be bridged.

Second, the authors stress the need for comprehensive health systems responses that go beyond the current disease or risk factor specific approaches. If South Africa could develop and document the impact of such integrated approaches from a health and economic perspective, it would contribute not just to better health in South Africa but to an emerging global debate about the future of health systems and how they need to be transformed to address the new threats of chronic diseases, be they AIDS, diabetes, TB or CVD.

The broader determinants of chronic disease risks are well described. The downside of uncontrolled globalisation with mass marketing of unhealthy products, increased trade and foreign direct investment in sectors, that if left unregulated lead to increased consumption of tobacco and alcohol, and the impact of urbanisation on risks and diseases, are appropriately mentioned. However, the response to these threats are not as well described, and the positive aspects of globalisation – better access to knowledge

and research about prevention and cure, new technologies and drugs, better organisation, and ability of civil society to tackle common threats to many countries by working together across the borders through the Internet – receive scant attention.

The high quality of work on describing the impact of chronic diseases – especially tobacco and diet/physical activity – has led to South Africa being seen as a world leader in tobacco control and in efforts to tackle physical inactivity and obesity in low-income populations. During the negotiations for the WHO Framework Convention on Tobacco Control (FCTC), South Africa played a leadership role in ensuring that the final text encompassed the most effective measures that succeeded in reducing tobacco consumption in South Africa over the last decade. This leadership role continues during the evolving implementation process of the FCTC during which time South Africa is continuing to strengthen its tobacco control laws to better protect the health of its people.

Tackling obesity will be more complex; nowhere in the world is there an example outside of a war or famine of obesity levels going down in a large population.[3] The trends reported in the report on obesity and type 2 diabetes are extremely worrying and demand strong multi-sectoral action. South Africa has a chance to provide leadership in obesity control.

This report documents the size of the chronic disease problem, and the likely future impact of chronic diseases on health and the economy. By doing so the authors draw attention to the severe consequences of inaction for ill health and suffering. In the right hands, this report could significantly contribute to much needed action in South Africa and around the world.

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CHAPTER 1

CONCEPTUAL FRAMEWORK
FOR CHRONIC DISEASES OF LIFESTYLE IN SOUTH AFRICA

Krisela Steyn[a]

1. INTRODUCTION

The quadruple burden of diseases in South Africa has serious consequences for the prevention and cost-effective management of chronic diseases and the unhealthy lifestyles and risk factors that precede them. The disease patterns in this region are characterised by a combination of poverty-related diseases together with the emerging chronic diseases associated with urbanisation, industrialisation and a westernised lifestyle. This double burden of diseases is exacerbated by high injury rates associated with the social instability of violence or high crime rates, and by the exploding epidemic of HIV/AIDS across the African continent. This multiple burden represents a demand on the health services of South Africa far beyond those experienced in developed countries and what the limited resources can accommodate. Because little recognition is given to the magnitude of the burden of chronic diseases of lifestyle (CDL) in South Africa, and prevention of unhealthy lifestyles, early diagnosis and cost-effective management of CDL risk factors are low on the list of priorities in relation to the other competing groups of diseases. The consequences for health care are inadequate preventive measures and care for CDL. Therefore, it has become critical that South Africa utilise its limited resources optimally and implement cost-effective health-promotion interventions to prevent the predicted epidemic of CDL in the face of all the other health needs in this region.[1,2]

2. INTERRELATED ASPECTS OF AN UNHEALTHY LIFESTYLE, EMERGING RISK FACTORS AND THE RESULTING CHRONIC DISEASES

The three most relevant elements of the unhealthy lifestyle predisposing to the development of chronic diseases are the long-term use of tobacco products, the lack of regular aerobic exercises during adult life and the consumption of an unhealthy diet over many decades. The latter refers to a diet resembling that of most developed westernised countries and consists of high levels of saturated fat, particularly of animal origin, and an imbalance between the different polyunsaturated fatty acids. This diet is also very high in sodium (salt), cholesterol, alcohol, sugar and energy intake, and very low in fibre, vitamin and trace element intake.

The adoption of an unhealthy lifestyle as set out above is later followed by the emergence of a range of CDL risk factors such as obesity, hyperlipidaemias, hypertension, diabetes, and tobacco addiction. These risk factors in their own right contribute to a range of disease processes like atherosclerosis, end-organ damage and the development of neoplastic cellular changes, which include tobacco- and nutrition-induced cancers, stroke, ischaemic heart disease, chronic obstructive pulmonary disease, emphysema, renal disease, cardiac failure and other end-stage diabetes complications, osteoporosis and liver cirrhoses. The interrelationships of the unhealthy lifestyles, risk factors and the resulting diseases are shown in Fig. 1.[3]

These interrelationships of unhealthy lifestyles, risk factors and the resultant chronic diseases emphasise the need to plan integrated comprehensive intervention programmes to manage chronic diseases in South Africa. Consequently, while acknowledging that each aspect of an unhealthy lifestyle and each risk factor require specific interventions, it would be inappropriate for a country's health services to develop intervention programmes focusing only on one risk factor or chronic disease without considering all the aspects of an unhealthy lifestyle and CDL risk factors. Such a single-minded

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approach could only have a limited impact in reducing the burden of CDL in South Africa. The biggest impact will be made by an integrated approach that promotes all aspects of a healthy lifestyle, including the early diagnosis of all CDL risk factors and their cost-effective management to reduce and postpone these diseases.

Another aspect is the synergistic effect that multiple CDL risk factors have in patients when considering all the risk factors in an integrated way. For example, the impact on total risk to develop cardiovascular diseases (CVD) grows exponentially as the number of risk factors increases in individual patients. Large cohort studies have enabled the development of formulae to express the total risk for patients or groups of patients who may have a CVD event in the future, by quantifying the impact of all the risk factors present in individuals. The most common total risk assessment formulae are based on data from the Framingham study conducted in the United States of America.[4] The total risk is usually expressed as the percentage chance of having a CVD event in the following 10 years.[4]

Two aspects of the total CVD risk formulae are of significance for South Africa. The first aspect addresses the applicability of formulae, such as the Framingham, to people from African origin, as they were developed in cohort studies on westernised people from mainly Caucasian origin. It is unlikely that a large cohort study similar to the Framingham study will be conducted in the resource-poor countries of sub-Saharan Africa to either generate regional appropriate formulae or validate these formulae for people of Africa. The second aspect involves a cost-effective approach for a country with scarce resources. This is achieved by the identification of those people who have the highest total risk of developing CVD in the future. These high-risk individuals would glean the most benefit through treatment in this community. Consequently, this approach will provide the best use of scarce resources.

However, these total risk calculations require determining serum total cholesterol levels and, at least, fasting blood glucose levels. These biochemical markers are frequently too expensive for poor countries. The need to develop total risk assessment formulae based on easily and cheaply measurable CDL risk factors is thus illustrated. These new formulae, however, would have to be validated in large cohort studies in developed countries where the necessary resources are available.

3. UNDERLYING INFLUENCES ON EMERGING CDL RISK FACTORS

3.1 Urbanisation

The impact of urbanisation on the emergence of CDL risk factors in sub-Saharan African countries is one of the major influences on the population, which is undergoing unprecedented levels of migration from century-old traditional lifestyles in rural areas to the large peri-urban settlements of cities in the region. Urbanisation has an effect on almost all the aspects of the migrants' lifestyle that contributes to increasing levels of CDL risk. This includes the influence on the migrants' diets, exercise patterns and the amount of tobacco products they use. In most cases reported, the diet of people in urban settings is more energy rich, with a higher salt, fat, and processed sugar-based intake, while fibre and potassium intake is lower because of less fruit and vegetables, than found in rural settings.[5] Most studies have also shown higher rates of tobacco use in the cities than in rural settings. In the urban settings, people tend to do less aerobic exercise. They use public transport and thus walk less, tend to do less labour-intensive work, and tend to watch television even in the poorer urban settings, compared to those living in rural settings.

Some examples of urban:rural CDL risk factor comparisons in South Africa will be discussed in the sections on the specific risk factors. However, a well-designed Kenyan study by Poulter and others is worth mentioning here. In a longitudinal migration study in Kenya Luo migrants who moved from a setting with low blood pressures (BP) to the city, Nairobi, had an increased BP after 6-12 months. An increase in salt consumption measured as an increase of the urinary sodium:potassium ratio, increased weight and pulse rate were also associated with the higher BP. Migration to an urban setting is a stressful life event and the increased pulse rate observed in the migrants suggests increased experience of stress compared to what their rural counterparts experienced.[6,7]

A number of cross-sectional studies in South Africa have shown that the people who have spent a larger proportion of their lives in an urban setting had significantly higher rates of diabetes, hypertension and smoking tobacco (women only) than those who had spent only a small proportion of their lives in the city.[8,9]

3.2 Globalisation, the media and advertising

The influence of globalisation and the media on South Africa and other countries in the region is of particular importance to the emergence of CDL risk factors in the region. This is most prominent for tobacco consumption in the region. As tobacco-control initiatives in the developed world increased dramatically, the tobacco industry needed to find new markets for their lethal products. With aggressive marketing, they soon succeeded in establishing such markets outside the developed countries by portraying young smokers as being successful in many spheres of life. For many people in the developing world cigarettes became an accessible way to participate in what is perceived to be the desirable westernised (American) lifestyle. In documentation of the tobacco industry available online, decisions on these websites indicate that policies of international companies in developing countries, including sub-Saharan Africa, involved setting up joint ventures with the smaller local tobacco companies. These would allow cheaper local tobacco brands to function as 'entry' products, while the imported higher-priced brands associated with social and economic success were actively advertised. Young adult smokers, and males and females in urban and cosmopolitan settings are their main targets.[10-12] Fortunately, South Africa's strict tobacco products control act and increased tax on tobacco products have provided the country with more protection against many of the multinational tobacco companies' initiatives than has been the case in other developing countries.

Globalisation also influences nutrition patterns in South Africa with the establishment of activities such as Coca Cola sales and the replacement of traditional beer with industrial beer of westernised countries across the continent of Africa. McDonald's opened their first outlets in South Africa in 1995 and by the end of 2002 had about 100 branches in the country, with plans to expand to other countries in the region. However invasive these activities may be, it is probably the media and their extensive advertising that influences people of Africa to move away from their traditional African diets and aspire to the typical Western diet. It is interesting to note that the traditional African diets have not achieved the same status throughout the world as those achieved by many Asian diets.

Behind the media activities are the large trans-national corporations whose influences are enormous, with budgets larger than that of some countries in sub-Saharan Africa and who back free trade. They promote the abolishment of agricultural subsidies in these countries and support the importation of cheaper, frequently subsidised, foods and other goods from the industrialised countries. This promotes the loss of food security of many small rural farmers who grow local staple foods, which have become more expensive than the subsidised imported foods. This drives the farmers off the land to the peri-urban settlements where the new lifestyle promotes the emergence of CDL risk factors. Furthermore, the increasing consumption of nutritionally poor products of large trans-national corporations, such as salt-rich snacks, or sugar and soft drinks results in the replacement of the intake of healthy local produce, for example milk, fruit or vegetables.

3.3 Agriculture

In sub-Saharan African countries, discussions about agriculture focus more on inadequate cultivation of sufficient food to maintain food security and prevent under-nutrition and starvation.[13] There are, however, a number of agricultural factors related to the emergence of CDL risk factors in the region that also plays a role. The cultivation of tobacco is of major importance to countries such as Zimbabwe, Malawi and Tanzania that grow tobacco on more than 1% of agricultural land. In South Africa the cultivation of tobacco decreased significantly during the last few decades. This is because tobacco companies could import tobacco from Zimbabwe and Malawi at lower prices. However, the cultivation of tobacco in the region has a major impact on agricultural patterns. The curing of tobacco, for instance, uses wood as fuel in the larger tobacco-growing countries. During 1999, 16% and 26% of deforestation was attributable to tobacco in Zimbabwe and Malawi, respectively.[14]

3.4 Legislation and trade agreements

The foregoing factors highlight the need for adequate legislation within countries and the necessary trade agreements among sub-Saharan African countries to protect the population against adopting an unhealthy lifestyle. Abedian et al.,[15] described the requirements of an optimal policy for tobacco control in these counties, and South Africa was fortunate that President Mandela expressed strong support for global tobacco control. Consequently, South Africa passed a Tobacco Products Control Act in 1993 and added extensive amendments to strengthen the bill in 1998. The impact of this legislation has led to a marked reduction in

tobacco consumption shown both by a reduced prevalence of tobacco smoking and reduced amount of tobacco sold in the country.[16] Very few other sub-Saharan African countries have high tobacco tax rates that contribute significantly to the reduction in cigarette smoking. Thus, smuggling of cigarettes between countries with high and low rates of tobacco tax has become a feature in this region.

4. LIFETIME SEQUENCE OF EVENTS INFLUENCING CDL PATTERNS

Although CDL usually present in middle age or later in life, the establishment of unhealthy lifestyles and the emergence of CDL risk factors occur much earlier. In fact, a number of factors that can influence the emergence of risk factors and CDL later in life are present in utero, or become established during childhood. Therefore, when considering the lifestyle and risk factors for CDL, it is necessary to have a life-long perspective. Fig. 2 shows this perspective along with the type of interventions and the target groups.

5. REALITIES OF THE HEALTH-CARE SYSTEM FOR CDL IN SOUTH AFRICA

A successful national CDL health-care programme consists of two elements and targets two different groups of society (Fig. 2). The first element relates to the prevention of the emergence of the CDL risk factors. The target for these activities is the population as a whole with the intention of preventing communities from adopting an unhealthy lifestyle, and is referred to as primordial prevention. Such preventive activities should use effective communication techniques, suitable to the cultural needs of the target community. The disciplines of 'Social Marketing' and Health Promotion provide successful methods that should be used to target the whole community. These preventive activities are neither the primary responsibility nor within the skills base of the health-care service providers at clinics, private practices or hospitals in South Africa.

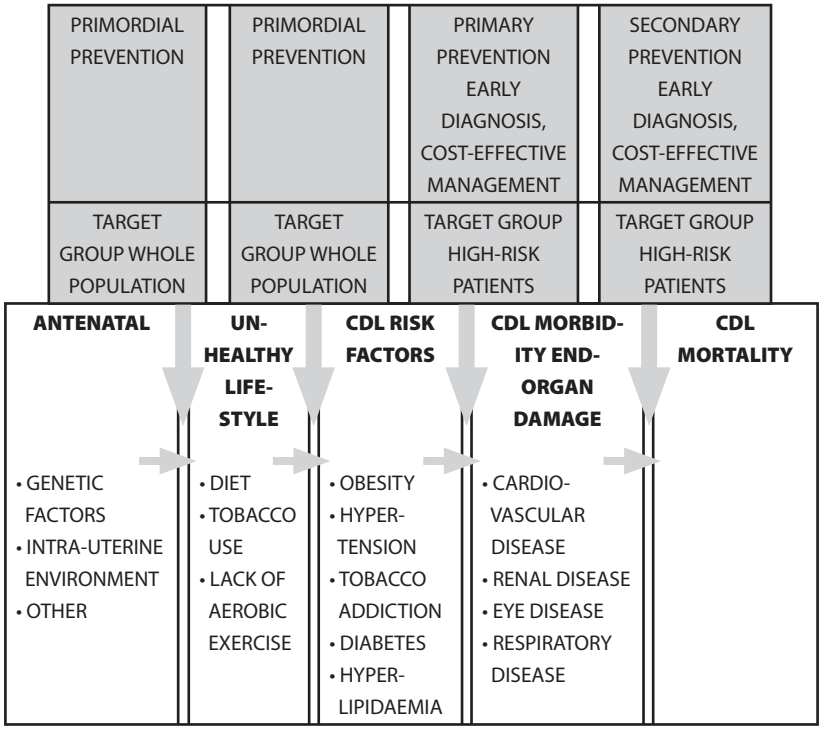

Figure 2: Lifetime perspective on the development and management of CDL

The second element relates to identifying those people in the community who have an increased risk for developing CDL, with the intention of treating and preventing the risk factors cost-effectively. This prevents damage caused to target organs in the body over decades and precedes CDL events such as heart attacks, strokes or renal impairment. This is referred to as primary prevention. Secondary prevention occurs when a patient with a CDL event is treated in order to reduce the

risk of further events. This last group of patients carries the highest risk in society for development of a CDL event, and therefore, represents the group of patients who will be most cost-effective to treat. These elements of health care fall squarely into the domain of the health-care services of countries.[17]

In South Africa, the focus on CDL prevention for those sectors of the society that have not yet adopted typical westernised/industrialised lifestyles is at a different phase than for those who have already adopted these lifestyles, which are also found in the high-income countries. This implies that the timing and type of interventions that are necessary for the different sectors of the South African community will vary. In typical westernised/industrialised South Africans, there is a pattern of high levels of unhealthy lifestyle habits, and CDL and their risk factors. Consequently, the focus of the successful CDL intervention programmes for these South Africans should be similar to those found in countries like the United States and Finland. The initial aim is to reduce the consumption of unhealthy foods, the reduction of use of unhealthy products like tobacco, and to increase physical activity patterns. In contrast, in South Africa for certain groups of the population the issue is still to prevent the adoption of unhealthy lifestyles that will result in CDL many decades later. This would suggest that the processes targeting the population as a whole might be of greater benefit in South Africa than was the case in the high-income countries. These actions include measures such as fiscal policies, regulations, and large public education initiatives.

5.1 Prevention of CDL risk factors

Unfortunately, prevention of the emergence of risk factors receives the least attention in South Africa's activities relating to health. Fortunately, the need for adequate prevention is the focus of the World Health Report of 2002.[18]

The report quantifies the global impact of several major risk factors, including some major CDL risk factors on current mortality and overall burden of disease. The report also highlights the benefit of effective interventions and emphasizes the cost-effectiveness of these in comparison to many other medical interventions commonly used in South Africa and elsewhere. Yach,[19] in an editorial in the Lancet, argues that one should focus on current prevalence and trends of CDL risk factors, such as tobacco addiction, physical inactivity, obesity, hypertension and hypercholesterolaemia, to understand the full impact on CDL patterns that will occur decades later. This approach is particularly important in South Africa and other countries in the region, since the time involved in the 'long incubation period' is mostly ignored when planning health delivery in communities exposed to high levels of CDL risk factors and the actual increases of CDL rates. Secondary CDL prevention can also make a strong impact on patients by reducing CDL risk factors. Yach[19] most pertinently asks why the public health community gives such a low priority to effective preventive measures for chronic diseases seeing that their cost-effectiveness have been shown to be so high. He suggests possible answers to the question and argues that slowing the incidence of new cases of almost entirely preventable CDL can be achieved by cost-effectively addressing CDL risk factors such as tobacco use, unhealthy diets and physical inactivity. He also emphasises the principles set out in the Ottawa Charter for Health Promotion, and the need to tackle risks together and within the social, economic, and political context of countries.[20] This approach to health promotion highlights another issue that is often ignored in sub-Saharan African countries when preventive actions are introduced. Frequently, health promotion material and programmes developed in the industrial world are implemented in this region without the necessary consideration of the local culture or the realities of people living in poor settings. Such an approach is doomed to fail. The only way to achieve success is to develop either new locally appropriate health promotion programmes, or carefully adopting material from other settings to fulfil local requirements.

5.2 Health-care services for CDL and their risk factors

South Africa has limited resources but an enormous burden in catering for the multiple burdens of diseases placed on the health services. When competing with the more acute and urgent conditions, such as trauma or severe illness caused by active infections, it is clear that provision for CDL services are less likely to be adequate. CDL lack urgency at every level of resource allocation and, consequently, unless a health service has a scientifically-based process of priority setting to ensure appropriate resource allocation, chronic diseases seldom receive the preventative and cost-effective care required.

Furthermore, health services in poorer countries are fundamentally based on a model of treating acute illness. Such a model, particularly in the public sector clinics catering for the poor, rarely provides appropriate health-promotion initiatives or educational needs for patients

with chronic disease. For example, the logistics of dispensing long-term medication for chronic diseases are seldom organised so that patients can obtain repeat prescriptions on a regular basis in an efficient way.

Effective CDL health care requires that the patients become active participants in their own care, as this will usually continue for the rest of their lives. The model for acute patient care, on which most countries in the region base their health-care facilities, does not incorporate the patient in an active way to ensure compliance with life-long medical treatment or the necessary lifestyle modifications. A patient-centred approach still needs to be developed for resource-scarce settings, such as the primary health-care services in the public sector of the country.

Health-care information regarding the effectiveness, or otherwise, of CDL treatments is seldom collected and rarely informs health-care services planned for the region. Therapeutic guidelines for CDL management are formulated by international agencies for global use and are frequently unrealistic for South Africa or other countries in the region with scarce resources. These countries seldom have the wherewithal to formulate their own guidelines. For example, suggested therapeutic agents are far too expensive for available budgets in South Africa. Some therapeutic guidelines target either medically qualified personnel or professional nurses with special training in CDL care. This level of staff is frequently unavailable in rural settings in South Africa. There is a real need for more realistic therapeutic guidelines with recommendations that apply to the staff and resources actually available. Furthermore, medication distribution and supplies are frequently inadequate, and result in the unavailability of the required medication at clinics. As can be expected these factors have resulted in inadequate care for patients with CDL or their risk factors.[21]

6. THE AIDS EPIDEMIC AND CDL IN SOUTH AFRICA

In South Africa, the question that must be considered is what the impact might be on the anticipated increase in CDL as the HIV/AIDS epidemic unfolds. The Actuarial Society of South Africa developed a model in 2000 (ASSA2000) to project how the AIDS epidemic could affect the patterns of mortality. The ASSA2000 model projects a tremendous increase in the mortality of young adults,[22] and was used to assess and project what the CDL mortality might be in 2010. These projections are shown in Table 1.1.

Table 1.1. Projected number of deaths per day in South Africa based on the ASSA2000 demographic and AIDS model[22]

Group of diseases	2000 (ASSA2000)	2010 (ASSA2000)	2010 AIDS treatment model (ASSA2002)*
Group 1 Infections, maternal, perinatal and under nutrition conditions	317	287	252
AIDS	454	2184	1050
Group 11 Chronic diseases	565	666	618
Group 111 Injuries	189	184	173
Total deaths	1525**	3322	2154

ASSA=Actuarial Society of South Africa

* The ASSA 2002 AIDS treatment model assumes prevention and treatment of 50% of AIDS patients in South Africa

** Without correction for the underreported deaths; 1265 deaths per day were registered in South Africa in 2000.

The projected mortality, expressed as deaths per day, attributed to AIDS is projected to increase from 77 per day in 1996 to 2184 per day in 2010. It is projected that during the same period the 487 chronic disease deaths per day in 1996 will increase to 563 per day, despite the enormous increase in projected AIDS deaths. This clearly suggests that irrespective of the deaths attributable to AIDS, there will be a slight increase in the mortality in South Africa attributed to CDL that will continue to play a significant role in South Africa and require prevention and cost-effective management.

The effect the high AIDS mortality in young adults in sub-Saharan African countries has on older people must be major. These older people with the higher CDL rates and risk factors not only have to care for their adult children suffering from AIDS, but also for their orphaned grandchildren. Although not yet formally evaluated, the impact this has on the quality of care for the middle-aged and elderly people with CDL must be extensive. As a result of the changing family structure and through the premature loss of their children, who traditionally would have cared for them in their old age, they are emotionally drained.[23] Furthermore, the funds available to the elderly previously used for food, water, electricity and visits to clinics and hospitals is limited and will impact on the care that is already insufficient for their chronic diseases.

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CHAPTER 2

MORTALITY PATTERNS OF CHRONIC DISEASES OF LIFESTYLE IN SOUTH AFRICA

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INTRODUCTION

A world-wide phenomenon of the twentieth century has been long-term declines in mortality levels. Within this decline in mortality, there has been a health transition[1] resulting from the combined effects of demographic ageing of populations as well as a change in the epidemiological profile. This has resulted in a shift from those diseases associated with under-development, such as infectious diseases and poor maternal and child health, to chronic degenerative diseases affecting adults.

Health transition theory, as it stands, is merely descriptive and does not explain how social and economic changes are related to these changes in health. Murray and Chen[2] proposed that the three established theories of mortality change viz, the income and food theory, the dissemination of modern technologies, and socio-cultural change that includes changing beliefs and health behaviours, are likely to explain this general mortality decline in an interactive way.

Omran[3] described how as infectious diseases decline, in most societies, there has been a concomitant increase in chronic diseases resulting from unhealthy pattern of living. Habits such as smoking tobacco, consuming an unhealthy diet, high in fat and low in fibre, and following a sedentary lifestyle, are acquired at a very early age as a consequence of the norms of society. These risky behaviours result in the emergence of a range of biological risk factors, which include tobacco addiction, hypertension, abnormal glucose metabolism, hyperlipidaemia or obesity. These risk factors often remain undiagnosed, and over decades lead to an increasing incidence of chronic diseases of lifestyle (CDL) such, as ischaemic heart disease (IHD), stroke, diabetes and smoking-related diseases, such as lung cancer and chronic bronchitis. These complex interactions between an unhealthy lifestyle, the resulting risk factors and the subsequent range of CDLs that have a major impact on mortality are represented in Fig. 1 in Chapter 1.[4]

Frenk *et al*.[5] have argued that in middle-income countries with different social classes, the more affluent segments of the population tend to pass through the stages of the transition first and are then followed by the poor. This process results in a protracted bipolar transition with the coexistence of both infectious diseases and CDLs in the population. Chopra and Sanders[6] reflect the polarized transition as an expression of combined and uneven development. This bipolar model also represents a deviation from the set sequence of stages postulated by Omran[3] and may well be bidirectional.[7] During the 1990s, the global trend of improving mortality has in some circumstances been reversed. The HIV/AIDS epidemic has resulted in rapidly increasing mortality in certain regions of the world, the political economic transitions in Eastern Europe appear to have resulted in rapid increases in CDLs and alcohol-related mortality and some conflict in some countries has resulted in a reversal of the trend of reducing mortality. These variations in the transition highlight the connections between social determinants and health.

In most settings, cardiovascular disease (CVD) comprises a large component of CDLs. However, these too appear to follow a transition. Pearson *et al*. have developed a model of the stages of the epidemiological transition within cardiovascular diseases that is shown in Table 2.1. In the first stage, rheumatic heart disease, infections and nutritional cardiomyopathies are the major component. Hypertensive heart disease and haemorrhagic strokes emerge during the age of receding pandemics. Entering the age of degenerative diseases, all forms of stroke and IHD result from growing obesity and diabetes. This is followed by the age of delayed degenerative disease when health care shifts the stroke and IHD into older ages. Yusuf *et al*.[7] suggest that there is a further stage of health regression and social

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upheaval with the re-emergence of deaths from rheumatic heart disease, infections as well as increased alcoholism, violence and IHD and hypertensive disease in the young.

Table 2.1. Phases of the epidemiologic transition in cardiovascular diseases

Phase of epidemiologic transition	Deaths from circulatory disease (%)	Circulatory problems	Risk factors
Age of pestilence and famine	5-10	Rheumatic heart disease; infection and deficiency-induced cardiomyopathy	Uncontrolled infection, deficiency conditions
Age of receding pandemics	10-35	As above, plus hypertensive heart disease and hemorrhagic stroke	High-salt diet leading to hypertension; increased smoking
Age of degenerative and man-made diseases	35-55	All forms of stroke; ischaemic heart disease	Atherosclerosis from fatty diets, sedentary lifestyle; smoking
Age of delayed degenerative diseases	Probably under 50	Stroke and ischaemic heart disease at older ages	Education and behavioural changes leading to lower levels of risk factors

Source: Pearson *et al*. 1993,[8] based on Omran 1971,[3] and Olshansky and Ault 1986.[9]

The development of chronic diseases appears to be occurring at a faster pace than occurred in the developed countries.[10] There have also been some differences in the transition for specific disease categories for developed and developing countries. One example is the peak prevalence of CVD found in the economically active segment of the population of developing countries as opposed to peaking in older people as occurred in developed countries. Besides the relatively early age of manifestation, the scale of the CVD epidemic in developing countries is influenced by the large size of the populations as well as the high proportion of young adults.

Leeder *et al*.[10] have described the concern about the potential impact of CVD in countries with developing economies as the 'race against time'. Projections of the mortality impact in four developing countries including South Africa highlight that CVD will affect people in these countries at a younger age than in the developed countries and that it will result in higher death rates. The study also suggests that CVD will increasingly affect the poor in these countries, something that has been observed in South Africa in the analysis of mortality data.[11] A cross-sectional analysis of the risk factors and the average income level across more than 100 countries suggests that the distribution of the risk factors for CVD will be concentrated in low and middle-income countries.[12]

The co-existence of ailments related to lifestyle was observed in the early 1950s in the urban setting of South Africa by Kark.[13] He coined the term "Community syndrome of hypertension, atherosclerosis and diabetes (CHAD)" to describe the diseases arising from the changing lifestyle as the African population urbanised. This chapter aims to review the mortality trends in CDLs in South Africa using routinely available data. Tracking cause of death rates in South Africa, like that in most developing countries, is constrained by the lack of data, particularly for the rural population.[14] Mann[15] argued that the varied population composition of this country provides a "South African window" of opportunity to examine the relationship between lifestyle and chronic diseases through the cross-cultural contrast in both lifestyle and disease profiles. The available data allow limited comparison between population groups and provinces. However, these provide only a crude sense of the variations in health and it is impossible to discern the independent contributions of culture and social class or genetic factors.

ADULT MORTALITY

Adult mortality rates in South Africa have been found to be relatively high,[16] even prior to the impact of the HIV/AIDS epidemic. This was particularly high for men; it was estimated that in the mid-1980s, on average 38.4% of 15-year-old South African men could expect to die before age 60. In the case of African men, the estimate was 40%, similar to the high levels estimated for sub-Saharan Africa.[17] The high level of premature adult mortality in South Africa was attributed to the combination of injuries, infectious diseases such as TB, and the emerging chronic diseases.[16] In contrast, compared with sub-Saharan Africa, the premature adult mortality for women was lower in South Africa where 25.4% of 15-year-old women could expect to die before age 60.[16] This could in part be attributed to the lower maternal mortality levels in South Africa.

There was little change in the levels of adult mortality during the 1990s, with the rapid spread of HIV yet to take its full toll. It is only towards the end of the decade that the impact of the HIV/AIDS epidemic has been observed on adult mortality.[18] By 2000, the levels of young adult mortality were about 2.5 times higher than what they used to be for women and 1.5 times higher than what they used to be for men.[19]

MORTALITY PROFILE IN 2000

The South African National Burden of Disease (SA NBD)[20] study grappled with the inadequacies of the cause of death statistics and using multiple sources of information derived coherent and consistent estimates for the level and causes of mortality in South Africa for the year 2000. The study highlighted the considerable impact of HIV/AIDS as a cause of death by then and described the 'quadruple' burden experienced in South Africa with the combination of pre-transitional causes of death and disease related to under-development, as well as CDL, injuries and HIV/AIDS. The study estimated that in 2000 there were more than 500 000 deaths. Of these, 37% were a result of CDL, 30% were a result of HIV/AIDS, 12% injuries and 21% were a result of infectious diseases and other conditions related to under-development. The age and sex distribution by broad cause group are shown in Fig. 2. While the impact of HIV/AIDS on young adults and children is unequivocal, the number of CDL in the older ages is also apparent.

Fig. 3 shows the leading causes of adult deaths in 2000 for men and women by age group. In the young adults aged 15-45 years, HIV/AIDS, TB, homicide and road traffic accidents are the most common causes of death. However, for the age groups over 45 years, CVD and lifestyle-related cancers feature among the leading causes of death. The patterns differ by sex. Homicide and road traffic accidents are more pronounced among the men. The proportion of deaths related to HIV/AIDS is striking among young adult women, and stroke and diabetes are more pronounced among women compared with men. Cancer is more prominent in the 45-64-year-age group, with lung cancer in the case of men and both cervical and breast cancer in the case of women.

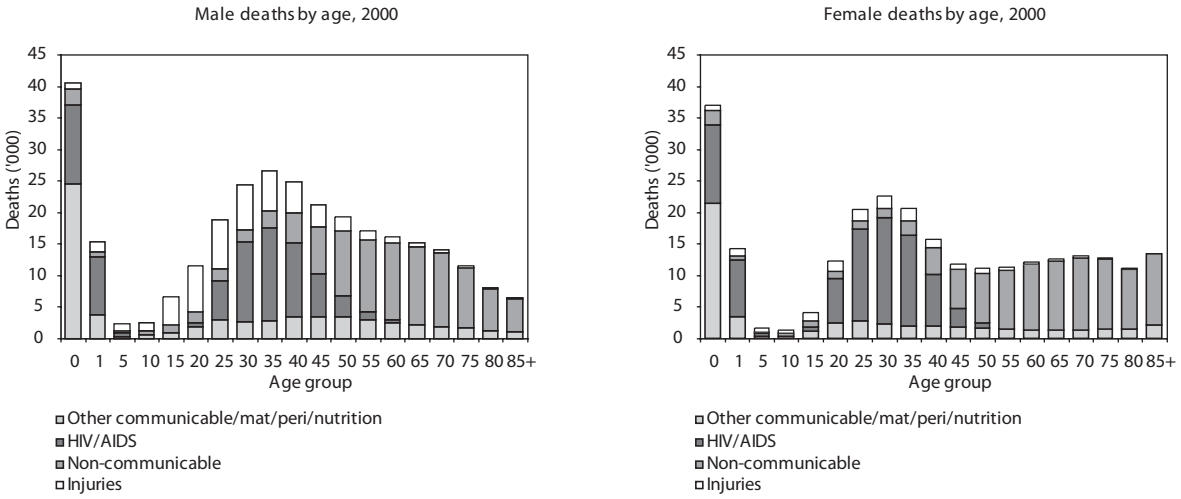

Figure 2: Age distribution of deaths by broad group and sex, SA NBD 2000
Source: Bradshaw *et al*., 2003[20]

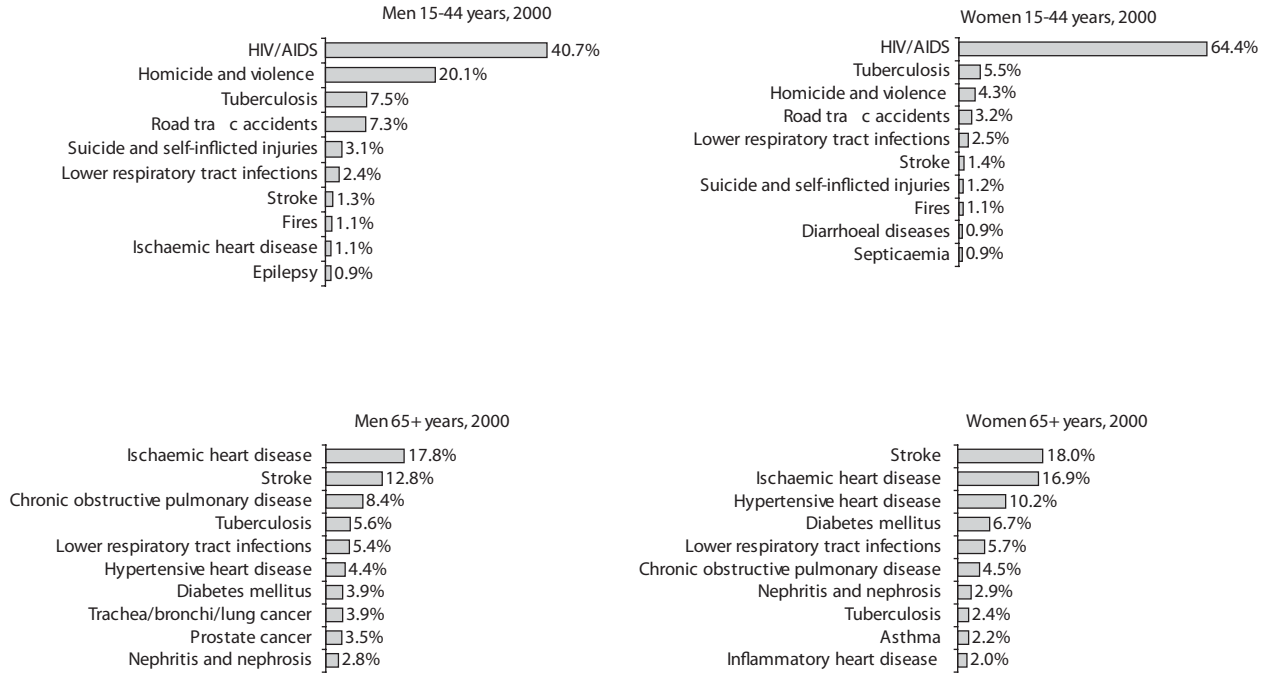

Figure 3: Top 10 causes of death for adults 15 years and older by age and sex, SA NBD 2000
Source: Bradshaw *et al*., 2003[20]

DIFFERENTIALS IN CHRONIC DISEASE MORTALITY

Estimates of age-standardised mortality rates for 2000 show that the all-cause mortality rates differ substantially between population groups (Table 2.2), being much higher for Africans than for the other groups. The rate for Africans was nearly double that for whites. In contrast, the death rates from CDL are fairly similar for the population groups, but slightly higher for Indians and coloured. The age-standardised death rates as a result of selected CDL estimated for 2000 differ by population group (Table 2.3). Death rates from cardiovascular diseases are similar for all groups but are extremely high for the Indians. Death rates from diabetes are also extremely high for Indians. Death rates resulting from neoplasms are highest for the coloured group, followed by whites.

Table 2.2. Age-standardised death rates per 100 000 as a result of CDL by population group, 2000

	African	White	Coloured	Indian	South Africa
All causes	**1613**	**937**	**1304**	**1172**	**1468**
Cardiovascular diseases	375	384	406	607	361
Neoplasms	126	199	212	121	149
Diabetes	59	23	64	111	49
Respiratory diseases	93	70	103	64	83
Other CDL	116	91	82	96	108
Total CDL	**769**	**767**	**867**	**1000**	**750**

Source: Comparative Risk Factor Assessment, 2006[21]

When considering the provincial mortality rates, there are similarly little differences in the age-standardised death rate from CDL between provinces (Fig. 4).[22] The poorer provinces had similar levels to those of the more developed provinces – all at about 750 per 100 000 population. However, the cause profile differs a little. The richer provinces of the Western Cape and Gauteng have higher cancer mortality rates. The Eastern Cape and the Northern Cape have higher mortality rates as a result of respiratory diseases.

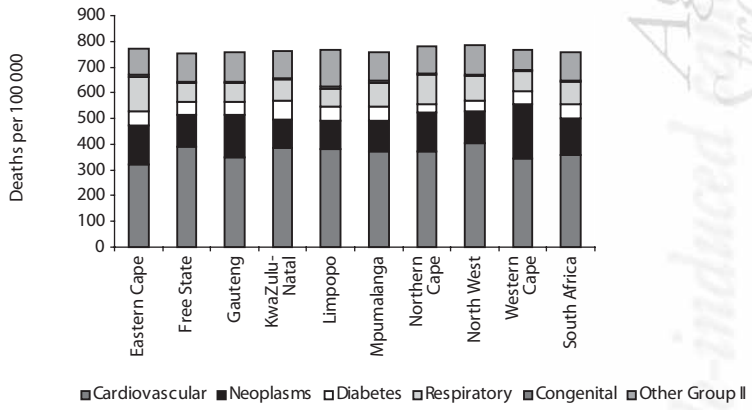

Figure 4: Provincial estimates of age-standardised death rates as a result of CDL diseases, 2000
Source: Bradshaw *et al*., 2004[22]

The lack of reliable cause of death data makes it impossible to fully examine the urban and rural differentials in mortality. Since high proportions of the white and Asian populations are already urbanised, the geographical patterns of chronic diseases experienced by the coloureds and blacks would be of particular interest. The analyses of the 1984-1986 data by magisterial district suggest that among coloureds, there were higher mortality rates for stroke in the more rural areas, while IHD tended to be a more urban phenomenon. [23]

TRENDS IN CHRONIC DISEASE MORTALITY

Studies of mortality trends have been restricted to selected population groups as a result of the limited availability of data. In 1988, the first year for which full data was ostensibly collected for the whole of South Africa (excluding the former Transkei, Venda, Boputhatswana and Ciskei) CDL accounted for 24.5% of the reported deaths of all ages and 28.5% in the 35-64-year age group.[4] This latter proportion represents the most economically productive sector of the population, suggesting that these diseases have an impact on the economy. It has been estimated that, prior to the AIDS epidemic, the proportion of deaths resulting from chronic diseases had been increasing for adults.[24] However, with AIDS as a competing cause, this proportion has decreased in recent years. By the year 2002, the national cause of death statistics shows that 18% of deaths of all ages and 20% of the 35-64-year-age group were a result of CDL.[25]

Community syndrome of hypertension, atherosclerosis and diabetes (CHAD)

Wyndham[26] described very high death rates as a result of IHD among white and Asian men that had increased during the 1980s and then appeared to plateau.[23] This was confirmed by the trends in age-specific mortality rates attributable to CHAD reported by Bradshaw *et al*.[23] (Figs. 5 and 6). While there are clear anomalies in the reported data (e.g. IHD mortality for coloured males from 1959-1967), it is possible to identify major trends. The rates are exceedingly high for Asians who experienced consistently high mortality because of hypertension, stroke, IHD and diabetes. An example is the highest overall IHD rates for Asians, approximately double the rate for the coloureds. Similar to the experience in developed countries during the 1980s, there appears to have been a rise and fall in stroke and IHD mortality in the three race groups, although the peak (often flattened) occurs at differing times for the different race/sex groups. This rise and fall of IHD mortality in these groups have been demonstrated previously,[23-29] as well as the pattern of a downward trend in stroke mortality.[26] However, it can be seen from the graphs that the downward trends often accompany upward trends in the ill-defined category. Lancaster[30] has suggested that there is evidence that the transfer of some causes of death from one ICD class to another, as well as changes in the prevailing ideas of aetiology and diagnosis have contributed to the downward trends observed in the United States and the United Kingdom. Recent analysis and modeling of the data from the United Kingdom have shown that there was substantial decline in IHD between 1981 and 2000.[31] This analysis demonstrates that more than half of the decrease could be attributed to reductions in major risk factors, principally smoking.

Diabetes is generally underestimated when a single cause of death is coded as in the case of South Africa. It is interesting to note that despite the increase in the ill-defined category, the diabetes mortality rates have increased. However, these increases are also consistent with the possibility of changing practices in diagnosis and coding with a shift from IHD to diabetes as the underlying cause. This phenomenon was clearly experienced in the last few years in the United States.[32]

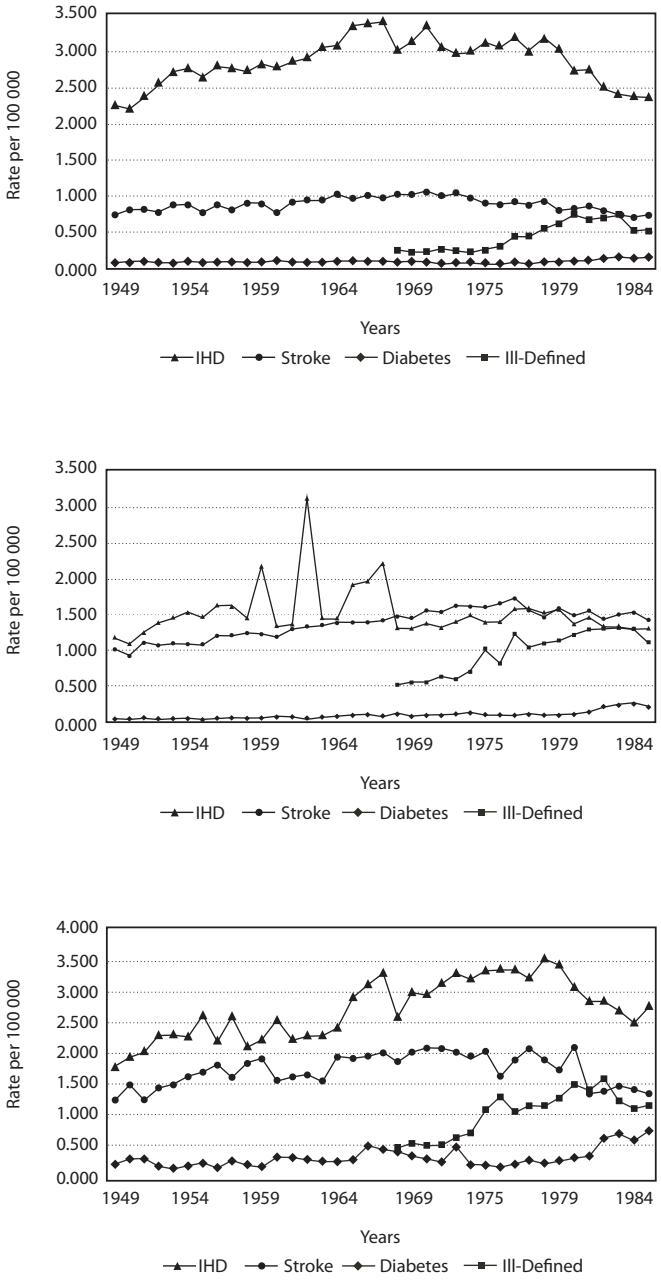

Figure 5: Age-specific death rates for CHAD-related conditions for male whites (top), coloureds (middle) and Indians (bottom), South Africa 2000
Source: Bradshaw *et al*. 1995[23]

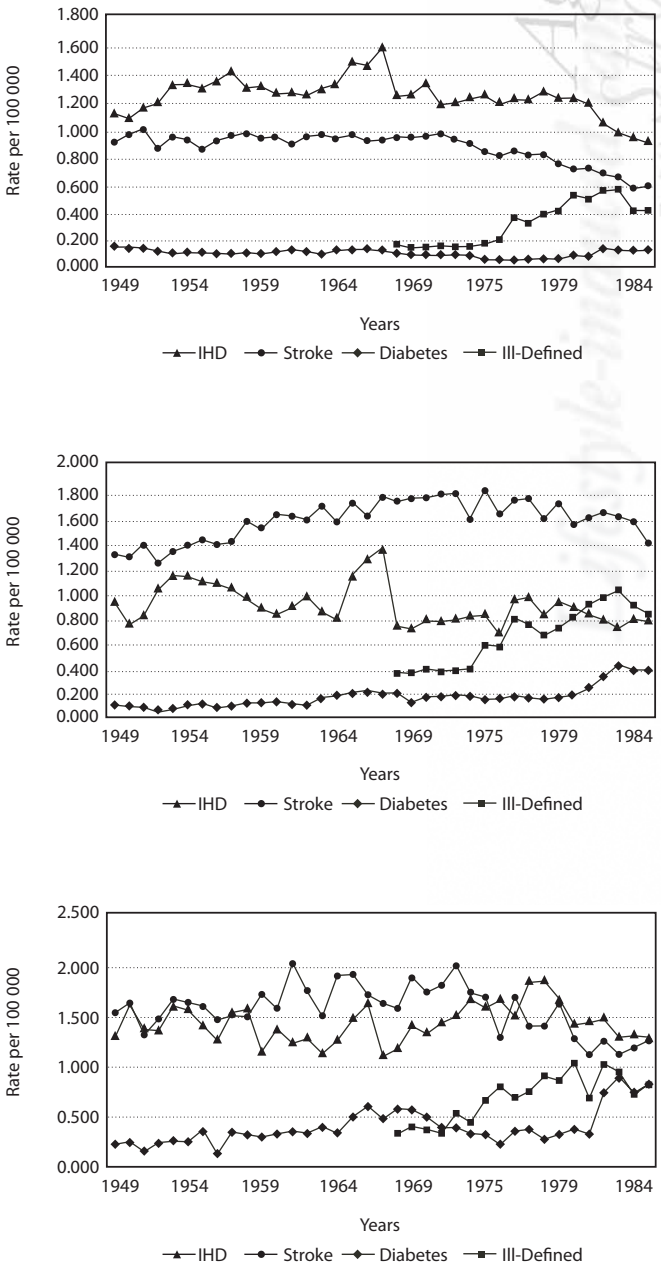

Figure 6: Age-specific death rates for CHAD related conditions for female whites (top), coloureds (middle) and Indians (bottom), South Africa 2000
Source: Bradshaw *et al*. 1995[23]

By 2000, the rates for CHAD-related causes show distinct profiles for the population groups. Indians have very high IHD and diabetes. Africans have high mortality from stroke and hypertensive heart disease. Whites and coloureds have high IHD mortality, while coloureds also have fairly high stroke mortality. Women have higher mortality from diabetes when compared with men and lower IHD and hypertensive heart disease. These differences suggest that the risk factor profiles differ by population groups which are at different stages of the health transition.

Table 2.3. Age-standardised mortality rates per 100 000 population for CHAD-related causes of death by population group and sex, 2000 (World Standard Population)

	African		White		Coloured		Indian		South Africa	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
Stroke	145	160	72	84	143	156	136	121	125	124
IHD	85	66	323	187	203	169	497	346	169	102
Hyper-tensive heart	72	115	7	15	19	56	34	30	48	70
Diabetes	48	66	22	23	40	80	74	140	43	54

Source: Comparative Risk Factor Assessment, 2006[21]

From Fig. 7, it can be seen that the CHAD mortality rates vary between the provinces. Mortality from IHD was highest in Western Cape, Gauteng and Northern Cape, and lowest in Mpumalanga, Limpopo and Eastern Cape. The IHD mortality rate was consistently higher for males than females. In contrast, stroke death rates for males were similar to the rates for females. The stroke death rates were particularly high in KwaZulu-Natal, and low in Gauteng. Provincial death rates attributable to hypertensive heart disease showed marked variations between the provinces, and higher rates for females than for males in all provinces except Mpumalanga. North West, Limpopo and Mpumalanga had the highest rates of hypertensive heart disease, while Western Cape and Gauteng had the lowest rates. The variations between the provinces also suggest that the risk factor profiles differ and that provinces are at different stages of the health transition.

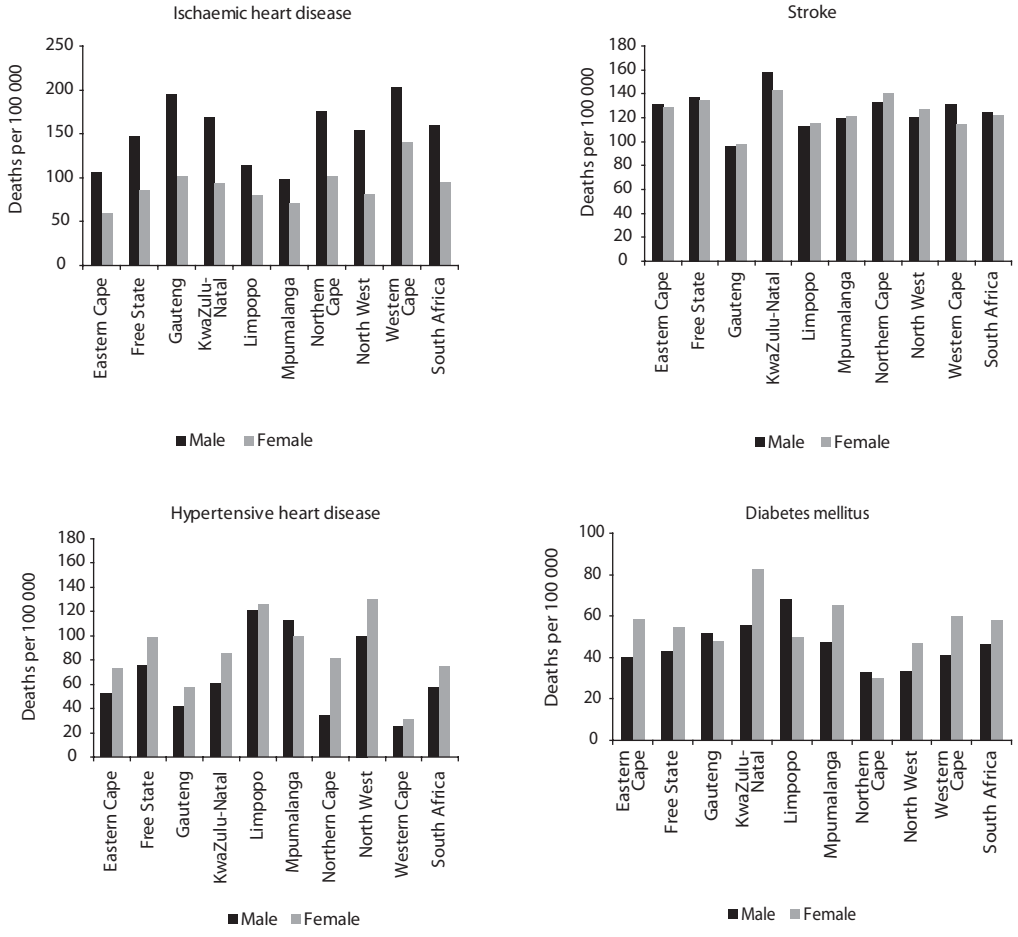

Figure 7: Provincial estimates of age-standardised death rates attributable to CHAD-related causes by sex, 2000

Source: Bradshaw *et al*., 2004[22]

Respiratory diseases

Bradshaw *et al*.[33] described the increasing lung cancer rates among whites, coloureds and Indians, a pattern subsequently confirmed by Wyndham.[34] It can be seen from Fig. 8 that the increase among coloured men was particularly marked. More recently, Ehrlich and Bourne,[35] reported increases in the asthma mortality trends in the 1960s for whites and coloureds that remained high for coloured men during the following years. However, these studies have failed to provide an overall sense of the epidemiological trends in chronic respiratory diseases among adults in South Africa as data for the majority of the population have been of poor quality.

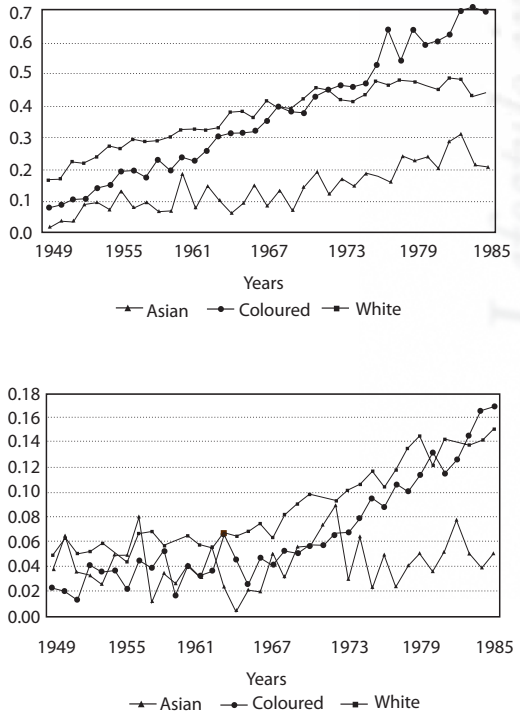

Figure 8: Age-specific death rates for lung cancer for male and female whites, coloureds and Indians, South Africa 2000
Source: Bradshaw *et al*. 1995[23]

Mortality rates from chronic obstructive pulmonary disease are about twice as high as those from lung cancer. From Table 2.4 and Fig. 8, it can be seen that lung cancer and chronic bronchitis are more common among men than women. This is likely to reflect the gender difference in the prevalence of tobacco smoking which has been much higher for men than women. It is also likely to reflect the higher occupational exposures to dusty environments experienced by men. Mortality from these respiratory conditions is extremely high for the coloured men. They are lowest among Indian women who have a low smoking prevalence. Fig. 8 shows that the provincial patterns differ for the two conditions with the lung cancer rates being very high in the Western Cape, while the mortality rates attributable to chronic bronchitis are highest in the Eastern Cape, and the Northern Cape.

Table 2.4. Age-standardised mortality rates per 100 000 population for respiratory diseases by population group and sex, 2000 (World Standard Population)

	African		White		Coloured		Indian		South Africa	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
Lung cancer	31	6	52	30	77	39	27	6	42	14
COPD	73	29	73	46	118	45	59	6	76	30

Source: Comparative Risk Factor Assessment, 2006[21]

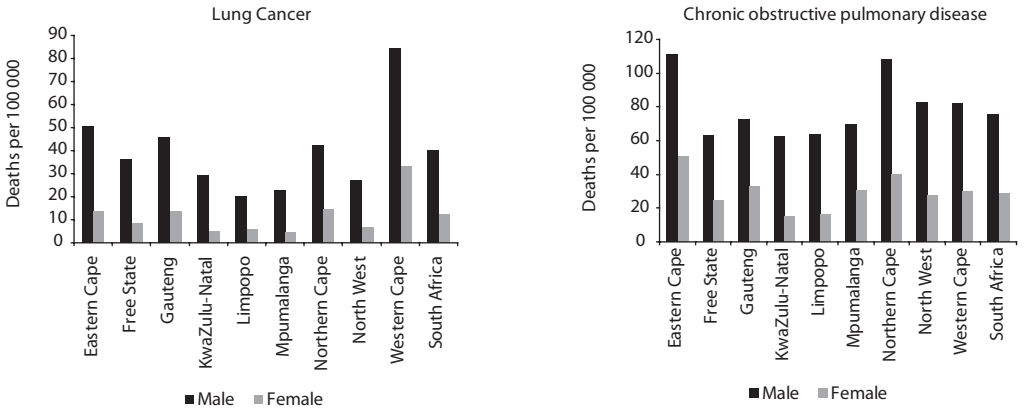

Figure 9: Provincial estimates of age-standardised death rates attributable to lung cancer and chronic bronchitis by sex, 2000

Source: Bradshaw *et al*., 2004[22]

Other cancers related to lifestyle

The most obvious cancer related to lifestyle is lung cancer, which has been demonstrated to be associated with cigarette smoking. Other cancers that were examined are breast cancer, possibly associated with nutrition and smoking, prostate cancer and cervical cancer, which may be linked to sexual behaviour. Bradshaw *et al*.[22] show that breast cancer rates among coloured and Indian women have been increasing, while the mortality rate for white women was fairly stable between 1949 and 1985. Cervical cancer rates for white and Indian women showed a decline during this period, while, in contrast, the rate for coloured women increased.[36]

The age-standardised rates are represented in Table 2.5 by population group while the provincial differences are displayed in Fig. 10. These show that breast cancer mortality is highest among the white, coloured and Indian women and that cervical cancer mortality is highest among African women and coloured women. Bailie *et al*.[36] argued that the high rates for these two groups reflect the lack of access to appropriately timed screening among the less advantaged. Mortality from prostate cancer is highest among white men, followed by coloured men. The rate is lowest among Indian men.

Table 2.5. Age-standardised mortality rates per 100 000 population for selected cancers by population group and sex, 2000 (World Standard Population)

	African	White	Coloured	Indian	South Africa
Breast - female	13	35	33	28	19
Cervical - female	27	5	22	8	21
Prostate - male	23	41	33	13	27

Source: Comparative Risk Factor Assessment, 2006[21]

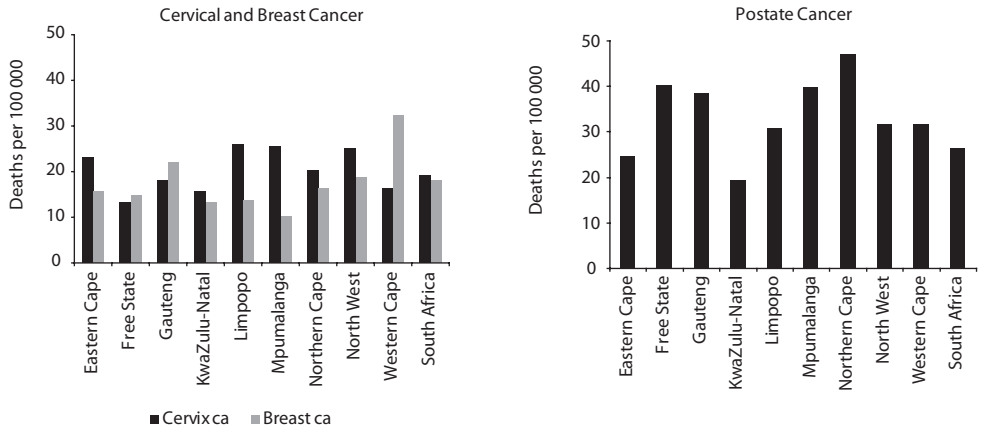

Figure 10: Provincial estimates of age-standardised death rates attributable to cervical and breast cancer for women and prostate cancer for men, 2000

Source: Bradshaw *et al*., 2004[22]

CONCLUSIONS

Unfortunately, there are no complete historical South African cause of death data available to observe clear, overall health transition trends and more specifically, transition patterns within CDL. This is a result of poor vital registration systems, exacerbated by the exclusion from official statistics in the apartheid past, of large sections of the population, officially residing in the so-called independent homelands. Taking into account the large group of ill-defined deaths, some changes to classification criteria, and incorporating improved coverage on cause of death, the recent Initial Burden of Disease Study[20] clearly shows that South Africa is in the midst of the health transition. Examination of the available trend data and mortality patterns of CDL presented in this chapter does allow glimpses of patterns predicted by classic transition theory. Some of the modified elements of transition theory are also apparent.

The burden of disease profile reflects the protracted polarised model of the epidemiological transition[5] characterised by the simultaneous occurrence of infectious diseases and CDL within a population. Living conditions in South Africa are heterogeneous with high levels of inequality and poverty arising from the uneven development, as well as urban and rural environmental differences. The additional transition stage of health regression and social upheaval suggested by Yusuf *et al*.,[7] associated with alcohol and violence, are evident in the South African disease burden, contributing to the quadruple burden of disease.

In addition to variations in living conditions, the South African population has genetic and cultural differences. CDL present a complex configuration among population groups and by province, linked to socio-economic differences. While the overall mortality rates from CDL do not vary, there are considerable differences by specific cause. Compared with the whites, the African population is earlier in the transition, while the coloured group may be in the additional stage of the transition that is put forward by Yusuf *et al*.[7] The poorer provinces appear to be in the earlier stages of the transition with high mortality from stroke. The more developed provinces are in later stages and have higher rates of IHD. In addition, there are high lung and breast cancer mortality rates especially for coloured South Africans. Unfortunately, the available data do not allow clear classification of the economic differences within the groups and consequent variation in the health transitional stage.

The World Development Report[37] of 1993 and others, such as the WHO Commission on Macroeconomics and Health,[38] advocate investing in health as a means of accelerating development. Analyses are presented to argue that good health increases the productivity of individuals, and therefore, the economic growth rates of countries. Investment in health leads to economic upliftment affecting factors such as income, education, employment status and occupation that impact on fertility and mortality trends. However, economic recession and inequalities would result in the re-emergence of CDL.

If one wants to influence the progression of the health transition, important variables to take into consideration are the environment, lifestyle and access to health care (both curative and preventive). Access to health care is a particularly relevant variable in South Africa, with the apartheid policies of the past having distorted access to health services. The trends in cervical cancer mortality data suggest that this is an important issue.

Health policy in South Africa has undergone major transition during this period of democratisation. Emphasis has appropriately been placed on a primary health-care approach. However, primary health care has tended to focus on strategies aimed at improving maternal and child health and managing acute conditions. While South Africa must address these priorities, the mortality patterns demonstrate that it is crucial that cost-effective interventions to prevent, treat and manage CDL must be incorporated into a comprehensive primary health-care strategy alongside the other specific aspects of health in South Africa, such as violence/trauma and HIV/AIDS. Unlike intervention strategies to promote child health, strategies to promote adult health are more complex, take longer to become effective and require complex intersectoral and political support.[39]

When considering health policy related to chronic diseases, the escalating health-care costs associated with increasing levels of chronic disease make it imperative to emphasise health promotion and the prevention of disease. This must be at the level of attempting to prevent the very emergence and establishment of lifestyles associated with elevated risk of disease through timely health education. This must address the underlying risk factors which are the engines driving the development of chronic diseases. Many of these risk factors are in turn generated by the powerful forces of urbanisation and globalisation.

Leeder *et al*.[10] emphasise that lifestyle choices occur within a context and reflect both individual choices as well as macroeconomic policies. These impact on CDL through agricultural policies, food marketing and regulation, tobacco production and sale, urban planning, employment and education. South Africa's effective tobacco control initiative provides a valuable model of macro-level interventions that are required to effect primordial prevention. This includes increased excise tax, restrictions of advertising and smoking in public places. At the same time it is crucial to provide good management

of the chronic diseases at the primary-care level in order to reduce complications. This includes early detection of chronic disease conditions and their risk factors. Health systems research is needed to develop appropriate models of primary health care to manage these conditions.

Health policy should be broadened so as to encompass the healthy population and aim at keeping it healthy, and the importance of improving the quality of life of those with disabling chronic conditions should be an acknowledged goal for health care. Raymond[40] has shown that the first two decades of the new millennium allow a unique opportunity to developing countries to manage chronic diseases, particularly cardiovascular diseases, before the growing numbers become too large to manage. As the birth rate declines, and before the number of older persons is excessive, the fiscal opportunity for preventive and supportive health-care systems is enormous. This is particularly true for South Africa which is expected to have a declining dependency ratio in the next few decades.

Understanding the mortality pattern experienced in South Africa is fraught with limitations because of the poor quality of data. The collection and collation of vital statistics have improved markedly, but there are still challenges, particularly in the rural areas. Adult mortality levels should be monitored regularly alongside the generally accepted childhood mortality indicators. The risk of a 15-year-old dying before the age of 60 years (45Q15) provides a very useful indicator for adult health, and this should be included in the health information system being set up to monitor progress in the health sector. Under-registration needs to be reduced further and the cause of death data needs to be improved so that full utilisation of the multiple causes of death details can be made in order to allow the emergence of a clearer picture of mortality patterns of chronic diseases in South Africa.

It would be useful for South Africa to set up a national macroeconomic and health commission that would identify the major health problems, the determinants and policy options. This commission would need to look at the costs of interventions and compare them with the costs of not acting.

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CHAPTER 3

PHYSICAL ACTIVITY
AND CHRONIC DISEASES OF LIFESTYLE IN SOUTH AFRICA

Estelle V. Lambert,[a] Tracy Kolbe-Alexander,[b]

PROLOGUE (*excerpted in part, from the Oxford Health Alliance Annual Report, 2005*):
Over the past 20 years, physical activity has become widely recognised as a "key" health behaviour, associated with reduced all-cause morbidity and mortality, as well as chronic diseases of lifestyle (CDL). The associated health benefits of physical activity accrue in a dose-dependent manner, and early adaptations in the transition from sedentary living to becoming moderately active, seem to have the greatest effect on risk reduction for CDL in men and women (Figs. 1 and 2).[1,2]

Generally, the health benefits of physical activity increase with increasing frequency, duration, and intensity of exercise. Data from longitudinal cohort studies suggest that physical inactivity is associated with at least a 1.5 - 2-fold higher risk of most CDL, such as ischaemic heart disease, type 2 diabetes, and hypertension. Furthermore, studies corroborate the existing public health recommendation suggesting that 30 minutes of accumulated, moderate-to-vigorous physical activity on most days, offers protection from these chronic diseases. The associated risk of inactivity is similar in magnitude to many other well-known risk factors, such as overweight, smoking, hyperlipidaemia, and low fruit and vegetable intake (see Fig. 2).[3]

In some countries, the direct health-care costs attributable to physical inactivity are more than 2.5% of the annual health-care budget. Moreover, as physical activity "protects" from an early age, these are likely to be underestimates of the attributable impact of inactivity on health-care expenditure. From a public health perspective, these effects are sufficiently large, and robust, and have been demonstrated in a variety of populations and contexts, to similar effect. Furthermore, because the prevalence of inactivity is generally higher than most other behavioural risk factors, the potential impact of population-based intervention may be great.

However, this potential has not been realised because of the paucity of evidence concerning the effectiveness of population-based or community-based strategies for physical activity intervention. This is particularly relevant to developing countries, which are not "protected" from the burden of inactivity, but reflect a paradoxical situation in which poverty co-exists with a high prevalence of obesity; and urbanisation is associated with decreased levels of daily physical activity. Furthermore, usual methods of surveillance, capturing leisure time activity, is often insufficient in these settings, where occupational activity and activity associated with transport may actually be inversely associated with recreation.

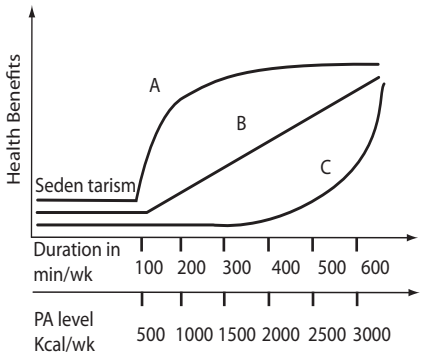

Figure 1: Theoretical dose-response effect for the health benefits of physical activity[1]

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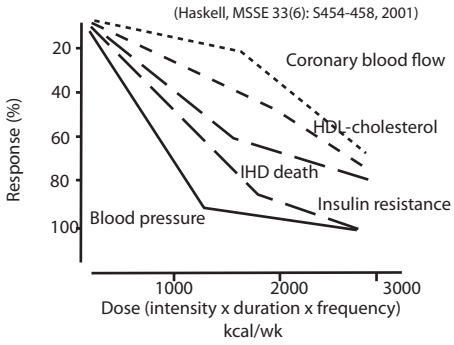

Figure 2: Theoretical dose-response of physical activity for health-related benefits[2]

Specific public health milestones have been identified which highlight the growing recognition of physical inactivity or sedentary living as a major risk factor for CDL. One such milestone is the 1995 US Surgeon General's report on the existing evidence-base concerning physical activity and health, positioning inactivity as a national public health challenge.[4] More recently, in May 2004, the World Health Assembly approved the World Health Organization (WHO) Global Strategy on Diet, Physical Activity and Health.[5] This strategy serves to establish physical activity promotion on the national health policy agendas of member states, specifically for the prevention and control of CDL. In conjunction with these policy initiatives, there has been an emergence of global surveillance of risk factors, including physical activity, thereby providing the impetus for both a global and national course of action.

Ten-year retrospective review of research priorities for physical activity in health in South Africa: 1995-present

Specific data concerning the national prevalence of physical activity or inactivity were notably absent from the chapter on exercise in the 1995 MRC Technical Report on CDL in South Africa.[6] Moreover, little or no data were present linking physical activity and/or inactivity to health outcomes in any South African population. However, in the intervening period, South African researchers and policy makers have begun to characterise the scope of the problem. In 1995, we highlighted the research priorities concerning physical activity and health in South Africa. These included:

1. identifying habitual physical activity patterns of various communities;
2. identifying factors that influence physical activity behaviour in various communities;
3. determining the benefits of physical activity for prevention of CDL in specific target groups, including the health insurance sector;
4. determining cost-effectiveness of physical activity; and
5. co-ordinating efforts to promote physical activity in different communities.

This report will address these areas of research priority, where data are available, and highlight new areas needed for research and advocacy, based firstly on the existing epidemiological, behavioural data available, and secondly, on the current national and global health policy environment.

Scope of the problem of inactivity in South Africa: prevalence of inactivity:

Levels of activity in children and youth:

In terms of activity levels in children and youth, there are self-reported data available from the National Youth Risk Behaviour Survey.[7] Table 3.1 presents these data, which suggest that more than one-third of children surveyed participate in insufficient or no moderate-to-vigorous activity weekly. Additionally, more than 25% of the youth surveyed reported watching more than 3 hours of television per day.[7] This emerging formative evidence warrants concerted public health focus, and very likely inter-sectoral strategies, so that primordial prevention can be implemented, particularly in children and youth.

Table 3.1. Percentage of 13 - 19-year-olds who participated in insufficient or no physical activity (n=10 100)

	Males	Females	All
Black	34.4	42.4	37.5
Mixed Ancestry	36.8	56.8	45.6
White	28.2	37	29.4
Indian	40.8	36	33
RSA	34.4	43	37.5

Source: Youth Risk Behaviour Survey, 2002

Levels of physical activity in adults:

Preliminary data on the patterns and prevalence of physical activity among black men and women living in the Cape Peninsula were presented by Sparling *et al*.[8] Most of the participants were employed in occupations requiring minimal physical activity (57%), and one quarter had occupations requiring moderate amounts of exercise (25%).[8] More than half of the total sample that was interviewed participated in physical activity outside of working hours (58.5%). When comparing the different age strata, the least active groups were those between the ages of 25-34 years compared to those who were 35-44 years and 45-64 years (54% vs. 61%).[8] Those aged between 45-64 years participated predominately in light intensity activities (58%) and only a small proportion engaged in strenuous physical activity (2.8%). Conversely, the younger subjects participated in more strenuous activities than light intensity activities.[8]

A subsequent study was conducted in the North West Province in an urban and rural community.[9] More than half of the subjects participating in this study were not sufficiently active as only 29% and 28% were classified as either inactive or moderately active. Furthermore, the men and urban dwellers were significantly more physically active than the women and those living in rural areas.[9]

Similar results were obtained from a peri-urban community of mixed ancestry (coloured) men and women. The Stanford 7-Day recall questionnaire was used to quantify habitual physical activity in a random population-based sample aged 15 years and older.[10] Approximately half of the total sample (49.7%) did not participate in 150 minutes or more of physical activity per week, which is the minimum recommendation required for achieving a health benefit. The prevalence of inactivity increased with increasing age, where 40% of those younger than 35 years where insufficiently active compared to 66% and 76% of those aged between 55 and 64 years and older than 64 years, respectively.[10]

More recently, in 2003, the International Physical Activity Questionnaire (IPAQ) was administered, as part of the World Health Survey, to a representative sample of South Africans (Table 3.2). The South African data were collected between December 2002 and May 2003, and included samples from urban and rural communities (n=2014). This survey found that less than one third of South Africans met the American College of Sports Medicine and Centers for Disease Control recommendation for health-enhancing physical activity (to accumulate 30 minutes of moderate activity on most, but preferably all days of the week), and that nearly half were reportedly inactive (46%).[11]

Table 3.2. Prevalence (95% CI) of physical inactivity in a representative sample of adult South Africans (World Health Survey 2003; World Health Organization)[11]

	Men	Women	All
Inactive (< 600 MET min/wk)	43 (38; 49)	49 (43; 54)	46 (42; 51)
Minimally Active (≥ 600 MET min/wk)	20 (16; 23)	27 (23; 30)	24 (21; 27)
Sufficiently Active (HEPA)	37 (32; 42)	25 (20; 29)	30 (26; 34)

HEPA (Health enhancing physical activity; ≥ 7 days of any combination of moderate and vigorous activity, ≥ 3000 MET min/wk)

The IPAQ is an interviewer-administered or self-administered questionnaire that was developed to compare physical activity patterns across different countries among adults 18-65 years old.[12] There are two versions of the questionnaire, the long IPAQ and the short IPAQ, and each of these had two versions in which participants either reported their "usual weekly" or "past week" physical activity patterns. Only activities lasting longer than 10 minutes are recorded. The short IPAQ contains information on time spent in moderate and vigorous activities and walking, including usual walking pace. Additionally, the total number of hours spent sitting during a week and weekend day are recorded. The long IPAQ is a more comprehensive tool containing information on weekly activities in household and yard-work activities, occupational activity, transport, leisure time physical activity and sedentary behaviour. Participants from 14 countries answered both the long and short IPAQ twice, 3-7 days apart, to assess its reliability.[12]

The results from this study underscore the low levels of physical activity in our nation. In addition, it supports the findings of other national studies,[7,9,13] which highlight women as a particularly vulnerable group for low levels of habitual physical activity. A more recent and comprehensive survey was completed in 2003-2004 on a sample of more than 10 000 adults using the Global Physical Activity Questionnaire (GPAQ), however, these data are not yet available. The IPAQ[12] has been validated for use in the South Africa population, and the GPAQ is currently undergoing validation (Tshabangu, unpublished data).

Levels of physical activity in older adults:

Prevalence of available physical activity data are largely derived from regional, cross-sectional risk factor surveys, and suggest that persons over age 55 have the lowest levels of self-reported moderate and vigorous physical activity. In a recent follow-up study of older South African adults from historically disadvantaged backgrounds, the Yale Physical Activity Survey for Older Adults (YPAS) was used to describe patterns of weekly activity spent in housework, gardening, and yard work, care-giving, exercise, and recreation.[14] Results from this study suggest that these South African seniors spent an average of 2583 kcal/wk (± 3027 kcal/wk) in physical activity, 65% less than that reported in a sample of North Americans of the same age.[15] These data suggest that in South Africa, physical activity levels decrease with increasing age. This has also been well documented in other developed countries.[16-19]

Evidence for physical inactivity as a risk factor for CDL within South African populations

Physical activity and health outcomes in older adults:

CDL in South Africa account for nearly 40% of adult deaths, and the majority of South Africans have at least one modifiable risk factor for chronic disease.[20] More specifically, conditions such as hypertension and diabetes in older South African adults are very common. For example, prevalence of hypertension (≥160/95 mmHg or under treatment) in black South Africans (> 65 years) living in urban and peri-urban communities has been found to be greater than 43% in men and more than 66% in women.[21] Similarly, older adults of mixed racial ancestry from the Western Cape region have a reported prevalence of hypertension of 66.7% (95% CI: 57.3 - 76.1) in men and 76.5% (95% CI: 68.3 - 84.7) in women.[14] Moreover, those individuals with hypertension are generally poorly controlled.[21]

Although the role of physical activity in the prevention and attenuation of CDL is widely recognised, even in older adults, there are little data on the prevalence of physically active lifestyles in older adults in sub-Saharan Africa. Few studies have also attempted to link physical activity to health outcomes or morbidity in this population.

In two separate South African studies in older adults from peri-urban communities,[14,22] current levels of physical activity were dissociated from various indicators of morbidity, such as blood pressure (BP), waist circumference, and body mass index (BMI), as well as prevalence of hypertension, diabetes and hypercholesterolaemia. This may be explained, in part, by a "healthy survivor" effect. On the other hand, moderate lifetime occupational physical activity levels recalled for the ages from 14-49 years using a historical activity questionnaire, were significantly and inversely associated with current systolic blood pressure, $r = -0.24$, $p < 0.05$.[22]

Although the burden of disease in relation to hypertension is well characterised, the burden attributed to low bone mineral density (BMD), osteopaenia and osteoporosis, has not been described in South Africa. However, we have recently demonstrated that occupational-related physical activity between ages 14 and 21 years in men, and 22 and 34 years in women is "protective" against low BMD, in particular, in older women from a working-class community in the Western Cape, whereas current levels of total weekly physical activity were not associated with BMD in this population.[23]

We only found a significant correlation between current recreational physical activity and estimated BMD and T-score for the women.[23] We considered the possibility that these recreationally active women were "self-selected", as they may have had higher energy expenditure levels in the previous age epochs. The high intra-class correlation coefficients obtained when tracking physical activity in household, occupational and leisure domains, demonstrates that those who were active in epoch one (14-21 years) were more likely to be active throughout life.[23]

These findings were further corroborated by a study of 152 older men (n=47) and women (n=105) from the West Coast (Western Cape) who had spent their lives working in the fishing industry. In this sample, more than 50% of men and women had apparent low BMD or osteopaenia. However, recalled occupational levels of physical activity between the ages of 14 and 21 years for men, and between the ages of 22 and 34 years for women, were found to be positively associated with BMD measured by calcaneal ultrasound ($r = 0.35$, $p < 0.04$ for men, and $r = 0.24$, $p < 0.04$ for women). Thus, current BMD was weakly, but significantly associated with occupational physical activity during the years of peak bone mass accretion, which may have protected these individuals from bone loss later in life.[24]

Although these studies have provided some evidence for the relationship between physical activity levels and potential morbidity experienced by older adults in cross-sectional, regional surveys, there are few published data from intervention trials, which have specifically attempted to increase levels of physical activity in older South African adults, in a controlled setting. In one recent example of a community-based intervention study, the effectiveness of a 20-week, low-intensity community-based exercise programme on both functional ability and health was investigated in older adults in the Cape Peninsula.[25] Three community centres were selected: two were randomly allocated to the same 20-week, twice-weekly exercise programme (EX; n=54) and a third to relaxation classes (control/CTL; n=21). All the participants were sedentary at baseline.[25]

Dynamic balance, measured by the time taken to walk 10 m with the tandem gait, improved significantly in the exercise group (64 ± 28 seconds at baseline to 43 ± 15 seconds at 20 weeks ($p < 0.001$). In addition, a significant increase in lower body strength, as measured by the number of sit-to-stand repetitions in 10s was observed in the exercise group ($p < 0.001$). No significant changes occurred in these measures in the CTL group. In a sub-sample of subjects who were hypertensive at the outset, exercise intervention was associated with a significant decrease in systolic BP (n=26; 146 mmHg to 140 mmHg; $p=0.005$) with no changes in the CTL group. Variables unaffected by exercise training were upper body strength, body composition and fat distribution, 20 m walk, cardiovascular endurance and time spent in recreational activities.

Therefore, a 20-week community-based, low-intensity exercise programme improves dynamic balance and lower body strength in community dwelling older adults and improves BP in hypertensive subjects. The activities of daily living (ADL) score, which has been linked to functional ability did not change significantly in this study population, and is largely because most of the participants had a high functional status at baseline. This model has been replicated in the form of a community-based, peer-led intervention programme called "Live It Up" currently being administered through senior clubs in the Western Cape. However, there is clearly a need for more research, in particular, evaluating the long-term effectiveness and sustainability of such programmes, as well as morbidity and mortality outcomes.

Physical activity and health outcomes in adults:

As has been previously mentioned, South Africa is a country undergoing rapid epidemiological transition, with a dual burden of infectious disease and CDL. For example, results from the 1998 Demographic and Health Survey suggest that overweight and obesity affect more than 55% of South African women.[26] This high prevalence of overweight and obesity among South African women, particularly from the indigenous (black) population groups has important health consequences, as it is associated with increased risk for CDL. The relationship between BMI and physical activity was investigated in 530 black women living in the North West Province as part of the 'Transition and health during urbanisation of South Africans (THUSA) study.[27] Physical activity was quantified using a Physical Activity Index (PAI) based on the Baecke questionnaire. Kruger *et al*.[27] reported that physical activity was significantly and inversely associated with BMI ($r= -0.14$; $p=0.001$) and waist circumference ($r= - 0.15$; $p < 0.00001$). Furthermore, the women who were in the highest tertile for physical activity were 62% less likely to be obese compared to those who were the least active (OR = 0.38; 95% CI: 0.22 - 0.66). Similarly, the women in the second tertile for physical activity had approximately half the risk of obesity when compared to those who were least active (OR = 0.52; 95% CI: 0.31 - 0.86). These findings therefore underscore the importance of the role of physical activity in the prevention of obesity and overweight in women. This is particularly important since

54% of the women participating in the study were classified as either overweight (BMI >24.9 and <30) or obese (BMI >29.9).[27]

In a more recent study, the same research group investigated the relationship between the prevalence of physical activity and risk factors for ischaemic heart disease (IHD) in men and women from urban and rural communities.[9] The risk factors for IHD that were measured in this study included BMI, BP, total serum cholesterol, triglycerides and fasting blood glucose and insulin. The only variable related to a reduced risk of IHD that was significantly associated with increased levels of physical activity was fasting insulin among the men. The most active men had higher systolic and diastolic BP results than the least active men (mean systolic BP 129 ± 1.57 mmHg versus 125 ± 2.18 mmHg and mean diastolic BP 78 ± 0.95 mmHg and 73 ± 1.32 mmHg). For the women, triglyceride concentration and fasting serum glucose were significantly and inversely associated with increased levels of physical activity.[9] Conversely, while high-density lipoprotein (HDL) cholesterol was directly associated with physical activity levels.[9]

More importantly, lower levels of physical activity were significantly associated with IHD risk factors for both the men and women who were overweight.[9] The men who were least active and who were overweight (BMI >25) had significantly higher total cholesterol, low-density lipoprotein (LDL) cholesterol, LDL:HDL ratio and fasting insulin levels than those who were moderately active and overweight. Similarly, the overweight and physically active women had significantly lower LDL cholesterol, LDL:HDL ratio and fasting insulin than the overweight women who were inactive.

In another cross-sectional survey conducted in a peri-urban community in the Western Cape, physical activity was "protective" against risk for type 2 diabetes. Those persons in the lowest quartile for physical activity energy expenditure had an odds ratio of 1.75 (95% CI: 1.07 - 2.86) for type 2 diabetes.[10] In a re-analysis of the same study, physical activity levels, along with a self-reported history of angina, patient awareness concerning hypertension and diabetes status, height, weight and waist circumference, contributed significantly to a global cardiovascular disease risk score.[13]

Finally, in a recent multi-country case-control study (INTERHEART) in which more than 15 000 acute myocardial infarction cases were compared to control subjects, in 52 countries, including South Africa, physical activity was again protective (OR of 0.86, 95% CI: 0.76 - 0.97).[28] The risk or preventable death attributable to inactivity (less than 4 hr/week of moderate or strenuous activity) was 12.2%.

Taken together, these studies provide substantive evidence for the putative protective role of physical activity against CDL, even in communities and populations undergoing the epidemiological transition. What is lacking are data from randomised controlled trials, or specific, prospective studies, characterising the effective dose-response and culture-specific activities required to prevent early morbidity and mortality actively.

Children and young adults:

While there is limited published data available concerning physical activity and adverse health sequelae in South African children, three recent studies provide sufficient evidence to "make the case" for primary prevention in this "at risk" group. Firstly, physical activity levels and opportunities for physical activity opportunities distribute differentially across socio-economic strata. For example, in the Birth-to-Twenty cohort, children from more affluent homes reported higher levels of physical activity, less television viewing time, and had a higher lean mass than their more disadvantaged counterparts.[29] These results suggest that those children from less affluent homes may ultimately be more likely to become obese later in life.[29,30]

Furthermore, there is indirect evidence that a "poor start" or early life stunting is associated with greater risk for obesity in schoolgirls, aged 10-15 years, from the North West province. Stunted girls were less physically active than their non-stunted counterparts were, however, even after adjusting for activity levels, these girls had greater subcutaneous fat deposition, and higher waist circumferences.[31]

Over and above these associations, physical activity levels have been positively linked with bone mineral density in black and white pre-adolescent South African schoolgirls,[32] and more recently, in 9-year-old white school children.[33]

However, little data are available concerning secular trends of physical activity, particularly those linked to obesity in South African schoolchildren. Moreover, no published studies are thus far available which specifically address the determinants and barriers to physical activity in this vulnerable group.

Public health and inter-sectoral initiatives aimed at increasing participation in physical activity

The Ministry of Health has initiated a consultative process to develop a series of guidelines for the prevention or management of CDL (separate guidelines are available for the prevention and management of diabetes, hypertension, hyperlipidaemia, and overweight). The directorate has also recognised the need to encourage physical activity, in particular, among older adults and initiated guidelines for promoting "active" ageing (1999). More recently, in November 2004, the Directorate of Health Promotions, within the Department of Health, launched an inter-sectoral strategy aimed at the Promotion of Healthy Lifestyles and change from risky behaviour, particularly among the youth. This forms part of the plan for comprehensive health care in South Africa, and is one of the strategic priorities for the period 2004 - 2009.

There are also initiatives within both the Ministry of Sport (Sport and Recreation South Africa) and the Ministry of Education, which provide a policy and programme framework that support the strategic priorities for health care. Sport and Recreation South Africa is responsible for devising and implementing sport and recreation policy, specifically targeting increased mass participation, as well as sports development. This mandate is reflected in the theme of the ministerial White Paper on Sport and Recreation in South Africa, which is "getting the nation to play".

Sport and Recreation South Africa has identified various levels of programme development, as a means of addressing this mandate. These include building multi-purpose sporting facilities in rural areas and socio-economically disadvantaged townships in urban settings to increase participation. In addition, the ministry has launched a programme of "Indigenous Games" as a means to capitalise on the cultural diversity of South Africa, by training leaders at a provincial level.

Siyadlala is a national project of Sport and Recreation South Africa, which is aimed at facilitating mass participation in sport and recreation activities, especially in disadvantaged communities in high crime areas and government priority nodal areas. The Siyadlala programme, launched in 2004, has actively employed 39 instructors to coordinate the introduction of new sporting codes to previously disadvantaged areas in some 400 "hubs". Thus far, none of these initiatives has received formal evaluation.

In 2002, combined talks were held between the Ministry of Education and that of Sport and Recreation to determine the way forward for sport at schools. In principle, it was decided that the Department of Education would be responsible for school sport and physical education under the umbrella of the "life-skills orientation" programme. This programme is implemented at a provincial level, according to regional priorities and needs. More recently, in March 2005, the Ministers of Sport and Recreation and Education signed a cooperative agreement for the coordination and management of school sport, with an emphasis on structured programmes of extramural sports at each school.

However, two recent initiatives that began in the non-governmental sector have enjoyed support and constructive input from the Department of Health, in particular, as well as the Department of Education and other stakeholders. These include the promotion of the Global Move for Health concept and the development of and adoption of a National Youth Charter for Participation in Sport and Physical Activity.

The original Move for Health day was initiated in response to the highly successful implementation of "Agita Mundo" in Brazil.[34] The Agita Mundo programme was formed in response to the high prevalence of chronic diseases of lifestyle among Brazilian men and women. Agita Mundo means, "Move for Health", and the main aim of this campaign is to educate individuals on the health and fitness benefits of exercise and to promote the implementation of physical activity programmes. This programme, which started in Sao Paulo, spread to the rest of Brazil, and then to the rest of the Americas, has subsequently been recognised as a model to promote mass participation in physical activity programmes.

Consequently, the World Health Assembly mandated its member states, of which South Africa is one, to celebrate "Move for Health" annually. The core message of "Move for Health" is to encourage individuals to accumulate 30 minutes of moderate physical activity on most days (at least 5) of the week.

The South African campaign has been named, "Vuka South Africa – Move for your Health", which means "Wake up South Africa, move for your health". The National Department of Health, together with its partners (National Departments of Education and Sport and Recreation South Africa; private companies, tertiary institutions and non-governmental organisations) launched

the Vuka South Africa – Move for your Health campaign in May 2005. Since its inception, there have been numerous planning meetings, culminating in a stakeholders' workshop that was held in September 2005. This workshop has served as a platform for the future implementation of the Move for Health programme, together with the monitoring and evaluation of the campaign.

Similarly, the development of a Charter for Physical Activity, Sport, Play and Well-Being for all Children and Youth in South Africa, the Youth Fitness and Wellness Charter, was initiated in October 2004. In developing the Charter, the UCT/MRC Research Unit for Exercise Science and Sports Medicine (ESSM) sourced similar such documents, which had been introduced internationally. These documents took into consideration existing documents that provide physical activity guidelines for adults, adolescents and youth in Australia, the Australian Charter for Physical Activity and Sport for Children and Youth, as well as the Charter for Physical Education and Sport, developed by UNESCO, the European Manifesto on Young People and Sport, the European Sports Charter and the consensus statement on organised sports for children published by the International Sports Medicine Federation (FIMS) in 1997.

Over the past century, mechanisation and urbanisation have greatly reduced both the necessity for physical activity at work and the opportunities for leisure time exercise. Many studies have established that this reduction in physical activity contributes to CDL, such as diabetes, heart disease and certain types of cancer, and risk factors, such as obesity and hypertension. In addition, while South Africa's past has distorted the importance of sport and recreation and denied millions the right to a healthier lifestyle, it is now clear that sport and mass participation in free play and physical activity are integral components of a national priority for reconstructing a unified country, developing a healthier society, and improving sporting excellence. The Youth Wellness and Fitness Charter seeks to address these issues at a multi-sectoral level.

Professor Kader Asmal, MP and chairperson of the Portfolio Committee on Defence, has agreed to become the official patron of the Charter and support the initiative in the way forward. This development opens the platform for direct national government intervention and associated policy decisions.

The focus of this campaign is on national and local government, working together with parents, sporting organisations, non-government and non-profit organisations, clubs, higher education institutions, schools, faith-based organisations, the youth sector, the private sector and other key role players. Through this campaign, communities and opportunities are created for all children to become physically active and to establish a lifelong commitment to an active and healthy lifestyle.

The campaign does not aim to introduce new interventions and programmes, but rather serves to educate schools about physical activity, nutrition and wellness, facilitate those interventions that are already in place, and to provide a support base for improving and enhancing school intervention programmes and those of private service providers.

The implementation strategy will be launched in parallel phases that will target the following groups and issues:

1. Policy (National Departments of Health, Education and Sport and Recreation).
2. Schools and education.
3. Parents, care-givers and the family unit.
4. Communities.
5. Health services.
6. Evaluation and research.

Current research priorities and advocacy for physical activity and health promotion

While there has been substantial research progress in the intervening ten years between the first published South African MRC Technical Report concerning physical activity and chronic diseases, there remain many important areas of research that have not been established. In the near future, we will confidently be able to report national adult physical activity prevalence data, using validated questionnaires, based on the WHO STEP-wise surveillance methodology. In addition, we have prevalence of inactivity in adolescents from the Youth Risk Behaviour Survey. However, we still lack data on determinants and barriers to participation in physical activity, and physical activity linked in a prospective manner to health outcomes, morbidity, and mortality. Moreover, there are no examples, at present of studies investigating the cost-effectiveness of physical activity or burden of disease models, which model the attributable burden associated with inactivity.

We have few examples of process evaluation, and even fewer of programme evaluation of community-based programmes, or public health initiatives, designed to increase mass participation in physical activity, or specifically to target vulnerable groups. There is also lack of measurement of physical activity and wellness interventions arising in other governmental sectors such as

education, and within the private sector such as the health insurance industry. These measurements are important in contextualising these initiatives in terms of potential health impact.

Finally, almost no studies exist in which the effectiveness of interventions for physical activity has been measured. Again, all of the aforementioned studies and data derived make up the essential ingredients needed for "making the case for physical activity" and the advocacy that follows.

EPILOGUE

South Africa forms part of the global community, and as such, government has embraced the WHO's Global Strategy on Diet and Physical Activity for Health. There is commitment to a Healthy Lifestyles strategy, and several public health initiatives under this strategy, including Vuka South Africa-Move for your Health, and the Youth Charter for Fitness and Wellness. Evaluation of these and other programmes and initiatives, ongoing surveillance of physical activity and other risk factors, and intervention studies, focused on targeted, vulnerable, or high-risk groups, are needed, to continue to address this important risk factor for CDL.

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CHAPTER 4

NUTRITION
AND CHRONIC DISEASES OF LIFESTYLE IN SOUTH AFRICA

Nelia P Steyn[a]

1. INTRODUCTION

South Africa has a complex mix of developed and developing areas in terms of its population and its economy. It has one of the highest Gini coefficients in the world (0.61), which illustrates the huge rift in income distribution between the majority of low-income households and the wealthy, minority group.[1] This element of unequal distribution is also evident in the dietary intake and the nutritional status of the South African population, which presents as a large prevalence of stunting in black children,[2] especially in rural areas, and a large prevalence of overweight and obesity in all ethnic groups, especially in urban areas.[3] For the majority of black population there are two scenarios. On the one hand, there is a large rural population, the majority of whom survive on an income of less than R1 000 per family/month, and usually still follow their traditional way of living. On the other hand, there is a growing urban population, which is faced with many new challenges and problems, including lack of housing, poor sanitation and sewage disposal, lack of adequate energy/fuel sources, lack of access to clean water and high rates of crime and violence.

In many ways, the newly-arrived urban dwellers have to change their lifestyle to adapt to the changes in their surroundings. Four of the most common lifestyle changes in this regard are a decrease in physical activity, a change in diet and eating patterns, adoption of tobacco use and increased alcohol use. It is difficult to describe these four factors in isolation since they are so intricately linked. In deep rural areas, physical activities are a routine part of everyday life. Few people in villages have cars, and transport is a dearly paid for luxury. Hence, villagers have to rely on walking. Children walk to school. Friends walk to each other's houses, and health facilities are often a long walk away.[4] Villagers have many routine physical activities, which include tasks like fetching water, making meals, fetching and chopping firewood and working in the fields. Since they seldom have electric appliances, they need to do all household tasks themselves. This means that they have less time for leisure time compared to their urban contemporaries. Even children depend on themselves to have fun and play games and are less likely to be occupied in sedentary pursuits.

However, over the last four decades television has slowly crept into the homes of more and more villagers, who now spend less time on activities and more time being inactive as a result of this. This has exposed them to the ruthless effects of advertising, which shows desirable foods, drinks and lifestyle, which are frequently beyond their reach. Many of these advertisements encourage unhealthy behaviour such as snacking on unhealthy food items and drinks.

In urban areas lifestyle changes have happened much faster.[5-9] Transport is readily available and there is no need or time for walking. In leisure time, watching television has replaced many physical and sporting activities. Furthermore, fast foods are available everywhere to replace the leisurely mealtimes when home-grown and indigenous foods were often the order of the day. Additionally, people may be exposed to unhealthy and polluted environments. There is a greater variety of food items available in urban areas. Many of these items will replace the typical rural foods of the past. These include foods which have traditionally been used as staples and are now replaced by township foods. Many of these are high in fat and sugar and have a low nutrient density.

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In order to understand the dynamics of dietary changes we examine the main food groups consumed by South African adults and children in urban and rural areas (Table 4.1). This Table presents a summary of data from combined databases using secondary data analyses (in lieu of no national data available on adults) to show the dietary intake of adults[10,11] and children (1-5 years)[2] in South Africa. Rural dwellers have a higher intake of cereals and vegetables. However, for most other food groups the urban adults and children far exceed the consumption of their rural fellows. This is particularly true for, sugar, meat, vegetable oil, dairy, fruit, roots, tubers and alcohol consumption.
To appreciate the magnitude of the transition and to tackle the changes in a meaningful way, it becomes important to identify the typical dietary pattern of the different populations in South Africa. This has more meaning if one evaluates these differences in terms of foods as well as in terms of nutrients. Four distinct types of diet can be identified and will be discussed below.

* Typical western South African diet;
* Typical rural African diet;
* Typical urban township diet;
* Indian urban diet.

The macronutrient compositions of these four dietary patterns are presented in Tables 4.2a and 4.2b and in Figs. 1-3 and will be discussed under the diet categories above. Furthermore, these diets are evaluated in terms of the WHO/FAO population goals.[12]

Table 4.1. Food groups consumed by South African adults and children in urban and rural areas[11]

	Adults and children 10+ years			Children 1-5 years		
Food groups	RSA g/day	Urban g/day	Rural g/day	RSA g/day	Urban g/day	Rural g/day
Cereals	870	736	1023	489	433	546
Sugar	76	120	27	65	93	39
Stimulants: tea, coffee	382	390	371	147	143	151
Vegetables	93	85	101	52	45	58
Meat and offal	86	102	67	45	56	34
Vegetable oils	8	11	5	5	6	3
Dairy	73	109	31	124	147	102
Fruit	61	83	36	48	70	27
Eggs	15	16	14	10	12	8
Legumes	35	34	36	17	15	18
Fish	12	14	10	7	8	5.8
Roots & tubers	40	59	19	29	32	27
Nuts & oilseeds	2	2	2	1	2	1
Alcohol	54	67	38	-	-	-
Soups	2.6	4.3	0.6	6	3	9
Condiments	0.5	0.7	0.3	0.2	0.2	0.1
Animal Fat	1.0	1.6	0.4	0.1	0.1	0.2

Table 4.2a. Comparison of macronutrient distribution in seven dietary studies in South Africa

Dietary factor	WHO[12] goals% of energy	CORIS[13] white rural	DIKGALE[14] black rural	BRISK[15] black urban	VIGHOR[16] white urban	Indians[17] urban	CRISIC[18,19] coloured urban (20-34 years)
Energy MJ		6.3 - 12.7	6.1 - 6.3	5.8 - 8.5	5.9 - 12.5	5 - 8.5	7.1 - 10.3
Total fat	15-30%	34.6 - 36.5	15.7 - 17.1	23.8 - 28.3	33.3 - 38.6	32.8 - 36.9	37.3 - 38
SFA	<10%	12.6 - 13.6	3.7 - 4.4	8.5 - 9.2	12.2 - 14.6	7.0 - 9.8	11.8 - 11.9
PUFAs	6-10%	5.9 - 7.0	3.7 - 3.9	4.5 - 7.2	5.6 - 7.8	9.5 - 12.5	9.1 - 9.2
CHO	55-75%	44.1 - 51.5	62.4 - 70.8	59.2 - 64.3	46.9 - 53.3	45.5 - 53.0	45 - 46.5
Free sugar	<10%	10.8 - 15.4	5.2 - 4.2	10.7 - 14.6	13.0 - 18.6	10.8 - 15.8	15 - 16
Protein	10-15%	13.8 - 16.6	14.2 - 15.6	13.1 - 15.3	13.6 - 16.3	11.9 - 13.8	14.9 - 15
Cholesterol	≤ 300 mg /day	243 - 509	144.9 - 116.6	-	140 - 176 mg /4.2 MJ	76 - 117 mg /4.2 MJ	290 - 440

Table 4.2b. The distribution of macronutrients in the diet of black South African males residing in different locations[20]

Dietary factor	WHO[12] goals	Rural n=194	Farm workers n=108	Informal settlement n=128	Middle class n=229	Upper class n=83
Energy (MJ)		9.6	8.9	9.3	9.9	8.3
Total fat (% of energy)	15-30	22.9	22.8	24.3	26.0	30.6
SFA (%)	<10	16.1	16.9	16.8	19.0	24.9
PUFAs (%)	6-10	14.8	12.2	14.6	16.5	17.2
CHO (%)	55-75	67.4	67.2	65.5	64.0	57.3
Protein (%)	10-15	11.6	12.1	12.0	11.8	13.2
Cholesterol (mg)	≤ 300	315	283	332	377	420
Fibre (g)		19.2	15.6	17.4	18.8	19.7

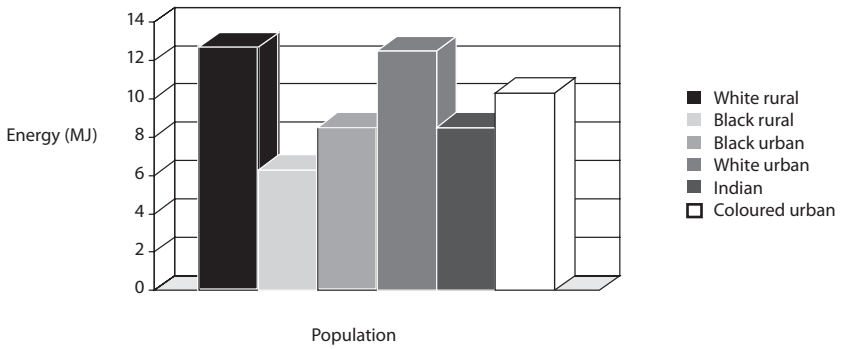

Figure 1: Mean daily energy intake of adult males as determined by secondary dietary analysis from studies between 1983 and 2002[12-20]

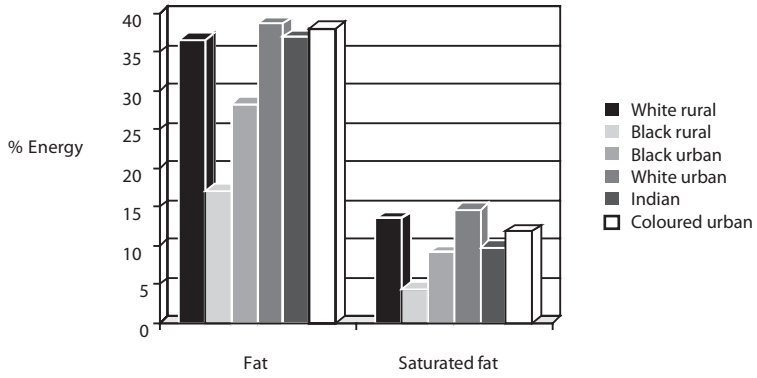

Figure 2: Mean daily fat intake as a % of total energy intake of males as determined by secondary dietary analysis from in studies from 1983 to 2002[12-20]

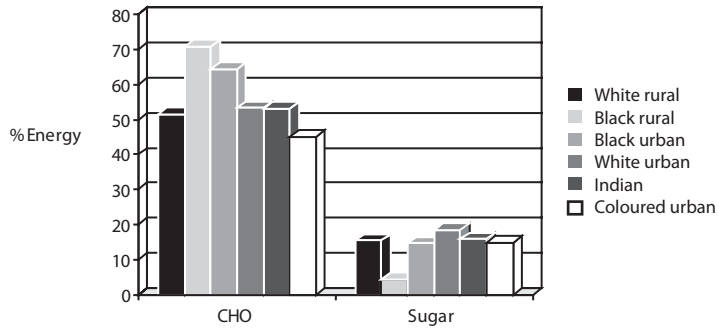

Figure 3: Mean daily carbohydrate and sugar intake (% energy) of males as determined by secondary dietary analysis from in studies from 1983 to 2002[12-20]

2. THE TYPICAL WESTERN SOUTH AFRICAN DIET

The typical western diet is the one followed by most of the white and coloured urban population and increasingly by black urban dwellers. The meal pattern is a three meal a day plan with one large meal being the main meal of the day.[21] Typically, the main meal contains a staple food, frequently rice and/or potatoes, a generous portion of meat or chicken, and generally at least 2 vegetables. Bread is usually eaten at one or more of the other meals. Since 1994, with the increased exposure to international communities, a greater variety, more fast food options, and more exotic items have also appeared on the menu.

In South Africa two large epidemiological studies have examined dietary intake in white South Africans.[13,22] The white South Africans in both studies had very similar energy intakes and the mean distribution of macronutrients was also similar, being higher than the WHO/FAO[12] population goals in most instances.

One of the earliest of these studies, the Coronary Risk Factor Study (CORIS), was undertaken in the seventies in three towns (rural) of the Western Cape. The total populations of the three towns who participated in 1979 comprised 7 188 subjects. Dietary intake data were collected by means of a 24-hour recall. The results indicate that fat intake was very high and did not conform to a prudent diet.[13]

Table 4.3 presents data on the food groups, actual foods, and portion sizes eaten by the white rural population in the CORIS study.[13] The adults were found to have a very high meat, dairy and egg intake, which accounts for the high percentage fat and saturated fat intake. The high sugar intake is due to table sugar, soft drinks, sweets, and instant puddings. Dairy was mainly in the form of whole milk and full-fat cheese. Fruit and vegetable intake per capita was high (392 g) and showed a substantial variety of different items. The fruit and vegetable intake was close to the 400 g recommended by the WHO/FAO.[12]

The second study on white adults was undertaken in the eighties on a random sample of white adults (n=317) living in the urban centres of Witbank and Vanderbijlpark. Dietary assessment was done by means of a 24-hour recall in order to typify a typical western diet in urban areas.[16] The study is known as the Vanderbijlpark Information Project on Health Obesity and Risk Factor (VIGHOR) study (Tables 4.2a & 4.2b). As can be seen, the macronutrient distributions are virtually

the same as those in the CORIS study, with the exception of a higher cholesterol intake in the latter. Unfortunately, there is little description of the actual foods consumed.

In 1982, a random sample of coloured urban subjects (n=976) were evaluated in the Coronary Risk Factor Study (CRISIC) which was undertaken in the Cape Peninsula (Tables 4.2a & 4.2b).[18,19] They had very similar intakes to those of the urban whites in VIGHOR. However, energy intake, carbohydrates, fat, and saturated fat were lower in coloured males compared with white males, while cholesterol and polyunsaturated fats were lower. Most nutrients did not conform to the prudent guidelines.

Unfortunately, little data on coloured rural adults are available, yet a study on adolescents shows interesting trends.[22] The study was undertaken on 11-12-year-old coloured, white and black children (n=872) in the Western Cape in 1986. It was found that in urban areas sugar, whole milk, brown bread, white bread, oats, maize meal, and condensed milk were the items most frequently consumed by coloured adolescents. In the rural areas, it was found to be sugar, brown bread, white bread, whole milk, sifted maize meal and non-dairy creamer. The energy and fat intake of the diet of the urban coloured children was higher than that of rural ones and lower in carbohydrates.[23] Another important finding was the degree of dietary diversification in the different population groups.[22] White urban children consumed a large variety as indicated by 74 different food items, while urban coloured and black adolescents had a variety of 50 and 45 respectively. In rural areas the variety decreased in all groups to 48 in whites, 42 in coloureds and 32 in blacks.

Table 4.3. Main food items consumed by a white rural group in the Western Cape Province (CORIS)[13] as determined by secondary data analysis[11]

Total food group	Food items included	% of group consuming the item	Per capita per day (g)
Alcoholic beverages	Cane spirits, brandy, gin, whisky wine, beer	27.4	97.7
Cereals	Bread, cookies, pancakes, pudding, cakes, rusks, wheat-based cereals, crackers, maize porridge, pasta, oats, samoosas, fat cakes, savoury charts, maize-based cereals	98.0	285.5
Fish	Sea fish, cooked fresh	21.5	27.4
Fruit	Apples, grapes, bananas, orange juice, peaches, avocados, fruit juices, canned peaches, pineapple, pears	68.7	251.6
Meat & offal	Mutton, chicken, meat products, beef sausage, beef, meat gravy, pork products, minced beef, dry meats	92.6	218.8
Milk and milk products	Full-cream milk, skim milk, butter, ice cream, high-fat cheeses, cheese spread, condensed milk	92.8	306.3
Eggs & products	Egg dishes	30.3	25.3
Nuts & oil seeds	Peanut butter	3.0	2.4
Pulses	Split peas, sugar beans, haricot beans	16.5	47.5
Roots and tubers	Potatoes, sweet potatoes, carrots, beetroot, potato crisps	72.1	148.5
Soups		3.5	7.1
Stimulants	Tea, coffee, chocolate sweets	96.5	848.0
Sugar & products	Sugar, jam, carbonated cold drink, squash, sweets, jelly, honey, instant pudding	88.5	209.6
Vegetables	Tomato, green beans, pumpkin/butternut, lettuce, onion, peas, gems, wild leaves (beetroot, pumpkin etc), cabbage, cauliflower, cucumber	77.3	139.7
Vegetable fats & oils	Brick margarine, medium/low-fat margarine in tubs, non-dairy creamer	87.1	25.3

3. DIET OF BLACK SOUTH AFRICANS RESIDING IN RURAL AREAS

Dikgale rural adults had the most prudent diet as far as compliance with the international guidelines goes (Tables 4.2a & 4.2b).[14] They had a very low fat intake and a high carbohydrate intake, which is typical of the traditional type of diet found in African countries in rural areas.[24] MacIntyre *et al*.[20] had similar findings for rural participants in their Transition Health and Urbanisation Study in South Africa (THUSA).

Table 4.4 presents dietary data of a black adult rural group (n=210) obtained by means of four 24-hour recalls.[14] The black participants had been randomly selected from the adult population in Dikgale in Limpopo Province. Some interesting differences are noted when comparing with the white adults in Table 4.3. The Dikgale adults had the highest per capita intake of cereals when compared with the white group (1034 g vs. 285.5 g). Furthermore, the black group had very little variety within the cereal group with only maize, sorghum and bread being consumed (54% brown, 11% white bread). Two items that had a higher intake in the black group were nuts and legumes. Legumes (65 g) made a significant contribution to the diet of the Dikgale group. Regarding all the other food groups, the white participants had much higher intakes. This was particularly noticeable for intake of meat (218.8 g vs. 64.2 g), dairy (306.3 g vs. 12.4 g), fruits and vegetables (392 g vs. 134.2 g) and vegetable fats (25.3 g vs. 2.3 g).

From a nutritional point of view, the different types of nutrient intakes of these two groups can be explained by their differing intakes of food groups. The whites had higher fat and saturated fat intakes based on their high consumption of meat, full-cream dairy products and vegetable fats. Conversely, the black group had a very high cereal consumption resulting in a high contribution of carbohydrate to energy intake. The black group had a very low intake of fruit and vegetables, i.e. 134.2 g compared with the 400 g recommended by the WHO/FAO.[12] Therefore, one would expect them correspondingly to have lower intakes of folate and vitamins A and C. When comparing the black group with the overall rural intake for South Africa (Table 4.1), there is a very close match on all food groups.

Table 4.4. Main food items consumed by a black rural group in Dikgale in the Limpopo Province using four 24-hour recalls

		Limpopo Province[11,14]	
Total food group	**Food items included**	**% Consuming the item**	**Per capita per day (g)**
Alcoholic beverages	Commercial and home-made beer	4.2	71.3
Cereals	Maize porridge, sorghum, brown bread, white bread	98.6	1034.5
Fish	Canned fish	3.2	3.3
Fruit	Apples, orange juice, avocados,	12.5	27.2
Meat & offal	Chicken, beef, giblets	46.3	64.2
Milk and milk products	Full cream milk, non-dairy creamers	10.2	12.4
Eggs & products	Egg dishes	7.4	8.8
Nuts & oil seeds	Peanut butter	6.6	2.4
Pulses	Kidney beans, sugar beans, haricot beans	22.2	65.0
Roots and tubers	Potatoes, sweet potatoes	10.6	25.4
Stimulants	Tea	69.4	485.4
Sugar & products	Sugar & cold drinks	65.7	23.7
Vegetables	Tomato, green beans, pumpkin/ butternut, lettuce, onion, peas, gems, wild leaves (beetroot, pumpkin etc), cabbage, cauliflower, cucumber	48.1	107.0
Vegetable fats & oils	Brick margarine, medium/low-fat margarine in tubs, non-dairy creamer, condensed milk, non-dairy cream, salad dressing, mayonnaise	25.5	2.3

4. BLACK URBAN (TOWNSHIP) DIET

Black urban participants had similar protein and sugar intakes to adults in the VIGHOR study and CORIS study. However, their fat intakes were lower and their carbohydrate intakes were higher as indicated by Figs. 2 and 3.

The Black Risk Factor Study (BRISK) remains the only recent study where the diet of a black urban population (n=983) has been studied in South Africa.[15] There are large differences in food intake between the urban and rural areas. Rural participants in Dikgale (Table 4.4) had a larger per capita intake of cereals of 1034.5 g per day, compared with 492.7 g in the BRISK study (Table 4.5). Vegetable intake was greater in Dikgale (107 g vs. 47.5 g) as were legumes (65 g vs. 27.8 g). Per capita meat intake was nearly double in BRISK (112.2 g) compared with Dikgale (64.2 g). Vegetable fat/oil were six times greater in BRISK (13.3 g) than in Dikgale (2.3 g). These findings are supported by results from a study undertaken on black first year female students at the University of the North, which showed some interesting differences between those girls from urban areas compared with those from rural areas.[25] Urban women consumed significantly more sugar (65.8 g vs. 52.2 g) and confectionary (290 g vs. 182.7 g than rural women did. They also had higher intakes of meat (124.0 g vs. 108.1 g), wheat products (275.5 g vs. 246.9 g), oil/fats (40.1 g vs. 33.8 g), fruit (687.1 g vs. 539.4 g) and beverages (339.6 g vs. 225.2 g). Students from rural areas had higher intakes of legumes (18.9 g vs. 6.3 g), and cereals, particularly maize meal (297.7 g vs. 206.7 g).

Table 4.5. Main food items consumed by a black urban group in Cape Town (BRISK)[15] as determined by secondary data analysis[11]

Total food group	Food items included	% of group consuming the item	Per capita per day (g)
Alcoholic beverages	Commercial and home-made beer	7.0	97.0
Cereals	Maize porridge, rice, brown bread, white bread, samp, fat cakes, savoury tart	98.5	492.7
Fish	Canned fish	10.6	12.5
Fruit	Apples, peaches, bananas, pears, orange juice, grapes, fruit juices	28.9	91.8
Meat & offal	Chicken, beef gravy, meat dishes, mutton, beef, beef offal, beef sausage, mince	74.0	112.2
Milk and milk products	Full cream milk, full cream processed milk (buttermilk & maas)	59.9	152.4
Eggs & products	Egg dishes	16.2	15.4
Animal fats	White, chicken fat, beef tallow	31.2	3.5
Nuts & oil seeds	Peanut butter	4.4	1.4
Legumes	Kidney beans, sugar beans, haricot beans	17.2	27.8
Roots and tubers	Potatoes, sweet potatoes	49.2	85.6
Stimulants	Tea & coffee	72.6	272.8
Sugar & products	Sugar, cold drinks, squash	89.1	215.7
Vegetables	Cabbage, tomato & onion, pumpkin/butternut, onion, peas, gems	42.8	47.5
Vegetable fats & oils	Brick margarine, medium/low-fat margarine in tubs, non-dairy creamer, condensed milk, non-dairy cream, salad dressing, mayonnaise	61.5	13.3

5. THE DIET OF THE INDIAN URBAN POPULATION IN SOUTH AFRICA

Dietary surveys in the Indian population are scarce and the one by Wolmarans *et al*.,[17] represents the largest study yet (Tables 4.2a & 4.2b). Little information is available on the actual foods consumed in this study, only the nutrients intakes are presented. The macronutrients show that total fat intake, polyunsaturated fat and sugar intakes exceed the recommended amounts.

In 1984 Mackeown *et al*.[26] reported on the diet of 4-5-year-old Indian children (n=598) in Transvaal. Food items which contributed most to the energy intake of their diet were (in descending order): malted milk (such as Milo), white bread, milk, brown bread, and sugar; while malted milk, mutton, milk, white bread and chicken contributed most to protein intake. Fat sources were margarine, malted milk, milk, crisps and cheese. In terms of percentage food items consumed, from highest to least, were milk, cold drink, tea, malted milk and squash.[27] The quality of the diet hence reflects certain unhealthy eating habits of Indian children, particularly the high consumption of sweetened beverages.

6. SOUTH AFRICAN FOODS ACCORDING TO FAO FOOD BALANCE SHEETS

In Table 4.6, food balance sheets for South Africa over a period of 40 years (1962 to 2001) are presented. It is important to remember that food balance sheets present total amounts of foods consumed, and present the results in a manner that reflects equal distribution: it presents the total of what is available and not how it was distributed. Furthermore, it is regarded as a very crude estimate of dietary intake and has only been included because national data on dietary intake surveys were not available prior to 1999. Certain trends have been noticed over the 40-year period. Per capita energy intake increased from 2605 calories per day in 1962 to 2921 calories in 2001, fat increased from 61.2 to 79 g, while protein intake increased from 68.4 to 79.0 g.

Cereal consumption increased from 169 kg per capita per annum in 1962 to 187.8 kg in 2001. A similar increase was noted for starchy roots (13-29.7 kg), vegetable oils (5.7-14.5 kg), fruits (24.1-36.0 kg), all alcoholic beverages (43.8-56.8 L), meat (31.6-37.5 kg), eggs (2.5-6.1 kg), and fish (5.5-7.9 kg). For some foods per capita intakes decreased: sugar and sweeteners (39.4-32.8 kg), offal (4.5-3.8 kg), animal fats (including butter) (3.0-0.7 kg) and milk (78.0-54.1 kg).

These data represent the following scenarios. Intake of cereals gradually increased, as did vegetable oils and the other items mentioned above. This accounts for the overall increase in energy intake (Fig. 4). The bad news is that vegetable oil (Fig. 5) and meat increased significantly, which accounts for the large increase in fat intake. Meat intake increased from 31.6-37.5 kg (per annum) between 1962 and 2001. This is indicative of an increase in saturated fat intake. Also of concern is the increase in alcohol consumption and the fact that vegetable intake remained constant (43.5-44.2 kg per annum). Overall, fruit and vegetable intake was 185 g/day in 1962 and 219.7 g/day in 2001. Although there is an increase in fruit and vegetables, the average is still far below the recommended amount of 400 g per day.[12]

In terms of the recommendations of the WHO/FAO,[12] the following trends in South Africa are not desirable:

1. Poor intake of fruit and vegetables
2. High and increasing fat (polyunsaturated and saturated) intake
3. Decrease in milk intake
4. Overall increase in energy intake
5. High and increasing alcohol intake
6. Low fibre intake – since intakes of fruit, vegetables and legumes are low.

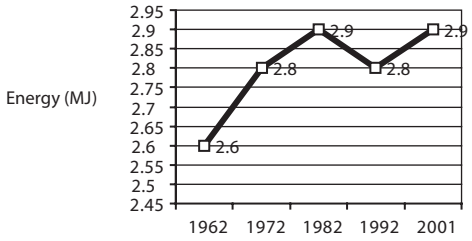

Figure 4: The per capita daily intake of calories (/1000) in South Africa between 1962 and 2001[28]

Table 4.6. Food balance sheets for South Africa between 1962 and 2001[28]

Products	Year 1962				Year 1972				Year 1982				Year 1992				Year 2001			
	Kg*	Cal	Pro	Fat	Kg*	Cal	Pro	Fat	Kg*	Cal	Pro	Fat	Kg*	Cal	Pro	Fat	Kg	Cal	Pro	Fat
Grand Total		2603	68.4	61.2		2819	74.6	66.4		2905	77.1	66.0		2790	75.3	68.8		2921	75.1	79.0
Cereal-Excluding Beer	169.3	1434	38.7	10.9	173.4	1467	39.9	10.7	186.1	1576	43.1	11.1	173.4	1480	40.0	10.5	187.8	1601	42.6	11.5
Starchy roots	13.2	27	0.5	0.0	22.6	45	0.9	0.1	25.3	50	1.0	0.1	24.9	50	1.0	0.1	29.7	58	1.2	0.1
Sugar & Sweeteners	39.4	383	0.0		40.5	394	0.0		39.6	386	0.0		35.5	346	0.0		32.8	319	0.0	
Pulses	2.5	23	1.5	0.1	3.4	32	2.1	0.1	3.2	29	1.9	0.1	4.0	37	2.4	0.2	2.8	25	1.7	0.1
Treenuts	0.1	0	0.0	0.0	0.1	1	0.0	0.1	0.1	1	0.0	0.1	0.2	1	0.0	0.1	0.3	2	0.1	0.2
Oilcrops	1.1	12	0.5	1.0	1.5	16	0.6	1.4	1.1	11	0.5	0.8	1.5	14	0.8	1.1	2.2	23	1.4	1.8
Vegetable oils	5.7	137	0.0	15.6	7.3	176	0.0	19.9	7.5	183	0.0	20.6	9.4	229	0.0	25.9	14.5	352	0.0	39.8
Vegetables	43.5	35	1.6	0.3	46.8	36	1.6	0.3	52.8	39	1.7	0.3	46.1	35	1.5	0.4	44.2	36	1.5	0.3
Fruits	24.1	26	0.3	0.2	38.0	41	0.5	0.3	30.3	37	0.4	0.2	35.4	42	0.5	0.2	36.0	41	0.5	0.3
Stimulants	1.7	5	0.4	0.3	1.8	6	0.4	0.4	1.3	5	0.3	0.4	1.1	2	0.2	0.1	1.1	3	0.2	0.2
Spices	0.4	4	0.1	0.1	0.4	4	0.2	0.1	0.4	4	0.2	0.1	0.3	3	0.1	0.1	0.2	2	0.1	0.1
Alcoholic Beverages	43.8	84	0.3		79.4	146	0.6		79.1	144	0.6		64.4	132	0.6		56.8	104	0.5	
Meat	31.6	202	11.9	16.8	35.4	221	13.3	18.3	36.8	222	14.0	18.0	43.0	246	16.6	19.4	37.5	204	14.4	15.8
Offal, edible	4.5	14	2.1	0.5	4.1	13	2.0	0.4	4.0	13	2.0	0.4	3.9	12	1.9	0.4	3.8	12	1.9	0.4
Animal fats	3.0	58	0.1	6.6	2.0	40	0.0	4.5	1.9	40	0.0	4.5	1.2	26	0.0	2.9	0.7	14	0.0	1.5
Milk	78.0	134	7.0	7.9	94.8	149	8.3	8.2	85.8	134	7.5	7.5	60.3	97	5.3	5.5	54.1	85	4.7	4.8
Eggs	2.5	9	0.8	0.7	3.6	14	1.1	1.0	4.6	18	1.4	1.2	4.7	18	1.5	1.3	6.1	23	2.0	1.6
Fish	5.5	14	2.5	0.4	7.9	19	3.0	0.7	8.7	15	2.3	0.5	9.2	19	2.9	0.8	7.9	16	2.4	0.6

*This amount can be divided by 365 to give per capita g per day

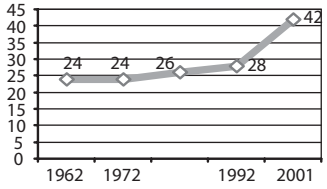

Figure 5: The per capita (g/day) intake of vegetable oil in South Africa between 1962 and 2001[28]

Ischaemic heart disease

Since the seventies researchers have been examining diet and ischaemic heart disease (IHD) in South Africa. Some of these studies are discussed here to illustrate the nutritional problems facing different population groups, particularly in those groups undergoing transition and acculturation.

Indians in South Africa have a high mortality of cardiovascular diseases.[29] Among the 778 subjects (15-69 years old) that were evaluated in Durban, 15% had a history of IHD. Dietary intake, particularly fat and saturated fat intake, plays a role in this high prevalence of IHD. Wolmarans *et al*.[17] examined the diet of randomly selected Indian adults (n=776) living in Durban (Tables 4.2a & 4.2b). Their findings showed that the total mean fat intake was more than 30% of energy intake (EI) and the saturated fat intake was higher than 7% in nearly all age and gender categories. The polyunsaturated fat intake was more than 10% EI; hence high P:S ratios were found. Fibre intakes in all categories were less than recommended for a prudent diet[12] and sugar intake was higher than the recommended 10% EI and ranged from 10.8-15.8%.

A similar intake was reported in an earlier study with 12-year-old Indian children living in Cape Town. In this study, it was found that the macronutrient intake as a percentage of EI was 36% for fat, protein 13% and carbohydrate 51%.[30] Sugar consumption was high and varied between 14-16% for girls and 13-17.6% for boys. Fibre intake was very low and ranged between 8-9 g/day.

Mia and Vorster[31] reported on IHD risk factors in Indian adolescents (n=321) aged 16-18 years who were residing in Lenasia in 1988 when the study was undertaken. They found that the teenagers habitually consumed a diet very high in fat (41.5-47.7% EI). Additionally, they reported on significant relations between increased serum low-density lipoprotein cholesterol (LDLC) and increased dietary cholesterol, vitamin B12, zinc and total fat, illustrating the important role of diet.

In 1982, the CRISIC study was undertaken with the objective of investigating risk factors for IHD in the coloured population. Overall, the diet was found to be low in fruit and vegetables, and dairy products.[18,19] In terms of nutrients, it was found that in a sample of 976 subjects (15-64 years) the diet was found to be very high in fat (37% EI) and animal protein, with a P:S ratio of 0.85. Only 32.2% of men and 27.5% of women consumed a prudent diet.[22] Furthermore, four variables which contributed 26.9% in linear regression in men were polyunsaturated fat, P:S ratio, saturated fat intake, and cholesterol intake. In women it was age, P:S ratio, and cholesterol. Saturated fat intake was found to be 29.9 g/day for men and 17.1 g/day in women. Fibre intake was low at 12.4-13 g/day.

A study of 11-12-year-old coloured children in the Western Cape found that there were differences in fat intake between urban and rural children. Fat as percentage of EI was 33% for urban boys vs. 29% for rural ones. In girls, this was 36% vs. 29%. Added sugar was 12% in girls and boys.[21]

IHD is one of the leading causes of mortality in white adults. In 396 white subjects examined in Durban in 1987, it was found that a history of IHD was present in 9.3% of adults.[32] However, prior to 1979 a paucity of data on the white population and dietary factors contributing to IHD existed. Hence, the CORIS study was undertaken in 1979 to examine the prevalence of risk factors in the white population in rural areas, as discussed earlier.

In 1988 a random sample of white adults (n=317) living in the urban centres of Witbank and Vanderbijlpark (VIGHOR) was evaluated by a 24-hour recall to typify a typical Western diet in South Africa.[16] It was found that fat and fibre intakes were not in line with those for a prudent diet. Total fat intake ranged between 33.3-38.6%, saturated fat 12.2-14.6%, added sugar 13.0-18.6%, and fibre 10.9-24.3 g (Tables 4.2a & 4.2b). Their mean dietary intakes were found to be very similar to the intakes of the CORIS participants. Furthermore, dyslipidaemia was common with males and females having serum total cholesterol (TC), LDLC and serum triglyceride (TG) mean values above the recommended cut-off levels. Additionally, the mean high-density lipoprotein cholesterol/total cholesterol (HDLC/TC) ratio values of the participants fell below the recommended value of 20%.

In the CORIS study, the meat group was the main source of fat and saturated fat in the diet, contributing 37-39% of total fat for females and males, followed by the fat group, which contributed 22-24% of EI. Only 23% of males and 19% of women had a fat intake less than 30% of EI and only 15% of males and 34% of women had a fibre intake ≥10 g/4.2 MJ.[13] A part of the CORIS project intake was also an evaluation of the diet of 3-4-year-old white children (n=194). Fat intake contributed 35% of EI and the P:S ratio was 0.52; a reflection of the diets of the adults.[33] A more disturbing aspect of their diet is the quality of the foods consumed. Bremner *et al*.,[34] evaluated the snacking habits of these white preschool children. Soft drinks were consumed most frequently, followed by fresh fruits and fruit juices, sweets, chocolates and sugar. Between-meal snacks contributed more than one-third of EI.

The black population in the rural areas of KZN has a diet that differs in its contribution to risk for IHD. Ndaba and O'Keefe[35] described the staple diet as comprising maize meal that is eaten 2-3 times a day. Bread is consumed about once a day and meat 2-3 times a month. Fresh vegetables are usually cooked with the maize, particularly the wild green leafy ones. Similar findings were found in studies undertaken in Limpopo province.[14] The diet is a very prudent one, which is low in total fat and saturated fat, low in non-basic foods and high in fibre.

According to Seftel *et al*.,[36] black people in rural areas have a favourable risk profile for IHD, except for their high Lp (a) levels. Their LDLC values were found to be low, providing a favourable HDLC/LDLC ratio. This profile may be enhanced by high levels of physical activity, combined with a prudent diet.

However, the BRISK study showed that there are changes in the diet of black Africans in accordance with how long they have resided in urban areas. Over time, they tend to adopt the unhealthy eating pattern of the white and Indian populations, as shown in Tables 4.2a, 4.2b and 5.[15] Comparison with rural adults show that they have a higher intake of energy, fat, saturated fat, polyunsaturated fat and sugar than their rural counterparts. Although these intakes are lower than those of white adults, they have already shifted towards being less prudent. More recently, the THUSA study.[20] showed similar results when comparing rural adults with upper-class urban residents (Tables 4.2a & 4.2b). Fat intake increased from 22.9% to 30.6%, carbohydrate decreased from 67.4% to 57.3%, and protein increased from 11.6% to 13.2% in rural to urban areas, respectively.

Type 2 diabetes

There are little data reported on the dietary intake of diabetics in South Africa. Indeed, it appears that less than 7% of patients are treated by di*et al*one.[37] Two cross-sectional studies have evaluated diet in type 2 diabetic patients in South Africa: one in the rural areas of Limpopo province[37] and one in the urban area of Ga-Rankuwa.[38] There were noticeable differences in dietary energy composition between the two studies. In the urban area, fat intake exceeded 30% EI and carbohydrate was less than 55%. In the rural area, the EI distribution fell within that recommended for a prudent diet. Although the food items eaten in the two areas were similar, there was a higher consumption of soft drinks in the urban group.

An intervention study was undertaken among overweight and obese diabetic patients in Ga-Rankua.[39] One group was given a Western type of diet, while the experimental group received a traditional African diet that was high in plant protein and complex carbohydrates and low in fat. After 5 months there was no significant improvement in glycaemic control in the experimental group. Nutritional research related to the prevention and management of diabetics in South Africa is scarce, even though diabetes contributes significantly to the burden of diseases in the country.[40]

Another trend in diet over the past decade has been the adoption of the glycaemic index (GI) as a tool to use in educating type 2 diabetics and weight watchers. A few local studies have also followed this trend by determining the GI of local foods.[41,42] However, the subject is still controversial and the American Diabetes Association (ADA) has indicated that they do not recommend the use of the GI at this time since there is insufficient supporting evidence. Similarly, the latest Mahan and Escott-Stump edition of Krause's Food Nutrition and Diet Therapy[43] concur with the ADA position.[44] In view of this, it is recommended that we take a "wait and see" outlook in South Africa until sufficient long-term data are available.

Obesity and overweight

The prevalence of overweight and obesity is very high in South Africans.[3] Fifty-six percent of women and 29% of men have a body mass index ≥25 kg/m^2. The problem is not only confined to adults. Findings of the NFCS revealed that the prevalence of stunting was 19.3% while

overweight and obesity affected 17.1% at the national level. Furthermore, stunting conferred an increased risk of overweight (OR=1.8).

Both management and prevention of obesity remain complex issues for health professionals to deal with. South Africa is facing the same burden of diseases associated with obesity, as do other developing countries, and the prevalence continues to rise worldwide.[45-48] One of the challenges facing health professionals is the treatment available to overweight and obese clients at health centres. This is also the case in South Africa where the total number of registered dieticians is less than 1 600. Consequently, nurses or doctors, who are not well trained in this regard usually do counselling. Another difficulty is the fact that there are few successful intervention models for health professionals to adopt. Such an intervention would need to include a physical activity component as well as a dietary component. It would also need to be available over a long period since it needs to be regarded as a lifestyle change and not as a quick weight loss fix. Currently, a myriad of solutions are available in South Africa, many of which defy the realms of science. Yet a public who is desperate for quick fixes will try one after the other to attain the elusive "slimness" promised.

In the past decade there has been an increase in the amount of literature relative to both food insecurity and to obesity.[49-52] Adams *et al*.[52] found that in Californian women obesity was more prevalent in the food-insecure (31%) than in food-secure women (16%). Food insecurity without hunger was associated with an increased risk of obesity in whites (OR=1.36). Food insecurity with hunger was associated with increased risk of obesity for Asians, blacks and Hispanics (OR=2.8). Similarly, Griffiths and Bentley[51] found that in urban India where 4% of the sample lives, 37% of the food-insecure women were overweight or obese, whereas in the rural areas more were underweight.

Health professionals and patients' knowledge about nutrition and chronic diseases

Recently, a nutrition-based knowledge test was developed and validated to evaluate the knowledge of health professionals in Cape Town.[53] The main findings were that health professionals remarkably identified the mass media as their main sources of information on lifestyle modification. They also identified lack of client compliance, lack of time and lack of knowledge as barriers, which prevent them from counselling on lifestyle modification. There were also physical barriers, such as lack of equipment and space at the health facilities.

A study in Limpopo Province showed that 56-72% diabetic patients (n=288) had a special diet explained to them by a doctor, 12-27% by a nurse, and only 4-16% had seen a dietician.[37] Less than half the patients had received food exchange lists, and they had many complaints about the dietary advice they had received, including cost, not being tasty, not traditional and that certain recommended foods were not available. Patients were asked about foods allowed in the diet,which they had been given. Numerous errors indicated that the health professionals were not au fait with the required dietary knowledge in this regard.

A study has also been undertaken to identify the nutrition knowledge of hypertensive patients attending Day Hospitals in the Cape Metropole.[54] Overall, patients' knowledge regarding their diet was poor. More than 34% of them believed that they could use flavour enhancers with mono-sodium glutamate instead of salt. Furthermore, 23.5% believed that smoked and tinned meat and fish have a low sodium intake. Only 15% of the group knew what their daily salt allowance should be.

7. DIETARY PREVENTION AND MANAGEMENT OF CHRONIC DISEASES IN SOUTH AFRICA

In 2003, the Centre for Health Systems Research and Development undertook a survey with regard to the treatment received by patients with chronic diseases.[55] Patients (n=1 500) were randomly selected from three provinces in South Africa. Hypertension was the disease most frequently seen in patients (41%) followed by diabetes (14%). Most of the advice given to patients was found to be related to body weight (34.4%) and nutrition (54.6%). Nearly 60% of patients were advised on changing their diet, while 45% were advised to increase their physical activity. Regarding the nutritional advice given, most of it was found to relate to decreasing fat, sugar and salt intake. Hence, dietary advice is perceived as a crucial factor in the treatment of patients with chronic diseases.

Although the Department of Health (DOH) focuses mainly on undernutrition in South Africa, they have set a strategic objective for nutrition-related chronic diseases. This is, "To contribute

to reduction of nutrition-related diseases of lifestyle (obesity, IHD, hypertension and type 2 diabetes)".[10] They substantiate this objective by quoting the prevalence of overweight and obesity in South Africa. The current prevalence of overweight is 19.8% in males and 26.1% in females, while obesity occurs in 9.3% of males and 30.1% of females.[3] The DOH has presented specific targets for the decrease of overweight and obesity in females by the year 2007. The targets for overweight are a reduction to 15% in males and 20% in females, and for obesity 7% and 25% respectively. However, the specific strategies to do this have not been spelled out. Despite this, certain initiatives have been implemented. Probably the most important of these is the development of the food-based dietary guidelines, which are aimed at the general public.[56] These guidelines can be viewed as an important preventative strategy for chronic diseases of lifestyle in the population.

The development of the guidelines is a joint initiative between the Nutrition Society, Association for Dietetics in South Africa, Medical Research Council, industry and the DOH. Some of the guidelines are particularly relevant to the prevention of chronic diseases, such as IHD and type 2 diabetes, and are as follows:

- *Eat plenty of fruit and vegetables ever day* – for their fibre, micronutrient, antioxidant and other essential properties;
- *Eat dry beans, peas, lentils and soya regularly* – for increased fibre, protein, and flavanoid intake;
- *Eat fats sparingly* – to prevent a high intake of fat and saturated fats;
- *Use salt sparingly* – because of the detrimental effect of a high sodium intake;
- *Use foods and drinks that contain sugar sparingly, and not between meals* –these foods have a low nutrient density, and because of the association of sugar with obesity and for the prevention of dental caries;
- *If you drink alcohol, drink sensibly* – excessive alcohol consumption is a risk factor for IHD, hypertension, diabetes;
- *Be active* – important preventative/management measure for diabetes, obesity, and improved hypertension.

One of the guidelines, however, is focused more on the prevention of protein, calcium, and iron deficiencies, and may cause some confusion: Chicken, fish, meat, milk or eggs can be eaten every day. Ideally, one would prefer to encourage the eating of fish to at least once or more times a week, the daily use of low-fat dairy products, and the use of lean meat on a less regular basis. This is particularly relevant to the intake of red meat, which is the main source of saturated fat, and has been increasing (Table 4.6).

The initiative regarding the food-based dietary guidelines has been taken further by the development of educational materials on each guideline. These guidelines are aimed at the public and have been developed in a way that most adults with some high school education will understand.

8. RECOMMENDATIONS

Nutrition and related chronic diseases in South Africa is still a neglected topic and needs to be addressed at many levels. From the perspective of the health professionals, there is a need for better knowledge to empower them to counsel patients requiring special diets. Additionally, barriers to such counselling need to be addressed. From the patient's perspective, they need to be provided with correct information and services, which deal with them in the long term.

To prevent the burden of chronic diseases in South Africa from increasing in the next few decades, active and progressive action is needed by policymakers. They should be reminded of the very important role diet plays as a determinant in most chronic diseases. It will not be possible to prevent or to manage these diseases without managing the dietary aspects. This implies that the population has to be educated regarding a healthy diet, in conjunction with being physically active and abstaining from excessive alcohol intake and tobacco use.

One way of achieving such a policy would be to initiate a task team to evaluate the current knowledge of chronic diseases in the training of health professionals, as well as strategies to provide suitable health education materials at primary care level and to schoolchildren.

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CHAPTER 5

TOBACCO CONTROL IN SOUTH AFRICA

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South Africa has made significant progress in the past decade in reducing tobacco use. Fewer people smoke, and fewer cigarettes are being smoked. This in time will translate into fewer deaths from diseases caused by tobacco use.

The country stands in sharp contrast to many other middle-income and lower-income countries where the tobacco epidemic is still growing. South Africa has shown that the tobacco epidemic can be curbed, if evidence-based policies – such as those contained in the World Health Organization's Framework Convention on Tobacco Control[1] – are implemented.

Large reductions in tobacco use occurred because of government commitment, allied to public health activism and community support. Research played an essential role by feeding both policy development and advocacy efforts.

In this chapter tobacco control research conducted in South Africa between 1995 and 2005 is selectively reviewed, its utility assessed, and priorities for future research are indicated. The research studies were identified by searching PubMed and supplemented by the author's personal knowledge of unpublished reports in this field.

QUALITY AND CONTENT OF RESEARCH

For the review, 57 research articles were selected. An overall assessment of the content of the research reveals a serious imbalance in the range and utility of the publications. Very few of the studies generated information that could be used to inform policymaking or that would have a direct impact on health. The majority (56%) of the studies dealt with basic descriptive research on tobacco use – including prevalence, behavioural and attitudinal studies. About 34% of the studies reported on the health effects of smoking, while 10% dealt with policy issues and economics.

This clearly suggests that if good quality policy relevant tobacco control research is to be produced, a priority research programme needs to be identified and then adequately funded.

TOBACCO USE

Information on tobacco use is required for measuring the impact of public health policies and for predicting the likely future disease burden. Tobacco use can be measured in terms of the number of people who use the product (prevalence) and the amount of tobacco consumed.

Several studies have measured tobacco usage among adults.[2,3] Though these surveys use different methods, have different sampling biases, and have taken place over different time periods; they do, when looked upon as a whole, provide useful information about smoking trends.

Cigarette smoking prevalence: Over the past decade, prevalence rates for adult daily cigarette smoking have continuously inched downward. Adult (15+ years) daily smoking rates fell by a fifth, decreasing from 30.2% in 1995 to 24.1% in 2004, according to the South African Advertising and Research Foundation surveys.[4] An estimated 2.5 million smokers stopped smoking during this period. Data from other national surveys confirm that between a fifth to a quarter of adults smoke cigarettes. The South African Social Attitude Survey in 2003 found that 21.4% of adults smoked, including 35.8% of men and 8.1% of women,[5] while the earlier South African Demographic and Health Survey reported a prevalence rate of 24.6% in 1998.[3]

The positive overall trend masks the fact that smoking rates remain alarmingly high in certain sections of the population (Table 5.1). Age, gender, 'race', cultural and economic characteristics all affect smoking prevalence rates. An Afrikaans-speaking, divorced coloured male, aged 40 years, living in a

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metropolitan area, with a primary school education and an income of R20,000 per year is most likely to smoke.[3,6]

Interestingly, poorer smokers are more likely to quit than smokers that are more affluent. Between 1993 and 2000, there was an annual decrease in smoking of about 0.89% in households earning less than R1400 a month, while smoking increased by about 0.33% in those earning more than R7000 a month.[6]

Table 5.1. Daily adult smoking prevalence rates by 'race' and gender, 1998.[3]

	% Male	% Female
African	33.9	4.2
Asian	47.7	7.6
Coloured	57.0	40.0
White	33.4	23.2

Cigarette consumption: In 2003, cigarette sales fell for the twelfth consecutive year in South Africa. This sustained drop is testament to the effectiveness of the country's tobacco control policies.

Annual cigarette consumption fell from 1.8 billion packs in 1993 to 1.2 billion packs in 2003 – a 33% decrease. Consumption fell despite an increase in the population size, so the per capita decline in consumption was even larger – falling by about 40% during the same time.[6]

The white community smokes the most heavily. In 1998, whites reported smoking an average of 18 cigarettes a day; the corresponding figure was 11 for Asians, 9 for coloureds and 7 for Africans. Women, on average, smoked about 2 cigarettes a day fewer than men.[3]

Although manufactured cigarettes dominate, hand-rolled cigarettes account for about 21% of the market, and such use is particularly common among African women and coloured men.[5]

Other tobacco products: In most of Africa, tobacco usage will be grossly underestimated if only cigarette smoking is measured. While the overall rate of smokeless tobacco use in South Africa is low at about 6%, black women are twice as likely to use snuff (12.6%) than to smoke cigarettes (5.3%).[3]

Nicotine delivery from the commercial brands of snuff sold in South Africa is higher than from comparable brands in the USA. A typical commercial snuff user may be receiving nicotine concentrations equivalent to smoking 20 cigarettes a day.[7] Homemade snuff (tobacco leaf ground with ash) seems to deliver lower levels of nicotine than commercial brands.[7]

School children: The measured declines in smoking among adults were also observed among the youth.

In 1999, nationally representative data on tobacco use among adolescents in secondary school (grades 8 to 10) became available for the first time when South Africa participated in the Global Youth Tobacco Survey (GYTS). This survey was conducted in 43 countries. The MRC repeated the survey in 2002. Among the key findings is that there were significant declines in cigarette smoking between the two surveys. The number of students who had never smoked increased by 20% (from 53.3% in 1999 to 62.4% in 2002) and the number of frequent smokers (smoked on 20 or more days in the past month) declined from 10.1% to 5.8% between 1999 and 2002.[8]

It is noteworthy that in 2001, the government banned tobacco advertising and the surveys provide data from before and after the ban. Although the declines in cigarette smoking cannot be definitely attributed to the ban, it is encouraging that the trend was in the expected direction.

Despite the fact that the law prohibits the sale of tobacco to minors or its free distribution, 66% of the students reported that they bought cigarettes in a store. Moreover, 22% claimed that they were offered free cigarettes by a tobacco industry representative.[8]

Children's attitudes toward tobacco are formed early. A study conducted in 1995 on 5-year-old children living in Soweto, Johannesburg, found that they had well-developed beliefs about tobacco use: 29% knew tobacco brand names, 77% thought tobacco was bad for you, 81% thought they would not smoke when they grew up, but 19% thought they would, and 7% had tried smoking.[9]

Quitting rates: About 72% of adult smokers say they would like to stop smoking (OFS) and 24% have tried to quit.[3] About 10% of those who had ever smoked cigarettes daily reported that they had successfully quit. Teenage smokers are equally disillusioned about smoking: 73% reportedly want to stop smoking and 74% had tried unsuccessfully to quit in the previous year.[8] Teenagers are not inclined to believe they are addicted to nicotine, even though they experience a significant level of withdrawal symptoms when they try to stop smoking.[10]

Quitting snuff is just as difficult as stopping smoking. About 67% of female users of smokeless tobacco surveyed wanted to stop using snuff, and 36% had tried to quit without success.[11]

Studies that measure the effectiveness of smoking cessation methods among South Africans are almost non-existent. A low-cost community-based tobacco control programme designed to build cessation skills was found to reduce the smoking rate significantly compared to before the programme.[12]

SMOKING AND WOMEN

Maintaining the low-levels of smoking among women in lower-income countries is one of the major challenges in tobacco control. Research into 'protective' factors is a neglected but highly important area of study.

One such project surveyed Xhosa-speaking women aged 15 to 64 years living in Cape Town. A quarter of those interviewed were smokers, 27% snuff users, 2% used both products, and less than 46% did not use tobacco.[13]

Tobacco users were found to be older and less educated than non-users. Tobacco use is perceived to be taboo for black women of reproductive age and those who use it do so secretly or only with trusted others. Over 75% of the women said that most Xhosa people would not approve of women smoking, and even the majority of smokers agreed with this. The reasons offered for why men should not smoke focused mainly (80%) on the negative health effects of cigarettes. By contrast, most of the reasons they gave for why women should not smoke (72%) were that it was disgraceful, shameful, and taboo for women to do so. Snuff users were similarly circumspect about their behaviour.

Social norms currently work against black women using tobacco, but it would be inadvisable to rely on traditional restraints to keep their tobacco usage rates low. Instead, tobacco control efforts need to start linking being tobacco free with the things black women value most, such as personal dignity, family welfare, upward mobility or access to personal and social development.

Smoking during pregnancy: It is estimated that about 20% of women in South Africa smoked during pregnancy and the rate was particularly high among coloured women.[14] Smoking significantly increased the risk of the two leading causes of perinatal death (preterm labour and abruptio placentae) at Tygerberg Hospital.[15] Yet only 12% of pregnant smokers presenting at the hospital were aware of these risks.[16] Most doctors in the public sector antenatal services in Cape Town do not regard smoking as a priority issue, and few advised their patients about the risks of smoking or quitting the habit.

Although it has been recommended that pregnant smokers attending antenatal services should receive appropriate information, advice and support throughout their pregnancy, this is unlikely to occur. Doctors are pessimistic about their ability to influence patients to quit.[17] This pessimism is misplaced, as even a brief intervention by a doctor can motivate people to quit. However, it points to a deeper problem that there is insufficient education of health professionals in this area. It is proposed that the training of health-care professionals has to change so that they are better equipped to deal with addictions.[18]

MORTALITY

In 2000, an estimated 4.83 million premature deaths in the world were attributed to cigarette smoking, 2.41 million in lower-income countries, and 2.43 million in industrialised countries. This amounted to 12% of the total global adult (30+) mortality.[19]

A conservative estimation is that in South Africa in 1998 about 8% of adult deaths (21 500 deaths) were attributable to smoking.[20] The proportion of deaths from tobacco is expected to continue to grow in the near future because the smoking epidemic is still maturing – that is, the fraction of those most vulnerable (older people who started smoking at a young age and have smoked throughout their lives) is still increasing.

The leading causes of death from smoking in South Africa are chronic obstructive pulmonary disease (COPD), tuberculosis (TB), lung cancer, and ischaemic heart disease (IHD). This mortality pattern is different from that in high-income countries where cardiovascular diseases and lung cancer are the main causes of death from smoking. Out of 100 people in South Africa who die from a smoking-related disease, 28 die of COPD, 19 of TB, 13 of lung cancer, 12 of IHD, 10 of cancer of the lip, mouth, pharynx and oesophagus, 9 of strokes and vascular disease and 9 of other conditions.[20]

It is estimated that if people stopped smoking, 58% of lung cancer deaths, 37% of COPD deaths, 20% of TB deaths, and 23% of vascular deaths could be avoided.

The above estimates come from an analysis of death certificates. In 1998, South Africa became the first country in the world to include questions on the smoking status of the deceased, and of the next of kin/informant, on the national death registration form.

An alternative method of estimating deaths from smoking – based on the absolute difference between the observed lung cancer death rate and the level in non-smokers – gives higher estimates of mortality from cigarette use. A study using this method found that smoking caused between 30 000

and 41 000 deaths in South Africa, accounting for 8% - 10% of deaths and 3.5% - 4.6% of DALYs in 2000, and ranked third (after unsafe sex and high blood pressure) in terms of mortality among 17 evaluated risk factors.[21]

Case-control studies have also established that smoking was the leading cause of a number of cancers in South Africa. In a mainly rural setting in Limpopo, smokers had a ten-fold increased risk of lung cancer compared to non-smokers (OR 10.7 and 5.5 for male and female smokers, respectively). Exposure to asbestos, and/or a dusty occupation (men), also contributed to the development of lung cancer.[22]

A study in Johannesburg-Soweto found that smokers had an increased risk of death from lung cancer (OR 9.8 in males and 13.5 in females), oesophageal cancer (OR 3.8 in males and 3.1 in females), oral cancer (OR 7.5 in males and 13.9 in females) and laryngeal cancer (OR 13.8 in males).[23] In this study, snuff use did not increase the risk of cancer. This finding is at odds with international studies. In a rural South African population of snuff dippers, 81% of them demonstrated keratotic lesions at the site of snuff placement.[24] The severity of the lesions was significantly associated with the brand of snuff use, suggesting that differences in the composition of snuff may explain why some snuff users do not get oral cancer.

Tobacco smoke pollution (TSP): In children, exposure to passive smoking is a cause of lower respiratory tract illnesses, chronic respiratory symptoms, middle ear infections, sudden infant death syndrome, and reduced lung function.[25]

Surveys show that large numbers of children are exposed to TSP in South Africa. A 1990 study of 5-year-old children in the Johannesburg-Soweto metropole found that 64% of the children were exposed to second-hand tobacco smoke. Coloured children were most frequently exposed, with 42% living in homes with two or more smokers.[26]

In Cape Town, 80% of 6-11-year-old schoolchildren were exposed to pollution from tobacco smoke. Using urinary cotinine concentrations to estimate exposure, the most important source of smoke pollution was maternal smoking, followed by the male parent and other household smokers.[27]

Among high-school students in Vanderbijlpark, Gauteng (average age 16 years) the prevalence of respiratory illness before and after 2 years, respiratory symptoms, earache over the past year, low birth weight and learning difficulties were found to be significantly increased in the children exposed to parental smoke in the home, especially those exposed to maternal smoking. Spirometric and serological measures, however, were not affected by passive smoking.[28]

Household smoking was confirmed as an important modifiable risk factor in asthma/wheeze among schoolchildren aged 7 to 9 years, and maternal smoking in pregnancy (OR 1.87; 95% CI: 1.25 to 2.81), and current household exposure (OR 1.15; 95% CI: 1.01 to 1.30) were independent contributors to this effect.[29]

ECONOMICS

In recent years, policy discussion on tobacco has moved increasingly into the area of economics. As a counter to health arguments, the tobacco industry publicises its supposed contribution to the economy. It points to the jobs and tax revenues it generates and argues that tobacco control policies would have dire economic consequences. In 2003, 3 000 people were employed in manufacturing and 23 600 (including seasonal workers) in farming, while the industry paid R6 billion in VAT and excise taxes.[30]

The tobacco control community, on the other hand, views tobacco not as an economic benefit but as a financial burden. The Medical Research Council estimated that tobacco use cost the South African economy twice as much in medical costs and reduced productivity as the industry paid in taxes.

The industry's arguments about taxes and jobs, though superficially compelling, are fatally flawed. The industry's case is based on the assumption that money spent on tobacco would disappear if tobacco sales declined. It ignores the fact that when smokers quit smoking, they switch their spending to other goods and services. This new spending will generate new employment in other sectors of the economy and new tax revenues.

Instead of leading to job losses, reductions in tobacco use would have a positive net economic effect and lead to increased employment in South Africa. It is calculated that in 1995, if smokers (who spent R1.8 billion on tobacco products that year) had given up smoking and instead spent their money like non-smokers or ex-smokers (these groups spend proportionally more than smokers on education, recreation and entertainment) between 9 000 and 50 000 new jobs would have been created. The new jobs would result because of a switch of spending from less to more labour-intensive industries.[31]

While debates on the costs of tobacco to society were previously mainly academic, they are now assuming legal importance. In the USA, for instance, 40 states sued the tobacco industry to recover publicly funded expenditures for the care of poor people made ill by cigarettes. Updated estimates of the costs of tobacco to the South African society are needed.

Excise taxes: Increasing the price of tobacco products is the single most effective short-term measure for reducing smoking. A 10% increase in the price of cigarettes in South Africa leads to an estimated 7% decrease in cigarette consumption.[31] Since the early 1990s, health advocates have called for large increases in tobacco excise taxes claiming it would be good for health, good for the exchequer and popular with the public.

These claims have proved to be correct. Between 1992 and 2001 in South Africa, the real (inflation-adjusted) price of cigarettes increased by 111%, real government revenues increased by 131% and cigarette consumption declined by 34%.[6] Furthermore, many smokers have supported tax increases as it provides them with an added incentive to quit.

Poorer people who smoke and who are traditionally less responsive to health education are more likely to quit when prices increase. Between 1990 and 1995, spending by poorer households on cigarettes decreased, while spending by the richest households increased fractionally.[6]

Despite the benefits, successive governments have been strangely reluctant to tax tobacco. Recent steep increases in the price of cigarettes were more a result of manufacturers driving up prices than of the state driving up taxation. Between 1990 and 2000, increases in taxes only accounted for 50% of the increase in real price; the other half was a result of industry-imposed increases in price.[6] The industry has been profiteering and its strategy seems to be to increase its profit margins at the cost of sales volumes. This finding suggests there is still much room for a stronger tobacco taxation policy in South Africa that will enhance government revenue and contain consumption. The National Council Against Smoking has called on the government to take a close look at the pricing policies and profit margins of the manufacturer's and has asked for excise tax policy to be revisited.[32] The government's objective should be to ensure that tobacco does not become more affordable. This requires increasing tobacco taxes at least at the rate of growth of incomes and considerably ahead of inflation. Ideally, some fraction of tobacco tax revenue could also be used to fund health promotion and smoking cessation.

Fires: Smokers' materials are a leading cause of residential fires and fire-related losses in South Africa, resulting in about 5% of all fires. In 2002, smoking caused 2 535 of the fires that fire-fighting units were called out to, most of them a result of discarded cigarettes setting fire to rubbish, grass or bush. In total, in 2002, there were 48 000 fires, which killed 290 people and caused damage totalling R1.2 billion.

LEGISLATION

The decline in cigarette consumption, after tobacco control legislation was enacted in the1990s, is perhaps the real test of the effectiveness of the government's tobacco control programme. Nonetheless, it is important to measure the implementation, enforcement, compliance and economic effects of the law.

In 2002, the compliance of public places in Gauteng, Limpopo and the Northern Cape with the restrictions on smoking in public places was studied.[33] The study found that varying levels of compliance with the law at pubs, restaurants and shebeens: one in three establishments was smoke-free; another 26% had separate smoking sections, but 44% still allowed smoking anywhere. The majority of the latter were small informal establishments, situated in rural areas. Encouragingly, nine out of ten workplaces had a policy regulating smoking.

Public support for the law was widespread and a sizeable fraction demanded the right to smoke-free environments. Over 80% of smokers and non-smokers agreed that restaurants and bars should have separate smoking and non-smoking areas. One in three non-smokers had complained about smoking in prohibited areas. The outcome of the complaint in 43% of cases was for the smoker to either stop smoking or go outside the building. In a minority of instances (21%) the smoker became argumentative or aggressive.[33]

A survey in 2004 by the tobacco industry found no support for allowing unrestricted smoking in a restaurant, while 19% preferred completely non-smoking venues, 58% were satisfied with separate smoking and non-smoking areas and 21% indicated no particular preference. There was support for tightening of the law with 68.2% of people polled agreeing that smoking should not be allowed at the entrances to public buildings.[34]

In contrast to the claims of the hospitality industry, few establishments recorded changes in income following the implementation of the law. About 69% of establishments experienced no change in income linked to the law, 19% reported a decline in income (mainly from lower cigarette sales) and 7% an increase in income.[33] A more formal economic analysis of the impact of the smoking restrictions on restaurant revenues – using VAT receipts from the period 1995 to 2003 as a proxy for restaurant turnover – found that the restrictions may have had a positive effect on revenues and certainly did not have a negative impact on sales.[35]

In distinct contrast to the above research, the Federated Hospitality Association of South Africa (FEDHASA) claimed, shortly after the introduction of the legislation in 2001, that 85% of its members did not obey the law but that sales were down 37% because of the legislation. This claim was widely reported by the media, even though it defied reason as a law, which according to FEDHASA was being widely ignored, still resulted in a loss of more than a third of restaurant sales.[36]

TOBACCO INDUSTRY DOCUMENTS

In the last 10 years a new field of tobacco control research has mushroomed internationally - namely, research into internal tobacco industry documents. Millions of pages of industry memos, research papers etc., were released onto the Internet as a result of legal proceedings in the US. These documents reveal the inner workings and strategies of the multinational cigarette manufacturers. Based on these documents the US Justice Department filed charges against the US tobacco industry, accusing it of (a) conspiracy to defraud consumers by denying the dangers of smoking and passive smoking; (b) sponsoring junk science by funding sympathetic scientists to carry out research to cloud the issue; (c) manipulating nicotine levels to keep smokers hooked; (d) intentionally marketing to underage youth; (e) promoting low-tar cigarettes as less harmful knowing this was not true; and (e) destroying and concealing documents to hide their illegal activities.

Some of the documents relate to South Africa and are revealing of industry strategies. For instance, a 1993 British American Tobacco Company (BAT) memo outlines preparations for a "media seminar". It reveals that the industry's "independent experts" were to be paid US $50 000 for a five-day visit to South Africa. The venue for the seminar had to be "somewhere pleasant (e.g. a beach resort)" because this "motivates the journalists to attend". The memo also cautioned that journalists unsympathetic to the industry were not to be invited.

Other documents relate to plans to undermine the work of the "outspoken, infamous anti-tobacco campaigner", Dr Derek Yach, and discuss strategies for overcoming the country's ban on tobacco advertising.

The documents are a key data source for research dealing with the industry marketing efforts, political strategies, or cigarette design research. A systematic examination of the documents relating to South Africa has not been undertaken.

RESEARCH PRIORITIES

This section outlines several areas in which research is needed to support effective tobacco control in South Africa. Gaps in knowledge and areas where regular updates of information are needed is identified. Some areas are of higher priority than others are. Policy makers, advocates, and researchers should together decide a key research agenda.

1. **What is the size of the problem?**
   * What is the prevalence of tobacco use and how do consumption patterns vary? In particular, what are usage rates among pregnant women and health professionals? Can rates among youth be updated every two years?
   * What is the impact of new products (snus, hookahs, bidis, etc.) on patterns of tobacco use? Will snus provide a gateway to smoking for youth or an exit strategy point from cigarettes for adults?
   * What is the incidence of, mortality from, and patterns and trends in tobacco-caused diseases? What are the health effects of smokeless tobacco, including snus, in South Africa?
   * What is the relationship between tobacco use, HIV/AIDS, and tuberculosis?
2. **What policies work, when and for whom?**

   General:
   * What gains in mortality and quality-adjusted life years are attributable to tobacco control policies?
   * To what extent has South Africa implemented the provisions of the FCTC and how best to monitor compliance?

   Economics:
   * What are the health and productivity costs associated with tobacco use in South Africa?
   * What are the cost-benefits of tobacco control policy to the South African economy?
   * What has been the impact of tobacco control policies on business (e.g., advertising agencies, media, casinos, restaurants, pubs, etc.)?
   * What would be the economic effect of a tobacco-free society?
   * What is the optimal level of tobacco excise tax from a health perspective?

* If smokers stopped buying cigarettes, how could the Treasury substitute for tobacco taxes?
* What are the determinants, process, and impact of the illicit trade in tobacco? What is the most effective way of reducing smuggling and counterfeit cigarette sales?
* How affordable is tobacco, particularly to children?
* What is the impact of tobacco taxes on the poor?
* Does the sale of single cigarettes and small packs make cigarettes more affordable? Would a ban on such sales reduce children's smoking? What effect would it have on adults?
* What information would be needed to convince health insurers that it is financially prudent to fund prevention programmes.

Youth:

* Do youth-targeted prevention campaigns, including school-based programmes work?
* What are the main sources of tobacco for minors?
* Laws banning tobacco sales to minors - do they matter? How can they be effectively enforced? Is a consumer boycott of stores making illegal sales a viable strategy?
* How effective are industry-sponsored programmes (e.g. retail awareness campaigns) in preventing the sale of tobacco to minors?
* Would the public and smokers support the licensing of the retail tobacco trade?
* How much public support is there for a policy that would require tobacco companies to be fined, taxed or refund the money they make from children's smoking?
* What guidance can we give to schools about optimal smoking control policies?
* What factors characterize young people who do not take up smoking?
* Can general life-skills' training change attitudes and intentions with regard to tobacco use?
* What is the relationship between smoking and the use of other licit and illicit drugs?

Product regulation:

* What factors characterize low-rate daily smokers in South Africa? Do they compensate for lower consumption rates by increased intensity of smoking?
* How do South African tobacco products compare toxicologically to products produced in other countries?
* How can the chemicals in tobacco and its smoke best be measured to approximate delivery under real-life situations?
* What proportion of morbidity and mortality could be avoided if tobacco products were modified to the lowest toxic level technologically possible?
* How much does the harmfulness of tobacco products need to be reduced to compensate for fewer people quitting smoking?

Cessation:

* What methods are used by South Africa to stop smoking and what are natural cessation rates?
* How effective is the Tobacco or Health Information Line in helping people quit?
* How affordable are smoking cessation aids?
* How can economically disadvantaged groups be supported in their quitting attempts?
* How can we make the most of health professionals?
* What strategies might be effective in assisting pregnant women to quit?

Determinants:

* How do we measure the cultural environment relevant to smoking, particularly for youth and women?

Health warnings and labelling:

* How could health warnings be improved to increase effectiveness? How many languages should be used? How frequently should new warnings be introduced to maximize impact? What public health strategies would enhance attention to warnings?
* Do people understand current nicotine and tar yield labels? Do smokers know that low-tar cigarettes are just as harmful?
* Would generic packaging make cigarettes significantly less attractive to youth?
* What information on additives and smoke constituents does the public need? What should appear on packaging? What does the public do with ingredient information?

Smoke pollution:

* What levels of compliance are there with the restrictions on smoking in public places, particularly in the workplace, restaurants, and bars and how can these are improved?
* Is there public support for smoking bans in cars with children, day-care centres and in restaurants?

* How can domestic workers be protected from tobacco smoke pollution at their places of employment?
* What are the preferences of employees in the hospitality industry, and of the public with regard to smoke-free policies?
* Are parents aware of the risks of smoking on their children's health in their homes/cars?

3. What are the information and educational needs?

* How complete is smokers knowledge and understanding of the health risks of smoking?
* Are smokers making informed choices to smoke?
* Do people understand the benefits of quitting?
* Do people know what is in tobacco and the effects of constituents on the body?
* What should people be informed and warned about? How should they be informed? What messages/images are effective among youth and women? What style of presentation maximizes comprehension and impact?
* What effect does media coverage of smoking issues have on public attitudes and perceptions? How can media coverage of the smoking issue be maximized?
* Would messages that decode the tobacco industry's deceptive practices be effective among young people in South Africa?
* Is teaching on tobacco control in schools of public health adequate and commensurate with the importance of the problem? How can teaching be improved?
* What incentives (continuing medical education points, practice accreditation, support schemes) can be provided for encouraging health professionals to engage in tobacco control?

4. What is the tobacco industry doing?

* What tactics are the industry using to circumvent the advertising ban and point-of-sale advertising regulations? What is the extent of overt breaches of these regulations?
* How does the industry continue to target youth?
* How much of tobacco industry profits stay in South Africa and how much goes to shareholders abroad?
* How has a shift away from tobacco affected former tobacco farmers and their workers economically? What crops are former tobacco farmers now growing?
* What effect does heavy pesticide use during tobacco growing have on the environment?
* What is the extent of occupational health problems among tobacco farm workers (e.g. green tobacco disease)?
* How viable are small-scale tobacco farming projects in South Africa?

CONCLUSION

Substantial progress has been made in conducting prevalence, health impact, and economic studies in South Africa. These have contributed greatly to the policy formulation. Nonetheless, research is still driven by the interests of the researcher and not based on policy needs. It is recommended that key stakeholders jointly decide a priority research programme, which should then be adequately funded. Some key areas for on-going research have been identified in this chapter.

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CHAPTER 6

EARLY LIFE ORIGINS OF ADULT CHRONIC DISEASES:
A SOUTH AFRICAN PERSPECTIVE

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INTRODUCTION

Over the past 20 years substantial epidemiological evidence has accumulated indicating that low birth weight is associated with an increased risk of adult-onset chronic diseases, such as hypertension, glucose intolerance, ischaemic heart disease and, more recently, osteoporosis. These studies have largely emanated from industrialised societies where birth records have been preserved for many decades and there is access to detailed growth data and health outcomes, in many instances through a sophisticated informatics network. Some have questioned the relevance of these observations to industrialised societies where low birth weight is becoming less common, but not to developing countries where the vast majority of low birth weight babies are born and which are currently experiencing a steep rise in the prevalence of obesity, diabetes and cardiovascular disease. However, countries with emerging economies have also contributed to the body of epidemiological data associating low birth weight with adult onset chronic disease, in particular studies from India, China, the Caribbean and South Africa.

This report will review evidence linking early life origins and adult, chronic diseases of lifestyle, with specific reference to South African studies. Furthermore, this report will consider the putative mechanisms for these associations, and, finally, attempt to highlight areas of research priority based on current national and global health concerns.

Intra-uterine and early life influences on obesity

Numerous previous reports have found an association between birth weight, subsequent growth and development, and attained body mass index (BMI). These relationships have generally been shown in children, but there are also reports in adults, with most studies showing a direct association, i.e. higher birth weight being associated with higher BMI, and, conversely, low birth weight associated with increased body fat content, because of reduced lean tissue mass, and increased central adiposity.[1-4] Other studies have found that the relationship between birth weight and subsequent BMI is J- or U-shaped.[4] However, the timing of the intra-uterine insult may also influence the nature of the relationship between birth weight and subsequent adiposity. Ravelli *et al*.[5] described the impact of intra-uterine undernutrition in a "natural experiment" which occurred in offspring born during the Dutch 'Hunger Winter' of the Second World War. In this instance, individuals who were exposed to the famine while in utero during the first and second trimesters were nearly three times more likely to become obese, compared to those who were not exposed. In recent reviews, this association between low birth weight and later obesity, as well as visceral fat accumulation, is corroborated.[1-3]

However, the association is not consistent in all settings, and in particular, in developing countries, the progression to obesity and associated morbidity appears to be usually dependent on the interaction between birth weight and subsequent growth during critical, developmental windows.[4,6,7] This has been described as a "thrifty phenotype".[8] Further to this is the potential for early life experiences, maternal nutrition and post-natal nutrition and timing of catch-up growth to modulate the expression of so-called intra-uterine programming for obesity.[4,9-11]

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Data from South Africa concerning early life "programming" and subsequent obesity are rather limited. One such study involves a small longitudinal cohort of children (n=162), resident in rural villages in the central region of the Limpopo province, followed from birth.[12] In this group, a high prevalence of stunting (48%), overweight (22%) and obesity (24%) were found at three years, while 31 (19%) of the children were both stunted and overweight. Being underweight at birth and rapid weight gain within the first year of life increased the risk of being overweight at three years six-fold. Demographic associations with being overweight at this age included: having a mother younger than 20 years old, having the mother as the main caregiver and having a working mother.[12]

In another example, researchers in the Birth-to-Ten study, a prospective cohort study of the determinants of growth, development and health in children born in the metropolitan area of Soweto and Johannesburg between April and June 1990, have published two reports assessing the relationship between birth weight, weight gain in infancy and subsequent adiposity. In 193 children with normal birth weights and anthropometry collected at age 2 and 9 years, children with rapid weight gain were significantly lighter at birth, but heavier, taller and had more subcutaneous total body and abdominal fat at equivalent BMIs.[13] Similarly, Crowther *et al*.[14] found that in 7-8-year-old children from the Birth-to-Ten cohort, weight gain velocity was associated with increased adiposity, measured by skinfold thickness.

Conversely, in another South African birth cohort, Levitt *et al*.[15] were unable to demonstrate an association between birth weight and adult obesity or adipose tissue distribution. This failure to show an association may be a consequence of the fact that the group were generally similarly socio-economically disadvantaged at birth, and that the sample size was relatively small. They were, however, able to distinguish that the attributes of the chronic disease phenotype in those with low birth weight was prominent and significant only in those who were currently above the median for BMI, fatness or centralisation of body fat stores.[16] Similarly, in the Birth-to-Ten cohort, those who had a low birth weight, but who were above the median weight for age when studied, also presented with increased blood pressure (BP) at age 5 years,[17] and a greater insulin response to oral glucose tolerance testing at age 7.[14]

Furthermore, South African studies, provide a consistent case for the role of early life exposures on later obesity. In the recent national Household Food Consumption Survey, nearly 20% of the more than 2800 children studied were stunted, while 17% were considered overweight. However, it was found that stunting itself conferred an increased risk for overweight in children (OR 1.8; 95% CI 1.48, 2.20).[18] Similarly, in another study of nearly 500, 10-15-year-old school girls from the Northwest province, stunting was also associated with increased deposition of subcutaneous fat, as well as centralisation of body fat stores, compared to non-stunted counterparts.[19]

Thus, South African studies of large and representative samples of children and pre-adolescents have demonstrated the association between adverse early life exposures and propensity to obesity. Further, the presentation of attributes of the chronic disease phenotype associated with early life programming has been more consistently demonstrated in those children or adults, whose current weight places them above the median for the sample population.

EARLY LIFE INFLUENCES ON THE CHRONIC DISEASE PHENOTYPE: FEATURES OF THE METABOLIC SYNDROME: BLOOD PRESSURE, GLUCOSE TOLERANCE, DYSLIPIDAEMIA, INSULIN RESISTANCE

As mentioned previously, an adverse intra-uterine environment, as determined primarily by low birth weight, is strongly associated with an increased risk of deleterious metabolic sequelae in adult life, including elevated BP, glucose intolerance/insulin resistance, dyslipidaemia and increased mortality from cardiovascular disease.[20-25] This has led to the hypothesis that events occurring before birth may 'programme' physiological responses which lead to cardiovascular and metabolic disorders in later life. Furthermore, the extent of metabolic dysregulation, including the degree of BP elevation, glucose intolerance and insulin resistance, is greater when low birth weight at term has been associated with adult obesity,[26-28] thereby suggesting an interaction between intra-uterine events and later environmental influences.

SOUTH AFRICAN STUDIES

These relationships have been explored in various South African cohorts, in children and adults at various ages, and stages of development. One such cohort is the Birth-to-Ten cohort, originally designed to examine determinants of growth, development, and health in children born in the metropolitan area of Soweto and Johannesburg between April and June 1990;[29] it has been extended for a further ten

years. The first report examined the relationship between BP and birth weight in 818 children from this cohort at age 5 years. Systolic BP was inversely associated with birth weight, independent of current weight, height, gestational age, maternal age, or current socio-economic status. Indeed, for every 1000 g increase in birth weight, systolic BP was 3.4 mmHg lower (95% CI 1.4, 5.3 mmHg). Further, the highest BP was noted in children who fell into the lowest quartile for birth weight (<2 800 g) and the highest quartile for current weight – suggesting that the birth-weight effect on BP may be amplified by early childhood events and subsequent growth.[17]

Metabolic studies, using an oral glucose tolerance test, were undertaken in a smaller representative subgroup of the Birth-to-Ten children (n=152) at age 7 years. In these children, an inverse association was found between birth weight and the 30-min plasma glucose concentration (r=-0.20, p=0.02), as well as the amount of insulin secreted within the first 30 min (r=-0.19, p=0.04) and the last 90 min of the oral glucose tolerance test (OGTT) (r=-0.19, p=0.04). These data confirm the relationship between poor foetal growth as measured by birth weight, and both glucose tolerance and insulin resistance.[14]

The effect of postnatal and early childhood weight accumulation on these relationships was assessed by separating the low birth weight children by current median weight. The group who were above the current median for weight (low-high), had greater 120-min insulin concentrations ($p < 0.05$) than those who were below the current median weight (low-low), suggesting that post-natal and childhood growth patterns modulate the development of insulin resistance. Surprisingly, the low-high group demonstrated more insulin sensitivity as assessed by greater suppression of non-esterified fatty acids postprandially, a measurement of the antilipolytic action of insulin, than the low-low group.[30] This finding may suggest tissue-specific down regulation of the insulin receptor or the insulin-signalling pathways.

The effect of birth weight and subsequent growth was examined on insulin secretory capacity in the same children. The low-high children had similar glucose responses to the OGTT but a greater beta cell response measured by the Δ $insulin_{30}/glucose_{30}$ ratio($p < 0.05$), total des-31,32 proinsulin, total proinsulin concentrations and higher 120 min insulin level as mentioned above, compared to the low-low children.[30]

A second South African cohort of full-term offspring of primaparous women of mixed ancestral origin who gave birth in the Groote Schuur maternity centre, Cape Town, in 1975 and 1976, were sampled at the age of 20 years (n=137). The sample was divided into those who were low birth weight (< 10th centile UFA) and those of normal birth weight (25^{th} - 75^{th} centiles AFA) for their gestational age, and these subjects were recalled for studies examining the association between birth weight and adult onset chronic diseases. The UFA group was still smaller and lighter, with a lower BMI, yet this group had significantly higher systolic and diastolic BPs than the AFA group (p=0.007) and diastolic (p=0.02) BPs, after covarying for current weight and gender.[16]

The low birth weight group also had higher fasting plasma glucose levels (p=0.047), and a greater proportion demonstrated glucose intolerance (11.9% vs. 0%, $p < 0.01$) compared to the normal birth weight group. Interestingly, the low birth weight or UFA group, had mothers who were smaller, weighed less and attained a lower level of education than did the mothers of the AFA group. Whether this implies a relationship between low maternal socio-economic status and the observed low birth weights observed, an intergenerational effect independent of socio-economic hardship or genetic influences that could play a role in the association between low maternal weight, low birth weight, and subsequent adult glucose intolerance, is uncertain.[16]

A later analysis examined whether the association between low birth weight and this chronic disease phenotype depended upon birth weight alone or upon an interaction between birth weight and the subsequent accrual of weight for height, the accumulation of fat generally, abdominally or attained height in this cohort.[15] This was assessed by dividing the two birth weight groups by the current median for each anthropometric measure. Subjects who were low birth weight (UFA), but above the median at 20 years for BMI, body fat or waist circumference had significantly higher levels of systolic BP (and for fatness, diastolic BP), plasma lipids (triglycerides, total cholesterol or low-density lipoprotein cholesterol) and insulin resistance which was measured by either fasting insulin or HOMA IR, than subjects who were UFA but below the median for the respective anthropometric measures.

However, none of these metabolic and BP effects were replicated when the interaction between low birth weight and current size was determined by height. Additionally, although the levels of current BMI, body fat and waist were similar in the respective above the median groups, those who were UFA had higher systolic BP and triglycerides (BMI and waist) and both systolic and diastolic BP (body fat) than the AFA group. On the other hand, the metabolic and BP levels were similar in the groups below the median, for all of the anthropometric measures, regardless of their birth weight.

A further study was conducted in preterm neonates. In this, the glucose and insulin responses to a meal test of milk were examined at 19.6 ± 12.2 days after birth. The neonates, who were small for gestational age and had the greatest postnatal gain in weight, had the greatest insulin resistance. These findings were notable for the extension of the association between low birth weight and insulin resistance from full to preterm children and the evidence that these abnormalities were already evident in the first few week of life.[31]

PUTATIVE UNDERLYING MECHANISMS FOR THE METABOLIC SEQUELAE ASSOCIATED WITH ADVERSE EARLY LIFE EXPOSURES

The explanation advanced for the so-called foetal origins of adult disease proposed by Hales and Barker[8] in the early 1990s was the thrifty phenotype hypothesis, initially relating specifically to type 2 diabetes. Their concept was that an adverse intra-uterine environment relating to poor foetal nutrition imposed mechanisms that programmed fetal metabolism for subsequent nutritional thrift. Should this state of nutritional hardship persist, the physiological adaptation would be appropriate. In contrast, should the individual subsequently be exposed to good or over-abundant nutrition, there would be a state of physiological maladaptation and disease, e.g. glucose intolerance would occur. An alternative theory, that of the thrifty genotype, had already been invoked by Neel[32] in 1962, to explain the profound rise in diabetes prevalence among traditional populations, such as the Pima Indians and Naurians, as their lifestyles changed from active hunter gatherers and farmers to more westernised ones.[33] The Naurians being typified by sedentary occupations and profound dietary changes. This theory proposed that genes, in this case diabetogenic genes, persisted in a population as they somehow provided a survival advantage in states of deprivation or famine. In states of plenty, on the other hand, these genes proved to be detrimental.

Notwithstanding, the extensive epidemiological and animal data associating low birth weight with adult chronic disease, and the assumption that low birth weight was a proxy for intra-uterine or foetal undernutrition, this is not necessarily the case. Many factors impact upon birth weight, such as birth order, gestational age, maternal age, maternal size, weight gain in pregnancy, maternal diabetes, maternal hypertension, maternal smoking, alcohol and drug use, stress and infection. Furthermore, while an adverse intra-uterine environment may have major long-term consequences, it may not always result in low birth weight. Experimental evidence to date clearly indicates that programming during gestation does occur. The mechanisms underpinning the programming are largely unknown, but include variation in organ structure, programming or imprinting of which, would of necessity occur during the phase of organogenesis. This might result in alterations in vascular supply, neural innervation or in the physical arrangement of cell types, as well as alteration in cell number, cellular proliferation or metabolic differentiation. The last is the process through which cells acquire a stable pattern of gene expression and refers to enzymes, hormones, transmembrane transporters, and hormone receptors that are additional potential mechanisms.[34] The period during which programming may occur is not simply limited to the time of gestation, the periconception period in addition to the early postnatal period also seem to be subject to these processes.

EARLY LIFE INFLUENCES ON BONE METABOLISM, FRACTURE RISK AND OSTEOPOROSIS

Bone mass of an individual in later life depends upon the peak bone mass obtained during skeletal growth, and the subsequent rate of bone loss in adulthood (Fig. 1).[35] Consequently, strategies to prevent osteoporosis may be aimed at either increasing bone mass acquisition during childhood and adolescence, or reducing the rates of bone loss during adulthood. The majority of variance in peak bone mass is accounted for by genetic factors, but it is likely that the interplay between environmental factors (exercise, nutrition) and the genome establishes the functional level of a variety of metabolic processes involved in skeletal growth.[36]

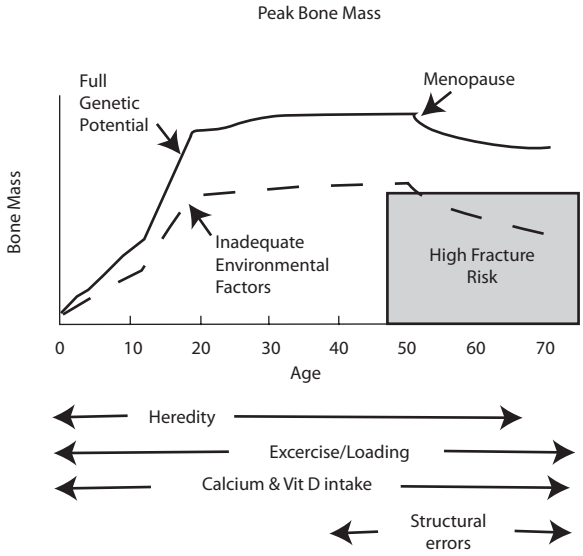

Figure 1. Schematic representation of determinants of peak bone mass. Derived from Heaney *et al*[34] with permission

Supportive evidence has accumulated suggesting that intra-uterine programming can contribute to the risk of osteoporosis in later life. Such evidence includes: (a) bone mineral measurements undertaken in cohorts of adults, whose detailed birth and/or childhood records have been preserved;[37,38] (b) physiological studies exploring the relationship between candidate endocrine systems that may be programmed (GH/IGF-I; hypothalamic-pituitary adrenal, gonadal steroid) and age-related bone loss;[39,40] (c) studies characterising the nutrition, body composition and lifestyle of pregnant women and relating these factors to the bone mass of their newborn babies;[41] and (d) studies relating childhood growth rates to the later risk of hip fracture.[37]

SOUTH AFRICAN STUDIES

In developed countries, emphasis is placed on the importance of optimising bone mass during childhood and adolescence to reduce the prevalence of postmenopausal osteoporosis. In South Africa, little is known of the factors which influence bone mass in the different racial groups with very different environmental factors. Although osteoporosis and minimal trauma fractures are thought to be uncommon in postmenopausal black women in South Africa, changes in lifestyle and dietary patterns associated with urbanisation and the move to a more westernised lifestyle pattern may predispose black females, who have spent most of their lives in an urban environment, to suboptimal peak bone mass and a greater risk of postmenopausal fractures than previously. Furthermore, the role intra-uterine programming, birth weight, and early growth and nutrition have on bone mass acquisition and fracture risk within a South African population has not been thoroughly explored. Currently, only two paediatric studies have explored the association between birth weight and bone mass.

The first study in a Johannesburg-Soweto-based birth cohort investigated associations between birth weight, weight and length at one year, and bone mass in a group of 10-year-old black and white girls and boys. Bone area (BA) and bone mineral content (BMC) measurements were made of the whole body, femoral neck, and lumbar spine using dual energy x-ray absorptiometry (DXA). Birth weight (BW), weight (WT1) and length (LT1) at one year were positively and significantly correlated with BMC of the whole body (both $p < 0.0001$), femoral neck (both $p < 0.0001$) and lumbar spine (BMC: BW & WT1: $p < 0.0001$; LT1: $p < 0.05$), in 10-year-old children. However, after correcting bone mass for confounders (ethnicity, gender, and body size (height and weight)), body size at one year, more so than birth weight, remained a significant predictor of BMC of the whole body (WT1: $p < 0.01$; LT1: $p < 0.05$) and of the femoral neck (WT1: $p < 0.05$; LT1: $p < 0.05$). The results suggest that small size at one year is associated with less bone mass of the whole body and femoral neck independent of body size effects. Consequently, growth and development both intra-uterine and up until one year of age, which are measures of genetic, intra-uterine and postnatal environmental factors, have consequences on the pre-pubertal skeleton.[42]

The second study, a birth cohort of mixed ancestral origin from a working class community in Cape Town, explored associations between birth weight and DXA-derived BMC of the whole body, femoral neck, and lumbar spine when the children were 7-8 years old. The study results showed a significant association between birth weight and the femoral neck BMC ($p < 0.005$). However, after correcting for current body size this association disappeared (Micklesfield *et al*, unpublished data).

In summary, further studies in South Africa are needed to conclusively determine the independent effect intra-uterine and early growth programming have on bone mass acquisition during childhood and adolescence, and the adult risk of fracture and osteoporosis. The same is not true for the metabolic and cardiovascular sequelae of these early events. The public health challenge in South Africa is however clear, i.e. prevention of stunting and subsequent rebound adiposity.

CONCLUSION

There is clearly evidence, both at a global level and in nationally representative studies, for the substantial impact of adverse, early life events on early growth, subsequent adiposity and metabolic sequelae and, finally, adult chronic disease morbidity. This is possibly predominantly the effect of programming of the various neuro-endocrine axes, and thereby altering, for example, appetite, sympathetic activation, insulin, growth hormone and cortisol metabolism. There is ample evidence for 1) various susceptible genotypes, and 2) the critical role of perinatal and subsequent growth trajectory, nutritional and physical activity exposures and even socio-economic status and education, on the final presentation of the chronic disease phenotype in response to the early life insults. These studies, and the respective gaps which remain unfilled, nevertheless highlight the importance of adopting a life-course approach to the prevention of chronic disease. This may be particularly important in developing countries, which are currently undergoing epidemiological transition.

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CHAPTER 7

OBESITY
IN SOUTH AFRICA

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1. INTRODUCTION

Obesity can be described as an imbalance between energy intake and expenditure such that excess energy is stored in fat cells, which enlarge or increase in number. However, this complex medical condition is affected by a host of contributing factors that will be discussed in the context of the South African situation. Obesity is defined as a body mass index (BMI) of >30 kg/m^2, according to WHO criteria.[1]

Obesity has become a global epidemic with an estimated 1.3 billion people overweight or obese.[2] Its prevalence in developed countries, such as the United States, is as high as 26.6% in men and 32.2% in women above age 20 years.[3] However, obesity is not only a problem of developed nations but is becoming an increasing problem in countries undergoing epidemiological transition, such as South Africa, Mexico and South American countries.[4-6] In South Africa, where under-nutrition, poverty, and infectious diseases, such as HIV/AIDS and tuberculosis, are realities, the problem of obesity could be viewed as less pressing. However, obesity and its co-morbidities negatively affect the lives of many South Africans and the consequent burden of disease contributes to the increasing cost of health care, both at a state level and in the private sector.[7]

2. EPIDEMIOLOGY OF OVERWEIGHT AND OBESITY IN SOUTH AFRICA

The overall prevalence of overweight (BMI >25) and obesity (BMI >30) in South Africa is high, with more than 29% of men and 56% of women being classified as overweight or obese.[4] This is higher than that reported in other African countries (Table 7.1), particularly in women, since nearly 30% of South African women aged between 30 and 59 years are obese. The first South African Demographic and Health Survey (SADHS), undertaken in 1998 and published in 2002,[4] included a sample of 13 089 South Africans aged 15-95 years old. Results highlight the influence of age, gender and demographics, as well as ethnicity and socio-economic status on the prevalence of obesity (Table 7.2).

In a sample of 7 726 South African women aged 15-95 years old, black women had the highest prevalence of overweight and obesity (58.5%), followed by women of mixed ancestry (52%), white women (49.2%) and then Indian women (48.9%). Urban women were found to have a significantly higher BMI than their rural counterparts, and in both groups, BMI was found to increase with age. Central obesity (defined by cut-off points for waist:hip ratio of 1.0 and 0.85 for men and women, respectively) was found in 42.2% of women and was most prevalent in urban African and women of mixed ancestry.[4]

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Table 7.1. Mean BMI of African countries categorised by age and gender, adapted from International Obesity Task Force: Global Burden of Disease Analyses 2002

Country	Sex	Age in Years						
		5-14	15-29	30-44	45-59	60-69	70-79	80+
Cameroon	M		23.7	24.4	24			
	F		24.6	24.8	25			
Ethiopia	M	14.2	17.5	18.3	18	18	17.9	19.8
	F	14.5	18.9	18.6	17.3	16.7	17.6	18.6
Gambia	M		19.6	20.5	20.9	21	20	
	F		21	21.9	21.8	21.3	20.9	
Ghana	M							
	F		21.8	22.4	21.4			
Kenya	M							
	F		21.7	22.3	22			
Malawi	M				19.8	19.8	19.7	
	F				20.5	20.5	19.6	
Mali	M		18.9	20.5	20.8	20.3	19.6	20.2
	F		19.9	21.1	20.6	20	19.5	20.8
Nigeria	M		19.8	20.9	21.5			
	F		21	21.8	20.3			
Senegal	M		18.2	19.9	21	20.7	19.8	19.2
	F		19.6	21.4	22.1	22.2	21.3	20.7
Seychelles	M		22.9	23.5	23.1	23.2		
	F		23.2	25.7	27.2	27.5		
South Africa	M	13.8	21.5	24.2	25.3	24.8	24.4	
	F	14	24.4	28.5	29.9	28.8	27.7	
Tanzania	M							
	F		21.8	22.3	21.6			
Zimbabwe	M	15.3	19.5	20.8	21	21	20.1	20
	F	15.4	21.3	23	23.5	21.8	20.5	20.3

A different pattern was seen in men. In a sample of 5 401 South African men aged 15-95 years, the prevalence of overweight and obesity was highest in white men (54.5%), followed by Indian men (32.7%) and men of mixed ancestry (31%), with the lowest prevalence in African men (25%). Older men and those living in urban areas had significantly higher BMIs than younger men and men living in rural areas. Central obesity was found in 9.2% of men with higher levels in older and white men.[4]

Furthermore, a major public health concern is that obesity and overweight are not limited to the adult South African population but have also been well documented in adolescents and young people. For example, 10% of South African women surveyed in the SADHS, aged between 15-24 years, were already considered obese.[4] In addition, the Youth Risk Behaviour Survey (n=9 054), conducted in 2002, found that over 17% of adolescents were overweight, and 4.2% were obese.[8] In a regional school-based health and fitness survey of nearly 5 000 children aged 12-18 years, it was estimated that the future prevalence of obesity in black girls at the age of 18 to be 37%, compared to 10% and 20% for white girls and girls of mixed ancestry, respectively (EV Lambert, unpublished data). Overall, current South African research suggests a significant problem of over-nutrition in adults and young women, and that urban black women are at greatest risk.

It is difficult to quantify the increase in prevalence of obesity in South Africa as, prior to the SADHS, only regional, cross-sectional studies were conducted, therefore. However, an increase in the prevalence of obesity has been reported in other developing nations undergoing epidemiological transition[6,9,10] For example, in the developing Mexican states, the prevalence of obesity in adult women increased from 9.4% in 1988 to 24.4% in 1999.[6] In Brazil, a tripling in the prevalence of overweight from 4.1% in 1974 (n=56 295) to 13.9% in 1997 (n=4 875) was reported in a sample group including both genders and all ages.

Table 7.2. The anthropometric pattern of adults (> 15 years) from the national DHS in South African population groups, adapted from Puoane *et al*.[4]

	Men %					Women %				
	African (n=4006)	Mixed (n=740)	Indian (n=174)	White (n=470)	Total (n=5390)	African (n=5897)	Mixed (n=986)	Indian (n=262)	White (n=572)	Total (n=7717)
Underweight BMI < 18.5	12.9	12.1	16.9	5.0	12.2	4.8	10.5	14.9	3.1	5.6
Normal weight BMI 18.5-24.9	61.7	57.1	50.3	40.4	58.6	36.7	37.3	36.1	47.8	37.8
Overweight BMI 25-30	19.4	23.1	24.0	36.3	21.7	26.7	25.9	27.8	26.5	26.6
Obese BMI > 30	6.0	7.7	8.7	18.2	7.5	31.8	26.3	21.1	22.7	30.0

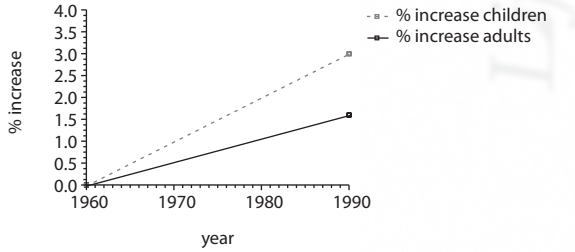

Figure 1: The percentage increase in obesity in children and adults between 1960 and 1990[14]

Similar findings have been reported in Mauritius, where the prevalence of overweight or obesity (BMI >25) increased from 26.1% to 35.7% in men and from 37.9% to 47.7% in women between 1987 and 1992.[11] Such marked increases in the prevalence of obesity may be attributed, at least in part, to rapid changes in dietary intake, urbanisation, changes in physical activity levels and leisure activities.[5,11,12]

Childhood obesity is an increasing problem worldwide with 22 million children under age 5 years being classified as overweight.[13] According to the NHANES III database, the prevalence of overweight (>95th percentile) in American children has tripled between the 1960s and the 1990s, in contrast to a 1.6-fold increase in adults over the same period (Fig. 1).[14,15] The increase in obesity is greatest in developing countries, as, for example, in Chile the prevalence of obesity in first graders increased from 6.5% and 7.8% in boys and girls, respectively in 1987 to 17% and 18.6% in 2000.[16]

Similarly, childhood obesity and overweight are becoming increasingly evident in South Africa. The National Household Food Consumption Survey reported that 17.1% of South African children between the ages of one and nine living in urban areas are overweight.[17] Moreover, the THUSA BANA study on 10-15-year-old children from five different regions in the North-West province found the BMI and percentage body fat of black children (17.4, 19.9%, respectively) and mixed origin (16.8, 17.6%) to be lower than those of white (19.0, 20.8%) and Indian children (17.5, 20.2%).[18] Body fat was significantly higher in girls of all races (23%) than in boys (15.2%). Results from this study suggest that ethnicity and gender affect BMI and body fat percent in South African children. In contrast, Monyeki *et al*.[19] found that the prevalence of obesity and overweight in rural children aged 3-10 years from Limpopo province was low (0-2.5% and 0-4.3% in boys and girls, respectively). Therefore, urbanisation also appears to influence the prevalence of obesity in South African children.

3. MORBIDITY SEQUELAE

Obesity can be classified as a chronic disease, similar to hypertension or insulin resistance. There are a large number of clinical problems associated with being obese. These can be categorised into those that are associated with excess adipose tissue and those that are associated with the metabolic effects of the increased adiposity.[20] Those diseases associated with increased fat mass include osteoarthritis, sleep apnoea and psychological problems, whereas the diseases associated

with the metabolic effects of adiposity include coronary heart disease (CHD),[21,22] hypertension,[23] type 2 diabetes mellitus[24-26] and certain types of cancer.[22,27,28] The metabolic effects of excess adipose tissue are exerted via increased release of free fatty acids (FFA) and the production of adipose-derived factors known as adipokines, that have specific functions, all of which are not yet fully understood. These products include hormones (leptin and adiponectin), cytokines (TNF-α, IL-6), transcription factors (PPARγ) and other adipokines (angiotensinogen, resistin). Additionally, enzymes integrally involved in the local production of cortisol (11β-hydroxysteroid dehydrogenase type-1) and oestrogen (aromatase) are also produced in adipocytes.[29]

However, the distribution of the adipose tissue influences its metabolism and thereby disease risk, independently of the effects of the size of the adipose tissue stores. Accumulation of fat in the abdominal area, particularly in the visceral fat compartment, is associated with increased risk of insulin resistance, diabetes, hypertension, dyslipidaemias and atherosclerosis.[30] Visceral adiposity is also the cornerstone of the metabolic syndrome, which is characterised by a clustering of cardiovascular risk factors, including insulin resistance and glucose intolerance, dyslipidaemia, hypertension and a prothrombotic and pro-inflammatory state.[31] Strong support for a causative role of visceral fat in the metabolic syndrome comes from studies in which surgical removal of visceral fat is associated with improved insulin sensitivity and delayed onset of diabetes.[32]

The physical and biological properties of visceral and subcutaneous adipose tissue are therefore different. Visceral adiposites are smaller than subcutaneous cells,[33] but are more lipolytically active because of increased density of β-adrenergic receptors.[34] In addition, the production of adiposity-derived proteins between adiposity depots is different. A recent study undertaken at University of Cape Town (UCT), found that the gene expression of leptin, adiponectin and hormone sensitive lipase were higher in subcutaneous adipose tissue depots compared to visceral adipose tissue depots (Goedecke JH, unpublished data). In contrast, angiotensinogen, TNF and IL-6 mRNA levels, as well as 11β-hydroxysteroid dehydroganse-type 1 enzyme, were greater in visceral compared to subcutaneous adipose tissue depots. These findings are supported by international studies.[29,35]

The disparate disease risk associated with the different adipose tissue depots has important implications for South Africa, a country of diverse ethnic origin. Differences in regional fat distribution have previously been reported in American women, with African-American women presenting with less visceral fat than do Caucasian women.[36-38] Similarly, a series of studies undertaken at the University of the Witwatersrand, comparing groups of 8 to 15 obese black and white women, demonstrated that black women had significantly less visceral adipose tissue than white women (~72 mm vs. 140 mm),[39,40] who were assessed using computerised tomography (CT), when matched for BMI.[41-43] However, despite having less visceral fat, the obese black women were more insulin resistant and described as having relative insulinopaenia compared to the white women.[41-44] In addition, *in vitro* and *in vivo* studies found greater adipose tissue lipolysis and a greater degree of adipose tissue insulin resistance in obese black compared to the obese white women.[42,44] These findings are similar to those in African-America women. Lovejoy *et al*.[45] found that African-American women were more insulin resistant than were Caucasian women, despite having less visceral adipose tissue. However, the insulin resistance in these women was associated with hyperinsulinaemia.[36]

Recent studies by Punyadeera *et al*.[46] did not find ethnic differences in insulin sensitivity or secretion, as assessed by standard oral glucose tolerance tests, though differences in visceral adipose tissue are described.[39,47] Furthermore, blood lipid levels remain different between the obese black and white women, with higher total cholesterol, low-density lipoprotein cholesterol (LDLC) and triglyceride concentrations in white women consistent with higher levels of visceral fat.[43,46]

In contrast to these findings, two recent studies undertaken in South African women found no ethnic differences in body fat distribution between black, white or mixed ancestry women of varying body fatness (Goedecke JH, unpublished data). Interestingly, these studies also explored ethnic differences in the deep and superficial subcutaneous adipose tissue compartments (separated at the level of the *fascia superficialis*), and, similar to recent international research findings, showed that the deep subcutaneous adipose tissue compartment showed as strong a relationship with insulin resistance as visceral adipose tissue.[48,49] However, no differences in deep or superficial adipose tissue area or volume were found between the ethnic groups. The main finding of these studies was that when women of different ethnic origin were matched for total and visceral adiposity, no differences in insulin sensitivity or their lipid profile were reported (Goedecke JH, unpublished data). Accordingly, no ethnic differences were found in the gene expression of adiposity-derived proteins shown to be associated with obesity and insulin resistance, including leptin, adiponectin, PPARγ, angiotensinogen, resistin, as well as cytokines (TNF-α, IL-6, IL-1) or those

products involved in local glucocorticoid metabolism (11β-hydroxysteroid dehydrogenase type-1, glucocorticoid receptor-α) (Goedecke JH, unpublished data).

Studies including a larger, more representative sample of South Africans are required to characterise ethnic differences in body fat distribution accurately to understand the nature of the association between body fat distribution and morbidity sequelae. In contrast to the small studies undertaken, results from the SADHS, which included over 7 000 South African women, found that black women and those of mixed ancestry had greater waist circumference and waist:hip ratios, as a proxy for central adiposity, than white or Indian women. In fact, more than twice as many black women as white women had a waist:hip ratio greater than 0.85 (35.3% vs. 17.4%, respectively).[4] Moreover, studies undertaken in the USA have found that the relationship between body fat distribution and risk factors for disease are different between African Americans and Caucasians.[36]

3.1 Type 2 diabetes

Obesity and type 2 diabetes are closely associated in men and women of all ethnic groups.[50,51] The risk of type 2 diabetes increases with the extent and duration of overweight and the degree of central adiposity.[20] In the Nurses Health Study, which included 114 281 female nurses, the risk of diabetes increased 40-fold when BMI increased from ≤22 to 35.[50] A similar relationship was observed in the Health Professionals Follow-Up Study that included a cohort of 51 529 men. In this study, they found that the relative risk of developing diabetes was 42 in men with a BMI of >35 compared to those with a BMI of <23.[51] According to government reviews in the UK, obesity (BMI >30) is associated with a relative risk of 5.2 and 12.7 for type 2 diabetes in men and women, respectively.[3] No large-scale risk assessment study for type 2 diabetes, including BMI as a determinant, has been undertaken in South Africa.

3.2 Coronary heart disease

Obesity is associated with an increased risk of CHD with a relative risk of approximately 2.8 and 3.4 for men and women, respectively.[52] Research on women in the USA found that the risk of developing CHD increased 3.3-fold when BMI was >29.[22] In South Africa, 4.8 million people presented with hypercholesterolaemia, with 3.1 million people having raised LDLC levels.[53] Both of these conditions lead to an increased risk of CHD. Interestingly, although they have a higher prevalence of obesity, black South Africans appear to be less prone to hypercholesterolaemia and raised LDLC levels than people who are white or of mixed ancestry.[53] For example, Seedat *et al*.[54] found that in an urban Zulu population, the prevalence of CHD was only 2.4%. In a study among 976 peri-urban South Africans of mixed ancestry from the town of Mamre, Steyn *et al*.[55] found that hypercholesterolemia was present in 47% of men and 46% of women.

3.3 Hypertension

Obesity is associated with a significantly increased risk of hypertension. According to a recent population-based survey, including 195 005 randomly selected American adults, obesity was associated with a relative adjusted risk of 3.5 for hypertension.[56]

According to the WHO/ISH guidelines for hypertension (140/90 mmHg), after adjusting for age, approximately 21% of the adult South African population are hypertensive.[57] Data from the SADHS showed that urban men of mixed ancestry had a lower risk of developing hypertension than black or white men, while rural African women had a significantly decreased risk of hypertension when compared to white women.[57] However, after sociodemographic variables are taken into account, there are no appreciable differences in the prevalence of hypertension among the population groups of South Africa.

3.4 Cancer

Obesity is associated with an increased risk of certain forms of cancer,[22,27] which have a hormonal basis.[58] Therefore, in women obesity is associated with cancers of the reproductive system, as excess body fat results in excess production of oestrogen by adipose stromal cells.[20] In men, obesity is associated with cancer of the rectum, colon and prostate.[20] Cancer also appears to be influenced by ethnicity, urbanisation and other socio-cultural factors. In 2004, Walker *et al*.[59] found that rural black South Africans had a very low incidence of breast cancer (5-10/100 000), whereas the incidence in urban black women was much higher (15.1/100 000).

3.5 Psychological implications

Overweight and obesity have psychological implications. Being overweight can lead to body image issues, unhappiness and disordered eating,[60-63] as the disorder is stigmatised.[64] Research has shown that overweight during adolescence has important social and economic consequences. In fact, a study reported that adult women who were overweight in adolescence were less likely to be married, had a lower household income and a higher household poverty rate than women who had not been overweight, independent of their baseline socio-economic status and aptitude test scores.[64] Research has also shown that women who do not meet cultural ideals with regard to weight may also be more likely to suppress anger and engage in anger avoidance behaviour.[62] Additionally, results from the Medical Outcomes Study Short-Form Health Survey (SF-36) demonstrated that obese people had abnormalities in health-related quality of life.[65]

3.6 Osteoarthritis

Osteoarthritis is significantly increased in overweight individuals.[20] Felson *et al*.[66] found that in an American population there was an increased risk of osteoarthritis of the knees and ankles in overweight men (relative risk=1.51) and in obese women (2.07). In South Africa, little epidemiological data have been published on this condition, with none related to obesity.[67,68]

3.7 Morbidities in children

Childhood obesity has negative health implications with approximately 60% of overweight 5-10-year-old children presenting with at least one associated cardiovascular risk factor and 25% presenting with two or more risk factors.[69] For example, a tremendous increase in type 2 diabetes in children and adolescents has been documented. In a longitudinal study in the USA, including 1 027 adolescents, it was found that the incidence of type 2 diabetes increased tenfold between 1982 and 1994.[70] Obesity, as well as family history and ethnicity, were found to be important risk factors.[70] In addition, similar to the findings in adults, intra-abdominal adipose tissue in obese children has a significant relationship with adverse health conditions, including dyslipidaemia and glucose intolerance.[71,72]

Childhood obesity also results in the development of co-morbid conditions of obesity in adulthood, since childhood obesity often persists into adulthood.[73-76] In fact, childhood obesity has a greater effect on the development of the metabolic syndrome than becoming obese as an adult.[77,78] A 55-year follow-up study of previously obese adolescents, showed a higher long-term mortality outcome with obesity in men, but not in women.[66] However, women who had been obese as adolescents were eight times more likely to report difficulty with activities of daily living than those who were lean in adolescence.[79] Additionally, obesity in adolescence has a negative impact on socio-cultural and economic factors, such as household income, self-esteem, marital status and education level, particularly in women. This can perhaps be because of weight-based discrimination.[64]

4. UNDERLYING MECHANISMS AND DETERMINANTS

4.1Genetics

Bouchard *et al*.[80,81] have reported that approximately 75% of the variation in percent body fat and total fat mass is determined by culture and lifestyle, whereas 25% can be attributed to genetic factors. Additionally, there is strong evidence for a genetic component to obesity in humans, based on correlational studies of BMI between family members, adoptees and their biological relatives, and between twins.[82,83] However, obesity is a polygenic condition with well over 50 different loci having been linked to it.[84]

Obesity is also a complex phenotype in which the interaction of multiple genes and environmental conditions leads to the manifestation of the condition. Although non-genetic factors are important, it is unlikely that these factors alone can fully explain the prevalence of obesity and associated co-morbidities in South Africa.

4.2 Intra-uterine and early life influences

There is a body of evidence linking an adverse intra-uterine environment to the development of chronic disease later in life. Early work by Barker and colleagues[85-87] in Southampton found an association between low birth weight and cardiovascular disease mortality.

There is now incontrovertible evidence, based on large numbers of epidemiological studies conducted in both developing and developed countries, that small size at birth

in full-term pregnancies is linked with the subsequent "programming" of the major features of the metabolic syndrome, i.e. glucose intolerance, increased blood pressure, dyslipidaemia and increased mortality from cardiovascular disease.[85-92] Over the past two decades, this field has progressed, and is now largely theoretically based on the so-called 'foetal origins' (of chronic disease). More recently, there is growing recognition of the importance, not only of intra-uterine programming, but also of subsequent early life influences, interacting with genetic factors, resulting in an adult chronic disease phenotype. However, what is less straightforward is whether foetal programming results in increased risk for the development of obesity. In one of the earlier studies, Ravelli *et al*.[93] described the impact of low birth weight on the subsequent risk for developing obesity in offspring born during the Dutch "Hunger Winter" of 1944-45. Individuals who were exposed to the famine while in utero during the first and second trimesters were nearly three times more likely to be obese as young adults, compared to those who were not exposed, or who were exposed during the third trimester. Two recent reviews have summarised the current evidence concerning the relationship between birth weight and later obesity. Ong and Dunger[94] corroborated the association between low birth weight and risk for increased adiposity in adulthood. Conversely, there are studies in which low birth weight has been associated with increased visceral adipose tissue distribution.[95]

However, in developing countries, the progression to obesity appears to be usually dependent, in part, on the interaction between birth weight and subsequent growth during critical developmental windows.[96] Furthermore, morbidity associated with low birth weight is also dependent on this interaction. This was elegantly demonstrated by, Crowther *et al*.,[90] who found that in 7-8-year-old children participating in the Birth-to-Twenty cohort, weight gain velocity was associated with increased adiposity, measured by skin-fold thickness. In the same cohort, those who had a low birth weight, but who were above the median weight for age when studied, also presented with increased blood pressure at age 5 years,[97] and a greater insulin response to oral glucose tolerance testing at age 7 years.[90] In another South African birth cohort, Levitt *et al*.[98] were unable to demonstrate an association between birth weight and adult obesity or adipose tissue distribution. Perhaps one of the most provocative cases for the role of early life exposures on later obesity may be found in the results of the recent national Household Food Consumption Survey. Nearly 20% of the children were stunted, while 17% were considered overweight. However, stunting was found to confer an increased risk for overweight in children (odds ratio: 1.8; 95% CI: 1.48, 2.20).[17] Furthermore, underweight children have been found in the same households as overweight caregivers.[99]

4.3 Dietary intake

Although excessive calorie intake is responsible for the development of obesity, high-fat diets promote fat accumulation significantly more than high-carbohydrate diets because of the high energy density, metabolic efficiency, palatability, poor regulation and weak satiating effect of fat.[100] This is especially relevant in South Africa where increased urbanisation is associated with the adoption of a more westernised diet, which is higher in fat and has less carbohydrate and fibre than a traditional diet. Bourne *et al*.,[12] in a review of the nutrition transition in the black population in South Africa, describe the trends in dietary intake from the few available studies undertaken in rural and urban areas. Although these diets met the prudent dietary guidelines, there was a general trend for an increase in fat intake and a decrease in carbohydrate intake in rural and urban areas. A comparison of macronutrient intake for adults, aged 15-64 years living in urban areas, showed a 10.9% reduction of carbohydrate intake (69.3% to 61.7%) and a 59.7% increase in fat intake (16.4% to 26.2%) from 1940 to 1990. The changes reported over this period were more dramatic than were those observed in Western countries undergoing rapid industrialisation over longer periods.[12] In contrast, the change in macronutrient intake was not as marked in the rural areas; studies undertaken between 1970 and 1990 observed an increase in fat intake from ~20% to 28% and a decrease in carbohydrate intake from ~70% to 60%. In the North West province, a recent study including 1 040 adult black women from 37 randomly selected sites, found a weak, but significant positive association between BMI and dietary energy and fat intake.[101] They also found that the lowest fat intake was observed in the rural areas (46 g/day), whereas the highest fat intakes were reported in the urban middle-class areas (56 g/day).

Therefore, a high dietary energy and fat intake is likely to be a major contributing factor to the high prevalence of obesity in South African populations, particularly those living in urban areas. However, a high dietary fat intake alone cannot account for the extent of the problem. Weight gain associated with a high fat intake may also be caused, in part, by an inability to

increase fat oxidation when fed a high-fat diet.[102,103] Indeed, Chitwood *et al*.[104] found that African American women had lower levels of fat oxidation at rest and during exercise than did their Caucasian counterparts. No studies are available that have examined ethnic differences in nutrient partitioning in South Africa. However, there are currently two studies being undertaken at the University of Cape Town that are characterising ethnic differences in nutrient partitioning in women. The first study is examining dietary intake in relation to resting energy metabolism using indirect calorimetry (EV Lambert, unpublished data), whereas the second study is accurately measuring 24-hr energy expenditure and fuel utilisation in a whole-room calorimeter (L Dugas, unpublished data).

4.4 Physical activity

The role of physical activity in the prevention and management of overweight and obesity is linked, in part, to the impact of physical activity on energy expenditure, body composition, and substrate oxidation and metabolism.[105] Furthermore, regular exercise is associated with increased adherence to dietary intervention for weight loss and weight control, improved self-efficacy and better long-term weight loss maintenance.[105] As such, physical activity has the potential to be a powerful "agent of change" in the prevention and management of overweight and obesity.

Despite the paucity of South African studies in which physical activity or inactivity have been studied in relation to obesity, the few published studies reflect the well-established, protective role of physical activity for the development of obesity and associated co-morbidities. The THUSA study has provided important insights into this relationship, in particular, in South African communities moving from urban to rural areas. In this cross-sectional study of approximately 1 000 persons, physical inactivity was a major determinant of obesity in adult black women of the North West.[101] Subjects in the highest tertile of physical activity were less likely to be obese (odds ratio: 0.38; 95% CI: 0.22, 0.66), and inactivity was the strongest predictor of obesity, when compared to other demographic and self-reported dietary factors.[101] Moreover, associated cardiovascular risk factors were significantly attenuated in those women who were physically active, even at the same level of obesity.[106]

In another survey, conducted in more than 550 economically active South Africans (from 2 100 who were originally contacted), self-reported inactivity was a major risk factor for overweight and obesity, along with lower levels of education, ethnicity and having at least one overweight parent.[107]

The protective effect of physical activity for obesity is not limited to adults, and, in fact, an inverse association between activity levels and fat mass, measured by television viewing time, has been reported in South African children.[108] In a regional, cross-sectional survey of children's health and fitness status of 12-18-year-old children in 14 schools in the Western Cape (boys n=2 026, girls n=2 792), current levels of obesity were associated with inactivity as measured by television time, lower fitness levels and a low reported daily intake of fruit and vegetables. Moreover, television viewing time was greater, and opportunities for school-based or after-school sports and physical activity were fewer, in persons of lower socio-economic status.[109]

4.5 Socio-cultural factors

In South Africa, there is large cultural diversity that influences perceptions of body image. However, as a whole, South African men and women have inaccurate perceptions of their body weight. For example, 9.7% of men and 22.1% of women of all races and ages perceive themselves as overweight, while 29.2% of men and 56.6% of women actually are overweight.[4] Only 16% of black South African women perceived themselves as overweight compared to 34% of women of mixed ancestry, 31% of Indian women, and 54% of white women. Therefore, it appears that when analysed by gender and ethnicity, only white South African women are able to perceive their actual body weight accurately.[4] Differences in the findings of these studies may relate to cultural factors.

Mvo *et al*.[110] and Clark *et al*.[111] have shown that an overweight body type has positive connotations within the black South African community, symbolising happiness, beauty, affluence, health and a negative HIV/Aids status. The racial difference in body image perception appears to stem from adolescence as Caradas *et al*.[112] found that the ideal body size desired by white girls was significantly smaller than that of the mixed race or black girls. Furthermore, dissatisfaction with present body size was significantly higher in white, compared to black or mixed race girls.[112] Additionally, a study of 150 black and white college students enrolled at the University of Natal showed that black men had significantly higher scores than white men on the Eating Disorder Inventory (EDI), suggesting that there could be a higher prevalence of eating disorder pathology in black men.

4.6 Education

The level of education appears to be related to overweight and obesity.[4,114] The national SADHS found that incorrect perception of body weight was related to lower levels of education and that women with the smallest waists were the most educated.[4] This study also established that low educational status was associated with a higher BMI in black African women. Conversely, men with more than eight years' schooling had a significantly higher BMI than those with less or no schooling.[4] This research shows that level of education plays a role in the development of obesity in South Africa.

4.7 Parity

Parity is associated with obesity in women.[115-119] In the Health and Retirement study, which included 4 523 American couples, among women a 7% increase in risk of obesity was documented for each additional child. Interestingly, the same study found a 4% increase in risk of obesity in men, suggesting that perhaps lifestyle changes after the birth of a child may lead to increased prevalence of obesity in both sexes.[116] The Stockholm Pregnancy and Weight Development Study found that weight increase during pregnancy was the strongest predictor for sustained weight retention one year after birth. They noted an increase in reported lifestyle changes, such as changes in diet, exercise and meal patterns, in women who retained more weight postpartum than those who did not. This again suggests that body weight after pregnancy could be determined, in part, by lifestyle changes associated with having children.[119] However, studies have shown that BMI prior to pregnancy,[117] young age at menarche, maternal age, time period from menarche to first birth and high gestational weight gain are important in determining the risk of becoming overweight after pregnancy.[120]

4.8 Stress

High levels of stress are associated with increased weight gain. Overgaard *et al*.[121] found that psychological workload was associated with higher weight gain in a sample 6 704 female Danish nurses, who were studied between 1993 and 1999. Dallman *et al*.[122] recently proposed a novel theory regarding chronic stress, comfort food and weight gain. They proposed that stressed or depressed people who have a decreased cerebrospinal corticotrophin-releasing factor, catecholamine concentrations, and hypothalamo-pituitary-adrenal activity may overeat to reduce the activity in the chronic stress response network.

South African research has shown that the stress of urbanisation may lead to increased incidence of chronic diseases of lifestyle. Steyn *et al*.[123] reported that in a sample of 986 black African men and women, aged 15-64 years living in the Cape Peninsula, those who spent larger proportions of their lives in an urban setting tended to have unhealthier lifestyles and higher risk for chronic diseases of lifestyle when compared to those who were less urbanised.

Taken together, these data suggest that there are certain environmental and socio-cultural factors contributing to the development of obesity in South Africans, and in particular, younger persons that may provide the basis for targeted public health intervention.

5. ADDRESSING THE PROBLEM: POLICY ENVIRONMENT AND THE INTERFACE BETWEEN GOVERNMENT AND CIVIL SOCIETY IN SOUTH AFRICA: STRATEGIES TO PREVENT AND MANAGE OBESITY

The South African policy environment for the prevention and management of chronic diseases of lifestyle reflects the epidemiological and health transition of this country, and the concomitant democratisation of South Africa, along with its rapid urbanisation. In 1996 the Directorate, Chronic Diseases, Disabilities and Geriatrics, was activated by the Department of Health and the first director was appointed. Over the past nine years, the Ministry of Health has completed a consultative process to develop a series of guidelines for the prevention or management of non-communicable diseases, including separate guidelines for the prevention and management of diabetes, hypertension, hyperlipidaemia and overweight. In addition, national food-based dietary guidelines were launched in 2004 and, more recently, in November 2004, the Directorate of Health Promotions, within the Department of Health, launched an inter-sectoral strategy aimed at the Promotion of Healthy Lifestyles and change from risky behaviour, particularly among the youth. This forms part of a plan for comprehensive health care in South Africa, and is one of the strategic priorities for the period 2004-2009.

In support of this initiative, the Department of Health has embarked on a programme of surveillance incorporating health indicators, such as BMI, physical inactivity and blood pressure.

This nationally representative survey that was first carried out in 1998, has been repeated in 2003-2004.[4] This survey provided the basis of the first published data concerning the South African national prevalence of overweight and obesity, and highlighted this problem as a major public health issue.[4] This will provide a means by which secular trends for these health indicators can be monitored, in response to the national health strategy.

Government has recently engaged, particularly at a multi-sectoral level, in the promotion of physical activity for health, via the education sector, and at a population level, through "Vuka-South Africa" or "Move for your Health". One of the target outcomes of this intervention is the awareness of the association between physical activity and maintaining an optimal weight. However, as with many programmes at both government and non-governmental level, there is often a failure to measure impact and effectiveness, or to provide adequately for implementation. This issue is currently being addressed in these initiatives by actively collaborating with the private sector.

In the private sector, there is increasing recognition of the complex nature of obesity prevention and management, and as such, over the past five years, continuing education has been provided at a professional level for doctors, nurses and other allied health professionals, through various foundations and professional bodies. Another important initiative in the private sector is the introduction of "wellness" programmes from major health insurers. These programmes encourage ongoing health-risk appraisal, including measurement of BMI and body fat levels, and reward and recognise maintaining a healthy weight, or engaging in appropriate weight loss strategies.

CONCLUSIONS AND RECOMMENDATIONS

From this review, it is apparent that obesity in South Africa is a growing problem in all sectors of the community, yet a particular challenge in children and urbanised black women. To address this problem and the associated morbidities in South African communities, a multi-sectoral approach is needed. This should include changes in policy aimed at creating an environment conducive and supportive for change, such as the promotion of physical activity and dietary education in schools. In addition, the opportunity for primordial prevention of obesity, particularly in children, should be promoted. These prevention strategies should be culturally sensitive and encompass programmes to improve the education, status and economic empowerment of women.

Future research should focus on intervention strategies aimed at reducing obesity and its morbid sequelae. These strategies should be culturally specific, with a particular focus on children and women, and should include dietary and behavioural aspects, as well as interactions with pharmacotherapy.

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CHAPTER 8

HYPERTENSION IN SOUTH AFRICA

Krisela Steyn[a]

High blood pressure (BP) or hypertension is a common condition in South Africa and is a risk factor for heart attacks, stroke, left ventricular hypertrophy, renal disease, and blindness. People who have hypertension are usually unaware that they have the condition, unless the BP has been measured at health-care facilities. It is therefore frequently referred to as a 'silent epidemic' in South Africa. Consequently, hypertension is universally underdiagnosed and/or inadequately treated resulting in extensive target-organ damage and premature death. Furthermore, hypertension frequently co-exists with other risk factors for chronic diseases of lifestyle (CDL), such as diabetes and obesity.

These interrelationships of hypertension with other CDL risk factors and the various possible target organs that can be influenced by uncontrolled hypertension result in a diverse picture that has an impact on the different population groups within South Africa. This picture can also be influenced by the impact of socio-demographic or genetic factors in different settings.

Seedat[1] summarised the pathophysiology of hypertension and response to treatment as follows: "Black hypertensive patients in South Africa are prone to cerebral haemorrhage, malignant hypertension, kidney disease leading to uraemia and congestive heart failure, whereas coronary heart disease (CHD) is relatively uncommon. In contrast, CHD is the major outcome related to hypertension in the white and Indian communities. In black patients with hypertension, the responses to antihypertensive medication such as the beta-blockers and the angiotensin-converting enzymes (ACE) inhibitors are poor, unless these agents are combined with a thiazide diuretic. Black patients respond best to diuretics, vasodilators or calcium channel blockers."

The impact of hypertension on mortality in an African population was assessed by Kaufman *et al*.[2] in 1996. They reported that the risk of death increased by 60%, with an increase of 20 mmHg in diastolic blood pressure (BP) in rural Nigeria, and estimated that the population attributable risk (the reduction in total mortality that would have been observed if hypertension were not present) was 7%, showing the impact of hypertension on all-cause mortality in rural Nigeria.[2]

BLOOD PRESSURE LEVELS AND THE PREVALENCE OF HYPERTENSION

The most comprehensive estimates of the prevalence of hypertension in South Africa is provided by the first Demographic and Health Survey (SADHS) that was conducted in the country in 1998.[3] An adult health module was developed for this cross-sectional survey, which used hypertension as an indicator condition to assess the prevalence, determinants, and quality of care provided for hypertensive patients. A random sample of 13 802 persons 15 years and older was selected, their BP was measured electronically, some risk factors for hypertension and chronic prescribed medications were recorded, as were socio-demographic data. Table 8.1 shows the sample sizes and mean diastolic and systolic BPs from this first SADHS, and Table 8.2 provides the crude and age-adjusted prevalence rates for hypertension in the whole population and the different ethnic groups in the country.[4]

Another important cross-sectional cardiovascular disease (CVD) risk factor survey was conducted by Connor *et al*.[5] in randomly selected general practices across the country. The study population comprised 9 731 persons, 30 years or older, attending the private sector primary health-care services. Hypertension was found to be the commonest of the CVD risk factors among all the study participants, but stood out as the risk factor with the highest prevalence in the black African community. After age and gender standardisation the overall hypertension prevalence rate was 55%, with 59% of black African people (95% CI 57-61), 55% of Indian and coloured people (95% CI 52-59 and 52-58, respectively) and 50% of white people (95% CI 49-52) diagnosed with the condition. In this study, hypertension was defined as having a current BP ≥140/90 mmHg or having a history of hypertension. However, in Table 8.2, hypertension is more common in white than in black people.

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Table 8.1. Mean systolic blood pressure, diastolic blood pressure, pulse and standard errors (SE) of South African adults in 1998[3]

	Men							Women						
Age group (years)	15 - 24	25 - 34	35 - 44	45 - 54	55 - 64	> 65	Total	15 - 24	25 - 34	35 - 44	45 - 54	55 - 64	> 65	Total
Total														
Number	1842	1086	1007	701	528	557	5738	2100	1634	1390	1088	938	914	8064
Systolic blood pressure														
(SE) (mmHg)	115(0.41)	120(0.58)	123(0.69)	130(1.08)	134(1.19)	140(1.49)	123(0.37)	106(0.38)	111(0.48)	118(0.66)	126(0.72)	134(1.05)	141(1.12)	119(0.36)
Diastolic blood pressure														
(SE) (mmHg)	69(0.33)	75(0.46)	79(0.47)	83(0.62)	82(0.66)	82(0.75)	76(0.25)	67(0.29)	73(0.35)	77(0.39)	81(0.43)	82(0.53)	82(0.54)	75(0.20)
African														
Number	1493	809	737	480	359	405	4283	1709	1257	1022	773	712	701	6174
Systolic blood pressure														
(SE) (mmHg)	115(0.45)	119(0.66)	122(0.84)	127(1.41)	132(1.43)	137(1.69)	121(0.38)	106(0.41)	111(0.55)	118(0.79)	125(0.87)	134(1.26)	139(1.28)	118(0.41)
Diastolic blood pressure														
(SE) (mmHg)	68(0.38)	74(0.52)	78(0.56)	81(0.78)	82(0.82)	82(0.88)	75(0.27)	67(0.31)	73(0.41)	77(0.45)	81(0.54)	82(0.61)	82(0.63)	75(0.23)
Coloured														
Number	207	158	154	103	80	70	772	224	227	197	161	102	97	1008
Systolic blood pressure														
(SE) (mmHg)	119(0.95)	127(1.67)	128(1.72)	135(2.56)	137(2.66)	142(4.57)	128(0.91)	108(1.46)	114(1.39)	123(1.90)	131(1.86)	135(3.16)	143(3.32)	122(0.91)
Diastolic blood pressure														
(SE) (mmHg)	71(0.72)	79(1.25)	82(1.21)	85(1.53)	84(1.29)	82(2.22)	79(0.61)	70(1.10)	75(0.95)	79(1.12)	83(1.08)	82(1.88)	81(1.77)	77(0.56)
White														
Number	93	87	85	99	70	66	500	97	94	110	113	89	100	603
Systolic blood pressure														
(SE) (mmHg)	122(1.84)	125(1.57)	126(1.75)	134(2.20)	137(3.55)	152(4.19)	132(1.44)	107(1.56)	110(1.14)	112(1.21)	124(1.79)	128(2.94)	147(2.94)	121(1.32)
Diastolic blood pressure														
(SE) (mmHg)	73(1.20)	77(1.47)	80(1.37)	86(1.45)	84(1.96)	85(1.91)	80(0.86)	68(1.20)	73(0.85)	74(0.90)	81(1.12)	78(1.35)	82(1.53)	76(0.59)
Indian														
Number	49	32	31	19	19	16	183	70	56	61	41	35	16	279
Systolic blood pressure														
(SE) (mmHg)	113(1.98)	117(3.07)	118(2.48)	134(3.28)	131(4.20)	131(3.36)	122(1.41)	100(1.31)	104(2.27)	110(1.87)	129(5.07)	136(2.75)	140(4.56)	114(1.54)
Diastolic blood pressure														
(SE) (mmHg)	69(1.14)	76(2.66)	76(1.95)	86(2.42)	81(2.49)	74(2.89)	76(0.97)	66(0.94)	70(1.54)	73(1.49)	80(1.89)	81(1.22)	77(1.32)	73(0.77)

Table 8.2. Prevalence of hypertension (%) in South African adults using South African[6] and ISH/WHO[7] cut-off points and the estimated number of hypertensive patients in the country

	Crude rates		Age-adjusted rates to SA population (Census 96)[8]		Age-adjusted rates to world population [9]		Estimated number of hypertensive patients (in 1000s) using 1996 Census data[8]	
	Cut-off point ≥160/95 mmHg or medication	Cut-off point ≥140/90 mmHg or medication	Cut-off point ≥160/95 mmHg or medication	Cut-off point ≥140/90 mmHg or medication	Cut-off point ≥160/95 mmHg or medication	Cut-off point ≥140/90 mmHg or medication	Cut-off point ≥160/95 mmHg	Cut-off point ≥140/90 mmHg
Overall	**14.8**	**23.9**	**12.7**	**21.1**	**15.7**	**25.2**	**3260**	**5500**
All Males	**12.6**	**22.9**	**10.9**	**20.9**	**14.1**	**25.1**	**1340**	**2600**
All Females	**16.3**	**24.6**	**13.9**	**21.2**	**16.8**	**25.3**	**1920**	**2900**
Ethnicity								
African	13.0	22.1	11.0	19.5	14.6	24.4	2120	3800
Men	10.5	20.2	9.3	18.6	12.9	23.5	850	1700
Women	14.6	23.5	12.2	20.1	15.7	25.0	1270	2100
Coloured	18.5	27.9	15.3	23.9	19.2	28.6	359	570
Men	13.6	25.9	11.4	22.9	14.9	27.3	129	260
Women	22.4	29.5	18.4	24.7	22.7	29.6	230	310
White	23.9	32.9	21.8	30.2	19.4	27.6	748	1040
Men	24.6	38.0	21.5	34.4	20.6	33.5	355	560
Women	23.4	29.1	22.0	27.1	18.5	23.3	393	480
Indian	18.3	24.4	15.9	22.0	19.8	26.3	118	169
Men	18.7	27.9	14.9	24.8	18.7	28.0	54	90
Women	18.0	22.1	16.5	20.3	20.5	25.3	64	79

DETERMINANTS OF HYPERTENSION IN THE SOUTHERN AFRICAN POPULATIONS

The elegant Kenyan Luo migration study of Poulter *et al*.[10] was the first to show that migration of people living in traditional rural villages on the northern shores of Lake Victoria to the urban settings of Nairobi was associated with an increase in BP. The urban migrants had higher body weights, pulse rates, and higher urinary sodium/potassium ratios than those who remained in the rural areas. This suggests a marked change in the diet of the new arrivals in Nairobi with a higher salt and calorie intake along with a reduced potassium intake due to consuming less fruit and vegetables. The higher pulse rates in Nairobi participants suggest that mechanisms related to increased autonomic nervous system activity could contribute to the higher levels of BP observed.[10,11]

Some sub-Saharan African countries still maintain large urban/rural prevalence differences. However, in South Africa such differences are no longer apparent. The prevalence rates in the rural areas have indeed increased to levels similar to those found only in the cities in the past. As an example, in the early 1990s, Mollentze *et al*.[12] showed that the rural community of QwaQwa in the Free State had a prevalence rate of 29% in a sample aged 25 years and older. This was similar to the prevalence rate of 30.3% in the peri-urban community of Mangaung in the same province.[12] However, Steyn *et al*.[13] found in the black community of Cape Town, that the duration of urbanisation independently predicted the presence of hypertension.

The THUSA study conducted by the group at Potchefstroom University focused on the factors related to hypertension in a black community undergoing the health transition.[14] Van Rooyen *et al*.[14] found that the BP was highest in the group of newcomers to the urban setting, and that factors related to urbanisation were positively associated with hypertension. BP correlated positively with age, level of urbanisation, waist:hip ratio and smoking tobacco. Additional factor analyses of these data found clusters of risk factors relating to hypertension. The most important of these included a cluster of malnutrition, which included high intakes of saturated fat, animal protein, sodium, and vitamins A and B6. A second cluster that was identified had characteristics of the metabolic syndrome. A third cluster consisted of a hypercholesterolaemic and obesity group of factors which included ageing, total and LDL cholesterol, triglycerides, high body mass index (BMI) and central obesity.[15]

Stress as a precipitating factor for hypertension is frequently mentioned, however, the scientific measurement of stress presents a challenge for scientists and consequently studies on this association is seldom reported in South African literature. Edwards[16] attempted to study this relationship in Xhosa-speaking unskilled workers in the Eastern Cape with a range of psychological scales. He failed to show any association between high scores identified with the use of the Bluen and Odesnik's Township Life Events Scale, Weiman's Occupational Stress Scale and Melamed's Emotional Reactivity scale, and BP levels.

The association between hypertension and obesity has been well documented in many studies in South Africa.[12-14] Despite this clear association it has been suggested that the noxious effect of obesity in black people is less than in people from other population groups. Most of the supporting evidence for this viewpoint is based on studies carried out in African Americans in the United States. A small study in South Africa by Walker *et al*.[17] suggested similar findings. This issue can be addressed through the analyses of the determinants of hypertension on the SADHS data set described below.

Some dietary factors are related to hypertension, including increased salt (sodium) intake and the decrease in fruit and vegetables (potassium), while a higher intake of alcohol products, particularly by men, plays a role. The data on the association between high salt (sodium chloride) intake and hypertension in black people from Africa have been summarised by Seedat,[18] who suggests that black people have an abnormal transport mechanism of sodium and a low rennin activity. A high intake of sodium is common in South Africa, particularly in poor settings, as it is used to preserve food or to make food tastier. Substantial amounts of salt are added to food, while cooking and monosodium glutamate-based flavouring cubes or salts are widely used to give taste to food. In addition to a high salt intake, people in sub-Saharan Africa frequently eat small amounts of fruit and vegetables resulting in low potassium intakes. Bread is a staple food for many people in the country and contains high salt levels. Salt facilitates the baking process of bread.

Charlton *et al*.,[19] determined the habitual sodium, potassium, magnesium and calcium intake across South African population groups in 324 people in a study conducted in Cape Town. They also identified the foods that mainly contributed to sodium intake and the proportion of salt intake that is added when preparing or consuming meals (discretionary sodium intake). They found that the mean urinary Na excretion values equate to a daily salt (NaCl) intake of 7.8 g, 8.5 g and 9.5 g in black, coloured and white South Africans, respectively. Between 33% and 46% of total Na intake was discretionary, while bread was the single greatest contributor to Na intake of the non-discretionary sources in all population groups. Calcium intake differed among the groups, with black subjects having particularly low intakes.

Urban/rural differences exist regarding sources of dietary Na, with over 70% of total non-discretionary Na being provided by the bread and cereals food group in rural black South Africans, compared to 49% - 54% in urban dwellers. All ethnic groups had sodium intakes in excess of 6 g salt/day, while potassium intakes in all groups fell below the recommended 90 mmol/day.

The sample size of the SADHS was sufficiently large to allow the estimation of the socio-demographic factors and independent associations of the known hypertension risk factors by means of a series of logistic regression analyses. Table 8.3 shows these series of regression models (Steyn *et al*. unpublished).

The results of the four models for hypertension generated by the multiple logistic regression analyses for all participants are shown in Table 8.3. Model I shows the unadjusted odds ratio for hypertension (cut-off point ≥140/90 mmHg) in the different population groups. The African rural group had significantly lower risk for hypertension, while the white group had significantly higher risk for hypertension than the African groups and the Indian group.

Model II shows that adjustments for gender and age attenuated the differences between the odds ratios for hypertension among the population groups of model 1. Only the rural African group had significantly lower risk for hypertension than the other four groups. The model also shows the marked influence of increasing age on the risk for hypertension.

Model III added adjustments for socio-economic factors to the analyses and showed that the differences of the odds ratios for hypertension among the different population groups became even smaller and that with the exception of the rural African groups there was no significant differences in the risk for hypertension among the population groups. There were no significant differences in the risk for hypertension among the asset index categories, while the risk for hypertension was significantly lower for those with more than 12 years' education.

Model IV added adjustments for additional known hypertension risk factors, and shows odds ratios for hypertension after adjusting for age, gender and socio-demographic factors. The independent association of these variables with hypertension is identified. The adjusted risk for hypertension was significantly lower in women compared to men.

Regarding BMI, the adjusted risk for hypertension was about 2-fold higher in obese participants compared to those with normal weight. Interestingly, being underweight had a protective effect. A family history of stroke and of hypertension was significantly associated with the adjusted odds ratio for hypertension. Participants who used alcohol excessively (positive CAGE questionnaire) had a significantly increased adjusted risk of having hypertension compared to those who answered negatively to the CAGE questionnaire.

Table 8.3. The results of four logistic regression analyses for hypertension, adjusting for age and gender, population group, other socio-economic indicators and for known hypertension risk factors in South African 15 years and older in 1998

Socio-demographic characteristics		MODEL I		MODEL II		MODEL III		MODEL IV	
	N	Odds ratio and 95% CI:		Odds ratio and 95% CI: adjustment: model I plus age and gender		Odds ratio and 95% CI: adjustment: model II plus socio-economic factors		Odds ratio and 95% CI: adjustment: model III plus risk factors	
Population group African rural	5119	1.00	-	1.00	-	1.00	-	1.00	-
African urban	4687	1.23	1.09-1.39	1.54	1.34-1.77	1.48	1.25-1.75	1.42	1.19-1.68
Coloured	1029	1.46	1.21-1.76	1.56	1.23-1.98	1.53	1.17-1.98	1.54	1.19-2.00
White	1684	2.02	1.62-2.51	1.66	1.34-2.05	1.84	1.36-2.48	1.84	1.35-2.51
Indian	433	1.24	0.99-1.55	1.30	1.00-1.69	1.31	0.94-1.82	1.38	0.99-1.92
Gender Men	5362			1.00		1.00		1.00	
Women	7590			0.98	0.88-1.10	0.98	0.87-1.10	0.80	0.71-0.90
Age 15-14 years	3738			1.00		1.00		1.00	-
25-34 years	2534			2.24	1.81-2.76	2.30	1.86-2.85	1.88	1.51-2.35
35-44 years	2261			4.84	3.95-5.93	4.94	4.00-6.11	3.73	2.97-4.68
45-54 years	1676			10.75	8.78-13.16	10.99	8.85-13.65	8.16	6.46-10.32
55-64 years	1388			16.67	13.39-20.74	17.01	13.41-21.57	12.90	10.05-16.55
≥65 years	1355			24.53	19.63-30.65	25.18	19.55-32.42	20.85	15.96-27.23
Asset index (Quintiles) Poorest group	2119					1.00		1.00	
2nd poorest group	2659					1.04	0.83-1.29	1.01	0.81-1.26
Middle group	2762					1.15	0.93-1.42	1.09	0.88-1.36
4th poorest group	2885					1.13	0.89-1.43	1.03	0.80-1.31
Richest group	2527					1.04	0.79-1.35	0.89	0.68-1.17
Education None	1839					1.00		1.00	-
1-7 years	3763					1.10	0.94-1.30	1.05	0.89-1.25
8-12 years	6553					1.09	0.90-1.31	1.02	0.84-1.23
>12 years	797					0.69	0.51-0.92	0.63	0.47-0.84
Body mass index Obese	2456							1.97	1.68-2.31
Overweight	3020							1.37	1.19-1.58
Normal weight	6188							1.00	-
Underweight	1288							0.62	0.50-0.77
Family history of hypertension Absent	9090							1.00	-
Present	3862							1.27	1.12-1.45
Family history of stroke Absent	12040							1.00	-
Present	912							1.35	1.12-1.64
Alcohol dependence Cage negative	10527							1.00	-
Cage positive	2425							1.16	1.01-1.34

The benefit of such detailed analyses and model building is clearly illustrated when differences are found between the adjusted odds ratios for hypertension in South African population groups compared to the calculations, which only standardised for age differences among the four population groups (Figs. 1 & 2). These earlier analyses suggested that the risk for hypertension is higher in white and Indian men than in coloured and African men. Similarly, the prevalence rates reported for women suggested that African women had the lowest prevalence rates of all the groups.[1] However, after the influence of gender, education, urbanisation in the African group, BMI, family history and excessive alcohol use were shown to be associated with having hypertension, it became clear that the rural African group of participants had significantly lower risk for hypertension than urban African, coloured and white participants. This suggests that there are no inherent differences among the population groups with respect to the risk of developing hypertension.

GENETIC BASIS OF HYPERTENSION IN SUBJECTS OF AFRICAN ORIGINS*

Despite the many environmental factors related to hypertension discussed above, various studies in South Africa suggest a possible genetic contribution to the origins of hypertension in black people. Steyn *et al*. (unpublished data) found that high BP is associated with a strong family history of either hypertension or stroke. While Loock *et al*.[20] showed that a family history of hypertension occurred 4.3 times more frequently in patients who had ischaemic heart diseases (IHD) compared to a matched group of patients without the condition (odds ratio of 4.33, 95% CI 2.21-8.52). This could provide a very cost-effective opportunity to identify people who need thorough screening for hypertension. Data from Nigeria suggest that genetic factors are relevant across Africa. Rotimi *et al*.[21] used computer models and regression analyses to estimate the degree of heritability of blood pressure in Nigerian families. The heritability estimate was 45% and 43% for systolic and diastolic BP, respectively. This emphasises the interaction between environmental influences and genetic factors in the aetiology of hypertension.

To evaluate the genetic basis of hypertension both genome-wide scans and candidate gene approaches have been employed. The genome-wide scan approach has failed to provide sufficient evidence for any single locus contributing to BP. Nevertheless, genome-wide scan approaches assume that micro-satellite markers selected will not miss important genetic variants, as the rates of recombination between markers are considered small. Furthermore, the results of studies utilising genome-wide scans and assessing BP as a continuous rather than as a dichotomous trait have not been completed.

Despite a number of gene candidates being evaluated, there is really only substantial evidence to support a role for two loci to date. In groups of European ancestry, there is both linkage and association data to support a role for the angiotensin-converting enzyme (ACE) gene in contributing to BP in men,[22,23] and for the angiotensinogen (AGT) gene in contributing to the presence of hypertension in women.[24,25] The ACE gene variant is associated with ACE activity and expression, but the exact function of the ACE gene variant (an intron polymorphism) has not been described. The AGT variants examined (M235T and a micro-satellite marker) are in linkage disequilibrium with a functional promoter region variant associated with alterations in basal transcription rates (-6G→A).[26]

In populations of African ancestry, data from small case-control studies (which are considered sensitive but are limited because of the non-random nature of subject ascertainment) and a large case-control study with over 700 cases phenotyped using 24-hour ambulatory BP monitoring and 700 controls (Norton, personal communication) suggest that the ACE gene variant has little effect in contributing to hypertension. Nevertheless, gender-specific effects need to be excluded. In addition, AGT gene variants that have been associated with hypertension in Caucasian groups are not implicated in subjects of African ancestry.[27] However, an alternative functional promoter region variant of the AGT gene (-217G→A) has recently been shown to be strongly associated with hypertension in a small African-American case-control study,[28] data that have now been confirmed in a large (see above) case-control study conducted in black South Africans (Norton, personal communication). The role of the -217G→A AGT gene variant in contributing to the variance of BP within families is now being assessed in a South African study. Furthermore, an additional functional AGT gene promoter region variant (-20A→C)[29] has been shown to modify the impact of body size on BP,[27] and the -217G→A variant's effect on the risk for hypertension (Norton, personal communication) in subjects of African ancestry, thus suggesting complex genotype-genotype and genotype-phenotype interactions of the AGT gene in subjects of African origins.

Other candidate gene variants implicated in BP control or hypertension in groups of European or African ancestry, including functional or potentially functional variants found within the guanosine trisphosphate protein β3 subunit gene,[30] the sodium epithelial channel gene,[31] the α-adducin gene,[32]

* *Information provided by Prof Gavin Norton, Associate Professor; Director of the Cardiovascular Pathophysiology and Genomics Research Unit, School of Physiology, Faculty of Health Sciences, University of the Witwatersrand.*

and the β_2 receptor gene[33] have not been shown to be associated with hypertension in all studies conducted in groups of African ancestry,[34-36] or have been shown to occur with too low a frequency to contribute substantially to population-attributable risk.[37] Presently, family-based linkage studies assessing BP as a continuous variable and utilising 24-hour ambulatory BP monitoring techniques are underway in South Africa to evaluate the role for these variants as determinants of BP in groups of African ancestry further.

MALIGNANT HYPERTENSION

Malignant hypertension also occurs more frequently in black people of South Africa than in the other population groups. Milne *et al*.[38] showed this in black patients hospitalised for hypertension. This condition is frequently related to severe renal disease and hypertensive encephalopathy. Data from the South African Dialyses and Transplantation Registry have shown that hypertension was responsible for 35% of end-stage renal failure in blacks and that malignant hypertension was diagnosed in 57% of the black patients with essential hypertension.[39] Untreated malignant hypertension has been shown to have a five-year survival as low as one percent.

HYPERTENSION IN CHILDREN

The Birth-to-Ten study (BTT) is a birth cohort study that was initiated in Johannesburg-Soweto in 1990. This study provided data on the determinants of BP in Sowetan children aged 1 year.[40] They found that 29.3% of the variance of systolic BP in these children was determined by weight, upper-arm circumference, age at which formula feeds were started, length and volume of the formula. The amount of salt added to the diet approached statistical significance. In a sub-sample of children, a correlation was found between the infant's BP and that of the mother. When the BTT children were 5 years old, BP was measured in 964 of them.

The mean systolic and diastolic BPs were significantly higher in the black children compared with those of the other groups. The black and coloured children had higher rates of raised BP than those of the Indian or white children.

Table 8.4: The mean BP and prevalence of hypertension in 5-year-old children participating in the Birth-to-Ten study[41]

	All	Black	Coloured	Indian	White
Mean systolic BP (mmHg) (SD)	107(13)	108(12)*#	105(11)	110(8)*	100(11)#
Mean diastolic BP (mmHg) (SD)	62(8)	63(8)*	61(9)	59(8)	56(8)*
% with BP ≥108/70 mmHg**	45.9	48.4	37.9	10.5	17.4
% with high normal BP ≥108/70 but <115/75 mmHg**	23.6	24.5	23.9	0	13
% with significant hypertension,					
BP ≥115/74 but <124/84 mmHg**	11.6	12,5	7	10.5	0
% with severe hypertension ≥124/84 mmHg**	10.7	11.4	7	0	4.4

* & # p<0.05 when comparing two variables marked with either * or #

** BP cut-off points for children 3-5 years according to JNC V[42]

Levitt *et al*.[43] showed that the systolic BP of the children at age 5 years was inversely related to birth weight independent of current weight, height, gestational age or socio-economic status. The highest level of systolic BP at 5 years was found in the children who had a low birth weight and who had picked up the most weight since birth, while the lowest BP was recorded in those children who had a normal birth weight and had gained the least weight since birth.

In a study in the North-West province in black children aged 10-15 years conducted by Schutte *et al*.,[15] a few nutrients were identified by means of stepwise regression analysis that were significantly associated with BP parameters in boys with hypertension. These nutrients were biotin, folic acid, pantothenic acid, zinc and magnesium. In girls with hypertension energy intake, biotin and vitamin A intake were associated with BP parameters. No such associations were found in the children with normal BP levels. The intake of there nutrients were all below the recommended dietary reference intakes. In this same study population BP was recorded using the Finpres apparatus and analysed by means of the Fast Modelflow software program.[44,45]

The results of this analysis suggest that in stunted children the arterial compliance was lower compared to this measure in normal children. The early changes in the cardiovascular system of stunted children may predispose these children in later life to develop increased BP (van Rooyen *et al*., unpublished).

TREATMENT STATUS OF HYPERTENSION

The quality of hypertension care received by South Africans is reflected in the proportion of persons with hypertension that are aware of having the condition, the proportion that are taking antihypertension medication, and the proportion with BP levels below the accepted target BP level. In 1998 when the first SADHS survey was conducted, the BP cut-off point of ≥160/95 mmHg was used to identify patients with uncomplicated hypertension. However, the internationally accepted cut-off point was ≥140/90 mmHg.[7] Since then, the latter cut-off point has also been accepted in South Africa.

Fig. 1 shows the treatment status for hypertension in South Africa in 1998 for the different population groups after age-standardisation of the first SADHS data. The treatment status is shown using both the cut-off points of ≥160/95 mmHg and ≥140/90 mmHg.

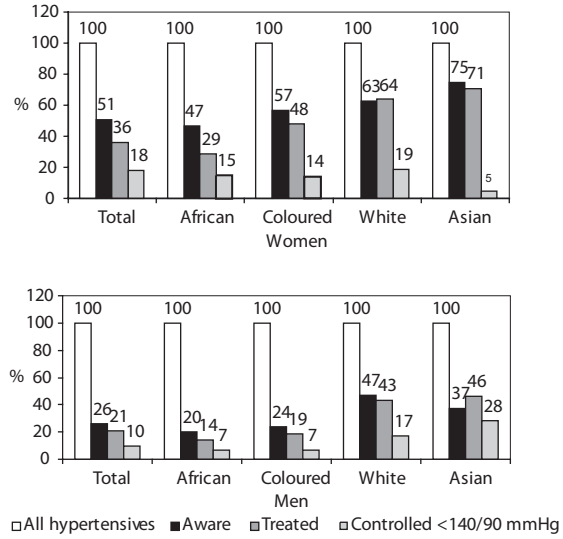

Figure 1: Treatment status of hypertensive (≥ 160/95 mmHg and/or on treatment) and controlled hypertensive (< 160/95 mmHg) South African women and men

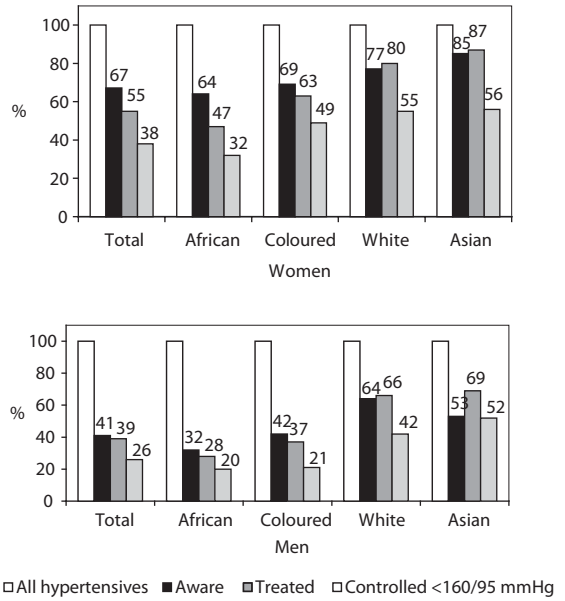

Figure 2: Treatment status of hypertensive (≥140/90 mmHg and/on treatment) and controlled hypertensive (<140/90 mmHg) South African women and men

Table 8.5. The results of a logistic regression analysis of socio-demographic variables and hypertension treatment status in South Africa in 1998 (hypertensive N=2 043)

Socio-Demographic Characteristics	Awareness of having hypertension Aware= 1183		Use of hypertension medication On medication= 1006		BP Controlled, (<160/95mmHg) Controlled= 700	
	Odds Ratio	(95% CI)	Odds Ratio	(95% CI)	Odds Ratio	(95% CI)
Asset index (Quintiles)						
Poorest group	1.00		-1.00		-1.00	
Second poorest group	1.057	(0.665 – 1.680)	1.049	(0.614 – 1.793)	0.905	(0.517 – 1.585)
Middle group	1.691	(1.090 – 2.624)	1.750	(1.069 – 2.864)	1.276	(0.731 – 2.228)
Fourth poorest	1.621	(1.002 – 2.623)	2.149	(1.231 – 3.753)	1.591	(0.866 – 2.921)
Richest group	2.247	(1.238 – 4.079)	3.485	(1.824 – 6.660)	2.327	(1.173 – 4.616)
Education						
None	1.00		-1.00		-1.00	
1 – 7 years	1.164	(0.863 – 1.571)	1.277	(0.933 – 1.747)	1.372	(0.977 – 1.925)
8 – 12 years	1.130	(0.805 – 1.588)	1.245	(0.889 – 1.743)	1.247	(0.872 – 1.784)
> 12 years	1.552	(0.834 – 2.889)	1.632	(0.869 – 3.064)	1.326	(0.674 – 2.609)
Age						
15 – 24 years	1.00		-1.00		-1.00	
25 – 34 years	14.001	(2.060 – 95.173)	15.426	(2.433 – 97.814)	10.725	(1.850 – 62.173)
35 – 44 years	16.027	(2.531 – 101.502)	25.412	(4.530 – 142.573)	14.212	(2.637 – 76.589)
45 – 54 years	36.412	(5.742 – 230.891)	58.364	(10.433 – 326.500)	28.904	(5.475 – 152.574)
55 – 64 years	38.022	(5.824 – 248.226)	64.725	(11.464 – 365.443)	28.488	(5.367 – 151.204)
≥ 65 years	31.863	(5.025 – 202.035)	60.926	(10.826 – 342.870)	26.360	(4.916 – 141.351)
Population group						
African	1.00		-1.00		-1.00	
Coloured	1.052	(0.716 – 1.544)	1.159	(0.759 – 1.769)	1.161	(0.749 – 1.801)
White	1.155	(0.650 – 2.052)	1.295	(0.743 – 2.254)	0.957	(0.557 – 1.645)
Indian	1.313	(0.714 – 2.415)	2.808	(1.531 – 5.149)	1.764	(1.032 – 3.015)
Geographic setting						
Urban	1.00		-1.00		-1.00	
Rural	0.696	(0.529 – 0.916)	0.835	(0.612 – 1.139)	0.954	(0.617 – 1.474)
Gender						
Men	1.00		-1.00		-1.00	
Women	3.545	(2.734 – 4.595)	2.459	(1.873 – 3.229)	2.006	(1.529 – 2.631)
Medical aid						
Membership	1.00		-1.00		-1.00	
Non-membership	0.828	(0.549 – 1.247)	0.568	(0.374 – 0.862)	0.587	(0.377 – 0.914)

In 1998, only 26% and 38% of men and women with hypertension, respectively, had BPs below 160/95mmHg. However, if the cut-off point of ≥140/90 mmHg is used to identify those with hypertension and who had controlled BP, only 10% of men and 18% of women had controlled BP. Such poor levels of control will contribute to the high rates of strokes and heart attacks occurring in the country.

The awareness of hypertension, the use of hypertension medication, and the control of hypertension (cut-off point <160/95 mmHg) among subjects with hypertension increased with increasing wealth and were highest in the richest group. Interestingly, higher levels of education among the participants with hypertension added no better treatment status than that achieved by being wealthier. Older participants with hypertension were more likely to be aware, use medication, and have a controlled BP. In fact, for people with hypertension a participant above age 44 years was about 28 times more likely to have controlled BP compared with those who were between 15 and 25 years.

Indian people with hypertension were more likely to be on medication and have higher levels of control than African men and women. There were no differences in the treatment status among the African, white and coloured participants with hypertension. Although rural participants with hypertension were significantly less aware of having the condition than their urban counterparts, no differences were seen between those on medication and those with controlled BP. Women were more aware of hypertension, took more medication and their BP was more controlled compared to men. Participants with hypertension who were members of the medical aid society and received medical care from the private sector were no more aware than those who had to use the public health-care sector. However, private-sector medical aid patients with hypertension were more likely to be on medication and to have controlled BP than were their public-sector counterparts.

The finding that young people with hypertension have poor hypertension control is of particular concern as they could be exposed to high BP for many years. This will result in serious end-organ damage affecting their eyes, kidneys, and coronary and cerebral arteries. Hypertension control in men was far less than that for women, suggesting that the group of people with hypertension with the least degree of hypertension control is the young, poor men irrespective of their population group.

Table 8.6 shows the antihypertension medication used by participants with hypertension during the first SADHS in 1998.

Table 8.6. Antihypertension medication used by patients with hypertension in South Africa in 1998, the first SADHS survey

HYPERTENSION Codes C02, C03, C07, C08, C09)* – % of persons taking drugs for hypertension	50.9	59.9	57.0
Number of hypertensive drugs used	426	1.13	1.56
Diuretics as % of hypertension drugs	35.9	45.9	43.2
Diuretics on their own as % of hypertension drugs	29.0	41.1	37.8
Low-ceiling diuretics (thiazide, others) (C03A/B) as % of hypertension drugs	14.4	18.2	17.2
High-ceiling diuretics (C03C) as % of hypertension drugs	7.8	6.0	6.5
Potassium-sparing agents (C03D) as % of hypertension drugs	1.9	4.8	4.0
Diuretics and potassium sparing agents (C03E) as % of hypertension drugs	4.9	12.1	10.1
Diuretics in combination (C02AA52/53) as % of hypertension drugs	6.9	4.8	5.4
Reserpine / diuretic and/or vasodilator	1.8	2.2	2.1
ACE inhibitors with diuretics (C09BA) as % of hypertension drugs	3.9	1.5	2.2
Beta-blocking agents & diuretics (C07B/C/D) as % of hypertension drugs	1.2	1.1	1.1
Beta-blocking agents (C07A/B/D) as % of hypertension drugs	16.9	7.0	4.7
Calcium-channel blockers (C08)	13.6	7.7	9.3
Agents acting on renin-angiotensin system (C09) as % of hypertension drugs	24.4	16.6	18.7
Plain ACE inhibitors (C09AA) as % of hypertension drugs	20.5	15.1	16.6
ACE inhibitors with diuretics (C09BA) as % of hypertension drugs	3.9	1.5	2.2
Antiadrenergic and other agents as % of hypertension drugs	16.3	27.7	24.4
Antiadrenergic agents – central acting (C02A) as % of hypertension drugs	14.8	25.2	22.3
Reserpine (C02AA02) as % of hypertension drugs	4.1	6.1	5.5
Reserpine / diuretic and/or vasodilator (C02AA52/53) as % of hypertension drugs	1.8	2.2	2.1
Methyldopa (C02AB01) as % of hypertension drugs	8.9	17.0	14.8
Antiadrenergic agents – peripherally acting (C02C) as % of hypertension drugs	0.9	1.8	1.5
Agents acting an arteriolar smooth muscle (C02D) as % of hypertension drugs	0.6	0.7	0.6

Of the hypertension drugs used, 48.6% were diuretics on their own or in combination with other agents. β-Blocking agents in combination or on their own accounted for 5.8% of the hypertension drugs. Calcium-channel blockers were 9.3% of the drugs. Agents acting on the renin-angiotensin system were 18.7%. Antiadrenergic and other agents accounted for 24.4% of hypertension drugs, of these 7.3% of drugs contained reserpine and 14.8% contained methyldopa.

While national guidelines for the management of hypertension in the primary health-care setting have been developed and launched,[46,47] the findings of the survey suggest that these are not being widely implemented. This is reflected in the poor level of control of hypertension that was achieved across the country in this first SADHS.[3] Diuretic agents are recommended as the first-line drug for all patients with hypertension, however, these accounted for only 43% of the antihypertensive agents used. Reserpine is the cheapest second-line agent suggested in the guidelines, but only about 5.5% of the antihypertensive drugs contained reserpine. The guidelines do not recommend methyldopa for hypertension, except for pregnant women.[47] This agent is expensive and has many side effects, but still accounts for 14.8% of all antihypertensive drugs used. It was used more frequently for women and in the public sector. At the time of the survey, no generic ACE-inhibitor was available in South Africa and it was a surprising finding that these expensive agents were used equally frequent in the public and private health-care sector.

Two other large studies in the private sector health-care services have been reported in South Africa. The first was by Edwards *et al*.[48] who had access to a computerised patient data set. The level of BP control of about 12 000 patients with hypertension attending private practices with 3 503 doctors working in South Africa could be assessed. All patients were covered by medical aid health insurance. The level of BP control achieved in these patients were high with 34.7% with BP <140/90 mmHg while another 42.8% had BP between 140/90 mmHg and 160/95 mmHg. Fifty seven percent of patients needed two or more drugs to achieve this level of BP control and the pattern of drug use was predominantly the more expensive newer drugs.

The second study was conducted by Connor *et al*.[5] in 9 133 patients attending 680 private practices throughout the country. They collected data on CHD risk factors and found that hypertension was the most common risk factor in all the population groups in South Africa, standing out as the major risk factor in black African patients. The proportion of patients with hypertension that had uncontrolled BP (>140/90 mmHg) was 47%.

Although little South African data exist to show that the reduction of BP in patients with hypertension will reduce morbidity and mortality locally, it undoubtedly is clear that the need to improve the diagnoses and treatment of hypertension in the country should be a priority, particularly in the public health care setting. Skudicky *et al*.[49] showed regression of left ventricular hypertrophy in previously untreated patients with the conditions at Baragwanath Hospital when given antihypertension medication. However, Seedat[50] emphasised that BP control in black patients with hypertension does not necessarily lead to improved renal function and, therefore, he considers hypertension to continue being an important cause of end-stage renal disease in sub-Saharan Africa.

MANAGEMENT OF HYPERTENSION

The management of hypertension in a society has two elements. The first should target the whole population and should in the first instance attempt to reduce the risk factors for hypertension in the society. This would entail reducing the very high rates of obesity, particularly in women, reducing salt intake and increasing the intake of at least potassium by means of higher vegetable and fruit intake and the reduction of high alcohol consumption. The second aspect of a community-based approach is to motivate people, particularly those at high risk, to have their BP checked. It is important that the community be informed about the need for screening, and understands the impact that poorly controlled BP has on health.

The second element of hypertension management involves the early diagnoses of patients with hypertension by primary health-care services and the cost-effective management of the condition. It also involves educating patients about their condition and working with them in a way that will allow them to attain the highest possible level of compliance to their management. Health services should in addition to achieving good BP control be screening on a regular basis for possible target-organ damage in their patients. South Africa needs to improve on both these aspects of good hypertension management.

COMMUNITY-BASED INTERVENTIONS

Studies to evaluate the benefit of community-based interventions in South Africa are rare. The CORIS study was done in three towns in the south-western Cape in the white communities.[51] This study developed a model of active community-based intervention set on the principles mentioned above. This showed that the intervention towns managed to achieve better BP control than the control town after four years of intervention. Resurveys of these towns showed that eight years after the end of the active intervention period, levels of risk factors in the control town had decreased to those observed in the intervention towns. This called for an explanation why an improved level of BP control occurred in the control town. Was it the cause of repeated surveys during the study or of a background intervention effect (secular trend of intervention) that occurred through activities of organisations, such as the Heart Foundation of Southern Africa, and other community-based interventions in the country as a whole? To answer to this, the level of hypertension control in towns near to the original control town that had not previously participated in the study was surveyed. A comparison of these towns in the south-western Cape showed that the new towns had similar BP levels as those of the original control town. This finding suggested that the secular interventions that occurred in the country as a whole were as effective in reducing BP levels and other CVD risk factors as did the active intervention phase of the CORIS study. Only, these occurred at a much slower pace than the active interventions.

The successful community-based CVD risk factor intervention programme that was developed during the CORIS study for the white community was transferred to the poor working-class community of Mamre, 40 km outside Cape Town. This setting was originally a Moravian Mission station. The objective of this study was to implement the CORIS intervention model in a poor community.[52]

The broad-based CVD risk factor intervention targeting the whole Mamre community was established around a BP station staffed by trained community health workers. They provided BP measurements and advice for improved compliance to treatment, as well as advice to control other CVD risk factors. Many community-based activities were part of the 5-year intervention programme, for example, street parades on "World No Tobacco" days, posters and billboards developed in collaboration with the community with heart health messages. The intervention was widely accepted by the Mamre community and some CVD risk factors were shown to be reduced in a before-and-after study.[53]

HEALTH SERVICES FOR HYPERTENSION

Chapter 17 provides details on the status of health services research for CDL in South Africa. This section will report briefly on some relevant findings.

The poor level of hypertension control in the community has led to a small number of health service-related projects in the country. Lunt *et al*.,[54] at a public-sector community health centre (CHC) in Cape Town, found that 51.4% of the 1 098 hypertension patients who visited this facility during a one-year period had a mean BP across the clinic attendance that was ≥ 160/95 mmHg. The level of control was worse in women 65 years or older. At a similar CHC in the region Steyn *et al*.[55] found that 41.6% of patients with hypertension at a CHC in the same region had BPs above 160/95 mmHg.

Edwards *et al*.[56] reported on the pattern of prescribing for hypertension, and tested the effect of introducing treatment guidelines and restricting the availability of less cost-effective antihypertensive drugs for the control of hypertension along with the cost implications of the intervention. This intervention resulted in a mean monthly cost reduction of R1.99 (24.2%) from R8.24 to R6.25 between the first and last prescription for each patient, providing an overall annual cost saving of R75 000 for the CHC. However, this intervention did not change BP control significantly.

Appropriate knowledge of health workers is essential to manage hypertension effectively. Little is known in South Africa about the capabilities of health workers to deal effectively with hypertension. The inclusion of community health workers (CHWs) as part of the health team is being considered in many provinces. Sengwana *et al*.[57] studied the knowledge, beliefs and attitudes about hypertension among CHWs living in the black townships in the Cape Peninsula. This study revealed an enormous need to train CHWs as in contributing to the care of patients with hypertension. Many of them believed in traditional medicines and home-brewed beer as the best treatment.

A better understanding of the role of the health team for hypertension control is needed, including understanding the patients' knowledge, attitudes, and practices relating to hypertension. In addition, the structural and logistical aspects of hypertension care in the health services also need to be studied.

APPROPRIATE GUIDELINES

The first management guidelines for hypertension in Southern Africa were developed at a Heart Foundation Hypertension Consensus Symposium in 1992, and were endorsed by the Medical Research Council and the Hypertension Society of Southern Africa.[6]

These guidelines suggested a cut-off point for BP ≥160/95 mmHg to define hypertension. However, the international guidelines published soon thereafter, suggested a cut-off point ≥140/90 mmHg. This prompted the Hypertension Society to revise their proposed cut-off point to a level of ≥140/90 mmHg and to suggest further refinements of the guidelines.[46,47]

This reduction in BP cut-off points led to a doubling in the number of people in the country who would be identified as having hypertension, an increase of approximately 3 million people. The guidelines summarised best medical practice in hypertension care, however, the extensive nature of the guidelines did not receive wide acceptance within the health-care settings. Daniels *et al*.[58] found that at public sector CHC in the Western Cape that the guidelines were not systematically implemented and that individual doctors consulted the guidelines infrequently. Several barriers were identified in the application of the guidelines, including the consultation process by which the guidelines were developed, time and cost constraints, scepticism about durability of the guidelines, conflict with local practices, health-system problems and patient beliefs. Daniels *et al*.[59] concluded that passive dissemination of guidelines to health-care professionals in primary care should be reviewed to overcome the barriers to their implementation.

The treatment status of hypertension followed over time can be used to assess how well the health-care services in the country are doing in diagnosing and treating patients with hypertension. As such, this can form part of a set of adult health indicators for an ongoing health surveillance system for South Africa as suggested by Steyn and Bradshaw.[60] The second SADHS took place during 2003/4. With the release of information by the National Department of Health on the treatment status of hypertension, the analyses of the BP data can be compared to those of 1998 (see elsewhere in this chapter). This will illustrate whether the BP treatment status has improved or deteriorated among the South African populations since 1998.

INDIGENOUS DRUGS

During the last decade in South African, a keen interest in the field of pharmacology to study indigenous plants and traditional medicines for possible development of useful medications in health care has been developed. One such investigation involved the study of triperpenoids isolated from *Olea europaea*, subspecies Africana (African wild olive). The isolated triperpenoids were studied in the Dahl salt-sensitive, insulin-resistant rat genetic model of hypertension and shown to prevent the development of severe hypertension, atherosclerosis and improved insulin resistance of the experimental animals. These products could potentially provide an effective and cheap treatment of salt-sensitive hypertension in the African population.[61]

CONCLUSION

The information presented in this chapter shows that hypertension is extremely common in South Africa. It is inadequately treated and poorly controlled. It also shows that data now exist to address the problem in the country. However, as was stated by Cooper *et al*.[62] about the situation of hypertension in sub-Saharan Africa: "The condition is fully treatable, but social conditions in Africa make the implementation of blood pressure control programmes difficult. Lack of a clear strategy based on evidence has undermined these efforts." They also estimated that the reduction in population attributable risk associated with treatment might lead to 2% in Africa compared with 0.15% in the United States. 'Number needed to treat' analyses showed that the cost of drugs to prevent one death is $1800 in Africa, if the cheaper drugs are used, while it is $14 000 to $1 million in the United States, depending on which drugs are used. These findings lead to the conclusion that the treatment of hypertension should be a health priority in sub-Saharan Africa in general and in South Africa in particular.

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CHAPTER 9

DYSLIPIDAEMIA IN SOUTH AFRICA

Frans J Maritz[a]

1. INTRODUCTION

Dyslipidaemia remains a major cardiovascular risk factor in the South African population. It affects some groups more than others, but is also affecting those previously at lesser risk who are now caught up in the changes brought about by development, the association with a westernised lifestyle, and the HIV epidemic. South Africa is already weighed down by a quadruple burden of disease, including the pre-transitional diseases associated with poverty and underdevelopment, the emerging "Western" chronic diseases of lifestyle, injuries, both intentional and unintentional, and HIV/AIDS.[1] A dramatic increase in obesity and diabetes, appropriately referred to as diabesity,[2] has been predicted globally for the next decade to the extent that it is referred to as a pandemic.[3] Dramatic increases in diabesity have been noted in westernised countries and have given rise to concern.[4] To regard this epidemic of diabesity as only a disorder of affluence is a profound misconception; the projected figures for sub-Saharan Africa tell another story[5,6] – the burden that diabesity will place on developing countries, including South Africa, is even greater than that expected in first world countries.[3]

Diabesity is associated with, and partly the result of, insulin resistance, and forms part of the insulin resistance syndrome.[7] Associated with this rise in diabesity there is an increase in all those cases of the insulin resistance syndrome who have not yet developed dysglycaemia yet are regarded as prediabetics.[8] This insulin resistance syndrome brings with it a particular and characteristic form of dyslipidaemia that is partially qualitative rather than quantitative in nature.[9] The Adult Treatment Panel (ATPIII) of the National Cholesterol Education Program (NCEP) acknowledges the importance of this syndrome as a cardiovascular risk factor and incorporates two components of the associated dyslipidaemia into its diagnostic criteria (i.e., the ones most likely to have the greatest clinical utility).[10] There are some indications that the projected epidemic of the insulin resistance syndrome is already well on its way in South Africa.[6,11,12] Accordingly, this review will focus mainly on the lipid abnormalities of the insulin resistance syndrome and which are likely to be the commonest form of dyslipidaemia to be seen in the country in the future, if not already present.

2. THE SOUTH AFRICAN LIPID GUIDELINES

The history and development of lipidology in South Africa was eloquently reviewed in the previous compilation of Chronic Diseases of Lifestyle by the Medical Research Council.[13] The authors identified the need for a new and updated set of guidelines for the management and treatment of dyslipidaemia. The publication of clinical guidelines for the diagnosis, management and prevention of the common forms of dyslipidaemia in South Africa appeared not long thereafter.[14] These guidelines defined the management of hypercholesterolaemia identified during screening and was illustrated by way of an algorithm. An individual's risk of cardiovascular disease was assessed by applying a scoring system that utilises the person's age, gender, total cholesterol (TC) level, high-density lipoprotein cholesterol (HDLC) level, the presence, or absence of hypertension and diabetes, and smoking status. This methodology was derived from the Framingham study.[15] The guidelines did not allow a family history to be factored in, but were otherwise widely accepted and disseminated for use. Nonetheless, the detection and management of dyslipidaemia, and especially in patients at high risk of cardiovascular disease, were found to be suboptimal in general practice.[16] The guidelines are still often not appropriately applied, resulting in inappropriate pharmacological therapy. The practice of treating hypercholesterolaemia with tablets alone and with little or no advice or encouragement regarding lifestyle modification is widespread.[17]

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At the time these guidelines were deliberated, a general lack of awareness existed of the dyslipidaemia of the insulin resistance syndrome and its impact on the future management of dyslipidaemia. Despite the already predicted pandemic of diabesity,[18] it was not sufficiently appreciated that there would be such a rise in the prevalence of a dyslipidaemia other than hypercholesterolaemia. Although the data had already been published, the concept of type 2 diabetes as a coronary equivalent had not yet been propounded.[19] Cholesterol modifying treatment, in many aspects, has entered a new era; the cut-off points for the levels of TC to be targeted for statin therapy have decreased, the goals of therapy are ever lower, the pleiotropic effects of statins are increasingly appreciated, and the efficacy and cost of statins have improved. Clearly, in this altered environment there is a need for a revision of the guidelines for the management of dyslipidaemia in South Africa.

3. INTERACTION OF CARDIOVASCULAR RISK FACTORS

A cholesterol-centric, or even a lipid-centric, view of cardiovascular risk, and a management strategy aimed solely at the modification of lipids, have no role to play in the management of individuals at high risk for cardiovascular events. The amount of time, either educational or with patients, which is devoted to smoking-cessation or lifestyle modification is inordinately less than the time spent on risk factors where there is a vested interest of the pharmaceutical industry. A system where a patient's hypertension is treated in one clinic, the lipids managed in another, the diabetes in another venue, the ischaemic heart disease (IHD) or other vascular diseases in yet another clinic, while the smoking cessation and lifestyle modification are managed by yet other people, cannot be ideal or cost-effective. Rather, a holistic approach to the management of the patient with cardiovascular risk factors needs to be promoted.

Cardiovascular risk factors are particularly prevalent in the South African population and are set to increase because of increasing urbanisation.[20] There is no lack of these risk factors in the black population, the prevalences of which are linked to increasing urbanisation.[21-30] What atherosclerotic vascular disease there is in the black population manifests itself by a high incidence of stroke.[24] Even within this group of black patients with stroke the incidence of IHD may be as high as their white counterparts.[25] It is consistently reported that the caseload of IHD is on the increase in the black population of South Africa and that more of these persons are seen suffering from myocardial infarctions, particularly in urban hospitals catering for the black population.

4. LIPID ABNORMALITIES

The prevalence of lipid abnormalities in South Africa has not been determined in a random population sample through national surveys. However, available data were collected from smaller regional surveys of randomly selected groups. The settings in which these studies (9.1--9.10) were conducted and the number of participants are shown in Table 9.1.[31-40] The distribution of the lipid parameters in the different population groups is shown in Table 9.2 for men and women in the age groups 25-64 years.

Table 9.1. Ten randomised community-based studies of participants (aged 25-64 years) with lipid values in South Africa between 1982 and 1996

Population group	Study site	Year	Men (N)	Women (N)	Total (N)
African rural	QwaQwa (Free State)[31]*	1990/1	279	574	853
	Dikgale (Limpopo)[32]†	1997/8	237	957	1494
African urban	Cape Town (Western Cape)[33]	1990	292	373	665
	Mangaung (Free State)[31]*	1990/1	290	468	758
	Durban (KwaZulu-Natal)[34]	1986	125	107	232
Coloured	Cape Town (Western Cape)[35]	1982	384	395	779
	Mamre (Western Cape)[36]	1996	276	370	646
Indian	Durban (KwaZulu-Natal)[37]*	1984/6	300	301	601
White	Durban (KwaZulu-Natal)[38]*	1987	173	181	354
	Robertson, Swellendam, Riversdal (Western Cape)[39]**	1983	2722	-	-
	Riversdal, Caledon, Bredasdorp[40]††	1993	163	164	327

* Oldest age category = 55-69 years

† Data of Dikgale study (1997/8) extracted from data from reference (32), youngest age group, 30-34 years

** Data of the CORIS study (1983) extracted from data from reference (39)

†† Age group 35-44 years

Table 9.2. Lipid profile in South African studies between 1982 and 1996

Population group and study		MEN								WOMEN							
		25-34 Years		35-44 Years		45-54 Years		55-64 Years		25-34 Years		35-44 Years		45-54 Years		55-64 Years	
		Mean total serum cholesterol (SD) in mmol/ℓ (TC)															
African rural	QwaQwa[31]	4.2	(1.1)	4.9	(1.2)	4.6	(1.0)	4.6	(1.5)	4.4	(1.0)	4.6	(1.0)	4.8	(1.1)	5.4	(1.3)
	Dikgale[32]	4.2	(1.2)	4.4	(0.8)	4.5	(0.9)	4.7	(1.0)	4.1	(1.0)	4.4	(1.0)	4.6	(1.1)	4.9	(1.2)
African urban	Cape Town[33]	4.0	(0.8)	4.2	(1.5)	4.2	(1.0)	4.7	(0.7)	4.1	(0.9)	4.4	(1.0)	4.7	(1.0)	5.1	(0.7)
	Mangaung[31]	4.7	(0.9)	4.9	(1.1)	5.1	(1.3)	5.1	(1.1)	4.4	(0.8)	4.9	(1.0)	5.5	(1.3)	5.4	(0.9)
	Durban[34]	4.5	(1.0)	4.8	(1.2)	4.9	(1.4)	4.9	(1.4)	4.6	(1.0)	4.8	(1.1)	4.8	(1.1)	4.8	(1.1)
Coloured	Cape Town[35]	5.6	(1.1)	5.9	(1.1)	6.1	(1.5)	6.1	(1.1)	5.3	(1.0)	5.8	(1.1)	6.3	(1.3)	6.6	(1.2)
	Mamre[36]	5.2	(1.2)	5.7	(1.3)	5.6	(1.1)	5.5	(1.2)	4.7	(0.8)	5.3	(1.0)	6.0	(1.1)	6.5	(1.3)
Indian	Durban[37]	5.5	(1.1)	6.1	(1.4)	6.3	(1.2)	5.6	(1.1)	5.1	(1.0)	5.4	(1.1)	5.9	(1.2)	6.1	(1.3)
White	Durban[38]	5.6	(1.1)	5.9	(1.2)	6.3	(1.4)	6.2	(1.1)	5.4	(1.2)	5.7		6.1	(1.2)	7.2	(1.4)
	Robertson, Riversdal, Swellendam[39]	5.7		6.2		6.4		6.3									
	Riversdal, Caledon, Bredasdorp[40]			6.0								5.6					
		Mean HDL cholesterol levels (SD) in mmol/ℓ (HDLC)															
African rural	QwaQwa	1.2	(0.4)	1.3	(0.5)	1.2	(0.4)	1.3	(0.6)	1.2	(0.4)	1.2	(0.4)	1.2	(0.3)	1.2	(0.3)
	Dikgale	1.2	(0.3)	1.2	(0.2)	1.2	(0.2)	1.2	(0.3)	1.2	(0.2)	1.2	(0.2)	1.2	(0.2)	1.2	(0.3)
African urban	Cape Town	1.4	(0.4)	1.4	(0.5)	1.3	(0.4)	1.4	(0.4)	1.4	(0.4)	1.4	(0.4)	1.4	(0.3)	1.5	(0.3)
	Mangaung	1.4	(0.3)	1.3	(0.5)	1.4	(0.6)	1.4	(0.5)	1.3	(0.4)	1.4	(0.5)	1.3	(0.4)	1.4	(0.5)
	Durban	1.3	(0.4)	1.2	(0.3)	1.2	(0.3)	1.2	(0.3)	1.3	(0.3)	1.2	(0.4)	1.2	(0.3)	1.2	(0.3)
Coloured	Cape Town	1.4	(0.3)	1.4	(0.6)	1.4	(0.4)	1.4	(0.5)	1.5	(0.4)	1.6	(0.5)	1.5	(0.5)	1.6	(0.5)
	Mamre	1.3	(0.4)	1.5	(0.6)	1.3	(0.6)	1.2	(0.4)	1.2	(0.3)	1.3	(0.5)	1.4	(0.4)	1.3	(0.3)
Indian	Durban	1.1	(0.3)	1.2	(0.4)	1.3	(0.6)	1.1	(0.3)	1.2	(0.3)	1.3	(0.7)	1.2	(0.4)	1.2	(0.3)
White	Durban	1.1	(0.3)	1.4	(0.7)	1.2	(0.4)	1.3	(0.5)	1.3	(0.6)	1.5	(0.5)	1.6	(0.8)	1.3	(0.4)

Mean HDL / total cholesterol ratio (%) (SD) (HDLC/TC)																	
African rural	QwaQwa	26	(10)	27	(10)	28	(10)	31	(10)	28	(10)	27	(10)	25	(10)	23	(10)
	Dikgale	31	(10)	29	(7)	27	(7)	27	(8)	31	(8)	29	(8)	28	(8)	26	(9)
African urban	Cape Town	37	(11)	34	(11)	32	(11)	31	(10)	35	(9)	34	(10)	31	(8)	30	(60)
	Mangaung	30	(10)	28	(10)	29	(10)	29	(10)	20	(10)	29	(10)	26	(10)	27	(10)
	Durban	31	(10)	26	(60)	26	(60)	26	(60)	30	(10)	26	(11)	26	(9)	26	(9)
Coloured	Cape Town	26		25		25		24		30		28		25		24	
	Mamre	27		26		24		23		27		25		24		21	
Indian	Durban	21		20		20		21		24		23		22		20	
White	Durban	21		26		20		21		25		26		28		20	
Mean triglyceride levels (SD) in mmol/ℓ (non-fasting) (TG)																	
African rural	QwaQwa (F)	1.3	(0.9)	1.7	(1.4)	1.5	(1.0)	1.5	(1.0)	0.9	(0.4)	1.1	(0.6)	1.4	(0.7)	1.5	(0.8)
	Dikgale (F)	1.0	(0.7)	1.3	(0.9)	1.4	(1.0)	1.5	(0.9)	0.9	(0.4)	1.0	(0.6)	1.2	(0.6)	1.3	(0.7)
African urban	Cape Town (NF)	1.3	(1.2)	1.6	(2.9)	2.0	(1.2)	2.2	(1.6)	1.0	(0.5)	1.2	(0.7)	1.5	(0.9)	1.9	(1.2)
	Mangaung (F)	1.3	(0.9)	1.5	(1.3)	1.8	(1.9)	1.4	(0.7)	0.8	(1.4)	1.1	(0.6)	1.5	(1.5)	1.5	(0.6)
	Durban (NF)	1.0	(0.4)	1.7	(1.6)	1.6	(1.1)	1.6	(1.1)	0.9	(0.4)	1.2	(0.8)	1.2	(0.9)	1.2	(0.9)
Coloured	Cape Town (NF)	1.3	(0.8)	1.8	(1.1)	2.2	(2.1)	2.8	(2.6)	2.5	(1.8)	1.4	(0.5)	1.6	(0.9)	2.2	(1.2)
	Mamre (F)	1.3	(1.0)	1.4	(1.0)	1.6	(1.0)	1.2	(0.6)	0.8	(0.4)	1.0	(0.4)	1.2	(0.6)	1.3	(0.6)
Indian	Durban (NF)	1.6	(1.1)	2.0	(1.6)	2.0	(1.2)	1.7	(0.8)	1.2	(0.6)	1.5	(0.8)	1.9	(1.2)	1.6	(0.8)
White	Durban (NF)	1.7	(1.5)	1.7	(1.4)	1.9	(1.3)	1.8	(0.8)	1.3	(1.1)	1.3	(0.9)	1.3	(0.5)	2.1	(1.0)
Mean LDL cholesterol level (SD) in mmol/ℓ (Friedewald equation)☒ (LDLC)																	
African rural	QwaQwa	2.9	(1.1)	2.9	(1.0)	2.7	(1.0)	2.4	(0.8)	2.8	(1.0)	2.9	(1.0)	3.0	(1.1)	3.5	(1.2)
	Dikgale	2.5	(1.0)	2.5	(0.7)	2.7	(0.9)	2.8	(1.0)	2.6	(0.9)	2.8	(1.0)	2.9	(1.0)	3.1	(1.1)
African urban	Cape Town	2.1	(0.7)	2.1	(0.7)	2.1	(0.9)	2.5	(0.8)	2.2	(0.8)	2.4	(0.9)	2.6	(0.8)	2.8	(0.6)
	Mangaung	2.8	(0.9)	2.9	(1.1)	2.9	(1.3)	3.0	(0.9)	2.7	(0.7)	3.1	(1.0)	3.4	(1.3)	3.5	(0.9)
Coloured	Cape Town	3.3	(1.0)	3.5	(1.1)	3.5	(1.1)	3.7	(1.1)	3.1	(0.9)	3.5	(1.0)	3.8	(1.1)	4.0	(1.1)
	Mamre	3.3	(1.2)	3.6	(1.1)	3.6	(1.1)	3.8	(1.1)	3.1	(0.8)	3.5	(1.0)	4.1	(1.1)	4.6	(1.1)

- Friedewald equation (triglyceride levels >4.5 mmol/ℓ excluded)

NF + F: Non-fasting and fasting blood samples used for triglyceride analyses

In general the serum TC values in the African population group were lower than the levels found in the other three population groups, and differences were larger in the older participants than in the younger ones. Typically, the TC values increased with age, though this phenomenon was far less marked in African population groups than in the other population groups.

The HDLC levels are also shown in Table 9.2. There were very few differences in the HDLC levels reported in the nine studies and consequently the ratio of HDLC to TC was generally found to be higher in the African population group than in the other three groups. This suggests that the African population group with its lower TC levels is experiencing additional protection against atherosclerosis-related diseases by virtue of its relatively higher proportion of protective HDLC.

Nine studies also reported the blood triglyceride (TG) levels of the different groups. Some studies analysed fasting blood samples while others used non-fasting samples. TG levels are the only lipid fraction that is influenced by fasting. This is seen in the significantly larger standard deviations of the distributions of TG levels in the studies where participants were non-fasting. Only six of the studies reported on the low-density lipoprotein cholesterol (LDLC) levels calculated with the Friedewald equation.[41] These six studies were all conducted in either the African or the coloured population group. As would be expected, the LDLC levels of the African population group were significantly lower than in the coloured group, again pointing to the relatively lower level of risk in the African group compared to other groups.

Table 9.3. Prevalence (%) of hypercholesterolaemia in South Africa in people 30 years and older. total cholesterol >5 mmol/ℓ

	Years	African	Coloured	Indian	White
Men	20-44	13.9	80.8	84.9	83.9
	45-59	22.0	84.5	92.3	93.8
	60 +	33.3	79.6	78.4	96.0
	30 +	19.7	81.7	86.5	90.0
	Total number (≥30)	589 584	591 758	209 266	1 240 006
Women	20-44	10.4	66.9	65.1	75.0
	45-59	40.4	94.8	87.8	95.3
	60 +	53.9	97.9	90.3	99.4
	30 +	29.2	79.9	77.4	88.4
	Total number (≥30)	963 500	657 360	204 117	1 311 614
All Persons	20-44	12.1	73.6	74.9	79.5
	45-59	31.6	90.0	89.9	94.6
	60 +	44.7	90.4	85.2	97.9
	30 +	24.7	80.7	81.7	89.2
	Total number	1 553 084	1 249 117	413 384	2 551 620

Total number South Africans 30 years and older with hypercholesterolaemia = 5 767 205

Table 9.3 shows the prevalence of hypercholesterolaemia in the age groups 30 years and older using a cut-off point of 5 mmol/ℓ. The prevalence rates were age-standardised against the actual population of the different groups recorded in the Census 2001 to obtain a national estimate for each population group and the entire population aged 30 years and older.[42] The marked differences between the prevalence rates among the African population and the other three groups are striking. However, it is an unexpected finding that about a quarter of all African people that were studied had a TC level of 5 mmol/ℓ or higher, a similar prevalence rate as found for hypertension in this ethnic group. This suggests that health services should consider screening African people aged 30 years or older for hypercholesterolaemia on examination. The data suggest that at least 1.5 million African people aged 30 years or older are hypercholesterolaemic. Furthermore, the older women were found to have hypercholesterolaemia far more frequently than older men. This could probably be associated with the high obesity rates recorded in older African women. For the other groups, men tend to have hypercholesterolaemia at least as frequently as women, with younger women having lower rates than those of men and older women having much higher prevalence rates. By extrapolating the prevalence to all South Africans aged 30 years or older, these findings indicate that more than 5.5 million people carry a risk for a chronic disease of lifestyle by virtue of their TC level.

Familial hypercholesterolaemia (FH), by virtue of founder gene effects, is very common in the Afrikaner population. In fact, the overall prevalence was estimated to be 1:72 compared to 1:500 worldwide.[43] However, this disease has also been noted in other ethnic groups, including those of Jewish origin as well as in Indians.[44-48] Although less common, FH also occurs in the black population[49] and a relatively more frequent polymorphism has been noted in the promoter region of the LDL-receptor gene.[50] The characterisation of the commonly occurring mutations has led to the development of a procedure for mutational screening of FH which clinicians can easily request.[51-53]

A strong family history of IHD is common in patients with acute coronary syndrome, ranging from 30% to 54%, and yet who do not have FH, suggesting an inherited basis for other risk factors for IHD in South African populations.

Familial hypercholesterolaemia and other forms of high TC can usually be effectively managed by statins. Their favourable effects on cardiovascular morbidity and mortality, as demonstrated in other countries, are bound to also occur in South Africa. Unfortunately, unless a particular patient's hypercholesterolaemia is responsive to lifestyle modification, the statin therapy should probably be given lifelong to maintain the cardiovascular benefit, and this has profound financial implications for the individual as well as health funders.

5. THE DYSLIPIDAEMIA OF INSULIN RESISTANCE

This pattern of dyslipidaemia is distinguished from hypercholesterolaemia because an increased LDLC level is not present; it is characterised by increased TG and a decreased HDLC level. This is often additionally characterised by postprandial lipaemia, extremely atherogenic, small, dense LDL lipoprotein particles and increased levels of ApoB (HyperApoB), and is associated with endothelial dysfunction, including a hypercoaguability resulting from, among others, increased Plasminogen Activator Inhibitor type 1 (PAI-1) levels and hyperfibrinogenaemia. This dyslipidaemia is recognisable as that occurring in type 2 diabetes but it is important to stress that it occurs in the presence of insulin resistance long before the onset of dysglycaemia. Indeed, this characteristic dyslipidaemia comprises part of the five diagnostic criteria proposed by the ATPIII of the NCEP for the insulin resistance syndrome: a) central obesity as measured by a waist circumference exceeding 102 cm in males and 88 cm in females, but there is evidence that an increased waist:hip ratio of more than 1 in males and greater than 0.8 in females may more accurately predict cardiovascular disease;[54] b) TG levels greater than 1.7 mmol/ℓ; c) an HDLC level less than 1 mmol/ℓ in males and less than 1.3 mmol/ℓ in females; d) a blood pressure greater than 130/80 mmHg; and e) a fasting plasma glucose greater than 6.1 mmol/ℓ. Of note is that diabetes need not be present to make the diagnosis of the common and ever-increasing syndrome. This pattern of dyslipidaemia clusters in certain ethnic groups susceptible to the development of insulin resistance[55,56] and may serve as a surrogate marker of the insulin sensitivity of a population.

Looking at the distribution of these dyslipidaemic parameters in the South African population can be instructive. This high TG/low HDLC pattern of dyslipidaemia is common in the South African Indian population[37,57,58] and also in Indians who suffer from IHD.[20,59-61] This comes as no surprise as this ethnic group has been demonstrated to have a very insulin resistant profile in which pre-diabetes and type 2 diabetes are common.[12,22,62-66] Again, it comes as no surprise that atherosclerotic vascular disease, and in particular IHD, also have a high frequency in this population.

Although the black population in Durban clearly was found to have lower TG levels than the Indian population[57,67] there is reason to believe that these differences may narrow with time as there are areas in South Africa where the black peoples are developing profiles associated with an increase in insulin resistance. Urbanisation has been associated with an increase in TG levels in black subjects,[23] and other epidemiological studies have demonstrated significantly raised triglyceride levels in blacks.[23,26,33] Whether these lipid profiles are indeed markers of insulin resistance remains to be determined. In the Western Cape, the relatively common occurrence of type 2 diabetes and its risk factors have been remarked on.[68] In an area predominantly inhabited by black subjects who have a high prevalence of hypertension, there were very strong associations with features of the metabolic syndrome and its other co-morbid conditions.[69] There is also a clear relationship between urbanisation in this population and the increase in cardiovascular risk factors.[70] There are firm data to confirm that urbanisation has an adverse effect on cardiovascular risk factors, including the lipid profiles,[23,24] and it has been suggested that urbanisation sets the stage for an epidemic of atherosclerotic vascular disease.[28]

The coloured population of the Western Cape has been shown to have a high prevalence of cardiovascular risk factors, particularly dyslipidaemia.[71-73] The data indicate that the presence of hypertriglyceridaemia is particularly common[71] as is hypertension and other co-morbid conditions of the metabolic syndrome. Diabetes and hypertension were also common causes of mortality – both co-morbid conditions of the insulin resistance syndrome. A recent study showed a high prevalence of central obesity and an associated clustering of cardiovascular risk factors, very

reminiscent of the insulin resistance syndrome.[74] Impressions gained from admissions at secondary hospitals in the Western Cape Province are that the insulin resistance is common in those admitted with an acute coronary syndrome.

6. INADEQUATE TREATMENT OF HYPERLIPIDAEMIA

A survey of 200 private practices across the country described the detection and management of hypercholesterolaemia in about 13 000 patients. Their mean TC level was 6 mmol/ℓ and 14% of them had IHD. However, their treatment status was generally poor with only 28% having a TC level below 5 mmol/ℓ. This demonstrates that large numbers of these patients who could benefit most and whose lives could be saved by cholesterol-lowering therapy were not receiving it.[16] The most effective treatment for hypercholesterolaemia is by the use of HMG-CoA reductase inhibitors, commonly referred to as statins. It seems astonishing that until 2004 in the Western Cape Province, statins were not freely available for managing dyslipidaemia, and patient's access in this huge geographical area was limited to lipid clinics at two academic centres where the waiting times exceeded one year. The reason for this has been attributed to financial constraints, despite abundant evidence to demonstrate the cost-effectiveness of statin therapy. A manager of a prominent academic health-care institution is purported to have stated that pharmacological lipid-modifying treatment would not be supported because dyslipidaemia was not a disease of the masses, whereas the statistics clearly show otherwise.

7. THE CHANGING PATTERN OF DYSLIPIDAEMIA

The various avenues of evidence suggest that there is an increasing trend towards an insulin-resistant phenotype in the different South African ethnic groups. Therefore, it has become apparent that lipidology can no longer be viewed in isolation, and the importance of screening individuals at high cardiovascular risk should be stressed repeatedly. At present, it is frequently found that many patients with acute coronary syndrome are discharged from hospital before having had a lipogramme done.

The various avenues of evidence suggest that there is an increasing trend towards an insulin resistant phenotype in the different South African ethnic groups. Therefore, it has become apparent that lipidology can no longer be viewed in isolation, and the importance of screening individuals at high cardiovascular risk should be stressed repeatedly. At present, it is frequently found that many patients with acute coronary syndrome are discharged from hospital before having had a lipogramme done. The high prevalence of dysglycaemia in patients with acute coronary syndrome suggests that it would be a highly cost-effective measure to perform a fasting glucose or a modified glucose tolerance test before discharge.[20,75] This is particularly relevant where the management of these patients is recommended,[76] and before the onset of type 2 diabetes at which stage the presence of IHD is already established.[19] The importance of this early, and hopefully preventative, management is all the more relevant because the atherogenic dyslipidaemia is already present long before dysglycaemia develops. Those managing dyslipidaemia should have a sound knowledge of insulin resistance and the consequent dysglycaemia.

A greater emphasis will have to be placed on the important role of lifestyle modification in the management of this syndrome. However, there are some data to indicate that lifestyle modification can be instituted with a beneficial effect even in South Africa,[77] but the large number of patients that are lost to follow-up in such a programme is a challenge that needs addressing.

Statins are now universally available, even in the public sector, and have been prescribed in the national Essential Drug List. They are extremely effective in the management of primary hypercholesterolaemia. They are the first choice drugs in patients with the high TG/low HDLC syndrome and who have a mild to moderately increased TG level; this is despite the fact that the effect of statins on TG and HDLC levels are minimal at best. The advent of a large portion of the population who will present with an insulin-resistant phenotype may in future dictate that other choices should be considered for the management of their dyslipidaemia, such as the Peroxisome Proliferator Activated Receptor (PPAR)-alpha agonists, the fibrates, or the more recent PPAR-gamma agonists. These both effectively decrease TG levels and increase HDLC levels, and, additionally, to a greater or lesser degree, improve insulin sensitivity. Unfortunately, the policies adopted by many health-care funders in both the public and private sectors still preclude the effective management of the dyslipidaemia of the insulin resistance syndrome. Implicit in the holistic management of the insulin resistance syndrome, before the onset of dysglycaemia, is the primary prevention of type 2 diabetes.[78]

8. THE COST OF LIPID-MODIFYING MANAGEMENT

There is no doubt that lipid-modifying therapy is expensive and, contrary to popular belief, the aggressive institution of lifestyle modification to achieve the results of published material is also expensive and may not be cost-efffective.[4] Undoubtedly, the misuse and inappropriate use of lipid-modifying drugs have wasted much money and have engendered a resistance in those who decide how health-care funds are distributed. There is enough literature to support the ultimate cost-effectiveness of the use of statins in first-world countries. However, can this automatically be assumed for developing countries where studies to demonstrate similar benefits are lacking, and are all the formulae for cost-benefit ratios appropriate for South Africa?

9. DYSLIPIDAEMIA AND THE HIV EPIDEMIC

South Africa is in the middle of an HIV epidemic which is predicted to increase.[79] The experience internationally with highly active anti-retroviral treatment (HAART) has shown that these drugs, and especially the protease inhibitors, may result in a metabolic syndrome qualitatively similar to that seen in diabesity.[80-82] These patients develop insulin resistance which is frequently severe enough to cause lipodystrophy,[83] which in turn is manifested by a central distribution of adiposity, but at other times by lipo-atrophy – an apparent paradox also seen in other causes of insulin resistance. The dyslipidaemia also manifests as a high TG/low HDLC syndrome, and severe cases can present as a chylomicronaemia syndrome.[84] The insulin resistance associated with HIV is reminiscent of the metabolic syndrome of diabesity in other ways: these patients show evidence of endothelial dysfunction and even increased PAI-1 levels.[85] Therefore, it is not surprising that this syndrome should be associated with an increased cardiovascular risk,[86] and mediated by mechanisms very similar to those postulated in diabesity. However, not all HIV-infected patients treated with HAART develop this insulin resistance syndrome, and the presence of a pre-existing genetic predisposition needs to be investigated. The treatment of this syndrome[87] incorporates many of the principles of the management of diabesity and studies have shown that they respond well to metformin[88] and very well to PPAR agonists.[89] The dyslipidaemia responds well to fibrates, but statins (except pravastatin), because of their metabolism by the hepatic cytochrome system, have the potential to result in unfavourable interactions with HAART,[90] although other researchers have reported that statins can be safely used together with HAART.[91,92] As HAART has now become more readily available and used, we can expect to see many more patients with this peculiar insulin resistance syndrome.

10. CONCLUSIONS

Dyslipidaemia is, quantitatively and qualitatively, an important cardiovascular risk factor in all population groups of South Africa. The advent of the predicted global pandemic of diabesity will profoundly affect persons of all social strata. The burden imposed by the insulin resistance of diabesity will be compounded by that seen with the use of HAART and this will affect the pattern of dyslipidaemia.

Lipidology should not be seen as a discipline that is reserved for an exclusive few with a detailed knowledge of obscure monogenetic disorders. Rather, because of the large number of diverse common disorders associated with dyslipidaemia, it behoofs all health-care workers to have a modicum of knowledge of lipidology, and special interest groups and societies devoted to dyslipidaemia should identify this as their primary objective.

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CHAPTER 10

DIABETES MELLITUS AND IMPAIRED GLUCOSE TOLERANCE IN SOUTH AFRICA

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DEFINITION, CLASSIFICATION AND DIAGNOSIS OF DIABETES MELLITUS, IMPAIRED GLUCOSE TOLERANCE AND IMPAIRED FASTING GLUCOSE

Diabetes mellitus is a diverse group of metabolic disorders with varied clinical characteristics united by hyperglycaemia, the final common biochemical abnormality. The ever-expanding knowledge base of diabetes necessitates the periodic review of its classification and diagnostic criteria. Thus, in 1998 the World Health Organization (WHO) published a revised classification and diagnostic criteria for diabetes that followed the American Diabetes Association's (ADA) extensive review of the subject.[1] These diagnostic criteria for diabetes and other categories of hyperglycaemia[1] are shown in Table 10.1.

Table 10.1. Values for the diagnosis of diabetes mellitus and other categories of hyperglycaemia

	Venous plasma glucose (mmol/L)
Diabetes mellitus:	
Fasting	≥ 7.0
or	
2-h post glucose load	≥ 11.1
or both	
Impaired glucose tolerance (IGT):	
Fasting concentration (if measured)	< 7.0
and	
2-h post glucose load	≥ 7.8 and < 11.1
Impaired fasting glycaemia (IFG):	
Fasting*	≥ 6.1 and < 7.0
2-h (if measured)	< 7.8

* The ADA recently proposed that the upper limit of normal for fasting plasma glucose be lowered to 5.6 mmol/L[2]

Adapted from Alberti *et al*.[3] (1998)

The WHO state for epidemiological or population-screening purposes, the fasting and/or 2-hour value after 75 g oral glucose may be used. If the oral glucose tolerance test (OGTT) cannot be performed, the WHO recommends that fasting plasma glucose alone can be used for epidemiologic purposes.[1]

Since the publication of the ADA and the revised WHO criteria, it became evident that the exclusive use of fasting plasma glucose to diagnose diabetes has an effect on the prevalence of diabetes, the phenotype identified, the ability of IFG to predict diabetes as well as cardiovascular disease and mortality.[4]

The WHO[1] also proposed a new classification system encompassing both clinical stages and aetiological types of diabetes mellitus and other categories of hyperglycaemia. The clinical stages include normal glucose tolerance, IGT or IFG, not insulin requiring and, finally, insulin requiring. These stages, regardless of their aetiology, progress through several clinical stages during their natural history. The stage of glycaemia may change over time depending on the extent of the underlying disease processes. Individual subjects may move from stage to stage in either direction.[1,3]

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The classification by aetiological type results from improved understanding of the causes of diabetes. The aetiological classification reflects the fact that the defect or process, which may lead to diabetes, may be identifiable at any stage in the development of diabetes - even at the stage of normoglycaemia. The severity of the metabolic abnormality can either regress (e.g. with weight reduction), progress (e.g. with weight gain), or stay the same. According to residual beta-cell function some individuals may need insulin for survival, while others according to the severity of the underlying metabolic abnormality, may need insulin for adequate glycaemic control.[1]

The WHO working group eliminated the terms 'insulin-dependent diabetes mellitus' and 'non-insulin-dependent diabetes mellitus' and their acronyms 'IDDM' and 'NIDDM'.[1] These terms were confusing and frequently resulted in patients being classified based on treatment rather than on pathogenesis. The terms type 1 and type 2 were retained.[3] The aetiological type named type 1 is primarily caused by pancreatic islet beta-cell destruction and is prone to ketoacidosis. Type 1 diabetes includes those cases attributable to an autoimmune process, as well as those with beta-cell destruction and who are prone to ketoacidosis for which aetiology and pathogenesis is unknown (idiopathic). It does not include those forms of beta-cell destruction or failure to which specific causes can be assigned (e.g. cystic fibrosis, mitochondrial defects).

THE PREVALENCE OF GLUCOSE INTOLERANCE AND ASSOCIATED RISK FACTORS IN SOUTH AFRICAN POPULATIONS

Few epidemiological studies have been conducted and reported since 1994. South Africa's first demographic and health survey, a landmark study, was conducted during 1998. In this, 13 827 adults (15 years and over) were interviewed.[5] There was a response rate of 93% with more than 60% of respondents living in urban areas. The self-reported prevalence of diabetes in males and females ≥ 15 years was 2.4% and 3.7%, respectively (see table). As expected, the Asian Indian community had the highest self-reported prevalence, followed by the coloured, white and black African groups. The prevalence of diabetes in urban males was 2.9% and urban females 4.4%, compared to 1.7% and 2.7% in the non-urban men and women, respectively. There was considerable geographic variation in the prevalence of diabetes. The highest prevalences were found in KwaZulu-Natal, Western Cape and Gauteng and the lowest in the Limpopo and North West Provinces.

Table 10.2. DHS: Self-reported prevalence of diabetes (%) in men and women ≥ 15 years by province and population group

Province	Women	Men
Western Cape	4.9	3.2
Eastern Cape	3.5	2.7
Northern Cape	2.9	2.1
Free State	2.3	1.3
KwaZulu-Natal	5.9	3.1
North West	1.1	0.9
Gauteng	4.3	3.3
Mpumalanga	2.8	2.0
Limpopo	1.2	0.9
Population group		
Black African	3.0	1.6
Urban	3.7	1.6
Rural	2.2	1.5
Coloured	5.8	3.1
White	4.8	6.0
Asian	11.5	8.5
Total	3.7	2.4

CROSS-SECTIONAL PREVALENCE STUDIES

Black African

Erasmus and co-workers examined the prevalence of diabetes in 374 factory workers in Umtata.[6] Using the standard 75 g OGTT, they reported an age-adjusted prevalence of diabetes and IGT of 4.5% and 5.1%, respectively. Of the nine diabetic workers, only one had been diagnosed with diabetes previously. This was a somewhat unusual finding as was the fact that obesity was not a risk factor for diabetes in this study.

A surprisingly high prevalence of diabetes has recently been reported from the rural region of the Limpopo province. This study has considerable flaws as freely acknowledged by the authors, namely a response rate of only 40% and a diagnosis of diabetes adjudged solely on fasting plasma glucose levels. Yet the diabetes prevalence was 8.8% in women and 8.5% in men.[7]

Cape Town Coloured

Levitt and co-workers[8] studied the prevalence of diabetes in 974 residents from the mixed ancestry (coloured) community of Mamre in the Western Cape. The age-standardised prevalence of type 2 diabetes in the age group 30-65 years was 10.8% and that of IGT 10.2%. In men an inverse relationship was noted between levels of physical activity and prevalence of diabetes. Age, family history of diabetes, waist circumference and physical activity were all identified as independent risk factors for diabetes, while sex, regular alcohol consumption and BMI were not. In this study, the population attributable risk fraction for upper segment fat distribution (waist circumference) and physical inactivity were 53% and 21%, respectively. The authors estimated that the crude prevalence of diabetes in this community might be reduced from 7.1% to 4% by reversing both upper segment fat distribution and physical inactivity.

A single study specifically examined the prevalence of diabetes in the elderly. In this the prevalence of diabetes in a representative sample of 180 coloured subjects (≥65 years) resident in Cape Town was 28% and 29% for men and women, respectively.[9] Previously 25% of the diabetes subjects were undiagnosed. Body mass and waist-to-hip ratio were the only risk factors identified for diabetes, leading the authors to implicate changes in body composition with age as a possible explanation for the lack of association between BMI and diabetes in this group. The high prevalence of diabetes identified in this study highlighted the need for routine screening for diabetes in elderly coloured subjects during visits to primary health-care facilities.

Differences in methodology between historic and more recent studies make it unclear whether the prevalence of diabetes is on the increase in South Africa, especially in the rapidly urbanising black communities. Longitudinal studies utilising WHO criteria are needed to resolve this issue, as well as to confirm previously identified risk factors for the development of IGT and diabetes in our diverse population groups.

Table 10.3. Recent cross-sectional diabetes prevalence studies

Setting	Population	Respondents (No)	Response Rate (%)	Age Range (yr)	BMI mean (SD)		Criteria for DM diagnosis	Age standardised prevalence (%)	
					Men	Women		Men	Women
Cape Town	Coloured	191	95.5	>65	24.0† (5.2)	28.7† (6.2)	WHO (1985)	25.7*	30.3*
Umtata	Black African	374	73	>20	23.9 (0.28)	30.4 (0.52)	WHO (1985)	4.5	4.5
Limpopo Province	Black African	1391	34	>30	23.7 (4.7)	27.2 (6.2)	ADA	8.5	8.8

† non diabetic
* not age-standardised

Sub-Saharan African collaboration re-analysed various cross-sectional population-based epidemiological studies conducted from 1985 to 1992 in order to examine the impact of the 1997 ADA criteria on the prevalence of diabetes and IGT in African subjects.[10] Data were available from rural and urban communities in Cameroon (n=1 804), Tanzania (n=10 013) and South Africa (n=3 799) (Table 10.4). The prevalence of diabetes based on the ADA criteria (using only fasting glucose concentrations) was higher in all Tanzanian surveys and in four of the five South African surveys, was unchanged in one South African study, and lower in both surveys from Cameroon, than when utilising the earlier WHO criteria. The absolute change in prevalence using the new criteria was small (<2.5%) with the exception of one survey (Mara). When combining both sets of criteria, as in the new WHO criteria (i.e. both lower fasting and original post-glucose levels), the prevalence of diabetes (crude, not age-standardised) was higher in

10 of the 11 surveys. In the other survey the combined prevalence was the same as that obtained when using the WHO criteria but higher than the prevalence when utilising the ADA criteria. The prevalence of IFG was lower than the prevalence of IGT with the exception of the Mamre community in South Africa. There was a poor level of concordance in the classification of individuals as diabetic using the ADA and WHO criteria and the range in Kappa statistic between the surveys was considerable. The Kappa statistic was lowest (<0.25) in the Tanzanian surveys, intermediate in four of the South African surveys and highest (0.86 and 0.61) in the Cameroon and one of the South African surveys. This application of the new WHO criteria would increase estimates of the total prevalence of diabetes in sub-Saharan Africa. The poor level of agreement between the categories IFG and IGT in these data sets and those of others,[5] demonstrate that IFG and IGT are not analogous. Much of the current knowledge of the epidemiology and natural history of glucose intolerance, diabetes, and the health risks associated with them are based on the 2-h blood glucose.[11] Consequently, it is advisable that diabetes prevalence studies in sub-Saharan Africa should use the OGTT.

Table 10.4. The prevalence* of diabetes and impaired glucose tolerance (IGT) classified by old WHO criteria, diabetes and impaired fasting glucose (IFG) classified by new ADA criteria and diabetes classified by new WHO criteria[10]

	WHO			ADA			
	Diabetes (crude)	Diabetes (age-standard-ised)	IGT (age-standard-ised)	Diabetes (crude)	Diabetes (age-standard-ised)	IFG (age-standard-ised)	New WHO diabetes (crude)
Cameroon							
Evodoula	0.9	0.7	3.6	0.8	0.7	0.3	0.9
Yaounde	1.4	1.5	3.4	1.4	1.2	0.3	1.5
South Africa							
Cape Town	6.3	8.0	7.1	7.3	9.2	2.3	8.7
Mamre	7.1	8.5	8.1	8.4	9.8	12.1	9.4
Manguang†	7.7	8.2	14.8	9.9	10.6	9.1	11.1
QwaQwa†	6.1	6.0	12.9	5.8	6.0	3.6	7.7
Durban	3.7	4.4	9.0	4.9	5.9	4.3	5.2
Tanzania							
Kilimanjaro	1.0	0.8	6.9	1.7	1.2	2.0	1.8
Mara	0.8	1.3	8.4	3.5	4.1	3.9	3.8
Morogo	0.8	1.0	8.1	1.1	1.2	1.7	1.7
Dar-es-Salaam	1.1	1.4	10.6	2.0	2.5	2.7	2.3

* Including both known and previously undiagnosed diabetes
† Age-standardised prevalence for ≥ 30 years

The global burden of diabetes was 124 million in 1997 and it was estimated that it will double to 221 million in 2010.[12] In Africa, the estimated number of diabetics in 1997 was 7.8 million, of whom 4.5 million were in North Africa, 1.08 million in Western Africa, 1.05 million in Eastern Africa, 0.26 million in Central Africa, and 0.82 million in Southern Africa.[9]

The impact of the HIV/AIDS epidemic on the projected prevalence of diabetes for Africa in 2010 must also be taken into account. In 1999, Panz and Joffe[13] assessed the impact that HIV/AIDS would have on the prevalence of type 2 diabetes in South Africa in 2010. The analysis was based upon an assumption that the population growth would fall from 1.9% in 1995 to 0.3% in 2010 because of the HIV/AIDS epidemic. They estimated that without HIV/AIDS the number of people with diabetes would increase from 1.6 million in 1995 to 3.5 million in 2010, and with HIV/AIDS to 3.4 million – a 3% reduction representing 100 000 fewer cases.[10] This was based on an assumed doubling of diabetes prevalence from 4% to 8%.

In 2005, Levitt and Bradshaw[14] re-examined this issue and extended the analysis to include the number of diagnosed cases in South Africa in 2010, since the latter is those seeking health care for diabetes. This was prompted by the availability of recent national 2001 census data, improved estimates of the burden of HIV/AIDS and estimates of the prevalence of diabetes that allow for subpopulation differences. Based on the ASSA2000 AIDS and demographic model the population growth rate in South

Africa is estimated to be 1.1% per annum in the presence of the HIV-AIDS epidemic compared with 1.8% in the absence of the epidemic.[15] Three different scenarios of diabetes prevalence were used: no rise, a 50% rise and a doubling. The projections calculated were based on assumptions of no changes in sexual behaviour or widespread use of anti-retroviral therapy (ART) including, for prevention of mother-to-child transmission. The number of known cases of diabetes was calculated based on evidence that approximately 50% of people with diabetes identified in local cross-sectional population studies were previously diagnosed.

As evident from Table 10.5 below, the total number of people with diabetes is going to increase, with or without the expected impact of HIV/AIDS and the extent of rise in diabetes prevalence. These data highlight the fact that South Africa, in common with other sub-Saharan African countries, should not lose sight of the impact and importance of diabetes, in the face of the HIV/AIDS epidemic. There will be a greater number of people with diabetes within the health system because of a number of factors including the ageing of the population, the expected changing prevalence of diabetes and although not included in the estimates, diabetes induced by ART.

Table 10.5. Demographic impact of HIV/AIDS on projected* prevalence of type 2 diabetes and patient load in South Africa

		2010		Decrease resulting from HIV/AIDS
	1995	Without HIV/AIDS	With HIV/AIDS	
Population ('000s)	40 410	52 706	47 392	
Growth rate (%)		1.8%	1.1%	
No increase in age-specific prevalence				
Adult Prevalence (%)	3.6%	4.1%	4.1%	
Projected number of cases ('000s)	959	1 528	1 344	184
Projected patient load ('000s)	479	764	677	87
50% increase in prevalence				
Adult Prevalence (%)	3.6%	6.2%	6.2%	
Projected number of cases ('000s)	959	2 292	2 015	277
Projected patient load ('000s)	479	1 146	1 008	138
100% increase in prevalence				
Adult Prevalence (%)	3.6%	8.2%	8.1%	
Projected number of cases ('000s)	959	3 027	2 631	396
Projected patient load ('000s)	479	1 514	1 316	198

* Projections were calculated using age-specific rates

FOLLOW-UP STUDIES

Motala and co-workers[16] conducted a 10-year follow-up study on 517 Indian subjects with normal glucose tolerance or IGT at baseline with 9.5% progressing to diabetes at 10 years with an age- and sex-adjusted diabetes incidence of 8.3% (rate of progression 0.95% per annum). Significant predictive variables for subsequent diabetes development included 2-h plasma glucose, BMI, and obesity. Obese subjects had a 4.6-fold greater risk of progressing to diabetes, indicating the importance of lifestyle interventions aimed at reducing weight in diabetes prevention in this group.

Motala *et al*.[17] investigated the importance of transient IGT in the migrant Indian population of Durban. A 75 g OGTT was repeated after one year on 128 Indian subjects previously diagnosed with IGT. Of these, 41 progressed to type 2 diabetes, 47 remained in the IGT category, and 40 reverted to normal glucose tolerance. The non-diabetic groups were re-evaluated by OGTT three years later. Thirty-two of the 40 subjects who had reverted to normal glucose tolerance status after one year completed the study. None developed diabetes, while 11 (34%) reverted to IGT again and 21 (66%) had persistent normal glucose tolerance. The authors concluded that transient IGT (IGT at baseline and normal glucose tolerance after one year) was not associated with a risk of progression to diabetes in a group of South African migrant Indians from the U.S.A with a high prevalence of diabetes.[17] This finding was in contrast to what was previously reported for Pima Indians. In South African Indians, an absence of obesity and lower 2-h plasma glucose at baseline was predictive (protective) for reversion to normal glucose tolerance in the local study. On the other hand, worsening of glucose tolerance in these subjects was associated with deterioration of beta-cell secretory function.

EPIDEMIOLOGY OF TYPE 1 DIABETES

There have been no reports on the incidence of type 1 diabetes from South Africa.

PATHOGENESIS OF TYPE 1 DIABETES

Until recently, little was known about the role of autoimmunity in the pathogenesis of diabetes in black South Africans. In an attempt to resolve this issue, the presence of glutamic acid decarboxylase (GAD) 65 antibodies was studied in 100 black patients with type 1 diabetes (age of onset < 35 years and BMI <27 kg/m^2) and 80 black patients with type 2 diabetes (age > 35 years and BMI > 27 kg/m^2).[18] The control group consisted of 50 healthy black subjects. Forty-four patients (44%) with type 1 diabetes were GAD antibody positive compared to two patients (2.5%) with type 2 diabetes. No patient with chronic pancreatitis or lipoatrophic diabetes was GAD antibody positive. One-third of black patients fulfilling the criteria for diabetic keto-acidosis and admitted to hospital was GAD antibody positive compared to 67% of white patients.[19] The black patients (mostly female) also had a greater BMI than white patients (23.1 vs. 20 kg/m^2) while 28% of black patients had C-peptide levels > 0.3 nmol/L compared to none of the white patients, indicating "fair" beta-cell function in the black patients. Autoimmune beta-cell destruction thus appears to have an important role in the pathogenesis of type 1 diabetes in African subjects.

Few studies in African populations have addressed the association between type 1 diabetes and HLA antigens. HLA class II alleles associated with type 1 diabetes were studied in 47 Zulu patients, and healthy blood donors were used as controls.[20] The HLA alleles associated with type 1 diabetes included HLA-DQB*0302, DRB1*09, DRB1*04, DRB1*0301, DQB*0 and DQA*03. Estimated haplotypes positively associated with type 1 diabetes included HLA DRB1*0301-DQA*0501, DRB1*04-DQA*03, DRB1*04-DQB*0302, DRB1*0301-DQB*0201, DQA*0501-DQB*0201 and DQA*03-DQB*0302. These findings were similar to those reported from Zimbabwe and other populations with type 1 diabetes.

THE PATHOGENESIS OF TYPE 2 DIABETES AND THE METABOLIC SYNDROME

A panel of experts who met under the auspices of the WHO and International Diabetes Federation (IDF) in Colombo, Sri Lanka (IDF, 2002), concluded that genetics, foetal history, lifestyle and stress all contribute to the occurrence of type 2 diabetes.[21] The genetic contribution to its aetiology has not been studied adequately in black South Africans. The importance of family history in black South African patients with type 2 diabetes was investigated in Umtata.[22] Altogether 304 (27.3%) of 1 111 diabetic subjects reported at least one diabetic family member compared to 8.4% of control subjects. Of the subjects with a family history of diabetes, 87.8% had a first-degree relative with diabetes, 10.5% a second-degree relative and 5.9% a third-degree relative. Of those with a positive family history, 6.6% had a diabetic relative from both paternal and maternal sides, 31.1% from the paternal and 60.6% from the maternal side. Interestingly, patients with a positive family history had an earlier onset of diabetes than those without a family history (45 years vs. 52 years). The authors concluded that a strong genetic component for diabetes was found in Xhosa-speaking black South Africans, a finding that merits further and more detailed studies, as does the differential in maternal and paternal inheritance.

The relation between glucose tolerance and birth weight in black South African children was investigated in a group of 7-year-olds from the Birth-to-Ten (BTT) cohort.[23] The BTT is a prospective cohort study (n=3 170) of the determinants of growth, development and health in children born in the metropolitan area of Soweto and Johannesburg between April and June 1990. Glucose tolerance tests were carried out on 152 subjects at age 7 years. This was a subgroup randomly selected from 468 subjects with complete birth weight, height and weight data at 1 and 5 years. Inverse correlations were found between birth weight and insulin secretion during the first 30 min, as well as at 90 min, and between birth weight and the 30 min glucose concentrations. Children born with low birth weights but who, at the age of 7 years, were above the current median for weight had greater 120 min insulin concentrations. Children who could be at greatest risk of developing type 2 diabetes are those who have low birth weights and then gain weight rapidly by 7 years. Progressive beta-cell failure occurs in both black South Africans and African Americans with type 2 diabetes, but a major insulin-resistant variant also exists in African Americans which is not so for black South Africans.[24]

The metabolic consequences in early adult life of low birth weight were also investigated in a group of persons of mixed ancestry.[25] The association between low birth weight and glucose intolerance, blood pressure and dyslipidaemia was studied in 137 twenty-year-olds. They were the full-term offspring of primaparous women who delivered in the Groote Schuur Hospital maternal obstetric unit in 1976. They had either a low birth weight (< 10th centile for gestational age) or a normal birth weight (25th - 75th centiles). The low birth weight group had an 11.9% prevalence of glucose intolerance (IGT or diabetes) compared with 0% in the normal birth weight group. The former group had significantly higher systolic

blood pressures but no significant differences were seen in plasma triglycerides, cholesterol, and cholesterol sub-fraction concentrations, a finding that was somewhat unexpected. The investigators also examined the possible contribution of deranged functioning of the hypothalamic-pituitary-adrenal axis to the development of the metabolic syndrome in later life. ACTH stimulation tests were performed on a subset of both the underweight and control groups (n=32 and n=36, respectively). Nine am plasma cortisol concentrations as well as cortisol concentrations post-ACTH were significantly higher in the group who was underweight at birth than the normal birth weight group.

Huddle[26] recently audited the outcome of pregnancy in diabetic Sowetan women with a short-term natural history of gestational diabetes from 1992 - 2002. There were 348 women with gestational diabetes. Diabetes persisted in the immediate post-partum period in 29 and developed in one woman a year later. Almost half (46.5%, or 148 of 318) of the remaining women returned for an OGTT 6 weeks post-partum. At this stage, 20.3% had IGT and 20.3% had diabetes.

These data clearly demonstrate the substantial risk of GDM for the development of type 2 diabetes in South Africa. Furthermore, the post-partum period may serve as an opportunity to introduce strategies to reduce the prevalence of diabetes.

THE METABOLIC SYNDROME

It has been known for some time that particular cardiovascular risk factors tend to cluster in the same individual more frequently than could be explained by chance alone.[27,28] This clustering of risk factors with glucose intolerance as a key feature has become known as the metabolic syndrome. The WHO in 1998 suggested the following working definition for the metabolic syndrome:[1] Glucose intolerance (IGT or diabetes) and/or insulin resistance together with two or more of the other components shown in Table 10.6. Several other components of the metabolic syndrome have been described (e.g. hyperuricaemia, coagulation disorders, raised PAI-1) but they are not necessary for the recognition of the condition.[1] The presence of the metabolic syndrome was associated with reduced survival, particularly because of increased cardiovascular mortality.[1]

Table 10.6. Other components of the metabolic syndrome

Impaired glucose regulation or diabetes
Insulin resistance (under hyperinsulinaemic euglycaemic conditions, glucose uptake below lowest quartile for background population under investigation)
Raised blood pressure ≥140/90 mmHg
Raised plasma triglycerides (≥1.7 mmol/L)[1] and/or low HDL-cholesterol <0.9 mmol/L for men; <1.0 mmol/L for women)
Central obesity (males: waist-to-hip ratio >0.90; females: waist-to-hip ratio >0.85) and/or BMI >30 kg/m^2
Microalbuminuria (urinary albumin excretion rate ≥20 μg min^{-1} or albumin:creatinine ratio ≥20 mg g^{-1}).

A different set of criteria for the diagnosis of the metabolic syndrome was proposed by the National Cholesterol Education Program (NCEP)[29] in 2001 (Table 10.7).

Table 10.7. ATP III Definition of the metabolic syndrome

Risk factor	Defining level
Abdominal obesity	Waist circumference
Males	>102 cm
Females	>88 cm
Triglycerides	>1.7 mmol/L
HDL-Cholesterol	
Males	<1.0 mmol/L
Females	<1.3 mmol/L
Blood pressure	>130/85 mmHg
Fasting plasma glucose	5.6-7.0 mmol/L

The International Diabetes Foundation (IDF) have recently published new criteria for the metabolic syndrome (2005)

For a person to be defined as having the metabolic syndrome they must have:
Central obesity (defined as waist circumference ≥94 cm for Europid men and ≥80 cm for Europid women, with ethnicity-specific values for other groups)
Plus any two of the following four factors:
Raised TG level: ≥150 mg/dL (1.7 mmol/L), or specific treatment for this lipid abnormality
Reduced HDL-cholesterol: <40 mg/dL (1.03 mmol/L*) in males and <50 mg/dL (1.29 mmol/L*) in females, or specific treatment for this lipid abnormality
Raised blood pressure: systolic BP ≥130 or diastolic BP ≥85 mmHg, or treatment of previously diagnosed hypertension
Raised fasting plasma glucose (FPG) ≥100 mg/dL (5.6 mmol/L), or previously diagnosed type 2 diabetes
If above 5.6 mmol/L or 100 mg/dL, OGTT is strongly recommended but is not necessary to define presence of the syndrome.

* These values have been updated from those originally presented to ensure consistency with ATP III cut-points

The clustering of cardiovascular risk factors in adult black subjects in the Free State was such that 31% fulfilled the WHO criteria for the metabolic syndrome.[30] The impact of the metabolic syndrome, however, on this population still needs to be determined. Because of the common occurrence and possible clustering of the individual components of the metabolic syndrome in adults of both sexes and in all ethnic groups in South Africa, it is reasonable to conclude that the metabolic syndrome already has or will soon have a significant impact on cardiovascular disease morbidity and mortality in this country. The overall prevalence of the metabolic syndrome, as defined by the NCEP criteria in the US population was 23% in both sexes and was, lowest in black men (14%) and highest in Mexican-American women (27%).

The association between measures of obesity and other cardiovascular risk factors were studied in 124 treated black female hypertensive subjects.[31] The prevalence of the different components of the metabolic syndrome (WHO definition) was: BMI >30 kg/m^2 66%, waist-to-hip ratio (WHR) >0.9 26%, IFG 13%, diabetes 9% and dyslipidaemia (fasting plasma triglycerides >1.7 mmol/L and/or HDL-cholesterol <1.0 mmol/L) 39%. Central obesity (waist circumference and WHR) was more strongly associated with fasting serum insulin, glucose, triglycerides, and uric acid than was BMI in this group of black hypertensive women.

Although the precise mechanisms that underlie the pathogenesis of the metabolic syndrome are unknown, the interaction between small birth size in full-term infants and subsequent growth patterns, in particular the development of obesity, is clearly an important process for the full expression of the chronic disease phenotype.[32] Attention should be given to reducing rates of childhood and adult obesity as well as seeking to minimize the recognised causes of low birth weight to prevent the emergence of the metabolic syndrome and the expected increase in numbers of subjects with type 2 diabetes in South Africa.

MICROVASCULAR COMPLICATIONS OF DIABETES

Mortality and outcome was studied in a cohort of 64 young black patients with type 1 diabetes followed for 10 years in Soweto.[33] Twenty-four individuals from the original cohort of 88 were lost to follow-up. Ten of the 64 remaining patients died during the 10-year follow-up period. Renal failure was responsible for the majority of deaths (5/10), while three patients died of hypoglycaemia, and one each of diabetic ketoacidosis (DKA) and septic abortion. Thirty-six patients were available for clinical evaluation at baseline and after 10 years. Diabetic retinopathy was present in 52%, peripheral neuropathy in 42%, autonomic neuropathy in 47% and nephropathy in 28%. Six (17%) of patients had no complications.

Adequate routine screening for diabetic retinopathy remains a challenge at all levels of health care in South Africa. Screening for diabetic retinopathy with 60˚ retinal colour photography may offer a viable and cost-effective solution.[34] In 663 consecutive patients screened for diabetic retinopathy at the Johannesburg Hospital, retinal photography had a sensitivity of 93% and a specificity of 89% for any retinopathy, and 100% and 75%, respectively, for severe retinopathy, compared to an ophthalmologist's assessment. In this study the cost of screening in 1996 was R21 per patient screened, R49 per patient with retinopathy and R135 for each patient referred.

In a busy tertiary care setting the overall prevalence of diabetic retinopathy using 60˚ mydriatic retinal photography was 39%.[35] Severe diabetic retinopathy was present in 13% of patients and was more frequent in African and Indian patients compared to European ones. In this study, diabetic retinopathy was significantly associated with the duration of diabetes and with low levels of serum C-peptide, adjusted for glucose concentration. Severe degrees of retinopathy were associated with duration, African ethnicity, and macroalbuminuria. Poor diabetes control in these subjects, possibly because of

the infrequent prescription of insulin, may have been responsible for the increased prevalence of severe retinopathy.

A high prevalence of complications of diabetes in patients with suboptimal glycaemic and blood pressure control was found in 243 black African patients attending community health centres in Cape Town.[36] The mean duration of diabetes was 8 years and the mean HbA_1c concentration of 10.5% reflected markedly sub-optimal diabetes control. Blood pressure control was satisfactory (SBP <140 mmHg and DBP <90 mmHg) in only 38.5% of patients taking anti-hypertensive medications. The prevalence of complications found in this study is shown in Table 10.4.

Table 10.8. Frequency of complications of diabetes in 243 black patients attending a community health care clinic in Cape Town

TYPE OF COMPLICATION	% (95% CI)
FEET	
Peripheral neuropathy	27.6 (15.2-39.9)
Peripheral vascular disease	8.2 (5.2-12.6)
Ulcers, sepsis, deformities	5.4 (2.1-8.7)
Amputation	1.4 (0.4-2.4)
Any foot problem	36.6 (23.3-50.0)
EYES	
Cataracts	
unilateral	6.2 (1.0-11.5)
bilateral	1.7 (0.0-3.4)
Retinopathy*	
background	35.4 (30.6-40.2)
preproliferative	14.3 (7.9-20.7)
proliferative	4.3 (1.0-7.5)
Macular changes	13.1 (7.9-18.4)
Visual acuity	12.0 (8.8-15.3)
normal	53.2 (47.0-59.4)
bilateral moderate	12.0 (7.4-16.6)
unilateral mod/unilateral severe bilateral severe	9.2 (4.7-13.6)
RENAL	
Proteinuria	5.3 (2.5-8.1)
Elevated serum creatinine	5.9 (3.6-8.1)
Abnormal albumin:creatinine ratio	36.7 (29.0-44.4)

* assessed by fundoscopy by a trained general practitioner

A retrospective analysis of the clinical records of 219 patients (132 black, 87 Indian) with diabetes of more than 10 years duration conducted in King Edward VIII hospital, also showed a high prevalence of microvascular complications.[37] In this study 47 patients (36 blacks, 11 Indians) had type 1 diabetes and 172 (96 blacks, 76 Indians) had type 2 diabetes. The mean age of onset of type 1 diabetes was 24 years for black and 16 years for Indian patients. The mean age of onset for black and Indian patients with type 2 diabetes was 42 years and 38 years, respectively. In patients with type 1 diabetes the prevalence of retinopathy was 56% and 46%, respectively, for black and Indian patients, while persistent proteinuria was present in 25% of black and in 18% of Indian patients. Hypertension was present in 34% of both groups. In the group with type 2 diabetes, retinopathy was also more common in the black compared to the Indian patients (69% and 59%, respectively), as was hypertension (84% vs. 47%), while persistent proteinuria was more common in Indian compared to black patients (30% vs. 18%). The mean serum creatinine concentration too was higher in black patients (147 µmol/L) than in Indian patients (113 µmol/L).

The frequency of diabetic retinopathy and nephropathy was studied in 30 patients with pancreatic diabetes matched with 30 patients with type 1 diabetes.[38] The prevalence of retinopathy was very similar in the two groups (33% of patients with pancreatic diabetes and in 40% of patients with type 1 diabetes). The spectrum of disease was also very similar in the two groups. The prevalence of microalbuminuria (33%) was also identical in the two groups. This data contradict the notion that microvascular complications are rare in patients with chronic pancreatitis.

Diabetic neuropathy was detected in 26% of female patients attending a primary health-care clinic in Mamelodi by utilising a nylon monofilament.[39] This technique was superior to pinprick and cotton wool to detect neuropathy while fair agreement was found between 10 sites and 3 sites tested with the monofilament.

The high prevalence of microvascular complications in patients with diabetes is of considerable concern as these are preventable or at least modifiable with good glycaemic and blood pressure control. Furthermore, as there is such restricted access for public sector patients with diabetic end-stage renal disease to dialysis or transplantation in South Africa because of severely limited resource allocation, the emphasis needs to be placed on prevention.[40] A greater demand for renal replacement therapy is expected because of a projected rise in diabetes prevalence.

In a study performed at Hlabisa district hospital, 253 Zulu patients with diabetes were evaluated for diabetes control and the presence of complications.[41] The mean age of the subjects was 56.5 years and the mean duration of diabetes after diagnosis 4.2 years (6 week to 60 years). Seven percent were classified as having type 1 diabetes and the remainder had type 2. The mean HbA1c concentration was 11.3%. Hypertension was present in 65% of patients and a target blood pressure of <130/85 mmHg was only achieved in 20% of them. Diabetic retinopathy was present in 40% of patients and an elevated albumin:creatinine ratio was found in 46%, while overt proteinuria was present in 13%. Foot pulses were absent in 17% of patients and foot ulceration was present in 6%. A history consistent with stroke was elicited from 8% of patients.

MACROVASCULAR COMPLICATIONS

There is not a great deal of recent data on the frequency of macrovascular complications in South African diabetic patients. A study conducted in Johannesburg indicated that the frequency of dyslipidaemia did not differ between two groups of black patients with type 2 diabetes, one with a higher and one with a lower socio-economic level, despite significantly worse diabetes control in the latter.[42] Serum triglyceride levels, however, were significantly increased in males from the higher socio-economic group. Interestingly, in female patients with type 2 diabetes from the lower socio-economic group, mean total serum cholesterol concentration increased from 4.8 mmol/L in 1976 to 5.3 mmol/L two decades later, while serum triglyceride levels did not change significantly.

Some of the problems regarding vascular evaluation in patients with diabetes were highlighted in a study of 85 black female patients attending a Mamelodi diabetes clinic.[43] None of the patients who had intermittent claudication according to the Rose questionnaire had both pedal pulses absent on the affected side. There was also a low prevalence of medial arterial calcification (10%) and this did not correlate with the ankle brachial index >1.3. This study showed good agreement between ankle brachial index and toe brachial index if the ankle brachial index was <1.3. The authors also found a good correlation between lower ankle brachial index and absence of both pulses in the foot suggesting these patients may benefit from more extensive work-up.

Although smoking is common among black patients with diabetes (20% compared to 28% in the general population),[44] macrovascular complications were absent in a cohort of 36 patients with type 1 diabetes followed for 10 years.[45]

The association of known cardiovascular disease risk factors with acute myocardial infarction in sub-Saharan Africa was explored in the Interheart study. This was a case-control study of patients with a known first myocardial infarction and is the longest of its kind in the region. Five risk factors – smoking, history of diabetes, history of hypertension, abdominal obesity and Apo B: Apo A1 ratio accounted for 89.2% of the population attributable risk (PAR) for acute MI in the overall African population and an 87.7 PAR in the black African participants. The strongest individual risk factors in the overall African population with diabetes (OR 3.55, 95% CI 2.53, 4.99) and hypertension (OR 3.44, 95% CI 2.64, 4.48) were similar to the overall international Interheart study. These data clearly indicate that diabetes is a major contributor to myocardial infarction in all ethnic groups in sub-Saharan Africa.[46]

ACUTE DIABETES COMPLICATIONS

Hyperglycaemic emergencies remain an important cause for the hospital admission of diabetic patients in South Africa.[47] Hyperglycaemic emergencies were responsible for 23.5% of the annual diabetes related admissions (n=614). Diabetic ketoacidosis (DKA) was the most frequent diagnosis (19.2%), particularly among the black African patients. A striking phenomenon was that 55% of patients fulfilling the criteria for DKA had type 2 diabetes. Severe infection along with relative insulinopaenia in African patients with diabetes was postulated to be responsible for this phenomenon. The overall mortality in the hyperglycaemic group was 5.5%, comparable to most western societies.

A study of 122 patients admitted to Groote Schuur Hospital over a 4-month period with 131 hyperglycaemic emergencies found that a smaller proportion with mild or severe DKA had type 2 diabetes. The predominant precipitating causes for admission were infections (47%) and non-compliance

with therapy (26%). The mortality rate in this study varied according to category of emergency. It was 3% in mild DKA, 11% in severe DKA and 19% in the hyperosmolar non-ketotic group.

In conclusion, in South Africa, a number of epidemiological questions remain. These include

1. Has there been a true increase in type 2 diabetes over the past decade, and, if so, what is the extent of the rise?
2. What is the extent of the rural-urban difference in diabetes prevalence?
3. What is the incidence of type 1 diabetes?
4. What are the health-care costs of diabetes?
5. What is the extent of the burden of diabetic complications, e.g. blindness and amputations?

The following studies would go some way to answer these questions:

- Examining the current prevalence of type 2 diabetes among rural and urban communities, ideally on a national basis.
- Initiating national type 1 diabetes registers to facilitate studies on the incidence, morbidity and mortality of this group of individuals.
- Initiating cohort studies to determine the natural history of diabetes and its complications in other countries.

This chapter has focused on the epidemiology of diabetes and its complications. It has not attempted to address any aspect of diabetes health-care research or management of diabetes as this is included in Chapter 17.

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CHAPTER 11

CHRONIC RESPIRATORY DISEASES IN SOUTH AFRICA

Rodney Ehrlich,[a] Anamika Jithoo[b]

This chapter is dedicated to the memory of Neil Walton White,[c] 1954-2004

1. INTRODUCTION

Scope

Epidemiological research into chronic respiratory disease in South Africa has grown over the last decade with the recognition of the burden of such disease on the health of the population. The aim of this chapter is to review the findings of such published research, mainly from 1994-2005, and their implications for prevention. The development of South African guidelines to improve the management of these diseases is also covered.

The most common chronic respiratory diseases in South Africa are asthma and chronic bronchitis/chronic obstructive pulmonary disease (COPD), and these are covered in detail. In addition, attention is given to air pollution and occupation as risk factors for chronic respiratory disease in South Africa. The chapter ends with recommendations for policy action and research.

Definitions

The lack of standard definitions for COPD and asthma historically makes it difficult to compare different studies and sources of information. A feature of the last decade has been the development of international consensus guidelines on the definition of asthma and COPD in an attempt to standardise diagnosis and treatment, notably the Global Initiative for Chronic Obstructive Lung Disease (GOLD)[1] and the Global Initiative for Asthma (GINA).[2]

GOLD has defined COPD as "a disease state characterised by airflow limitation that is not fully reversible. The airflow limitation is usually both progressive and associated with an abnormal inflammatory response of the lungs to noxious particles or gases".[1] The guidelines refer to both typical symptoms and a history of exposure to risk factors as a basis for suspecting the presence of the condition, while spirometry is required to confirm the diagnosis. Chronic bronchitis, i.e. chronic cough with phlegm, may be present with or without airflow limitation. The GOLD definition treats chronic bronchitis without airflow limitation as "Stage 0" ("at risk"), while COPD proper requires evidence of airflow limitation, with or without symptoms.[1] A post-bronchodilator ratio of forced expiratory volume in one second (FEV_1) to forced vital capacity (FVC) of less than 70% is the necessary spirometric criterion for COPD proper, while the value of post-bronchodilator FEV_1 as a percentage of its predicted reference value determines the staging of severity of COPD from I ("mild") to Stage IV ("very severe").[3]

A recent consensus document by the European Respiratory Society and American Thoracic Society served to unify global definitions and solidified the departure from older definitions by recognising COPD as a disease resulting from an inflammatory process.[4]

For purposes of questionnaire-based epidemiological surveys the original British Medical Research Council definition of chronic bronchitis - "cough with phlegm for three successive months for at least two successive years" - has been frequently used.[5] This definition has the advantage of being relatively simple and now has sufficiently long usage to allow population prevalences to be compared. The disadvantage, in the absence of spirometry, is that the prevalence of COPD cannot directly be inferred from the prevalence of chronic bronchitis.[6]

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GINA defines asthma as "a chronic inflammatory disorder of the airways in which many cells and cellular elements play a role. The chronic inflammation causes an associated increase in airway hyperresponsiveness that leads to recurrent episodes of wheezing, breathlessness, chest tightness and coughing, particularly at night or in the early morning. These episodes are usually associated with widespread but variable airflow obstruction that is often reversible either spontaneously or with treatment".[2]

As in the clinical setting, it is not easy to distinguish clearly between asthma and COPD in epidemiological studies, particularly in smokers and older people. Epidemiological studies rely heavily on symptom questionnaires. While some of these questionnaires have been standardised and validated among adults and children in developed countries, their validity in South Africa has not been established. In particular, studies specifically comparing standardised questionnaires with spirometry are lacking. However, for asthma, questionnaire-based symptom definitions have been shown elsewhere to perform better in studying comparative prevalence than an objective test such as non-specific bronchial hyperresponsiveness (BHR). This is because questionnaires offer an optimal balance of sensitivity (identifying cases) and specificity (excluding non-cases), whereas tests of BHR tend to be specific but not sensitive.[7]

Burden of mortality and morbidity

Worldwide in 2001, COPD was the fifth most common cause of death,[8] responsible for 4.7% of deaths and 2.0% of disability adjusted life years (DALYs).[9] A 30-year projection from 1990 predicted a steady rise in the number of COPD deaths to the third most common cause worldwide by 2020.[10] Most of the projected DALY burden will fall on developing countries.[10] The actual burden in middle and low income countries is difficult to assess because of under-recognition of COPD as well as the underdevelopment of routine data systems and a paucity of surveys.[11,12] The reasonable prediction is that the prevalence of COPD will rise as the populations age in these countries and as tobacco use increases.[12] There is already evidence from East Asia that the actual burden of disease is higher than the WHO estimates.[12] There is, however, a scarcity of data from Africa.

In South Africa, respiratory disease as a group, but excluding tuberculosis, was ranked as the seventh most important cause of DALYs (4.7%) in 2000.[13] COPD alone was responsible for 2.3% of all deaths in 2000, although only 1.1% of years of life lost, indicating its concentration at older ages.[14] The true proportion of deaths to which COPD contributes is almost certainly higher, since COPD is likely to be under-certified as an underlying cause where the immediate cause is stated as respiratory infection.

Asthma is not ranked among the top 15 causes of death globally, as it is largely an adequately controlled disease in developed countries. It ranked only at 30th as a cause of DALYs in 2001 (WHO, 2002),[9] responsible for one percent of DALYs lost (comparable to diabetes)[2] and 0.4% of all deaths.[9] In South Africa, asthma ranked somewhat higher, at 13th as a cause of death (1.5% of all deaths) and 18th as a cause of years of life lost (0.9%).[14]

It is striking that while South Africa is ranked 25th worldwide in the prevalence of asthma (estimated at 8.1% over all ages), it runs fourth in asthma mortality rates in the 5-34-year age group, at approximately 1.5 per 100 000, falling between Turkmenistan and Uzbekistan.[15] Similarly, the asthma case fatality rate in South Africa is reported as being the fifth highest in the world at 18.5 per 100 000 asthmatics.[15]

Causes of COPD and asthma

COPD as understood in developed countries is primarily caused by tobacco smoking, and prevention activities are appropriately directed at tobacco control. By contrast, the causes of asthma are still poorly understood although research has become increasingly rich in hypotheses. Health system activity in asthma is thus largely directed at secondary prevention through early diagnosis and appropriate management.

In South Africa, the pattern of asthma and COPD reflects the structure of society with its high degree of industrialisation, high rates of smoking among some sections of the population, extensive urban and rural poverty, and the persistence of epidemic infectious diseases. In addition to tobacco smoking as a cause of COPD, post-tuberculous lung damage, occupational exposures, indoor and outdoor domestic air pollution and cannabis smoking have been identified as playing a role in chronic airflow limitation in South Africa, and are discussed in this chapter. Causes of asthma are more complex. Childhood asthma has to date been more closely studied than adult asthma, and gender, family history, urban residence, proximity to sources of pollution, allergic sensitisation, body mass index (BMI) and passive smoking have all emerged as predictors of asthma in cross-sectional studies of prevalence. However, it should be borne in mind that cross-sectional studies have difficulty distinguishing underlying causes of asthma from aggravating factors.

Paradoxically, infection may play an important role in determining the pattern of chronic "non-communicable" lung disease in a country such as South Africa. For example, a history of pulmonary tuberculosis has been shown to be a significant predictor of chronic respiratory symptoms in the general population.[16,17] By contrast, a decline in infectious challenge in early childhood has been hypothesised to explain the rise of allergic asthma incidence over time and the positive rural to urban gradient of asthma.[18,19]

2. COPD

Prevalence and risk factors

Since Wicht *et al*.[20] published their study on the "Diffuse Obstructive Pulmonary Syndrome" in 1977, few studies have investigated COPD in general populations in South Africa (Table 11.1). There is only one published study and one abstract reporting spirometry.[21,22] Table 11.1 thus lists mainly studies which have reported self-reported chronic bronchitis as an outcome.

The South African Demographic and Health Survey 1998 (SADHS)[23] was the first study to provide national prevalence figures for chronic bronchitis,[16] viz. 2.3% in men and 2.8% in women > 14 years of age, predictably lower than found in workforces in Africa exposed to dust and other respiratory hazards.[24] Prevalences in the age group 15-43 years in the SADHS were low compared to those from European studies, while comparable national prevalences were not available for the older group. The slight female excess was surprising given that national figures for current smoking in the SADHS were 42% among men and 11% among women.[23]

Table 11.1. Prevalence of COPD and chronic bronchitis in population surveys in South Africa

Study (yr published)	Population, (N, age range)	Outcome measure	Age stratum (yr)	Prevalence (%)	
				Male	Female
Wicht[20] (1977)	Northern Suburbs, Cape Town (507, 20-80 yr)	$FEV_1/VC < 70\%$	< 40	9.0	14.0
		Chronic bronchitis	> 40	37.0	21.0
			< 40	4.3	1.8
			> 40	12.2	4.7
Nriagu (1999)[26]	South-central Durban* (693, > 17 yr)	Chronic phlegm > 3 months in past year	> 17	31	
Jithoo[21,27] (2003, 2005)	Ravensmead, Uitsig, Cape Town (3 512, ≥ 15 yr)	Chronic bronchitis	≥ 15	7.5	
		Chronic bronchitis	≥ 40	12.6	9.2
		COPD**	≥ 40	30.3	19.0
Ehrlich[16] (2004)	National sample (13 468, > 14 yr)	Chronic bronchitis	15-43	1.5	1.9
			≥ 44	4.2	4.3

FEV_1: Forced expiratory volume in one second. VC: Vital capacity

* Area in vicinity of petrochemical refineries and other industry

** Jithoo[22]

In statistical modelling to mutually adjust the effects of different risk factors, smoking and a past history of tuberculosis emerged as predictors of chronic bronchitis in both men and women.[16] Reported occupational exposure (to smoke, dust, fumes, strong smells, or work underground in a mine, > 1 year) was associated with chronic bronchitis in men, while domestic exposure to smoky fuels (coal, wood or other biomass) was associated with chronic bronchitis in women. Further analysis (R Ehrlich, unpublished data) confirmed that the highest stratified prevalence of chronic bronchitis, adjusted for age and smoking, occurred in rural African* women (3.2%). As the prevalence of smoking daily or occasionally in this group was only 7.5%, exposure to domestic fuel pollution is the most likely explanation for this.

The results of two community studies emphasise the importance of environmental conditions in the aetiology of chronic bronchitis. Jithoo *et al*.,[21] studied a low- to middle-income community in Cape Town with very high prevalences of current smoking (58.9% in men and 42.9% in women) and history of tuberculosis (9.7%). The prevalence of chronic bronchitis was 9.2% in women and 12.6% in men over age 40 years.[21] These local data report prevalences that are much higher than the

* *Race groups are reported as used in the original data source and are understood primarily as reflecting a complex social stratification.*

national prevalence and are reflective of the high smoking prevalences, heavy tuberculosis burden and poor working and living conditions in this community. The study by Nriagu *et al*.,[26] which found very high respiratory symptom prevalences in a south-central Durban community, was carried out because the population had identified pollution by local industry as a source of respiratory illness.

Population studies are useful for estimating population attributable fractions, i.e. the proportion of the disease occurrence in the population attributable to the risk factor, on the assumption that the association is causal. Table 11.2 from the study by Ehrlich *et al*.,[16] illustrates that while tobacco remains a major contributor to chronic bronchitis in South Africa, the combined burden of past tuberculosis and occupational exposure in men is equal to that of smoking, while in women the combined burden of past tuberculosis and domestic fuel exposure exceeds that of smoking.

In the Cape Town study of chronic bronchitis,[21] the population attributable fraction for tobacco was 30.7% for smoking 1-14 cigarettes per day and 14.5% for smoking ≥ 15 cigarettes per day. In addition, occupational exposure contributed 22.2%, cannabis smoking 19.3%, and tuberculosis 5.5%. Smoky domestic fuel use was rare as most households used electricity. The population attributable fraction for cannabis is striking. Research on the impact of cannabis on respiratory disease is lacking in South Africa, and the significant pulmonary toxicity of cannabis smoking is very poorly publicised. Despite the illegal status of the drug it is widely used. Twelve percent of the sample in the Cape Town study population reported ever having used the drug and seven percent reported current use. As self-reported usage is likely to be understated owing to the sensitive nature of such questions, it is suspected that true prevalence of usage is slightly higher.

Table 11.2. Population attributable fractions for modifiable risk factors for chronic bronchitis in South Africa[16]

	Men (N=5 671)			Women (N=7 929)		
	P	POR	PAF	P	POR	PAF
Past tuberculosis	2.9	4.9	10	2.0	6.6	10
Occupational exposure	26.8	1.6	14	-	-	-
Smoky domestic fuel	-	-	-	33.8	1.5	14
Current smoking, 1-14/day	30.6	1.5	13	8.7	2.3	10
Current smoking, 15+/day	8.7	2.5	12	1.9	1.8	1

P: Population prevalence of exposure. POR: prevalence odds ratio. PAF: population attributable fraction (rounded)

Both the SADHS[23] and the Cape Town[21,27] studies found tuberculosis to be associated with chronic bronchitis. The association of past tuberculosis with both chronic cough and sputum and impairment of lung function has been noted locally in South African gold miners.[28,29] The loss of lung function increases incrementally with the number of previous episodes of tuberculosis.[28] Post-tuberculous lung function loss does not seem to meet the GOLD definition of the airflow limitation of COPD as "usually … associated with an abnormal inflammatory response of the lungs to noxious particles or gases".[1] However classified, tuberculosis appears to be an important cause of chronic lung disease in South Africa.

Guidelines for COPD management

South African consensus guidelines for the management of COPD were published in 2004,[30] incorporating GOLD recommendations and a recognition of the cost constraints on drug prescription in South African health care. There was also recognition of domestic and occupational exposures and previous lung infections, such as tuberculosis, as risk factors for COPD in addition to tobacco consumption. Treatment guidelines were directed at prevention of exacerbations and improvement of quality of life of patients with COPD as well as at smoking cessation efforts. Recommended treatment modalities reflected the development of long-acting beta$_2$ agonist and anticholinergic drugs and emerging evidence on a limited role for inhaled corticosteroids in the treatment of COPD.

Spirometry is central to the diagnosis and management of COPD. An investigation in 1991 found very poor quality spirometry practice among 45 medical practitioners, including 26 physicians.[31] Knowledge of international spirometry standards, spirometer working mechanisms and calibration ranged from poor to completely unsatisfactory in most practices, as did the standard of test quality assessment and interpretation of results. Quality control of spirometry has thus long been a concern and a number of guidelines on the subject have been published, including two applicable to the occupational health arena where routine spirometry is common.[32-34] The reviews concur on the

elements of good quality spirometry, viz. an understanding of the indications for the test, calibrated equipment meeting international performance standards, trained health personnel performing the test, adequate subject preparation and proper interpretation. There are no recent published data on what proportion of routine spirometry outside of specialist centres meets these quality criteria.

3. ASTHMA

Prevalence and risk factors in children and adolescents

Asthma in children and adolescents has received more attention than adult asthma because of lack of confounding by COPD or tobacco-related disease in children, and because school studies provide access to children and allow good estimates of community prevalence (Table 11.3).

The most common questionnaire measures reported are wheeze in the past 12 months and self-reported asthma ("asthma ever") whether based on a doctor's diagnosis or not. Answers to these questions were in fact found to be the most reproducible of a number of questions in a study of Cape Town schoolchildren.[35] From Table 11.3 it is striking that the prevalence of self-reported asthma in South Africa is relatively consistent across studies – between 10% and 13%. There is much more variation in wheeze in the past 12 months, at least partly attributable to different age groups studied, as the prevalence of wheezing declines with age.

The CHAMP (Chestiness in Childhood Asthma in Mitchell's Plain) study is the only local study to report prevalence in pre-school children.[42] The study found a high prevalence of symptoms in children aged 2-6 years, with 36.7% reporting wheeze in the past 12 months. Asthma diagnosis was a little more common in this pre-school age group (13.1%) than in the school-going group (11.2%). Prevalence of diagnosis was slightly higher than reported from a pre-school study in the United Kingdom[36] but much lower than that reported in an Australian study.[37] The threshold for paediatric diagnosis of asthma in pre-schoolers is thus likely to vary between countries for given symptom prevalences. This is perhaps not surprising as the interpretation of wheezing in pre-school children is more difficult than in schoolchildren, given the various forms of early wheezing, including transient wheezing, viral induced wheezing and persistent wheezing with atopy.[38]

Table 11.3. Prevalence of reported asthma and recent wheezing in child and adolescent populations in South Africa

Study (yr published)	Population (N, age range)	Outcome measure		Prevalence (%)
Burr [40] (1994)	Southern Suburbs, Cape Town (1 180, 12 yr)	Wheeze past 12 months		17.8
		Asthma ever		11.5
Ehrlich[35] (1995)	Mitchell's Plain, Cape Town (1 955, 6-10 yr)	Wheeze past 12 months		26.8
		Asthma ever		10.8
Nriagu[26] (1999)	South-central Durban* (367, < 17 yr)	Shortness of breath with wheeze past 12 months		16.0
		Asthma ever		10.0
Poyser[41] (2000)	Cape Town (5 178, 13-14 yr)	Wheeze past 12 months		16.0
		Wheeze past 12 months (video**)		6.4
		Asthma ever		13.3
Pather[42] (2002)	Mitchell's Plain, Cape Town (17 446, 2-15 yr)	Wheeze past 12 months 2-6 yr		36.7
		Asthma ever	7-12 yr	27.5
			2-6 yr	13.1
			7-12 yr	11.2
White[43] (2003)	Northwest suburbs, Cape Town* (3 162, 9-15 yr)	Wheeze past 12 months		33.0
		Wheeze past 12 months (video**)		18.3
		Asthma ever		23.7
Obihara[44] (2005)	Low-income area, Cape Town (861, 6-14 yr)	Asthma ever		12.3

* Residential areas in close proximity to petrochemical refineries and other industry

** Respondents wrote down answers in response to video scenes of symptomatic children

The International Study of Asthma and Allergy in Childhood (ISAAC) is a worldwide study using a common method to study asthma prevalence and risk factors, including a video prompted questionnaire of scenes depicting asthma symptoms.[39] Cape Town participated in Phase I[38] and Phase II (H. Zar, unpublished data), studying a random sample of Cape Town adolescents.[41] In international comparison of the ISAAC Phase I results, the prevalence of wheezing in this Cape Town population lay in the mid-range internationally.[39]

Tests of non-specific bronchial hyperesponsiveness (BHR) (Table 11.4) offer an objective measure of a trait associated with asthma, although BHR is not a necessary condition for the identification of asthma for epidemiological purposes.[7] Prevalences of BHR should thus not be compared directly with questionnaire prevalences. Three findings stand out in Table 11.4. The first is the positive rural urban gradient, confirming that asthma is at least partly a disease of urbanisation.[45-47] The second is the secular increase in the prevalence of BHR between the late 1970s[45] and the late 1990s,[47] although part of the difference may be attributable to a more liberal criterion for positivity in the latter study. This increase appears to have been relatively much greater in rural children. Finally, there is the remarkably high prevalence among Durban schoolchildren.[48] This is apparently attributable to their living in proximity to industrial and petrochemical industry emissions, but the absence of a control area should be noted.

On adjusting the rural urban gradient in BHR (to exercise) for a number of potential confounders, Calvert[49] showed this gradient could be fully explained by a combination of greater atopy, evidence of Ascaris infection, greater BMI and the absence of an animal in the house among urban children (Table 11.5). He speculated that an increase in nutritional status as reflected in a higher BMI that accompanied urbanisation allowed a greater expression of atopy in the form of skin prick test reactivity.

Independently, the protective effect of having animal presence in the house (in this case farm animals in the rural sample) is consistent with a version of the "hygiene hypothesis", viz. that the microbial environment, including the presence of endotoxin, rather than specific clinical infections, is important in the programming of the immune system in early life.[18] Obihara *et al*.,[44] in a cross-sectional study of low-income Cape Town children and adolescents found tuberculin skin test response (> 10 mm) to be inversely related to the history of allergic disease in general (asthma, hayfever and eczema). This "protective" effect of tuberculin response was strongest for hayfever (odds ratio 0.40, 95% CI: 0.21-0.77).

Table 11.4. Prevalence of non-specific bronchial hyperresponsiveness in child and adolescent populations in South Africa

Study (yr published)	Population (N, age range)	Outcome measure	Prevalence (%)
Van Niekerk[45] (1979)	Transkei (671, 6-9 yr); Gugulethu, Cape Town (694, 6-9 yr)	≥ 15% ↓ in FEV_1 or PEF after exercise	0.14 rural 3.17 urban
Vermeulen[50] (1990)	Transkei (1 014, 8-16 yr)	≥ 20% ↓ FEV_1 after histamine	14.2 rural
Terblanche[51] (1990)	Northern suburbs, Cape Town (1 192, 6-19 yr)	> 10% ↓ in FEV_1 after exercise	5.1 urban
Nagel[52] (1992)	Southern suburbs, Cape Town (1180, 12 yr)	> 15% ↓ FEV_1 after exercise	4.1 urban
Steinman[46] (2003)	Transkei; Urban Cape Town: (a) informal, (b) middle class (418, 10-14 yr)	≥ 20% ↓ FEV_1 after histamine	17 rural 34.4 urban (a) 33 urban (b)
Calvert[47] (2005)	Transkei (1 671, 8-12 yr); Khayelitsha, Cape Town (1 651, 8-12 yr)	> 15% ↓ FEV_1 or ≥ 26% ↓ FEF25-75 after exercise	8.9 rural 14.9 urban
Mashalane[53] (2003)	Thokoza (475, 9-10 yr)	> 15% ↓ PEF after exercise	7.2
Robins[48] (2005)	South-central Durban* (222, grades 3-6)	> 20% ↓ FEV_1 after methacholine	50 urban

FEV_1: Forced expiratory volume in one second. PEF: Peak expiratory flow. FEF25-75: Forced expiratory flow between 25% and 75% of the forced vital capacity.

* Residential areas in close proximity to petrochemical refineries and other industry.

The association between asthma and passive smoking, particularly maternal smoking in pregnancy and in the child's early life, is now well established,[54,55] although the mechanism remains elusive. Local studies have confirmed this association. A large cross-sectional study of primary schoolchildren in a heavily smoking Cape Town population found a robust association between childhood asthma/wheezing and maternal smoking in pregnancy, the number of smokers in the household and the concentration of cotinine (a nicotine metabolite) measured in the child's urine.[56] Maternal smoking was by far the largest contributor.[57] Exposure to maternal smoking in pregnancy was reported in 53% of the children with asthma/wheeze and 36% of controls. Nationally, 9% of pregnancies involved foetal exposure to passive smoking.[23] The association of a range of upper and low respiratory symptoms with maternal smoking was confirmed by Richards[58] in a study of adolescents in the Vaal triangle. The stronger effects of maternal smoking may be because of longer or closer exposure of children to smoking by mothers and/or possible in utero initiation of respiratory tract damage.

In a study of aggravation of asthma by maternal smoking, Ehrlich *et al*.[59] found that the mean FEV_1 was lower among those asthmatic children whose mothers smoked. Surprisingly, frequency of BHR to histamine was lower among these children when compared to asthmatic children of non-smoking mothers, especially if the mother smoked ≥ 15 cigarettes per day. Maternal adjustment of smoking habits in response to smoking may be an explanation of this counterintuitive finding. However, the mechanism of aggravation of asthma by passive smoking remains obscure, particularly as passive smoking does not appear to be associated with differences in atopy.[60]

Table 11.5. Predictors of bronchial hyperresponsiveness to exercise among 8-12-year-olds in Transkei and Khayelitsha, Cape Town[49]

Predictor		Odds ratio (95% CI)*
Residence:	Rural	1.00
	Urban	0.52 (0.25-1.09)
Atopy: quantiles of wheal diameter	0 mm	1.00
	0.75-2.3 mm	1.29 (0.74-2.24)
	2.4-4 mm	1.19 (0.66-2.12)
	4.1-7 mm	2.70 (1.46-5.01)
Ascaris infection:	No	1.00
	Yes	1.87 (1.15-3.06)
Body mass index tertile:	Lowest	1.00
	Middle	1.37 (0.90-2.07)
	Highest	2.36 (1.54-3.69)
Animals "come into" house:	No	1.00
	Yes	0.66 (0.44-0.99)

CI: confidence interval

* Adjusted for education of head of household and number of household assets owned

Asthma in adults

Adult asthma (Table 11.6) has been less studied than among children and has relied entirely on questionnaire self-report. In the study based on the SADHS,[17] the sociodemographic predictors of wheeze among adults in the past 12 months in multivariate analysis were female sex, older age (> 44 yrs), having less education and (independently) being white. Environmental risk factors were a history of tuberculosis, smoking and occupational exposures. This combination of risk factors and their similarity to the findings for chronic bronchitis (see above) suggest that the wheeze symptom in adults may be unable to distinguish between asthma and COPD. Even when the analysis was restricted to asthma ever, similar environmental risk factors emerged as for wheezing (with the addition of not having medical aid), suggesting that even a reported diagnosis of asthma may be non-specific.[17]

Table 11.6. Prevalence of self-reported asthma and wheezing in adult populations in South Africa

Study (yr published)	Population, (N, age range)	Outcome measure	Prevalence %	
			Male	Female
Wicht[20] (1977)	Northern Suburbs, Cape Town (507, 20-80 yr)	Self-reported asthma	7.7	11.9
		Ever wheeze with shortness of breath	9.6	8.9
Nriagu[26] (1999)	South-Central Durban* (693, ≥ 17 yrs)	Shortness of breath with wheeze past 12 months	28	
		Asthma ever	12	
Jithoo[27] (2003)	Ravensmead/Uitsig, Cape Town (3 512, ≥ 15 yr)	Wheeze past 12 months	12.7	
		Doctor diagnosed asthma	7.9	
Ehrlich[17] (2005)	National sample (13 826, > 14 yr)	Wheeze past 12 months	14.4	17.6
		Asthma ever	3.7	3.8

* Residential areas in close proximity to petrochemical refineries and other industry

Asthma severity, hospitalisation and mortality

The 1995 ISAAC study showed that while the prevalence of lifetime or recent wheezing symptoms was higher in adolescents from well-off suburbs than from poor suburbs, poorer children who did wheeze were more likely to suffer frequently.[61] Living in a socio-economically deprived suburb has also been shown to be strongly correlated with admission to an intensive care unit for asthma and to asthma mortality.[41]

Thus, while asthma prevalence is not necessarily associated with poverty, the complications of asthma are. The high global ranking of South Africa in asthma death rates and case fatality rates relative to population prevalence described earlier[15] is likely to reflect both living conditions conducive to aggravation of asthma and inadequate health services.

Zar *et al*.[62] reported that between 1980 and 1997 there had been a steady decline in asthma deaths in South Africa and a decline in paediatric near-fatal asthma episodes in Cape Town. Adult ICU admissions and the proportion requiring ventilation had remained unchanged. Possible factors mentioned by the authors as responsible for the decline in mortality were improved access to medical care and treatment of acute asthma, use of inhaled corticosteroids and asthma education. However, the same study found that the white population had half the asthma death rate of the coloured population, a situation that had not changed since an earlier study.[63] Almost three-quarters of the deaths occurred outside a health facility. Thus, while asthma care may have improved overall in Cape Town, the data suggest sharp persisting socio-economic disparity in access and/or quality of care.

In a study of factors distinguishing cases of near-fatal asthma from other cases of acute asthma presenting to hospital, no difference in health-care access or medication supply could be found between cases and controls.[64] The cases did show lower mean beta-agonist usage in the 24 hours prior to admission and a greater frequency of previous tuberculosis. Modifiable factors characterising acute asthmatics at risk of death thus remain somewhat elusive, but may include impaired perception of severity. The association with previous tuberculosis is interesting in the light of the findings discussed earlier between previous tuberculosis and chronic respiratory symptoms.

Studies of asthma care

With recognition of the secular rise in asthma prevalence in a number of countries came the realisation that asthma was under-diagnosed and under-treated. A large Cape Town study found that only 53% of children with multiple current asthma symptoms were recognised as having asthma.[65] Recognition was associated with access to private care, to being on inhaled therapy and maintenance therapy and to having used a peak flow meter.[65] In the SADHS, regular recent medical treatment among those with a history of asthma or symptoms (based on demonstration to the interviewer of medications kept in the home) was less likely among women, Africans, those with smoky domestic fuel and with fewer household assets (as markers of rural residence and poverty respectively).[17] The apparently lower treatment rate of women was surprising given that women had a higher prevalence of recent wheezing than men.

Recent guidelines for asthma management have emphasised the use of inhaled adrenergic and corticosteroid agents.[66,67] The SADHS revealed an apparent preference among respondents for oral medication, with 39% of respondents using oral xanthines and 28% oral adrenergics for "asthma and chronic bronchitis", in contrast to 15% using inhaled adrenergics and 15% inhaled glucocorticoids.[23] This preference may be that of the prescribers or consumers for the oral medication, but either way

there is cause for concern because of the lower benefit:cost ratio of oral than inhaled medication for a given dosage, the greater difficulty of controlling dosage and the larger potential for side effects.[2]

Similar preferences regarding medication were found in a study of knowledge, attitudes and practice of parents of asthmatic children in a low-income Cape Town community with high asthma prevalence.[68] Resistance to inhaled therapy was reported, with reliance on syrups and home remedies. There was low compliance with prescribed medication. Parents also complained of poor levels of service offered by public sector clinics. The authors concluded that there was an urgent need for asthma education of parents and improvement in the quality of public service asthma care.

The CHAMP study (see above) used academic detailing by a pharmacist targeted at private general practitioners as an intervention to improve childhood asthma management in an urban setting in Cape Town.[69] General practices were randomised and children with asthma symptoms linked to practices via a large school survey.[70] At one-year follow-up the children who were patients of the intervention practices had a small but statistically significant greater improvement in an asthma symptom score than children who were patients of the control practices.

Treatment of lung diseases in the public sector was targeted in a randomised controlled trial in the Free State, named the Practical Approach to Lung Disease in South Africa (PALSA).[71] Combined syndromic evidence based guidelines with two to six training sessions were aimed at primary-care nurses in resource-poor public-sector clinics, enabling them to diagnose and treat common lung diseases like asthma. WHO guidelines were adapted to suit local circumstances. The adapted guideline was validated prospectively, confirming that it performed well as a screening, diagnostic and treatment tool when compared to specialist diagnosis.[71] Some aspects of respiratory care were significantly improved in the intervention group compared to the control group, in particular, the provision of inhaled corticosteroids (odds ratio 1.90, 95% CI: 1.14-3.18).[72]

Guidelines for treatment of asthma

Updated guidelines for the management of asthma in adults[67] and children[66] were published in 2000. As with earlier guidelines, emphasis was laid on appropriate staging of severity and early use of inhaled corticosteroid therapy. The guidelines incorporated the improved understanding of the role of long-acting beta agonists and the introduction of leukotriene receptor antagonists. However, cost of medication is recognised as a significant barrier to optimal asthma care in South Africa, particularly within public-sector budgets,[73] as is the case generally in low-income settings.[74]

4. CHRONIC RESPIRATORY DISEASE AS A RESULT OF ENVIRONMENTAL AIR POLLUTION

There have been relatively few studies of air pollution since the large Vaal Triangle studies undertaken in the early 1990s that were reviewed in the previous Report,[75] and elsewhere.[76]

Indoor air

South Africa embarked on a large-scale electrification programme during the 1990s, with an increase in the proportion of households electrified from 36% in 1994 to about 68% (of 10 million households) at the end of 1999.[77] A much higher percentage of urban households (80%) than rural (46%) were electrified by that date. A large proportion of the population is thus still dependent on highly polluting biomass fuel (wood, grass or dung) and fossil fuels (coal) for their indoor cooking and heating requirements. Rural homes in South Africa have been measured as having a higher level of respirable particulate matter and carbon monoxide than their electrified counterparts.[78] In a Cape Town peri-urban area use of paraffin was associated mainly with an elevated carbon monoxide concentration.[79]

Poorly ventilated combustion of biomass fuel by itself is well established in poor rural settings in other countries as a cause of chronic bronchitis.[80-82] The SADHS found that 32.6% of men and 38.2% of women were exposed to smoky domestic fuel (wood, coal or dung).[83] There was a very strong association between exposure to smoky domestic fuel and markers of poverty as well as rural residence. The same survey found an association between chronic bronchitis and smoky domestic fuel only among women.[16] Rural African women, the group most exposed to this type of indoor air pollution, are thus a major contributor to the higher prevalence of chronic bronchitis overall in women than men in South Africa despite lower smoking prevalences.[84] (See text under COPD above).

Outdoor air pollution

Two recent investigations have focused on localised air pollution in the vicinity of industrial areas in close proximity to residential suburbs, one in Durban and one in Cape Town. In the study in south-central Durban, Nriagu *et al*.[26] found very high prevalences of respiratory symptoms. Surprisingly, only 10% of children and 12% of adults reported doctor-diagnosed asthma, no different from that reported elsewhere in the country, suggesting under-diagnosis of these conditions. Asthma prevalence was very strongly correlated with school absenteeism (odds ratio 44, 95% CI 13-141), highlighting the adverse impact of asthma on quality of life and presumably on learning in children.

A high prevalence of respiratory symptoms was also found by White *et al*.[43] in a study of children in the northwest suburbs of Cape Town in the vicinity of a petrochemical refinery, much higher than reported in a previous asthma symptom survey in greater Cape Town.[61] In this mainly middle-class study area, 23.7% of children reported that they had ever had asthma and 64.6% reported that they had ever had hayfever. Using the local petrochemical refinery as the putative point source, symptoms were associated with a meteorologically estimated exposure incorporating wind direction and speed and distance from the refinery. The study was not able to test any hypothesis regarding the specific emission that might be responsible. Previous monitoring of sulphur dioxide levels in the area, for example, had shown relatively low concentrations. However, the results were compatible with the hypothesis that petrochemical refinery emissions were an important risk factor for asthma or asthma exacerbation among children in this area.

5. CHRONIC RESPIRATORY DISEASE AS A CONSEQUENCE OF OCCUPATION

The contribution of occupational exposures to chronic bronchitis and asthma symptoms at the general population level has been mentioned above. The specific chronic occupational lung diseases that have received the most attention over the past decade have been diseases caused by mineral dusts, particularly in gold miners, and occupational asthma.

Chronic lung disease caused by mineral dusts

Workers inhaling silica dust are at risk of silicosis, tuberculosis, COPD and lung cancer.[85] Prior to 1994, very few studies had been published on black mineworkers, who traditionally have held dustier jobs than white mineworkers, veiling the significant epidemic of silicosis in the gold mining industry.[86,87] The true toll of occupational lung disease in black gold miners is now emerging. Studies of ex-miners in labour sending areas of the Eastern Cape[88] and Botswana[89] found very high prevalences of radiological silicosis, of the order of 25%. In 2004, Churchyard *et al*.[90] published the first study using dust exposure data of exposure-response relations for silicosis in active black South African gold miners. Almost 20% of older, longer-service gold miners had developed silicosis, confirming the large burden of the disease in this group. Assuming stable dust counts over a long period, this burden occurred despite a mean quartz exposure well below the recommended occupational exposure limit for respirable quartz of 0.1mg/m^3. The findings are consistent with the view that the lengthening of the average duration of service on the mines, together with failure to control dust to an adequate degree over the past three decades, have contributed to a rising prevalence of silicosis.[86,91]

Both silica exposure and silicosis are risk factors for pulmonary tuberculosis.[92] While the incidence of this disease among gold miners was high prior to the HIV pandemic, HIV co-infection has led to a fourfold increase in the incidence rate among gold miners, reaching approximately 2000 per 100 000 miners in one group of mines in 2000.[93] Corbett *et al*.[94] have shown in another group of mines that while HIV infection and silicosis increased the incidence of tuberculosis in gold miners fivefold and threefold, respectively, the combined effect of HIV and silicosis was to increase the incidence of tuberculosis by 15 times. In the light of the above findings, the need to control silica exposure should be a priority of the mining industry and government.

Chronic lung disease in coal miners has been barely studied in South Africa. A recent study demonstrated a relatively low prevalence of radiological coalworkers' pneumoconiosis, i.e. 2-4% (depending on x-ray reader).[95] An autopsy study of coal miners found length of service to be associated not only with silicosis and coal workers' pneumoconiosis defined pathologically but also with emphysema after controlling for smoking.[96]

With regard to COPD in gold miners, an early study of mortality in white miners showed that smoking and silica exposure acted synergistically in increasing the risk of death from COPD.[97] In a study of lung function loss, the same author found that the average loss of FEV_1 attributable to the

effects of 25 years of gold mining was 236 ml in comparison with the average loss attributable to smoking one packet of cigarettes per day over 30 years of 552 ml.[98] Past tuberculosis is also a potent cause of lung function loss in miners, with the proportion with chronic airflow limitation rising from 18.4% among those with one previous episode to 27.1% among those with two previous episodes of pulmonary tuberculosis.[28] While smoking is prevalent among certain groups of mineworkers, this is not universally so, with the prevalence ranging between 10% and 75%, depending on age, country of origin and previous employment.[99] As smoking becomes more common among black mineworkers, the prevalence and severity of COPD in this group can be expected to rise.

Occupational asthma

A recent authoritative international review of the proportion of adult asthma attributable to occupation put the figure at 15%.[100] A study of acute asthma at a hospital casualty department in Cape Town found that 13% of cases were consistent with occupational asthma, within the range of the above review.[101] Aggravation of asthma by work was reported in 25.7% of these asthmatics.

Between 1997 and 1999, a voluntary register, Surveillance of Work-related and Occupational Respiratory Diseases in South Africa (SORDSA), recorded 324 cases of occupational asthma, a national incidence of 17.5 per million employed persons.[102] Isocyanates (a component of automotive spray paints and other products), latex, flour and grain, and platinum salts were the most common agents. However, the above must be regarded as a minimum incidence as most cases are likely to be unreported.

The findings of workforce specific studies of asthma and respiratory allergy more broadly, using different methods are presented in Table 11.7. These reveal the existence of a serious problem in these industries.

A local study of prognosis of occupational asthma suffered from a low response rate, but among those cases followed up as many as 16.2% were no longer working.[103] Only 55% of workers had submitted claims for compensation. The poor functioning of the compensation system for occupational asthma[104] and for occupational disease in general[105] has been well documented.

Table 11.7. Occurrence of occupational asthma or respiratory allergy South African workforces

Workforce (N) (author, yr published)	Agent	Condition	Prevalence or incidence (%)
Platinum refinery (78) (Calverley 1995)[106]	Platinum salts	Platinum salt sensitivity	41 (24 month incidence)
Poultry workers (134) (Rees 1998)[107]	Feed, poultry matter (feathers, droppings, serum)	Asthma symptoms	12
Hospital workers (2 316) (Potter 2001)[108]	Latex	Latex allergy (ocular, respiratory and skin)	9.2
Vineyard workers (207) (Jeebhay 2002)[109]	Spider mite	Work-related spider mite respiratory allergy	7
Sea food processing (594)(Jeebhay 2003)[110]	Fish products, fish parasite	Occupational asthma	3
Bakery employees (517) (Jeebhay 2005)[111]	Flour grains (wheat, rye) and alpha amylase	Occupational asthma	11
Grain mill (111) (Jeebhay 2000, 2005)[112, 113]	Grains, storage pests (mealworm)	Work-related wheeze	13

Guidelines for management of occupational lung disease

Guidelines for the diagnosis and management of occupational asthma have been published in South Africa, the most comprehensive being that in the Handbook of Practical Allergy.[114] Guidelines for the diagnosis and compensation of a number of occupational lung diseases have been issued, e.g. the asbestos related diseases,[115] and more recently in the form of "Circular Instructions" by the office of the Compensation Commissioner under the Compensation for Occupational Injuries and Diseases Act. These can be accessed on the Department of Labour website under Regulations and Notices under the above Act (http://www.labour.gov.za/programmes/). Guidelines currently available (either on line or on request) cover occupational asthma, irritant-induced asthma, work-aggravated asthma, byssinosis (airways disease associated with cotton dust), upper respiratory tract disorders, mesothelioma, lung cancer and tuberculosis in silica exposed workers.

6. POLICY AND RESEARCH

Primary prevention of disease

COPD has been called "the hidden epidemic" with the diagnosis going unrecognised or unrecorded by health-care providers.[11] This relative neglect may be partly as a result of the condition affecting primarily older people, and therefore being seen as a disease of "lifestyle", i.e. subject to individual choice, and thus overshadowed by other health priorities competing for scarce health system resources. There may also be the perception, for example in Africa, that it is a disease of concern mainly to developed societies. In fact, most cases now occur in middle income and poor countries, especially given the huge burden in China and other Asian countries.[11,12]

Enough is known about the causes of COPD to direct policy and research effort to finding the most effective preventive strategies to stem the enormous toll of morbidity, health service costs and loss of working days associated with the disease.[116,117] Tobacco impact and control remain a research priority. Although much is known about the effects of tobacco, it seems that each country needs indigenous research to remind policy makers of the local burden. Thus, epidemiological monitoring of tobacco usage,[84,118] morbidity and mortality[119] remains important in South Africa. There is evidence that tobacco usage is falling among all but the highest income groups.[120] The increased cost of smoking is likely to be responsible for this pattern of change. Epidemiological monitoring needs to be supplemented by monitoring of policy and control activities. South Africa now has a decade's worth of serious tobacco control activities dating from the Tobacco Products Control Act of 1993, which requires critical reflection on its effectiveness. This is dealt with in more detail in Chapter 4 of this Report.

Complementary to upstream measures to reduce tobacco consumption are multidisciplinary approaches to understanding the determinants of smoking behaviour, for example, based on theories of behaviour change. One of the few such examples in South Africa is focused research into reducing the high smoking prevalence among low-income coloured women using public health antenatal facilities.[121-122]

The role of post-tuberculous lung disease in contributing to the burden of chronic respiratory disease in South Africa is emerging.[16,17,21] Research into tuberculosis and its control is a national priority and hardly needs emphasis. However, a better understanding of the pathophysiology of airflow limitation following tuberculosis is needed as there is relatively little work on the subject.[123] Such understanding may point the way to therapeutic strategies for control of symptoms in these patients.

The problem of indoor and localised outdoor air pollution as a result of polluting domestic fuels is complex and admits of no easy solution.[76,124] The current programme to greatly expand electrification to households in all areas of the country is likely to produce a substantial health benefit. However, large-scale electrification is unlikely to be viable in rural areas. Here the emphasis needs to be on cleaner but affordable stoves, a substantial barrier in very poor communities.[76] South Africa's heavy reliance on coal for electricity generation also confers substantial external costs in ambient pollution,[124] which need to be taken into account in contemplating the benefits of electrification. Alternative domestic fuels, where affordable, are another solution. For example, paraffin (kerosene) is less polluting than coal,[125] although it is associated with increased risk of accidental child poisoning. Improvements to housing through relatively simple low-cost interventions, such as better thermal insulation and solar water heaters, are other approaches to reducing the volume of polluting fuels burned.[126]

Other than the Vaal Triangle study,[127] there is a striking lack of large-scale epidemiological studies of the impact of ambient air pollution in South Africa. There is a need for properly funded studies of sufficient power to determine health effects in areas of high or increasing air pollution. In addition to traditional industrial pollution, the extent and impact of photochemical smog, resulting from the action of sunlight on oxides of nitrogen and hydrocarbons and which is becoming more common in heavily congested urban areas, need to be monitored.[79]

There is now enough evidence for a general contribution of workplace "dust, gases, fumes and vapours", as well as of specific agents, such as silica, coal, grain dust and welding, to the occurrence of COPD to include occupational health measures as a priority component of public health action to control COPD.[100,128] Prevention of occupational respiratory disease is predicated on the enforcement of engineering and other well-established workplace controls required by the Occupational Health and Safety Act (No. 85 of 1996) and the Mine Health and Safety Act (No. 29 of 1996). However, there are a number of barriers to compliance, the most important being reluctance on the part of owners to incur the costs of appropriate technological controls. The risk assessment and monitoring of airborne hazards required by the law are absent or poorly carried out for preventive purposes in many South African workplaces, even in the mining industry.[129] The state's ability to enforce legislation is also weak, a situation attributable to skills shortage and fragmentation of enforcement

efforts across different government agencies.[130] Trade union pressure, historically an important force for improvement, has been attenuated by the effects of labour market restructuring and globalisation on unions' bargaining power in various sectors.[130]

Protective statutory occupational exposure limits are another element of control of occupational respiratory hazards. Emerging evidence described above for the "occupational COPD effect" suggests that the legislative standard for so-called "nuisance dust" (i.e. low toxicity dusts without substance-specific occupational exposure limits) are insufficient to protect against COPD.[128] Also, much of the evidence on exposure-response relationships has come from cross-sectional studies, which suffer from well-known selection biases as well as difficulties in constructing historical exposures. Cohort studies, which could reduce some of these biases, are expensive and require the resources of a large industry. Although gold mining is one such industry, there are as yet no published cohort studies of black gold miners that could provide important evidence of exposure-response relationships for silicosis and tuberculosis and also better characterise the increasing risk of COPD among such miners.

With regard to asthma, there has been a burgeoning of research internationally over the past three decades, stimulated by the rising prevalence and burden of complications of asthma. There is now a large database of comparative asthma prevalences among children which have served to test various hypotheses about the population distribution of asthma. In South Africa, studies have almost all been confined to the Eastern Province (Transkei) and Cape Town. There is a real need for similar studies to be carried out elsewhere, particularly in the inland regions.

Asthma research has been rich in hypotheses, with the "hygiene hypothesis" in particular appealing to a wide audience because of its elegant biology and seeming ability to explain many of the unanswered questions about asthma trends. This hypothesis, which has undergone modification over time,[18] has not been subject to systematic testing in South Africa, although some support for it can possibly be found in the studies reviewed above by Calvert[49] and, at least as regards childhood hayfever and eczema, by Obihara *et al*.[44]

The state of knowledge of the causes of asthma is such that it lends itself less well to primary prevention approaches. The role of prolonged breastfeeding in prevention of allergic disease in childhood was recently tested retrospectively in a cross-sectional study in Cape Town and found to be associated with reduced allergic disease only in those children whose parents were not atopic.[44] This may have implications for reducing the risk of allergic asthma. However, there are two other areas where known preventive activities could make a substantial difference: passive smoking and occupational asthma.

The impact on asthma and respiratory illness in general of smoking by mothers in pregnancy and by parents who have children in the home, is now well characterised. The considerations above concerning tobacco control are thus relevant to asthma, with a particular educational focus required for parents of young children.[131]

Considering that between 10% and 15% of new adult asthma is occupational and that a larger proportion is aggravated by work, control of specific workplace exposures could make a significant difference to population incidence of asthma. Research which measures the burden and is able to characterise the asthmagenic risk of specific agents (see Table 11.7) serves to focus attention and prevention efforts. Most of these studies have been in food processing where workers are exposed to high molecular weight compounds. Apart from platinum salt asthma, asthma associated with exposure to low molecular weight chemical agents, such as isocyanates, sulphur dioxide, formaldehyde, chrome and other metals have not been the subject of significant epidemiological studies in South Africa. Reasons for this lack include the relatively low number of exposed workers in each of the relevant workforces and the absence or low predictive utility of immunological tests for these agents.

Secondary prevention of disease

Secondary prevention of disease includes early diagnosis and cost-effective management. The public health and clinical approaches to asthma have usually been distinguished from those with respect to COPD. For example, while measures aimed at COPD, such as control of tobacco and of domestic and workplace air pollution, are likely to have a positive impact on the prevalence of asthma as well, medical evaluation and therapy have been emphasised as central to public health approaches to asthma.[132] However, with guidelines for both diseases emphasising control of risk factors, patient education, early diagnosis to prevent progression, as well as optimal drug therapy,[1,30,66,67] the difference between COPD and asthma management in this regard may be diminishing.

International publications focusing on management of COPD and asthma in developing country settings are also becoming more common.[12,133] However, a number of barriers to improved management of these diseases in low-resource settings have been cited. These barriers include insufficient skilled health-care personnel, inadequate training of practitioners in optimal management of these conditions, high cost and limited availability of medications, and failure to use or lack of basic diagnostic equipment. In the primary-care setting, asthma is under-treated, antibiotics over-prescribed and tuberculosis under-diagnosed.[72] All of these factors are likely to contribute to the socio-economic and racial group differentials in morbidity and mortality of asthma and COPD in South Africa described above, as well as widening the gap between the private and public sector in quality of care.

A study by the South African Thoracic Society found that while pulmonology had grown as a discipline, pulmonologists were concentrated in Gauteng, Western Cape and KwaZulu-Natal, with a minority in the public sector.[134] The decline in clinical technology posts for lung function technologists in public sector facilities has also been noted.[33] There is thus a need for a national human resources plan for skilled personnel in pulmonology based on an estimate of future needs and a training and placement strategy to meet these needs. A plan for the deployment of pulmonology skills in referral and tertiary hospitals has in fact recently been developed.[135]

The relatively high cost of medication is another barrier to optimal management of asthma and COPD, particularly in a resource strapped public sector struggling with many competing primary health-care goals.[73,74] However, the cost-effectiveness of good control of asthma using maintenance corticosteroids has been shown in a developing country setting.[136] Also, innovative alternatives to expensive spacers for inhaled medication in young children have been developed in South Africa.[137] It is important to provide evidence to health service managers whose drug procurement policies are based purely on the cost of medication, that failure to take into account the "downstream" costs of treating complications of asthma will result in higher costs for the system as a whole,[138] even without taking into account impacts on work productivity and disruption of family life.

While consensus guidelines need to be widely publicised to medical practitioners, there is evidence that publication alone of such guidelines is insufficient to change practitioner diagnosis and treatment behaviour.[139] The CHAMP study described above found benefit in asthma outcomes in children from a single academic detailing visit to general practitioners, but ways of institutionalising such visits remain elusive. With regard to smoking cessation, there is evidence that simple advice by medical practitioners is able to produce some benefit in patients.[140] However, local medical practitioners in public sector facilities were found to be unaware of guidelines for structured smoking cessation counselling in pregnancy.[121] Some were also pessimistic about their ability to influence such smoking behaviour given the pressures on antenatal care delivery and the barriers to quitting among their patients.[121]

A further barrier to improvement of the quality of care for asthma and COPD is the failure to use basic lung function testing in diagnosis and monitoring. A study of asthmatic children aged 6-8 years in Cape Town, found that only 46% of diagnosed asthmatics and 13% of undiagnosed asthmatics reported ever having used a peak flow meter.[65] There are no data on what proportion of primary-care facilities in South Africa has working spirometric equipment, but the Cape Town experience is that very few have such equipment, making it impossible to properly apply the guidelines for diagnosis and management of COPD.

Operations research is thus needed to identify barriers to the implementation of recommended COPD and asthma care at a primary-care level, particularly in the public sector, and ways to implement practice guidelines. The PALSA study described above is important in that it takes into account the reality that primary care in South Africa will increasingly need to be supported by clinical nurse practitioners, and demonstrates that a syndromic approach to lung health using limited training of nurses, can produce benefit in patient management.[72]

With regard to occupational asthma, secondary prevention in the form of early diagnosis improves prognosis if the patient is able to avoid further exposures.[141] The ability of workers to avoid sensitising exposures is dependent on a legislative framework, including compensation, which allows for redeployment without threat to wage or job security and for retraining for a new occupation. Efforts currently underway to improve the efficiency of the compensation system for occupational disease will reduce some of the costs, particularly those related to delays in settling claims, currently borne by workers.[142] However, with an unemployment rate of the order of 40% in South Africa,[130] diagnosis of an occupational disease will remain a serious threat to the patient's livelihood.

7. CONCLUSION

Much has been learned about COPD and asthma in South Africa in the decade since the last edition of this Report, stimulated by international efforts to standardise both the study of these conditions and their management. Although COPD is a preventable disease, we are destined to watch its inexorable increase in South Africa unless measures to prevent smoking and to control occupational exposures are pursued vigorously by the state and agencies involved in health promotion. Early detection of COPD through use of guidelines and spirometry should be the health service component contributing to prevention at an individual and population level.

In the case of asthma, we are still searching for the underlying causes of secular shifts in the condition and its severity. With its relatively rapid social and economic change, South Africa is well placed to investigate emerging hypotheses on the contribution to the population incidence of asthma of changing infection rates, immunisation rates, diet, family size and other correlates of development. However, the advances in management of the asthma will not reach the majority of the population unless ways can be found to ensure a sustained improvement in the basic quality of asthma care, particularly in public health services.

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CHAPTER 12

LIFESTYLE-INDUCED CANCER IN SOUTH AFRICA

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1 INTRODUCTION

1.1 Global burden of cancer

Worldwide, there were approximately 10.1 million new cases, 6.2 million deaths and 22.4 million persons living with cancer in the year 2000.[1] This represents an increase of 19% in incidence and 18% in mortality since 1990, in keeping with population growth and ageing. In terms of incidence, the most common cancers worldwide (excluding non-melanoma skin cancers) are lung, (12.3% of all cancers), breast (10.4%) and colorectal (9.4%).[2] For any disease, the relationship of incidence to mortality is an indication of prognosis. As lung cancer is associated with poor prognosis, it is also the largest single cause of death from cancer in the world (17.8% of all cancer deaths). Cancer of the stomach (10.4%) and liver (8.8%) rank second and third, respectively, in terms of deaths. Differences in the distribution between the sexes are largely attributed to differences in exposure to risk factors rather than to variations in susceptibility. Generally, the relationship of incidence to mortality is not affected by sex.[2]

Although the risk of developing cancer is still higher in the developed regions of the world, the control of communicable diseases, as well as population ageing in developing countries, point to an increasing burden of cancer worldwide.[3] Pisani *et al*.[4] have projected a 30% increase in the number of cancer deaths in developed countries, and more than double this increase (71%) in developing countries from 1990 to 2010 because of demographic changes alone.

The unequal distribution of cancer burden between the developing and developed world can largely be explained by differences in the distribution of aetiological risk factors, including infectious agents and differences in lifestyle. Dietary factors are believed to be of major significance.[2] Cancer is not a rare disease in Africa. In addition to the huge load of AIDS-related Kaposi's sarcoma, the probability of developing cancer by age 65 years in a female living in Kampala or Harare is only 20% lower than that of females in Western Europe.[5] However, cancer treatment facilities in most of Africa are minimal.[5]

This chapter outlines the epidemiology and aetiology of the ten leading cancers in South Africa, with special emphasis, wherever possible, on South African research attempting to quantify the local burden of cancer and estimate the burden attributed to selected risk factors. Such studies are important in helping to better allocate resources towards the prevention and treatment of cancer. The focus will also be on research into the causes and prevention of these cancers. According to Doll and Peto[6] about 75% of cancers in the United States in 1970 could have been avoided, and more recently, Parkin *et al*.[7] estimated that there would have been 22.5% fewer cases of cancer in the developing world in 1990 if specific infections had been prevented. Lifestyle-induced cancers are likely to affect various population groups differently. Because of the diversity of cultures and lifestyles in the South African population, cancer burden, wherever possible, is reported by age, sex, and population group.

1.2 Cancer mortality trends

Bradshaw and Harrington[8] reviewed available mortality data for South Africa from 1949-1979 for whites, coloureds and Asians, and from 1968-1977 for Africans in urban areas. In African males, there were increases in oesophageal and lung cancer mortality while in females there was a small increase in mortality from cervix, breast and lung cancer, while stomach cancer

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declined slightly. In coloured males, there were dramatic increases in mortality from lung and oesophageal cancer over the period 1949-1979, while stomach cancer mortality declined after 1969. The rates for both cervix and breast cancer increased for coloured females over that period while the rates for stomach cancer decreased.

In white males, there was a threefold increase in lung cancer rates, while there was decrease of about the same magnitude in stomach cancer. Mortality from prostate and colorectal cancers remained stable. In white females, breast cancer mortality increased while lung cancer rates more than doubled. Colorectal cancer remained stable and mortality from cervix and stomach cancer declined. Because of the small numbers of deaths, mortality rates in the Asian population show much fluctuation from year to year. Lung cancer mortality increased over the period 1949-1979 in Asian males while breast cancer increased in females. There was a decline in mortality rates of stomach cancer in Asians of both sexes.[5]

1.3 Risk factor profile

The lifestyle of the urban African population, particularly in the main industrial areas of Johannesburg and Soweto, has changed dramatically over the last few decades. In terms of risk factors for cancer, there have been higher rates of smoking and alcohol consumption.[9-11] The relationship between alcohol and the emergence of a modern urban-industrial system, however, is complex as highlighted by van Onselen,[12] with the development of alcohol regulation in South Africa serving the interest of the mining industry. In the 1890s, unskilled workers were initially encouraged to consume vast quantities of alcohol and the mine owners profited from the sale of alcohol to their workers. However, after 1896, when the deep mines on the Witwatersrand went into production, the mine owners needed a sober labour force and the sale of liquor to Africans was restricted. Traditional beer (home and commercially brewed using local recipes) became the main type of alcohol used.[10] Then in 1962, legislation that made it illegal for Africans to purchase 'western spirits' was repealed, and since then there has been a marked increase in their consumption.[10]

In addition to these leading risk factors associated with a western lifestyle, other risk factors associated with poverty and underdevelopment, such as poor nutrition and exposure to indoor smoke from solid fuels, still persist and are responsible for significant increases in some cancers. Unsafe sex and associated infection with sexually transmitted infections, including HIV, is one of the leading causes of disease burden in South Africa and increases in some cancers can be attributed to this important risk factor.

The current mortality pattern of chronic diseases reflects a lifetime of exposure to unhealthy lifestyles. Unhealthy lifestyles in our society are steadily given up by the wealthy and taken up among the poor, who, as they age, are placed at risk for these chronic diseases.[13] Although cancer is a leading cause of death in all communities in South Africa, the types of cancer differ between poor and rich areas. Oesophageal cancer is by far the most common cause of premature mortality for males in poor areas, followed by lung cancer and liver cancer. For males in rich areas, lung cancer is the most common followed by oesophageal cancer and leukaemia. Cervical cancer is the most common cause of premature mortality for females in poor areas, followed by oesophageal cancer and breast cancer. In rich areas, breast cancer is the most common cause of premature mortality followed by cervical cancer and lung cancer.[14]

2 BURDEN OF LIFESTYLE-INDUCED CANCERS IN SOUTH AFRICA

2.1 The South African National Burden of Disease study

Initial estimates from the South African National Burden of Disease study (SA NBD)[15] were recently revised using more recent data.[16] Revised estimates show that in the year 2000, all cancers as a group (this disease category is also referred to as the malignant neoplasms category) accounted for 41 657 (8.0% of all) deaths and were ranked as the fourth leading cause of death for all persons. Among older (60+ years) persons, cancers as a group ranked second to cardiovascular disease and accounted for 15.3% of all deaths.[15] The top 20 causes of cancer deaths for South Africa in 2000 were ranked for males, females, and persons by percentage of all cancer deaths and the results are presented in Table 12.1.

The aero-digestive cancers (trachea/bronchi/lung and oesophageal cancers) were the leading causes of cancer deaths in South Africa. In males, trachea/bronchi/lung (referred to as lung) cancer accounted for 21.9% of all cancer deaths, followed by oesophageal cancer (16.7% of cancer deaths) and prostate cancer (11.8%). Cancer of the cervix (17.2%), breast (15.6%) and lung (10.9%) were among the top causes of cancer deaths in females (Table 12.1). For most

cancers including lung, oesophageal, stomach and liver, cancer deaths were higher among males than females (Fig. 1). Age-standardised (to the world population)[17] mortality rates/100 000 for each cancer by sex and population group for South Africa 2000 are presented in Table 12.2. The age-standardised all-cancer death rate of 148.6 per 100 000 for persons for South Africa 2000 is compared with other countries in Fig. 2. South Africa ranks high with rates similar to those in developed countries such as England and Wales, although the pattern of cancers is different (this is described in more detail in the epidemiology sections). Age-specific death rates for males and females are presented in Figs. 3 and 4. It is interesting to note that death rates for trachea/bronchi/lung and oesophageal cancer in males begin to increase from the relatively younger age group of 35-44 years. In females, death rates for breast and cervical cancer begin to increase from the 25-34-year age group.

Table 12.1. Percentage of cancer deaths by cause, South Africa 2000

Persons			Males			Females		
Rank	Cause of death	%	Rank	Cause of death	%	Rank	Cause of death	%
1	Trachea/bronchi/ lung cancer	16.5	1	Trachea/bronchi/ lung cancer	21.9	1	Cervix cancer	17.2
2	Oesophageal cancer	13.4	2	Oesophageal cancer	16.7	2	Breast cancer	15.6
3	Cervix cancer	8.4	3	Prostate cancer	11.8	3	Trachea/bronchi/ lung cancer	10.9
4	Breast cancer	7.7	4	Liver cancer	7.8	4	Oesophageal cancer	9.9
5	Liver cancer	6.4	5	Stomach cancer	6.5	5	Colorectal cancer	6.9
6	Colorectal cancer	6.2	6	Colorectal cancer	5.4	6	Liver cancer	4.9
7	Prostate cancer	6.1	7	Mouth and oropharynx	4.6	7	Stomach cancer	4.7
8	Stomach cancer	5.6	8	Leukaemia	3.8	8	Pancreas cancer	3.7
9	Pancreas cancer	3.7	9	Pancreas cancer	3.7	9	Ovary cancer	3.5
10	Leukaemia	3.5	10	Larynx cancer	3.0	10	Leukaemia	3.2
11	Mouth and oropharynx	3.3	11	Lymphoma	2.8	11	Corpus uteri cancer	3.1
12	Lymphoma	2.5	12	Bladder cancer	2.2	12	Lymphoma	2.1
13	Larynx cancer	1.8	13	Bone and connective tissue cancer	1.7	13	Mouth and oropharynx	2.0
14	Ovary cancer	1.7	14	Brain cancer	1.3	14	Bone and connective tissue cancer	1.6
15	Bone and connective tissue cancer	1.7	15	Kidney cancer	1.2	15	Brain cancer	1.2
16	Bladder cancer	1.6	16	Melanoma	1.1	16	Bladder cancer	1.0
17	Corpus uteri cancer	1.5	17	Non-melanoma skin cancers	0.7	17	Melanoma	1.0
18	Brain cancer	1.3	18	Breast cancer	0.2	18	Kidney cancer	0.9
19	Melanoma	1.0	19			19	Larynx cancer	0.6
20	Kidney cancer	1.0	20			20	Non-melanoma skin cancers	0.5
21	Non-melanoma skin cancers	0.6	21			21		
	All cancers	100.0		All cancers	100.0		All cancers	100.0

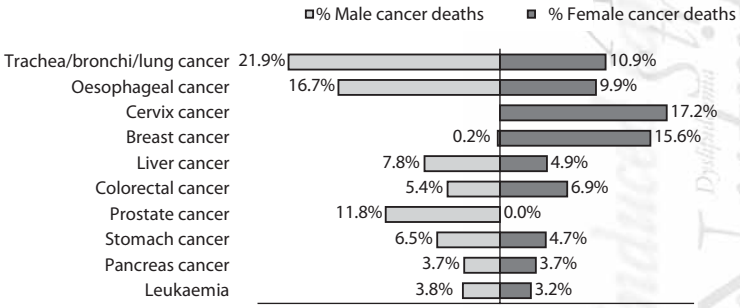

Figure 1: Percentage distribution of the top ten causes of cancer deaths by sex, South Africa, 2000[16]

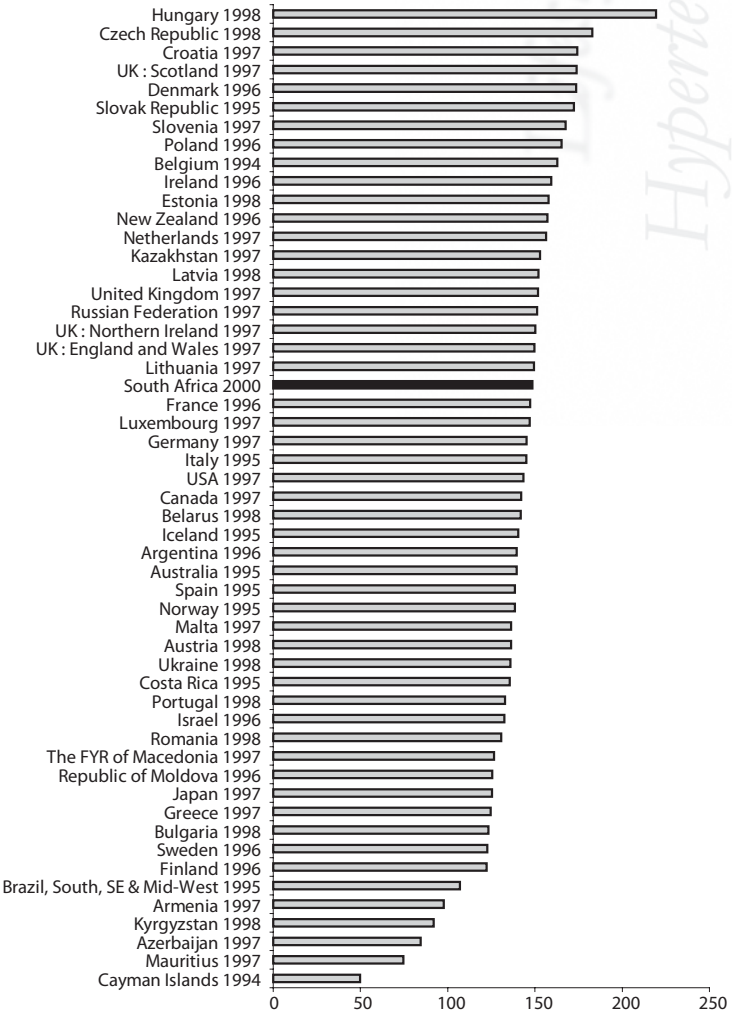

Figure 2: International comparisons for malignant neoplasms age-standardised (to the world population) rates/100 000[17] (South African data have been adjusted, whereas only raw data are available from certain countries)

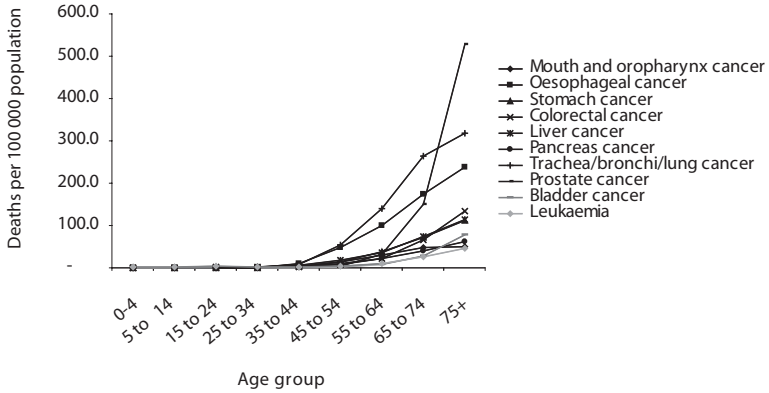

Figure 3: Male age-specific cancer deaths rates, South Africa 2000[16]

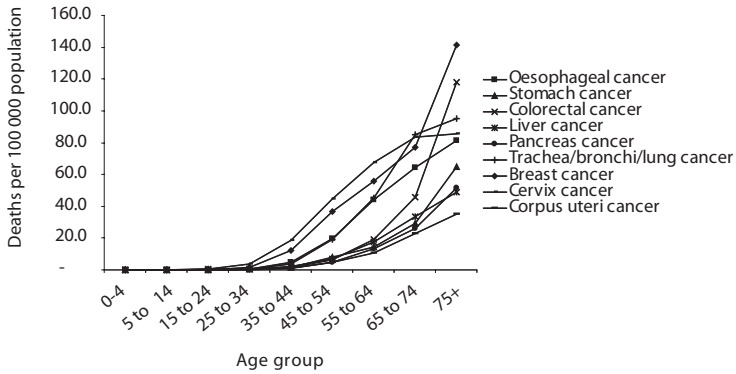

Figure 4: Female age-specific cancer deaths rates, South Africa 2000[16]

2.2 Population group differences in mortality profile

Population group estimates of the revised SA NBD study indicate that the highest age-standardised cancer death rates are found in the coloured population (212.5/100 000), followed by the white (198.9), African (126.0) and Asian (121.4) groups (Fig. 5 and Table 12.2). The coloured population had the highest rates for cancer of the lung (54.6) and stomach (19.3). White males had the highest prostate (41.1) and colorectal (24.3) cancer death rates. The breast cancer age-standardised death rate was highest in white females (35.2). The African population had the highest death rates from cervical cancer (26.9) in females and oesophageal cancer in males (41.4) and females (17.6).

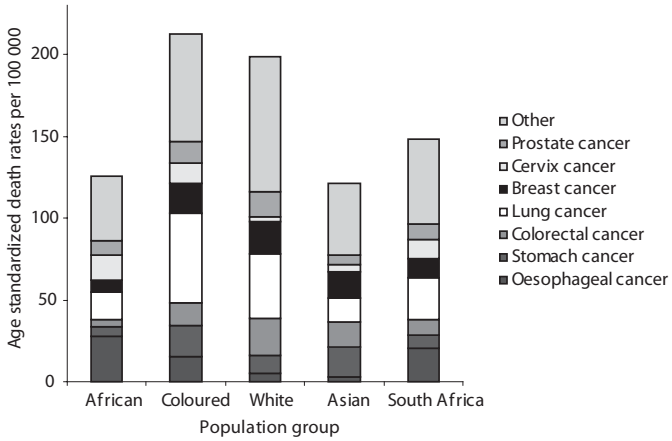

Figure 5: Population group estimates of age-standardised (to the world population) cancer death rates, 2000[16]

Age-specific death rates for males and females by population group for the most important cancers are shown in Figs. 6 (a and b) and 7. For lung cancer, age-specific death rates were also plotted on a logarithmic scale for ages 35 years and older (Fig. 6b). The rapid increase in the rate of prostate cancer in older ages (Fig. 3) reflects the pattern seen in white males (Fig. 7). In some cases, particularly noticeable for cervical cancer in coloured females and lung cancer in coloured males, the age distribution follows an "S" shape rather than a steep or progressive increase with age. This "S" shape is indicative of an exposure to risk factors being introduced at a certain age resulting in a more sudden increase with age. Provincial and population group differences, as well as age and gender patterns, will be discussed in more detail in the epidemiology section of the specific cancers.

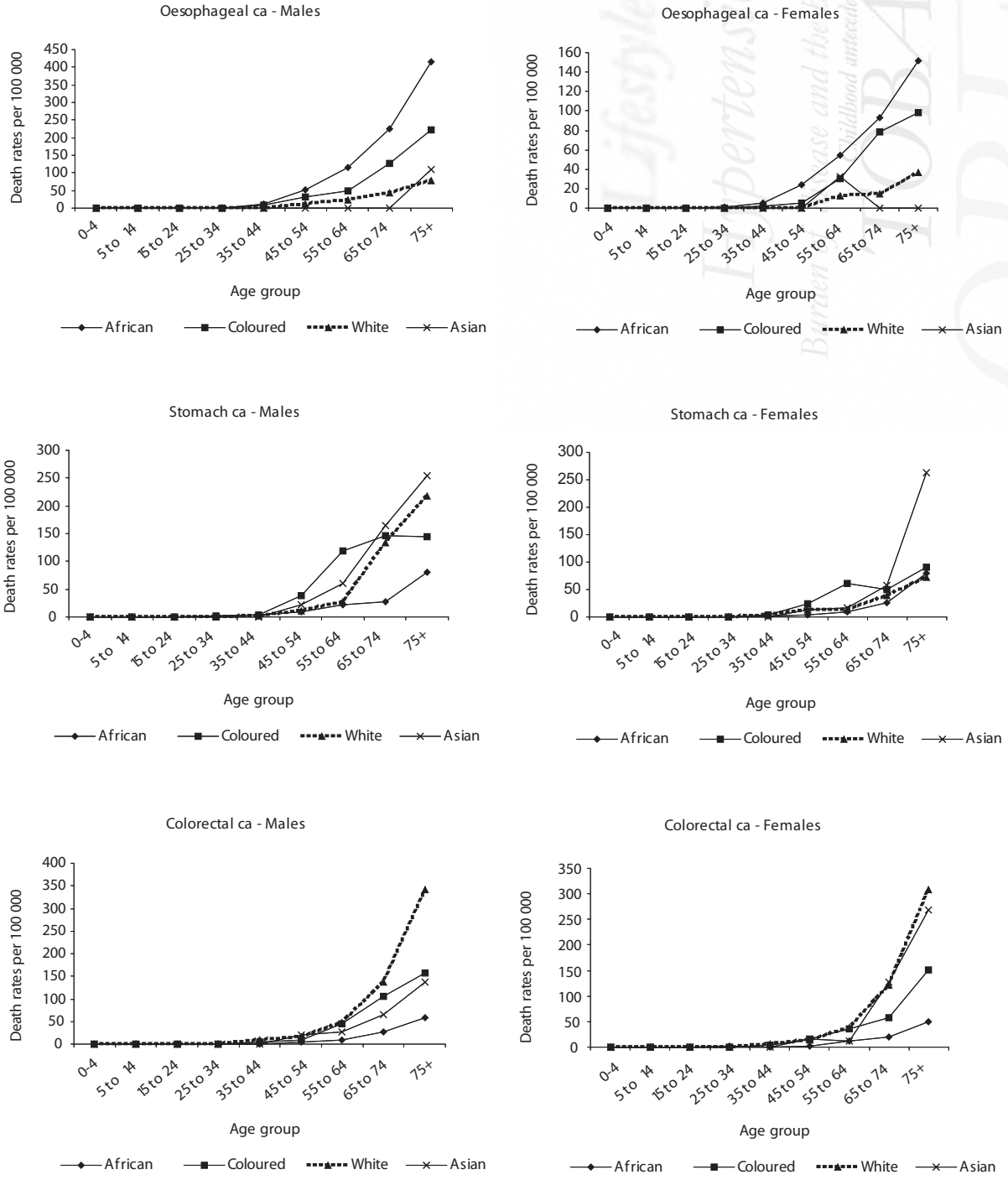

Figure 6a: Age-specific death rates for selected cancers by sex and population group, South Africa 2000[16] (Asian female rates are unstable because of small numbers)

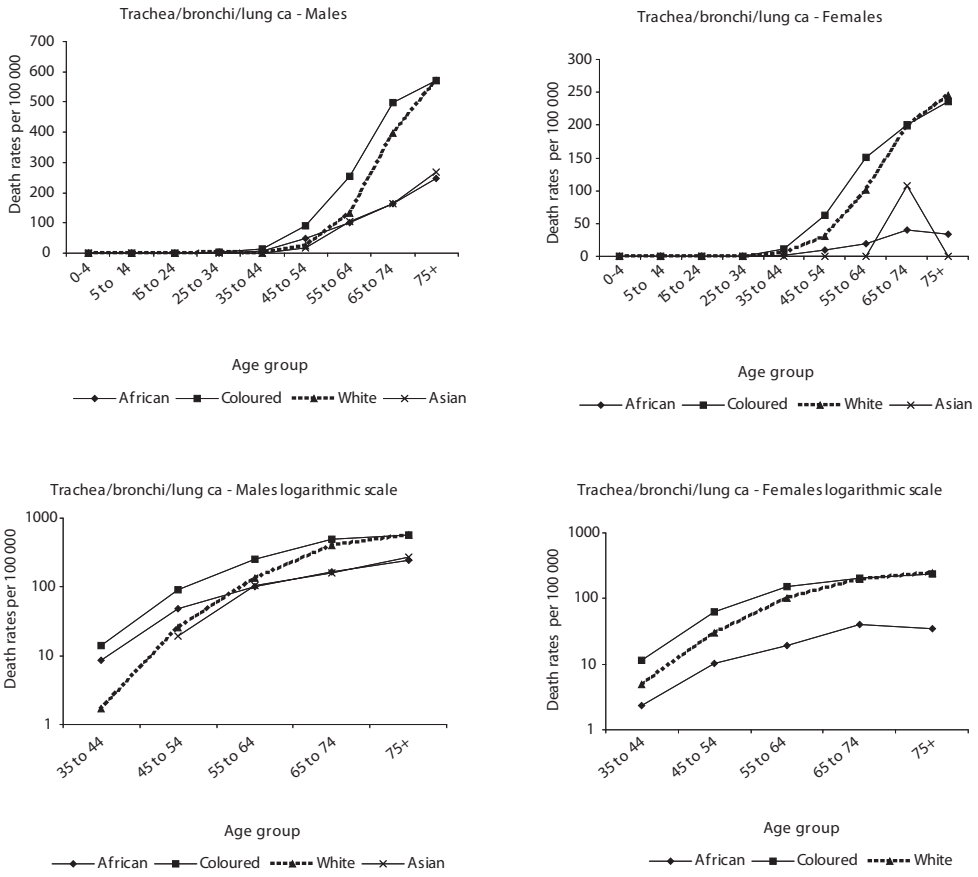

Figure 6b: Age-specific death rates for lung cancer by sex and population group, South Africa 2000[16] (Asian female rates were excluded from log scales because of small numbers)

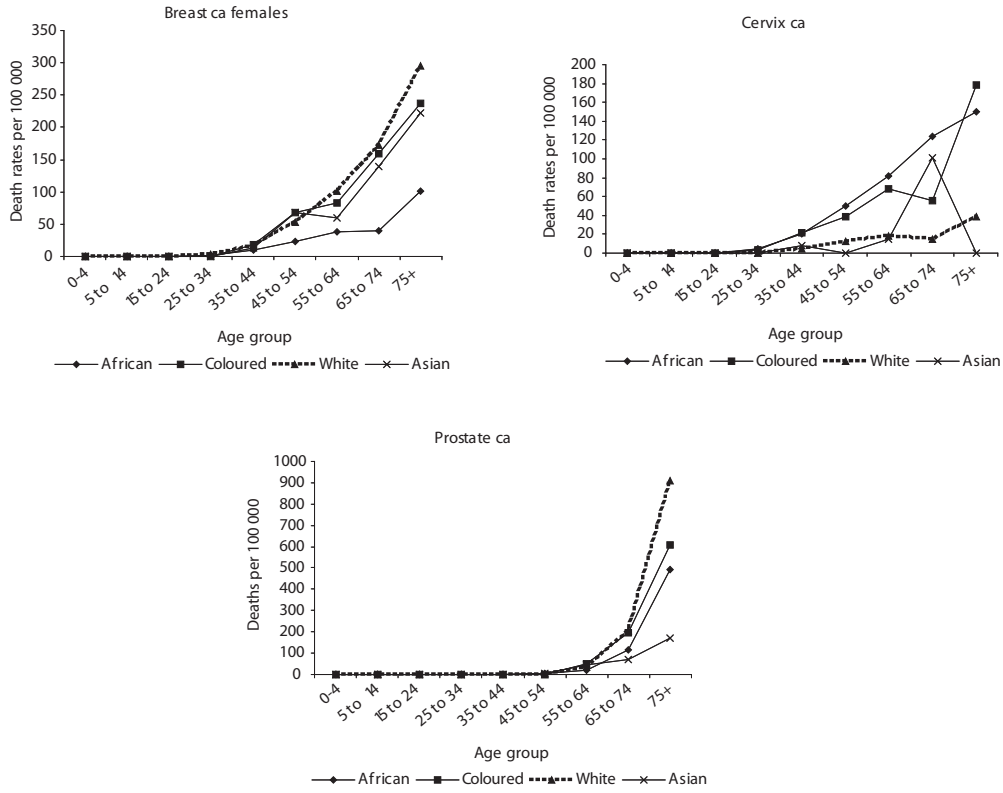

Figure 7: Age-specific death rates for selected cancers by population group, South Africa 2000[16] (Asian female rates are unstable because of small numbers)

Table 12.2. Age-standardised (to the world population) death rates per 100 000 by sex and population group, South Africa 2000[16]

	African			Coloured			White			Asian			South Africa		
Cancer site	Males	Females	Persons	Males	Females	Persons	Males	Females	Persons	Males	Females	Persons	Males	Females	Persons
Mouth and oropharynx	7.7	2.4	4.7	17.3	4.4	9.8	6.7	2.6	4.4	0.9	5.2	3.3	8.5	2.5	5.0
Oesophagus	41.4	17.6	27.6	22.0	10.4	15.2	7.7	3.0	5.0	3.3	2.6	2.7	31.6	12.4	20.2
Stomach	7.4	5.2	6.2	27.0	13.6	19.3	17.3	7.3	11.3	23.7	13.8	18.2	12.5	5.9	8.5
Colorectum	4.7	4.1	4.3	15.3	12.6	13.7	24.3	21.2	22.6	12.0	17.4	15.3	10.8	8.6	9.5
Liver	16.3	6.6	10.7	9.1	8.6	8.6	7.8	5.1	6.2	7.7	6.5	7.1	14.0	6.0	9.3
Pancreas	4.6	2.6	3.5	9.1	8.7	9.0	12.9	10.2	11.5	3.0	5.4	4.4	7.2	4.7	5.7
Larynx	4.9	0.6	2.5	10.2	1.9	5.4	4.1	0.5	2.0	11.5	0.0	4.6	5.7	0.7	2.7
Trachea/bronchi/lung	31.1	6.3	16.9	77.1	38.8	54.6	52.3	30.1	39.1	27.5	5.6	15.1	42.3	13.8	25.3
Bone and connective tissue	1.6	1.3	1.5	2.6	4.7	3.9	3.9	2.0	2.9	1.9	0.0	0.8	2.4	1.8	2.1
Melanoma	0.4	0.1	0.2	0.9	0.5	0.6	6.6	4.8	5.7	0.0	0.0	0.0	2.0	1.2	1.6
Non-melanoma skin	0.6	0.5	0.6	2.2	0.0	1.0	1.8	0.7	1.2	0.0	0.8	0.4	1.2	0.6	0.9
Breast	0.3	12.7	7.3	0.0	32.7	18.7	0.0	35.2	19.5	0.4	28.5	16.0	0.5	19.0	11.3
Cervix	0.0	26.9	15.0	0.0	21.7	12.4	0.0	5.5	3.0	0.0	7.6	4.3	0.0	20.8	11.9
Corpus uteri	0.0	4.6	2.6	0.0	5.5	3.3	0.0	2.6	1.6	0.0	1.9	1.1	0.0	3.9	2.3
Ovary	0.0	2.7	1.5	0.0	1.7	1.0	0.0	10.2	5.6	0.0	6.5	3.5	0.0	4.3	2.5
Prostate	22.9	0.0	9.0	33.2	0.0	12.7	41.1	0.0	15.7	13.2	0.0	5.6	26.8	0.0	9.8
Bladder	2.4	0.8	1.4	9.6	2.2	5.1	8.7	2.4	4.8	4.0	0.0	1.7	4.7	1.2	2.5
Kidney	0.6	0.3	0.5	3.1	1.3	2.1	4.5	2.6	3.4	3.3	0.0	1.4	2.1	1.0	1.4
Brain	1.0	0.4	0.7	0.5	1.1	0.8	5.3	5.4	5.3	0.0	1.4	0.8	2.1	1.5	1.7
Lymphoma	2.8	1.5	2.1	4.5	3.6	4.0	6.8	5.2	5.8	7.7	2.4	5.0	4.4	2.5	3.3
Leukaemia	3.2	2.0	2.6	4.0	3.2	3.4	12.2	7.1	9.4	3.9	9.6	6.8	5.7	3.5	4.4
Other cancers	4.4	4.6	4.5	5.8	9.3	7.8	11.8	14.2	13.1	7.0	0.0	3.1	6.6	6.6	6.6
Malignant neoplasms	158.2	103.8	126.0	253.3	186.5	212.5	236.0	177.9	198.9	131.0	115.3	121.4	191.0	122.4	148.6

2.3 Provincial differences in mortality profile

Estimates of provincial cancer death rates[18] are shown in Fig. 8. The Western Cape had the highest cancer death rates followed by Gauteng, the Northern Cape and the Eastern Cape provinces. The lowest rates were found in KwaZulu-Natal (KZN), Limpopo and Mpumalanga. The profile of the type of cancer also differed enormously across the provinces. The lung cancer rate among males in the more developed province of the Western Cape was extremely high. Prostate cancer was highest in the Northern Cape, followed by Free State, Gauteng, and Mpumalanga (Fig. 9). The Eastern Cape had particularly high rates of oesophageal cancer, as did males in the North West province. Nationally, cervical cancer and breast cancer death rates were at similar levels. However, there were provincial variations in the pattern of these cancers. The Western Cape had much higher breast cancer rates, while the poorer and more rural provinces of Mpumalanga, Limpopo, and the Eastern Cape had much higher cervical cancer rates (Fig. 9). It should be noted that the national average in the provincial study is slightly higher than the revised SA NBD estimates.[16]

The variations between the provinces may be related to levels of wealth and development, population group differences and demographic features of the province, geographical differences and environmental exposures, as well as access to health services or other basic services. The average profile of a province, furthermore, obscures the variability within a province. Studies comparing the mortality experienced by the different population groups, social classes and ethnic groups and for small areas may provide useful insight into the factors associated with the variations in health outcomes.[18]

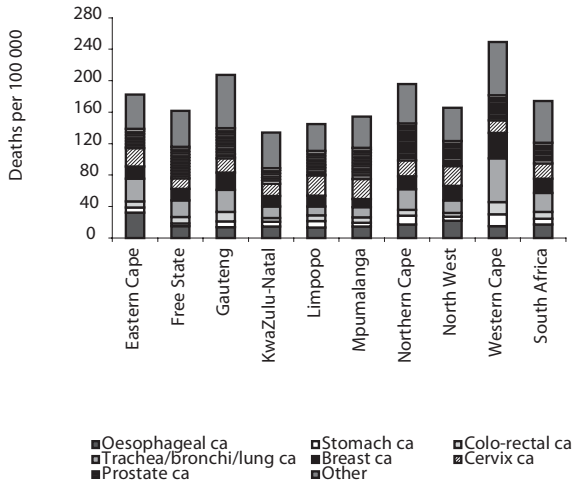

Figure 8: Provincial estimates of age-standardised cancer death rates, 2000[18]

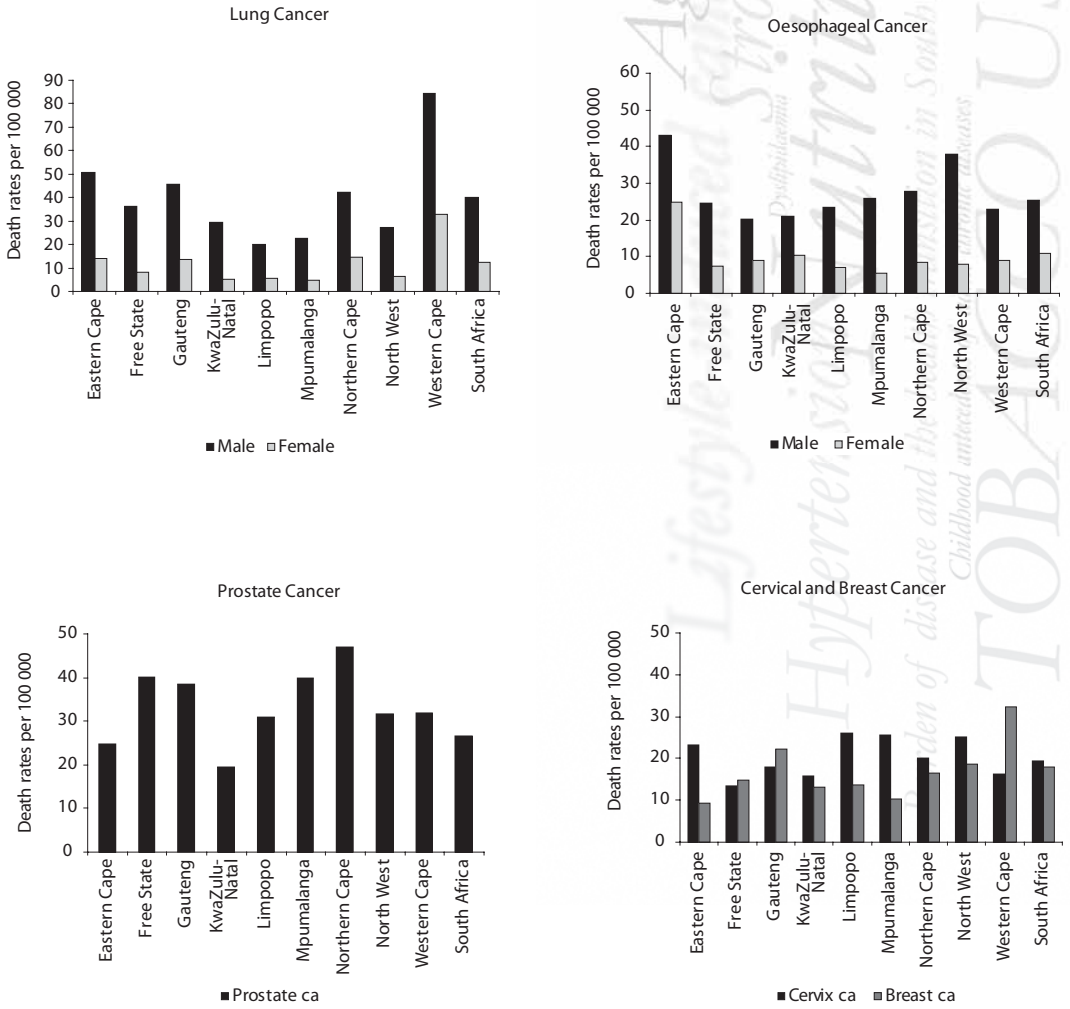

Figure 9: Provincial estimates of age-standardised death rates caused by selected cancers by sex, 2000[18]

2.4 Cancer incidence data for South Africa

2.4.1 The National Cancer Registry

In 1986, a national, pathology-based cancer registry was established at the South African Institute for Medical Research (now the National Health Laboratory Service) as a collaborative venture with the Cancer Association of South Africa (CANSA) and the Department of Health. The National Cancer Registry (NCR) is a voluntary national cancer surveillance system. Cancer data are collected from both public and private pathology laboratories nationally, and it is the only source of national cancer incidence data, albeit the rates reported are an underestimate of the true burden. Only incident cases of primary invasive cancer diagnosed by histology, cytology or haematology are recorded.

The main objectives of the NCR are to monitor cancer burden and to publish and report cancer incidence for every year, stratifying by sex, age and population group. The NCR also attempts to report time trends. Every year approximately 80 000 cases of cancer are reported to the NCR of which about 60 000 are new cases. In 1998 and 1999, 60 172 and 60 343, respectively, new cancer cases were reported to the NCR.[19] The bulk of these were diagnosed and reported by laboratories in Gauteng (40.8% of new cases), which also has the highest number of cancer-diagnosing facilities, then KZN (18.6%) and the Western Cape (17.9%). This reflects the unequal distribution of cancer diagnostic facilities in South Africa and the movement of cancer patients seeking treatment in neighbouring provinces, as well as the transfer of specimens for testing to the more developed provinces. Missing information on population groups remains a major concern. Hot-deck imputation methods have been developed in an attempt to provide some continuity in population specific rates.[19] Male (29 428) and female (30 480) cancers comprised 50.5% and 48.8%, respectively, of all cancers in 1999, where sex was known, similar to the numbers and proportions in 1998.

Overall, the white population comprised the highest proportion of all cancer cases: 45.2% and 46.4% in 1998 and 1999, respectively (including basal cell carcinoma (BCC) and squamous cell carcinoma (SCC) of the skin). The black population comprised the second highest proportion of new cases (39.4%, 36.8%), followed by the coloured population (8.3%, 9.1%), while the Asian population had the lowest number of reported new cases (2.3%, 2.1%).

Childhood (age 0-14 years) cancers comprised about 1% and 2% of all female and male cancers, respectively, reported for both 1998 and 1999. The top four childhood cancers in males were leukaemia, brain, kidney and non-Hodgkin lymphoma, while in females it was leukaemia, kidney, brain and bone.[19]

The frequency distribution of the top ten cancers for the two years 1998-99 and all ages is shown in Fig. 10. Breast and cervix cancers and BCC comprised more than half of all the female cancers reported in 1998 and 1999. In males, BCC (23.3%) and prostate (13.6%) cancers remained the first and second most common cancers.

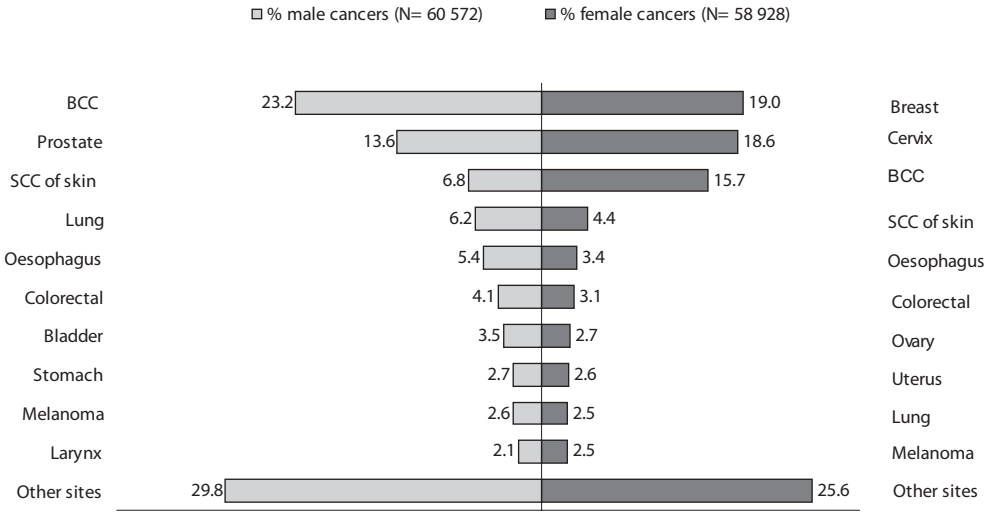

Figure 10: Percentage distribution of 10 most common cancers reported to NCR by sex, South Africa 1998 and 1999[19]
BCC Basal cell carcinoma
SCC Squamous cell carcinoma

BCC and SCC of skin are the most prevalent neoplasms, particularly among the white population group, and tend to overshadow all other cancer sites. Consequently, the common practice internationally is to exclude BCC and SCC of skin from the calculations of total cancer rates, and therefore all incidence rates and rankings reported in this chapter, exclude these two cancers. Table 12.3 presents a summary of the five leading cancers diagnosed in 1998 and 1999 for each population group in males and females. In South Africa, 1 in 4 males and 1 in 5 females (aged 0-74 years) were estimated to be at risk of developing cancer.[19] In 1999, the cancer age-standardised (to the world population) incidence rates (ASR) were 148.9 and 134.9/100 000, in males and females, respectively. The five leading cancers in females, in order, were those of the breast, cervix, colorectum, oesophagus and corpus uteri. Cancers of the prostate, lung, oesophagus, colorectum and bladder were the five leading cancers in males.

White males had the highest ASR in 1999 (277.1/100 000) followed by coloured males (214.8), Asian (126.8) and African males (97.1). White females also had the highest ASR (230.5), followed by coloured (171.0), Asian (143.2) and African females (103.7). Because of serious under-reporting in the African population, age-standardised incidence rates are probably underestimated. It is interesting to note that while the age-standardised death rates for all cancers in males are higher than rates in females for each population group, NCR data shows that the overall cancer age-standardised incidence rates in African and Asian females are higher than those in males of the same population group.

Despite several limitations, the data compiled by the NCR are the only comprehensive source of information on the incidence of cancer in South Africa. As the NCR reflects national rates of histologically diagnosed cancer, these can form the basis of minimal estimation of incidence. Until now, these data have been used to inform development of

the draft national policy guidelines for cancer prevention and control,[20] as well as to inform research and for teaching purposes.

2.4.2 The Umtata Registry

The Umtata Registry[21] includes a large number of cases diagnosed among the residents of the Umtata district, the former Transkei 'homeland', in the Eastern Cape. Incidence rates were calculated for the period 1996 to 1998 using the census data for 1996. The overall cancer incidence is 141.3/100 000 in males and 105.8 in females. The most important cancers in males were cancers of the oesophagus (ASR 62.5), lung (ASR 15.7) and liver (ASR 16.0). In females, the main cancers were those of the oesophagus (ASR 34.5), cervix (ASR 26.3) and breast (ASR 14.9).[5]

2.4.3 The PROMEC rural districts' Registry

A population-based cancer registry was established by the Programme on Mycotoxin and Experimental Carcinogenesis (PROMEC) of the Medical Research Council (MRC) in the Bizana, Butterworth, Kentani and Lusikisiki districts of the Transkei in 1981.[22] This population-based registry systematically and continuously registers all cancer cases identified within the defined geographical area. During the period 1996 to 2000, 1394 new cancer cases were reported by the PROMEC registry (552 males and 842 females).[23] The most common were oesophageal, cervical, breast, lung, prostate and liver cancers. The low overall age-standardised rates for all cancers (44.8/100 000 for males and 46.5 for females)[23] for the period 1996-2000 and some irregularity in numbers of cases registered by year and district suggest possible under-diagnosis and/or under-registration.[5] The reasons for the observed decrease in the number of cases in the four districts include, among others, a decline in health-care delivery services and poor record keeping leading to underreporting.[23] Despite these limitations, however, results from the PROMEC Registry should be treated as minimum levels of incidence of cancer in the four districts.[23]

2.4.4 Elim Hospital

Data were collected at Elim Hospital in Limpopo Province during 1991-1994.[24] In males, the leading cancers were oesophagus (17.7%), mouth (16.5%) and liver (15.6%), while in females the main cancers were cervix (39.8%), breast (12.9%) and oesophagus (5%).[5]

Table 12.3. Summary incidence rates for the leading five cancers by population group and sex, South Africa 1998 and 1999[19]

	1998			1999		
Pop/Sex	Cancer	ASR	LR	Cancer	ASR	LR
Asian Female	Breast	45.26	18	Breast	49.62	18
	Cervix	16.39	49	Cervix	11.02	81
	Uterus	11.76	65	Colorectal	7.31	99
	Colorectal	10.45	78	Uterus	7.13	106
	Stomach	6.5	120	Ovary	6.29	121
	All	164.59	6	All	143.24	7
Asian Male	Prostate	20.41	46	Prostate	18.34	39
	Stomach	12.8	64	Colorectal	14.28	51
	Lung	12.18	59	Lung	12.93	63
	Colorectal	11.01	94	Stomach	12.77	66
	Leukaemia	7.69	170	Bladder	10.46	108
	All	139.87	7	All	126.81	7
Black Female	Cervix	42.1	21	Cervix	34.88	25
	Breast	17.98	51	Breast	18.39	49
	Oesophagus	7.36	108	Oesophagus	6.95	113
	Uterus	3.92	193	Uterus	4.68	157
	Ovary	3.07	257	Ovary	2.76	313
	All	111.00	9	All	103.71	9

Black Male	Prostate	20.64	42	Prostate	17.17	50
	Oesophagus	15.59	53	Oesophagus	14.13	59
	Lung	12.07	68	Lung	9.28	87
	Larynx	4.37	193	Larynx	4.09	193
	Stomach	3.6	233	Colorectal	2.96	286
	All	109.94	9	All	97.11	10
Coloured Female	Breast	45.21	19	Breast	49.77	18
	Cervix	29.04	30	Cervix	26.35	34
	Colorectal	7.99	109	Colorectal	9.66	89
	Lung	7.55	100	Lung	9.65	76
	Stomach	6.8	118	Uterus	6.61	107
	All	158.98	6	All	171.04	6
Coloured Male	Prostate	47.14	17	Prostate	47.98	19
	Lung	20.15	38	Lung	23.48	32
	Colorectal	13.76	58	Stomach	16.25	51
	Stomach	13.55	63	Colorectal	14.09	56
	Oesophagus	13.36	59	Bladder	12.53	66
	All	202.59	5	All	214.79	4
White Female	Breast	76.04	12	Breast	76.46	12
	Melanoma	15	66	Colorectal	17.52	48
	Colorectal	14.99	58	Melanoma	16.73	61
	Cervix	14.5	67	Cervix	12.04	81
	Ovary	10.81	78	Ovary	10.07	82
	All	230.28	4	All	230.46	4
White Male	Prostate	78.51	10	Prostate	74.38	10
	Colorectal	23.74	35	Colorectal	25.44	31
	Bladder	23.74	35	Bladder	23.69	35
	Lung	21.7	35	Melanoma	20.94	43
	Melanoma	19.27	48	Lung	20.74	37
	All	284.55	3	All	277.13	4
All Females	Cervix	34.43	26	Breast	33.41	27
	Breast	32.70	27	Cervix	28.69	31
	Colorectal	5.83	154	Colorectal	6.61	131
	Oesophagus	5.95	136	Oesophagus	5.49	143
	Ovary	4.91	166	Uterus	5.09	146
	All	136.74	6	All	134.86	6
All Males	Prostate	37.59	22	Prostate	34.12	24
	Lung	15.18	52	Lung	13.56	59
	Oesophagus	12.56	65	Oesophagus	11.33	73
	Colorectal	9.44	92	Colorectal	9.74	83
	Bladder	8.63	98	Bladder	8.24	104
	All	156.18	4	All	148.87	5

ASR: Age-standardised incidence rate/100 000 (adjusted for unknown age); LR: Lifetime risk (0-74)

(All rates exclude BCC and SCC of skin)

2.5 CANCER BURDEN ATTRIBUTABLE TO SELECTED RISK AND LIFESTYLE FACTORS

Comparative Risk Assessment (CRA) of the SA NBD 2000 study was carried out using methodology developed by the World Health Organisation for its 2002 World Health Report.[25,26] The goal was to estimate the contributions of a selected group of major risk factors in various levels of causality to the burden of disease in 2000.[27] In line with the unique quadruple burden of disease in the country, preliminary results from the risk factor study show that the loss of health in South Africa is dominated, on the one hand, by risk factors related to poverty and underdevelopment, such as undernutrition, unsafe water, sanitation and hygiene and indoor smoke from solid fuels, and, on the other hand, by risk factors associated with a western lifestyle, such as alcohol and tobacco use, high blood pressure and high cholesterol levels. Unsafe sex is the leading risk accounting for approximately 31.5% of all healthy years of life lost in 2000.[27] Interpersonal violence is another important risk factor, which, together with alcohol, contributes to the high injury burden.

Population attributable fractions for the various risk and lifestyle factors that were analysed, where cancer is an adverse outcome of exposure, are presented in Table 12.4. These include mainly the diet-related risk factors, such as high body mass, low intake of fruit and vegetables, and physical inactivity, unsafe sex, the addictive substances tobacco and alcohol, as well as one of the environmental risks, exposure to indoor smoke from solid fuels. The prevalences of exposure to some of these risk factors are presented in Table 12.5.

Table 12.4. Population attributable fractions by risk factor and sex (% DALYs for each cause), South Africa, 2000 (adapted)[27]

	Males	Females
Other diet-related risks and physical inactivity		
High Body Mass		
Post-menopausal breast cancer	-	13
Colorectal cancer	12	22
Endometrial cancer	-	60
Low fruit and vegetable intake		
Oesophagus cancer	24	24
Stomach cancer	24	24
Colorectal cancer	3	3
Trachea/bronchi/lung cancers	15	16
Physical Inactivity		
Female breast cancer	-	17
Colorectal cancer	26	28
Sexual and reproductive health		
Unsafe sex		
Cervix uteri cancer	-	100
Addictive substances		
Tobacco		
Mouth, oropharynx, larynx, oesophagus, sinus cancer	58	25
Trachea/bronchi/lung cancers	78	62
Digestive, urinary, cervical cancer	16	3
Other cancers	14	4
Alcohol		
Mouth and oropharynx cancers	29	16
Oesophagus cancer	37	23
Liver cancer	30	16
Larynx cancer	43	28
Female breast cancer	-	6
Environmental risks		
Indoor smoke from solid fuels		
Trachea/bronchi/lung cancer	2	4

Table 12.5. Summary prevalence of selected risk factors related to cancers by sex, South Africa 2000 (adapted)[27]

	Prevalence criteria	Males	Females	Data source
Other diet-related risks and physical inactivity				
High body mass	Mean body mass index (BMI kg/m^2)	23.4 (SE 0.09)	27.3 (SE 0.10)	SADHS 1998 adult data ages 15+ years[28]
	Proportion overweight (BMI 25-29.9)	19.8%	26.1%	
	Proportion obese (BMI 30+)	9.3%	30.1%	
Low fruit and vegetable intake	Average intake (g/day)	219	219	WHO/FAO 2003[29]
Physical inactivity	Proportion with no physical activity	43.4%	48.5%	WHS 2003[30]
Addictive substances				
Tobacco*	Proportion currently smoke daily	36.7%	9.4%	SADHS 1998[28] adult data ages 15+ years
Alcohol	Proportion consuming alcohol	44.6%	16.9%	SADHS 1998 adult data ages 15+ years[28]
Environmental risks				
Indoor smoke from solid fuels	Proportion households:			South African Census 2001[31]
	using solid fuels	33%	33%	
	using coal	7%	7%	

* Current smoking prevalence not used in calculation of tobacco population attributable fraction, because of lag effect (method described by Groenewald *et al*. (unpublished data)

SE: standard error

WHS 2003: World Health Survey 2003

SADHS 1998: South African Demographic and Health Survey 1998

3 IMPORTANT LIFESTYLE-INDUCED CANCERS IN SOUTH AFRICA

3.1 Aerodigestive cancers

In the South African population, lifetime risks of developing cancer of the upper aerodigestive system (including oesophageal, lung, oral cavity, nasopharyngeal and laryngeal cancers) are 1 in 20 for African males and 1 in 76 for African females.[32] Tobacco and alcohol consumption appear to be important risk factors for their development. However, only a few studies from Africa have investigated the relative importance of these exposures.

3.2 Lung cancer

3.2.1 Descriptive epidemiology

Lung cancer is the leading cancer worldwide, with an estimated 1.24 million new cases (12.3% of all cancers) having occurred in the year 2000.[1]

In South Africa in 2000, lung cancer, with its rather poor prognosis, was the leading cancer among males in terms of deaths (21.9% of all male cancer deaths)[15] but ranked second in terms of incidence (5.9% of all male cancers reported to the NCR in 1999).[19] In females, lung cancer ranked third in terms of deaths (10.9% of all female cancer deaths), and seventh in terms of incidence (2.4% of all female cancers). The age-standardised death rate for males was 42.3/100 000, with a much lower age-standardised incidence rate (ASR) 13.6/100 000. Lung cancer was more common from age 50 onwards, with an ASR of 28 in the 50-54-age group and peaking at ages 65-69 years, with an ASR of 89.

In females the age-standardised death rate was 13.8/100 000, and the ASR 4.4. Lifetime risk (age 0-74 years) of developing lung cancer was 1 in 59 in males and 1 in 177 for females in 1999.

The age-standardised mortality rate in 2000 was highest in coloured males and females (77.1 and 38.8/100 000, respectively), followed by white males and females (52.3 and 30.1, respectively). The death rate was lower in the African population at 31.1 and 6.3 for males and females, respectively, and lowest in the Asian population group (27.5 and 5.6 for males and females, respectively) (Table 12.2). The Western Cape had the highest lung cancer age standardized death rates, followed by the Eastern Cape and Gauteng provinces. Rates were lowest in Limpopo province (Fig. 9).

In 1999, the age-standardised incidence rate was also highest in coloured (23.5/100 000), and white (20.7) males, followed by Asian males (12.9), and lowest in African males (9.3), possibly because of underreporting in this population group. In females, age-standardised incidence rates in coloured and white females were similar and almost fivefold higher than in African females (9.7 vs. 2.0/100 000).[19] Coloured females, however, were at a slightly higher risk of developing lung cancer than white females (LR = 1 in 76 vs. 1 in 80, respectively).

Age-standardised rates reported for the Umtata Registry in the Eastern Cape were similar to the national incidence rates for the African population (15.7 and 3.6/100 000 for males and females, respectively) for the period 1996-1998, but lower incidence rates were reported in the PROMEC rural districts' registry for 1996-2000, (6.2 and 1.3 for males and females, respectively).[23]

The highest incidence rates for lung cancer occur in developed countries. Lung cancer rates in males in England (1993-1997, 53.1/100 000) were more than double the incidence rates in South African white and coloured males. In most developing countries, incidence rates are higher in the white population group than the black one, while in developed countries, such as the United States (1993-1997), the reverse is the case (ASR 86.5 for black vs. 55.6/100 000 for white people).[5] South African lung cancer incidence rates were higher than the West and Central African countries, such as Mali (4.8/100 000) and Uganda (1.5), but lower than North African countries, such as Tunisia. White male and female Zimbabweans in Harare (1990-1997) had the highest recorded lung cancer rates in Africa (ASR = 38.4 and 24.5, for males and females, respectively).[5] For African Zimbabweans (ASR for 1994-1997 = 12.1), rates were similar to South African rates in the African population in males, but for females, African females in Zimbabwe (5.9) experience double the incidence rate of African females in our country.

3.2.2 Lifestyle factors

Tobacco smoking

Tobacco smoking is the leading cause of lung cancer,[33] with a clear dose-response effect related to both duration of smoking and amount smoked. In 1985, it was estimated that about 76% of all lung cancer worldwide (84% of cases in males and 46% in females) could be attributed to tobacco smoking.[34] Preliminary results from the South African CRA study indicate that 78% of the lung cancer burden in males and 62% in females could be attributed to tobacco in 2000 (Table 12.4). Indications of a role for smoking in the development of lung cancer among more urbanised African males from Johannesburg and KZN in South Africa, and Bulawayo in Zimbabwe, have been observed since the 1960s with the incidence of lung cancer already beginning to rise at that time.[35,36]

A more recent case-control study in Limpopo province described the first association between smoking and lung cancer in African females. Although tobacco smoking was shown to be the most important risk factor for the development of lung cancer, environmental exposure to asbestos, a 'dusty' occupation in males and indoor air pollution may also contribute to the development of lung cancer in this province.[37] In males, the risks associated with lung cancer were 9.4 in heavy smokers (1-14 g tobacco daily) and 12 in light smokers (15+ g daily), compared with non-smokers. Female current smokers had a 5.5-fold increased risk of lung cancer compared with non-smokers.[37]

In 1995, an ongoing case-control study was initiated among newly diagnosed African cancer patients admitted to Chris Hani-Baragwanath, Hillbrow and Johannesburg Hospitals, which are the main teaching and public referral hospitals for cancer patients in Johannesburg and Soweto in the Gauteng province. These data were analysed to estimate the importance of tobacco and alcohol consumption and other suspected risk factors with respect to cancer of the oesophagus (267 males and 138 females), lung (105 males and 41 females), oral cavity (87 males and 37 females) and larynx (51 males).[38] Cancers not associated with tobacco or alcohol consumption were used as controls (804 males and 13 70 females). In males the risks for lung cancer relative to non-smokers were 6.8 in

ex-smokers, 6.2 in current light (1-14 g tobacco/day) smokers and 24.2 in current heavy (15+ g/day) smokers. Among females, the risks were 7.1 in ex-smokers, 10.7 in light smokers and 50.8 in heavy smokers.[38]

Estimates for smoking among South Africans vary considerably. In addition, usage varies between different communities, with smoking among coloured males and females being equally common, smoking by African females much lower than by African males, and the white community having intermediate rates.[39,40] In the South African Demographic and Health Survey (SADHS) of 1998, the national prevalence for current daily smoking was higher in African urban males (35.3%) than in white males (33.4%), although the prevalence in African urban females (5%) was lower than in white females (23.2%).[28]

The prevalence reported for the urban current daily smokers of all population groups in Gauteng was 35.5% for males and 10.8% for females.[28] The current cigarette smoking prevalence in the Johannesburg/Soweto case-control study was 32.8% for African males and 8.3% for African females in the control group.[38] A prevalence of 55% and 10% for males and females, respectively, was obtained for African adults in Gauteng from the multi-stage cluster sample survey conducted in 1995.[39] The lower rates found in the Johannesburg/Soweto case-control study could partially be explained by the fact that the study did not cover individuals who had access to private or company medical care.

Notwithstanding the limitations of cross-sectional studies, an analysis of adult data from the SADHS indicates that in the 25-34-year age group, the proportion of current daily smokers is about the same in African and white males. From age 35 years and older, the proportion of African men who are current daily smokers is actually higher than in whites (48.3% in African vs. 39.5% in white in the 35-44-year age group). It is only in the 15-24-year age group that African males have slightly lower smoking rates than white males.[40] African females, however, have much lower smoking rates than both white and coloured females at all ages.

Prevalence of cigarette smoking among South African grade 8-10 learners was 23%, with the highest rate reported among young coloured males (36%) and the lowest prevalence among African students (10.5%).[41] Although smoking rates are high in South Africa, average tobacco per capita consumption is lower than in countries with the highest lung cancer rates, particularly in the African population.[19]

The differences in smoking rates among the population groups at different stages of the health transition, as well as the gender differences, are reflected in the age-specific death rates for lung cancer presented in Fig. 6b. However, it is important to note that these death rates reflect exposure to tobacco in the past. Lung cancer death rates were highest in the coloured population in both genders, followed by white males and females. African males had lower rates than coloured and white males in the older age groups, but the lung cancer death rates in African males in the 35-44-year age groups (9 vs. 2/100 000) and 45-54 (57 vs. 30) are higher than in the white population (Fig. 6b).

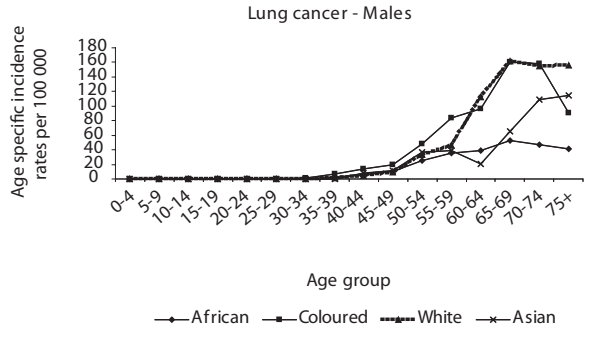

Figure 11: Age-specific incidence rates of lung cancer in males by population group, South Africa 1999[19]

Even with high levels of underreporting in the African population, the age-specific incidence rates for lung cancer in young African males were also higher than in young white males (6 vs. 4 in the 40-44-year, and 11 vs. 9 in the 45-49-year age groups). In the older age groups, the rates in African males were much lower than in white males (47 vs. 155 in the 70-74-year, and 44 vs. 155 in the 75+-year age groups) (Fig. 11). However, this was not observed in African females, where lung cancer incidence and death rates are lower at all ages.

The much lower smoking rates among female cases (45.4%), when compared to males (90.8%) in the Johannesburg/Soweto case-control study, indicates other causes for this cancer.[38] These could include among others, passive smoking (in the 1995 survey, 48% of all adults reported exposure to smoking by at least one household member),[39] exposure to indoor smoke from solid fuels during cooking and the presence of various infectious and inflammatory conditions, genetic, hormonal, and nutritional factors (males traditionally receive the best and most food when there are shortages).

Nutrition

In the comparative risk assessment study, preliminary results show that about 15-16% of all healthy years of life lost because of lung cancer could be attributed to low intake of fruit and vegetables (Table 12.4). The average daily fruit and vegetable intake per capita was very low (219 g in adults 15 years and older) in South Africa 2000 (Table 12.5).

Indoor smoke from solid fuels

Nationally, the proportion of households using solid fuels for cooking and heating is about 33%,[31] and it has been estimated that about 4% of lung cancer in females and 2% in males can be attributed to exposure to this risk factor (Table 12.4). In Limpopo province, about 80% of the population uses solid fuels as a primary source of energy for heating and cooking. Mzileni *et al*.[37] found a significant association between lung cancer and indoor pollution for both sexes combined (RR 2.0, 95% CI: 1.1-3.6) in this province. Contrary to what might be expected, the use of wood, coal or anthracite for heating was not a significant risk factor for lung cancer in the Johannesburg/Soweto case-control study. This may be attributable to low cumulative exposure since heating in the Johannesburg area is only necessary at night for a few months of the year, as winter days are mostly sunny and mild.[38]

3.2.3 Occupational exposure

Because of its long involvement in asbestos mining and processing South Africa has one of the highest incidence rates of mesothelioma in the world.[5] Incidence rates in the white population are similar to those in other countries where asbestos was formerly mined, such as Australia.[5,42,43]

Lung cancer was associated with birth or residence in areas where asbestos was mined in the South African case-control study by Mzileni and colleagues.[37] The study by Parkin *et al*.[36] in Zimbabwe, however, found no association between lung cancer and occupation in asbestos mines. In Zimbabwe mainly chrysotile asbestos is mined, whereas in South Africa crocidolite and amosite (associated with a much higher risk of lung cancer), as well as chrysotile, are mined. Excess lung cancer risks related to asbestos exposure have been found in white miners (standardised mortality ratio (SMR) 1.4 for amosite and 2.0 for crocidolite).[44]

South African gold miners have been observed to be at an increased risk of lung cancer in various cohort studies.[45-47] Two case-control studies, however, did not show an association, with most of the excess risk in the miners caused by smoking.[48,49] In a study by Hnidzo *et al*.[50] in 1997, an increased risk of lung cancer was found in patients with prior silicosis, after adjustment for smoking, but not with uranium production. In the Zimbabwean study, Parkin *et al*.[36] also found an increased risk of lung cancer in subjects who reported having worked in mines extracting nickel and copper (after adjustment for smoking) but not gold, chrome or coal. In a study among South African iron moulders, a significantly increased proportional mortality ratio for lung cancer was found in those who died after the age of 65 years.[51]

A slight increase in lung cancer with an odds ratio (OR) of 2.9 (95% CI: 1.1-7.5) in males working in 'potentially noxious' industries was observed in the Johannesburg/Soweto case-control study.[38] This group of industries included: metal and non-metallic mineral, chemical, petroleum, coal, rubber, plastics, wood and paper manufacturing and processing; the motor vehicle industry; construction; and mining and quarrying.

3.3 Oesophageal cancer

3.3.1 Descriptive epidemiology

The incidence of oesophageal cancer is high in the African populations of Eastern and Southern Africa and low in Northern, Western, and Central Africa. Despite certain data limitations making comparability difficult in some of the earlier surveys, South Africa

has experienced an enormous increase in the incidence of this cancer since the 1950s.[10] The risk was much higher than the national average in the Eastern Cape Province, particularly the rural areas of the former Transkei 'homeland'[52,53] where nutritional factors and consumption of maize contaminated with Fusarium sp may play an important role. Since the mid-1980s, the incidence of this cancer has decreased, as shown in the declining proportion of oesophageal cancers over time reported to the National Cancer Registry. The reasons for these secular trends remain uncertain.

Data from the PROMEC Registry in the Transkei have also shown an apparent decrease in the incidence rate of oesophageal cancer. The overall incidence rates for oesophageal cancer during the period 1996-2000 were 31.2 and 21.8 (per 100 000) in males and females, respectively, whereas during 1991-1995 higher rates of 76.6 and 36.5 for males and females, respectively, were recorded. Oesophageal cancer remained the most common cancer reported in males and females during the period 1996-2000, accounting for 63% of all male and 44% of all female cancer cases.[23] Data for 1981-1984[54] and 1985-1990[53] suggest that the incidence of oesophageal cancer has been declining in the high-risk districts of Butterworth and Centane, and increasing in the low-risk districts of Bizana and Lusikisiki. In 1996-2000, the highest male age-standardised rates were still recorded in Centane (44.8/100 000), followed by Lusikisiki (35.0), Bizana (31.0) but with Butterworth, the more industrialised district with an urbanised community, having the lowest rates (14.2).[23] The reasons for this equalization of the oesophageal cancer rates are also unclear, but it is possible, given the high rates of migration and differences in access to health services and diagnostic facilities between the two regions, that some of the previous differences in risk may have been exaggerated.[5]

The national ASR (11.3/100 000 in males and 5.5 in females), as reported by the NCR for 1999, was two to three times lower than current rates in Centane, Bizana and Lusikisiki districts. NCR incidence data for 1999 indicates that oesophageal cancer ranked third in males (5.2% of all male cancers) and fourth in females (3%). The lifetime risk of developing oesophageal cancer in males dropped from 1 in 65 in 1998 to 1in 73 in 1999. The risk of developing cancer of the oesophagus in males was double that of females (1 in 143 in 1999).[19]

Marked population group differences exist with the highest incidence rates observed in the African population. Oesophageal cancer was the second leading cancer in African males (ASR 14.1) with a lifetime risk of 1 in 59 in 1999. Among African females (ASR 7.0), it was the third leading cancer and the lifetime risk of developing it was 1 in 113 in 1999.19 Survival from oesophageal cancer is poor and it ranks higher in terms of deaths. In South Africa, oesophageal cancer was the second leading cause of cancer deaths in males (16.7% of all cancer deaths) and the fourth leading cause of cancer deaths in females (9.9%). Mortality rates were highest in the African population group, followed by the coloured, white and Asian groups. Oesophageal cancer was the leading cause of male cancer deaths in the African population (age-standardised mortality rate 41.4) and the second leading cause of cancer deaths after cervical cancer in African females (17.6) (Table 12.2), with relatively young age groups affected and rates increasing steadily from age 35-44 years (Fig. 7). The poorer Eastern Cape Province had the highest age-standardised mortality rates for oesophageal cancer for males and females in the country (Fig. 9). Mortality rates were also high in the North-West province.

Incidence rates recorded for African males (17.2/100 000) and females (8.4) in Harare, Zimbabwe, 1994-1997, were slightly higher than national African rates reported by the NCR for 1999. The age-standardised incidence rate (62.5) recorded for males in Umtata (1996-1998) was the highest recorded in Africa.[5] This cancer also ranks high in countries such as Iran and China, and is a leading cause of cancer deaths among male African Americans. The aetiology is not clear as these countries have very different cultures and diets.[23]

3.3.2 Lifestyle factors

Tobacco and alcohol

Worldwide, numerous case-control and cohort studies have shown that tobacco and alcohol increase the risk of oesophageal cancer, and that their joint effect is multiplicative.[33,55-57] Previous case-control studies from South Africa[35,58-60] and Zimbabwe[61] showed an elevated risk for tobacco smoking in the development of oesophageal cancer. Only a few local studies have shown that alcohol and tobacco consumption have independent (and combined) effects on risk.[10,38,62] The more recent studies will be discussed in detail.

A hospital-based case-control study in the former Transkei also found a positive association with smoking but not with drinking of traditional beer.[60] The 1988 hospital-

based case-control study in Soweto, however, found that alcohol and tobacco had an independent and multiplicative effect on the risk of developing oesophageal cancer[10] with an OR of 39 observed in heavy drinkers who also smoked heavily.

In the more recent Johannesburg/Soweto case-control study, black males and females who smoked heavily (15+ g tobacco/day) had a six-fold elevated risk of developing oesophageal cancer compared with non-smokers. 'Frequent' alcohol consumption, on its own, caused a marginally elevated risk for oesophageal cancer (OR 1.7, 95% CI: 1.0, 2.9, for females and OR 1.8, 95% CI: 1.2, 2.8, for males). For alcohol consumption in combination with smoking, the risks for oesophageal cancer increased significantly (OR 4.7, 95% CI: 2.8, 7.9 in males, and OR 4.8, 95% CI: 3.2, 6.1 in females)[38] compared with lifelong non-smokers and non-drinkers. The reason for the discrepancies in these results may be that many earlier studies were conducted when the principal beverages had a low (2-4%) alcohol content.

Nutrition

Other risk factors for oesophageal cancer include poor socio-economic conditions,[63] poor nutritional intake, and a diet lacking in vitamins A and C, riboflavin, nicotinic acid, magnesium and zinc.[58,64] Contamination of maize with Fusarium verticillioides (previously known as Fusarium moniliforme) and the consequent ingestion of mycotoxins (possibly fumonisins) produced by this fungus may also play a role.[65,66] Many of the world's 'hot spots' for oesophageal cancer are in populations that are poor and consume restricted diets. Maize, which has low levels of niacin, riboflavin, vitamin C and other micronutrients, is the staple in the Eastern Cape. In addition, homegrown and stored maize is often contaminated with Fusarium species, which produce mycotoxins recognised as being 'possibly carcinogenic' by an IARC (International Agency for Research on Cancer) working group.[67] Contaminated ears are often used for brewing beer while the 'good' ears are consumed as porridge.

At an average intake per capita of only 219 g/day in adult South Africans, preliminary results from the Comparative Risk Assessment study indicate that about 24% of oesophageal cancer burden in South Africa in 2000 could be attributable to low intake of fruit and vegetables.

Residence in the Eastern Cape

Various studies have been conducted in the former Transkei region of the Eastern Cape, where high incidences of oesophageal cancer were first recorded in 1955-1969.[52] The Johannesburg/Soweto case-control data confirm a higher risk for oesophageal cancer, following adjustment for other factors, for those patients who had lived in that area. Contrary to studies conducted in the Transkei, the case-control study found greater risks for females (OR 14.7, 95% CI: 4.7, 46.0) than for males (OR 3.1, 95% CI: 0.9, 10.8) of developing oesophageal cancer with 35 or more years of residence in the Eastern Cape. This can be explained by the fact that the Transkeian studies looked at individuals who were probably full-time residents of that area, whereas in the case-control study the males may have been migrant workers who still considered Transkei their home but who worked in the Johannesburg area most of the time.[38]

3.3.3 Infections

Infection with human papilloma virus (HPV) type 16 has been implicated as a risk factor for oesophageal squamous cell carcinoma, although the evidence is inconsistent.[68,69] It is possible that HPV is just an indirect measure of poorer environmental conditions known to be risk factors for the development of oesophageal cancer.

3.3.4 Genetic factors

Increased risks of oesophageal and upper-digestive tract cancers have been found in relation to the presence of the mutant allele of aldehyde dehydrogenase 2 (ALDH*2) in Japan.[70] ALDH2 is a key enzyme that eliminates acetaldehyde formed from alcohol. The mutation in ALDH*2 leads to inactivity of the enzyme and accumulation of acetaldehyde, which is thought to be a carcinogen. The relevance of ALDH2 metabolism in the epidemiology of oesophageal cancer in Africa, however, is unclear.[5]

3.4 Oral cancer

Oral cancers include cancers of the lip (excluding skin of lip), tongue, gum, mouth and salivary glands. Cancer of the mouth is the most common oral cancer in South Africa. It is more prevalent in males, comprising 1.5% of all male cancers but only 0.6% of all female cancers.

The risk of developing mouth cancer in males was more than three times that in females (1 in 254 for males, and 1 in 861 for females in 1999). The age-standardised incidence rate for cancer of the mouth was the highest in African males (2.8/100 000 in 1999) being the eighth leading cancer in this group. Age-standardised rates were also high for Asian females (2.8) and lowest in African females (0.7).[19] Incidence rates for cancer of the mouth are highest in Bombay, India. Female South African Asians rank second (to Indian females) worldwide and African males rank third in the world, with only males in India and blacks in the United States reporting higher rates.[19]

Mouth and oropharynx cancer ranked eleventh in South Africa in terms of deaths accounting for 3.3% of all cancer deaths in 2000. Age-standardised death rates were highest in coloured males (17.3), followed by African males (7.7) and then white males (6.7). Although Asian males had the lowest death rates, Asian females had the highest age-standardised mortality rates (5.2) among females in South Africa, 2000 (Table 12.2).

3.4.1 Lifestyle factors

Tobacco and alcohol

Tobacco is a risk factor for oral cancers, whether smoked[33] or chewed.[71] Chewing the areca (betel) nut is an important risk factor in Asian communities worldwide, including South Africa. Alcohol consumption is another important risk factor[55] and acts multiplicatively with smoking.[5] Differences in the prevalence and use of tobacco and alcohol may explain the differences in incidence between males and females in the different population groups.

In the Johannesburg/Soweto case-control study the OR associated with light smoking (1-14 g tobacco/day) in males was 6.1 (95% CI: 2.5, 14.8) and with heavy smoking (15+ g/day) it was 12.5 (95% CI: 4.6, 33.5). In females, the OR associated with light smoking was 3.9 (95% CI: 1.5, 10.3) but the risk of developing oral cancer was not significantly increased in female heavy smokers, possibly because of small numbers (OR 6.2, 95% CI: 0.9, 44.2). Daily alcohol consumption, adjusted for smoking, did not significantly increase the risk of developing this cancer in either sex.[38] Several studies have shown a significantly increased risk of developing mouth and oropharynx cancers with increased alcohol consumption, and preliminary results from the South African CRA study show that about 29% of the burden from mouth and oropharynx cancer in males and 16% in females is attributable to alcohol consumption (Table 12.4).

Nutritional factors

Diets low in fruit and vegetables, possibly because of a low intake of micronutrients, especially vitamin C, have been found to increase the risk of developing this cancer.

Infections

The HPV appears to play an aetiological role in cancers of the oropharynx and possibly oral cavity.[72] HPV-16 was the most common type of HPV DNA detected in tumour tissue.[72]

3.5 Laryngeal cancer

Laryngeal cancer was the eighth leading cancer in males (2.1% of all male cancers) with an ASR of 4.7/100 000 in 1999. The lifetime risk of developing cancer of the larynx in males was 1 in 168 in 1999. Cancer of the larynx was less common in females, comprising only 0.4% of all female cancers per year (ASR 0.8 in 1999).

Although laryngeal cancer was the fourth leading cancer in African males and ranked lower in the other population groups, coloured males had the highest incidence rate of laryngeal cancer (10.0), followed by white (5.2), African (4.1) and Asian males (1.1). In terms of age-standardised mortality rates, Asian males had the highest rates (11.5), followed by coloured (10.2), African (4.9) and white (4.1) males. Females of all population groups had very low and similar mortality rates.

3.5.1 Lifestyle factors

Tobacco and alcohol

In the Johannesburg/Soweto case-control study, 51 male cases of laryngeal cancer were compared with 804 controls with cancers not associated with tobacco or alcohol. Females were not included in the analysis because of the small number of cases. Almost all the males (49/51) with laryngeal cancer smoked. The risk of developing the cancer was significantly increased in both light (1-14 g tobacco/day) (OR 10.2, 95% CI: 2.1, 49.3) and heavy

(15+ g/day) (OR 23.6, 95% CI: 4.6, 121.2) smokers compared with non-smokers. Although a strong body of evidence exists for an increased risk of this cancer with increased alcohol consumption, this was not observed in the case-control study.[38] Results from the South African CRA study show that about 43% of laryngeal cancer burden in males is attributable to alcohol consumption (Table 12.4).

3.6 Female breast cancer

3.6.1 Descriptive epidemiology

Breast is the most common cancer in females worldwide and accounts for about one quarter of all female cancers.[73] The WHO estimates that just over a million new breast cancer cases occur worldwide annually. Increasing breast cancer trends are reported particularly in previously low incidence regions, including Africa and Asia, and increases greater than 1% per year have been reported in developing countries.[5,74,75] In Uganda, increasing breast cancer incidence rates have been observed since 1960.[76]

Breast cancer was the second leading cause (15.6%) of cancer deaths in females in South Africa in 2000 (Table 12.1). The more developed provinces, Western Cape and Gauteng, had the highest age-standardised breast cancer deaths rates, with Mpumalanga having the lowest rate (Figs. 8 and 9).

Breast cancer was the leading cause of cancer deaths among South African white females. The age-standardised death rate was highest in white females (35.2/100 000), almost three fold higher than in African females (12.7), followed by coloured (32.7) and Asian females (28.5). The age-specific death rates for breast cancer by population group are shown in Fig. 7. Death rates are very similar in the younger age groups (2 in African, 1 in coloured and 4 in white females in the 25-34-year age group, and then 10 in African, 18 in coloured and 17 in white females in the 35-44-year age group). It is only in the older age groups that African females have much lower rates (101 in African females compared with 295 in white females in the 75+-year age group). This pattern is also evident in terms of incidence.

Breast cancer was the leading female cancer in terms of incidence in 1999. In that year, 19.4% of all the cancers reported to the National Cancer Registry were breast cancer (5589 cases). The age-standardised incidence rate in 1999 was 34.6/100 000 and the risk of developing breast cancer in females was 1 in 26 in the age range 0-74 years (Table 12.3).[19] About 50% of female breast cancers occur in women 55 years and older. Breast cancer incidence rates increase with age with rates as high as 162/100 000 in the 75+-age group. Much lower rates were reported in women younger than 55 years: the age-specific incidence rate in women aged 35-39 years was about 24. Similar rates were reported in a study in the Western Cape on African and coloured females younger than 55 years, which showed an overall incidence rate of 23 in 1994/5.[77] About 58% of the breast cancers in women younger than 55 years were diagnosed at stages 1 and 2, while 42% were diagnosed at advanced stages (3 and 4).[77]

There are also marked differences in incidence among the different population groups. Since the establishment of the NCR in 1986, breast cancer has been the leading incident cancer in white females, with ASRs ranging between 64 in 1993 to 76.5 in 1999, and a lifetime risk as high as 1 in 12 in 1999.[19,32] Coloured and Asian females had similar ASRs of 49.8 and 49.6, respectively,[19] with a lifetime risk of developing breast cancer of 1 in 18. In 1999, the national overall incidence rate in African females was 18.4. Again, the differences in rates between the white and African females are more pronounced in the older age groups, while in the younger age groups, the incidence rate in African females is closer to that of white and coloured females (Fig. 12).

Incidence rates for breast cancer appear to have been increasing in the four districts of the Transkei region from 1996-2000 when compared with the 1985-1990 and 1991-1995 periods.[23] Breast cancer was the third most common cancer among women reported to the PROMEC cancer registry from 1996-2000, accounting for 16% of all female cancers. Incidence rates in African women in the more urban Butterworth district (14.9) were similar to national rates for African women, with much lower rates reported in the Centane (6.1), Bizana (5.6) and Lusikisiki (3.7) districts.[23]

Breast cancer rates in sub-Saharan Africa are significantly lower than those reported for other continents. In Africa, white women in Harare, Zimbabwe, had the highest rates (ASR for 1990-1997 121.2), followed by South African white women (ASR for 1999 76.5). Despite the underreporting of the NCR in South Africa, rates in African females are comparable with those reported in developing countries. However, rates in South African Asian females are almost double those reported in Bombay, India.[19]

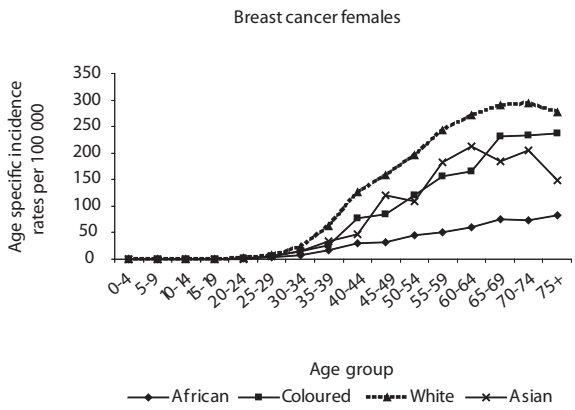

Figure 12: Age-specific incidence rates for female breast cancer by population group, South Africa 1999[19]

3.6.2 Reproductive factors

Reproductive and hormonal factors are the most important known risk factors for breast cancer.[5,73,74] Breast cancer is known to occur more frequently among women with the following history: early menarche; who are either nulliparous, have few children or have their first birth at late age; and have a late menopause. Young coloured females who began menstruation at age 13 were found to have slightly increased, but not statistically significant, risk of developing breast cancer (OR 1.3, 95% CI: 0.8, 2.0) relative to those starting at age 17 or older ages. Although this association appeared stronger among African females (OR 1.9, 95% CI: 0.5, 7.4), it was also not statistically significant.[78] Deliveries occurring before age 30 have been shown to have a protective effect,[79] while in Uganda Ssali *et al*.[80] showed an increased breast cancer risk from age of delivery of 22 years or more (OR 4.3, 95% CI: 1.7, 10.8).

Available evidence shows no association between the use of injectable progestogen contraceptives and the development of breast cancer.[81,82] A small but increased risk (OR 1.2, 95% CI: 1.0, 1.5) was found in African and coloured females who were using oral contraceptives and this association was strongest in females younger than age 35 (OR 1.7, 95% CI: 1.0, 3.0).[81] Post-menopausal oestrogen therapy showed a small increase in risk with longer duration of use, while hormone replacement therapy (HRT) in post-menopausal females has shown a two-fold increased risk in current users, compared to never-users.[83]

3.6.3 Lifestyle factors

The risk of breast cancer is clearly associated with socio-economic status, with females with higher education or income being at higher risk.[5,84] These differences may be attributable to the prevalence of risk factors between the social classes, such as the reproductive factors mentioned above and other known risk factors for the disease including alcohol consumption, diet, smoking, body weight, physical activity and genetic factors. The evidence of smoking on breast cancer remains inconclusive. Increased body weight has been found to increase the risk, whereas physical activity has been found to be beneficial at all ages in reducing risk. Physical inactivity, though, has harmful effects and the prevalence of this risk factor is extremely high in South Africa. As a result, preliminary results from the risk factor study indicate that about 17% of breast cancer cases are attributable to physical inactivity. Obesity is another common problem, and high body mass accounts for about 15% of post-menopausal breast cancer. Hazardous and harmful alcohol consumption is low among females in South Africa and hence only about 6% of breast cancer can be attributed to this risk factor.[27]

3.6.4 Genetic factors

Familial risk of breast cancer is mediated through the major susceptibility genes BRCA1 and BRCA2. Around 2% of breast cancers are likely to be attributable to BRCA1 mutations in European females. Not much is known of the prevalence of mutations in BRCA1 and BRCA2 in African populations.[5]

3.7 Liver cancer

The highest liver cancer incidence rates have been reported in Western and Central Africa, Eastern and South Eastern Asia and Melanesia. In most countries, males were at least twice as likely to develop liver cancer as females.

Low incidence rates were observed in South Africa. Liver cancer is grossly under-reported by the NCR because the liver is not commonly biopsied. This is largely because of complications, as well as the widespread availability of less invasive methods of diagnosis, such as alpha-fetoprotein (AFP) and sonography. Unfortunately, the NCR does not receive reports on AFP levels from pathology laboratories.

Liver cancer only comprised about 1.2% of all male cancers reported to the NCR in 1999. The lifetime risk of developing liver cancer in males was almost twice that in females (1 in 369 in males and 1 in 695 in females). The age-standardised incidence rate was highest in African males (2.6/100 000) and females (1.3).

As this cancer has a very poor prognosis, the number of deaths should not be very different from the number of new cases. Underreporting of liver cancer to the NCR resulted in age-standardised death rates being much higher than age-standardised incidence rates in South Africa. Liver cancer was the fourth leading cause of cancer death in males (7.8% of cancer deaths) and the sixth in females (4.9% of cancer deaths). The age-standardised mortality rate was highest in the African population (16.3 and 6.6, for males and females, respectively). The coloured population ranked second (9.1 and 8.6), followed by Asians (7.7 and 6.5) and whites (7.8 and 5.1).

Low incidence rates were also reported for African males by the PROMEC Registry. The highest incidence rates were reported in Centane and Bizana (both had ASRs of 4.1), followed by Lusikisiki (3.8) and Butterworth (3.2), with very low rates reported for females in all districts.[23] Other countries in Africa had much higher incidence rates of liver cancer; for example, The Gambia (ASR 48.9 in males for 1997-1998) and Africans in Harare in Zimbabwe (ASR 26.0 in males for 1994-1997).

3.7.1 Infections

Hepatitis B infection

Many case-control studies have confirmed the relationship between infection with hepatitis B virus (HBV) and liver cancer.[85] The recognition of the hepatitis C virus (HCV) and its role in hepatocarcinogenesis is more recent.[85] It seems that HCV causes liver cancer by chronic hepatitis and cirrhosis, both known to act as precursors of liver cancer through the intense hepatocyte regeneration occurring in these conditions.[5]

In a South African case-control study of the relative roles of hepatitis B and C in the aetiology of hepatocellular carcinoma in black hospital patients, the presence vs. absence of HBV surface antigen (HBsAg) (OR 21.8, 95% CI: 8.9, 53.4), as well as the seroprevalence of antibodies to HCV (HCV Ab) (OR 6.1, 95% CI: 2.8, 13.7) were associated with a significantly increased risk of hepatocellular carcinoma.[86] The effects of combined infection with HBV and HCV are not very clear. Kew *et al*.[86] observed an 82.5-fold increased odds of developing liver cancer in patients who were both HBsAg and HCV Ab seropositive.

3.7.2 Lifestyle factors

Aflatoxin contamination of local food samples

Aflatoxins are produced by moulds of the *Aspergillus* species, which infect stored grains and nuts. Aflatoxin B has been classified by IARC as a human carcinogen. In Africa, high levels of contamination have been found, particularly in groundnuts and maize. Significant rank order correlations between aflatoxin intake and primary liver cancer incidence in gold miners in the former Transkei districts were observed.[87]

Alcohol consumption

Alcohol consumption is another important risk factor. English *et al*.[88] found a 45% elevated risk of liver cancer in males and females who drink responsibly, while the risk was increased three-fold in males and 3.6-fold in females who drank in the hazardous and harmful alcohol categories. Results from the South African CRA study indicate that 30% of liver cancer burden in males and 17% in females are attributable to alcohol consumption (Table 12.4).

3.8 Non-melanoma skin cancers

Non-melanoma skin cancers are often difficult to ascertain because these cancers, although very common, are rarely fatal. Completeness of registration varies widely. About 2.75 million new cases of skin cancer are diagnosed worldwide every year.[89] Around 75% of skin cancers are of basal-cell origin (BCC), about 22% are squamous-cell (SCC), and about 3% are other skin carcinoma.[90] In Africa, incidence rates are low in the black and high in the white population.

In 1999, about 23% and 16% of all new cancers in males and females, respectively, were BCC, and about 7% and 4% in males and females, respectively, were SCC. Combined, these non-melanoma skin cancers comprised relatively high proportions of all male and females cancers every year. As opposed to melanoma, which develops later in life, non-melanoma skin cancers occur at younger ages. In males in 1999, age-specific incidence rates in the 35-39-year age group were as high as 20/100 000, increasing to 884 at ages 75 and older. The estimated risk in males in 1999 was about double that of females: 1 in 12 South African males and 1 in 25 females had a lifetime risk of developing this cancer, with an ASR of 74.5 for males and 38.6 for females.[19]

More than 80% of non-melanoma skin cancer reported to the NCR during the period 1998/99 occurred in the white population (both sexes). The highest ASR occurred in white males and females (271.1 and 149.9, respectively). The lifetime risk of developing this cancer was 1 in 4 in white males and 1 in 7 in white females. ASRs were also high in the coloured population group (62.9 and 30.8 in males and females, respectively). Age-standardised incidence rates were low in Asian and African population groups.

Whites in Zimbabwe had the highest incidence rates in Africa (635.3) for the period 1990-1997.[5] Both melanoma and non-melanoma skin cancer incidence rates in white South Africans were high and similar to that observed in Australian Caucasians but about four-fold higher than rates reported in the UK and France.[5,19] The African population in South Africa had higher incidence rates than seen in other parts of Africa, probably because of the fairer skin in black South Africans compared with a darker skin in other parts of Africa.

Non-melanoma skin cancer ranked very low in terms of deaths, accounting for only 0.6% of all cancer deaths in South Africa 2000. Age-standardised deaths rates were low in all population groups.

3.8.1 Lifestyle factors

Susceptibility to skin cancer is inversely related to the degree of melanin pigmentation. The incidence of non-melanoma skin cancer increases in frequency with increasing proximity to the equator and fair-skinned populations exposed to ultra violet (UV) radiation are at high risk.

In Africa, these cancers also commonly occur because of depigmentation attributable to chronic scarring, and have been associated with tropical scars.[5,19] The majority of these are SCC and usually located in the lower limbs. SCC following leg ulcers was shown to decrease in Tanzania because of improved treatment of tropical ulcers and better nutrition.[5]

3.9 Prostate cancer

On a global basis, prostate cancer is the third most common cancer in males with most of this cancer burden occurring in Europe and North America. A general increase in prostate cancer rates has been reported worldwide.[5,91]

Increases in prostate cancer incidence rates are mainly attributable to the increasing use of the prostate specific antigen (PSA) diagnostic test as a screening tool. Between 1988 and 1994, the incidence rate of prostate cancer in New South Wales, Australia, rose by 125%, and overall the age-standardised mortality rate fell by 19% between 1991 and 2001.[92] Prostate cancer incidence rates are therefore largely influenced by screening. Incidence rates are likely to increase in population groups where screening for this cancer is common.

In South Africa, the incidence rate in white males has increased almost three-fold, but this increase was not observed in African males. The ASR in white males increased from 27.1 in 1988, to 63.5 in 1997, to 74.4/100 00 in 1999[19,93,94] The increase in ASR for African males has been relatively small: from 14.4 in 1988 to 17.2 in 1999. Further studies are needed to confirm the accuracy of prostate cancer incidence rates in the African population in South Africa, to help resolve the uncertainty around underreporting in this group.[19]

Prostate cancer was the leading incident cancer in males in 1998 and 1999, comprising, on average, 13-14% of all male cancer cases. The age-standardised incidence rate was 34.1 for males in 1999 with a lifetime risk of developing the disease of 1 in 24.[19]

A shift from oesophageal cancer as the leading incident cancer in African males to prostate cancer from 1996 onwards was observed by the NCR. Prostate cancer is now the leading male cancer in all population groups. The risk of developing the cancer in whites in 1999 (1 in 10) was twice that in coloureds (1 in 19), four times that in Asians (1 in 39) and five times that in Africans (1 in 50).

This is a cancer of the elderly, with more than 75% of cancers worldwide occurring in males aged 65 years and older and the risk increasing steeply with age. This steep increase was observed in both age-specific incidence and death rates in South Africa (see Fig. 3 for death rates).

In terms of deaths, prostate cancer is the third leading cancer in men, accounting for 11.8% of all male cancer deaths. The age-standardised mortality rate for all males in South Africa in 2000 was 26.8/100 000. White males had the highest age-standardised deaths rates (41.1), followed by coloureds (33.2), Africans (22.9) and Asians (13.2). In white men, the ratio of incidence to mortality for this cancer is 1.8, while in Africans the death rate is actually higher than the incidence rate.

The overall incidence of prostate cancer in the four districts of the Transkei was low (3.6) compared with national rates reported by the NCR. The more industrialised district of Butterworth had the highest ASR (7.4), followed by Centane (3.5), Bizana (2.1) and Lusikisiki (1.3).

Relatively high incidence and mortality for this cancer have been recorded in African populations and in populations of African descent.[5] In the United States, the incidence rate in the black population is about 72% higher than the white population.[5] The higher rates in the South African white population probably reflect better access to modern diagnostic and treatment methods, as well as testing for PSA.

3.9.1 Lifestyle factors

The environmental risk factors for prostate cancer are not well understood. Several studies have implicated dietary fat in the aetiology of prostate cancer, and there is a strong association with intake of animal products, especially red meat. There is little evidence of a link with high body mass or for a protective effect from high fruit and vegetable intake and physical activity.

3.9.2 Genetic factors

Genetic factors rather than diet may explain observed racial differences and elevated risk in men with a family history of prostate cancer, but no studies have been carried out in Africa.

3.9.3 Infections

In a recent study by Fernandez *et al.* 2005,[95] the risk of prostate cancer increased among males with a history of sexually transmitted infections (OR 1.7, 95% CI: 1.1, 2.5) and among males who reported having sexual intercourse more than 7 times per week compared with males who reported a weekly frequency of 3 times or less (OR 2.1, 95% CI: 1.2, 3.7). This study supports the hypothesis that an infectious factor related to sexual behaviour could be involved in the occurrence of the cancer.

3.10 Colorectal cancer

Colorectal cancer is the second most common fatal malignancy in affluent societies (second to lung cancer) but rarer in developing countries. In 2000, colorectal cancer was the fourth most common cancer in the world. About 945 000 new colorectal cases are reported worldwide each year.[5,96] A general increase in international incidence trends for cancers of the colon and rectum was reported during 1960-1980 in both sexes.[97,98] Data from Uganda showed an increase in colorectal cancer incidence rates of more than two-fold from 1960-1966 to 1995-1997 (ASR of 3.0/100 000 to 6.8 in males, and from 2.7 to 6.6 in females).[76]

Earlier data from the 1960s showed that a large proportion of colon cancers in Africa occurred mostly on the left side.[5] Recent studies conducted at Pelonomi Hospital in South Africa, Ghana and Nigeria show that most colorectal cancer patients presented late with advanced disease and a higher proportion on the right side.[99-101]

In South Africa, colorectal cancer is the sixth leading cause of cancer deaths among males (5.4%) and the fifth among females (6.9%). Colorectal cancer is an important cause of cancer deaths in the white population. The age-standardised death rate was more than 5 times greater in the white population (22.6) compared with the African population (4.3).

In 1998/1999, colorectal cancer comprised 3.7% of male and 3.4% of female cancer incident cases and ranked fourth and third in males and females, respectively.[19] The age-standardised incidence rate for colorectal cancer in males was 9.7, while that in females was lower 6.6. Colorectal cancer incidence rates were also highest among white males and females (Table 12.3).

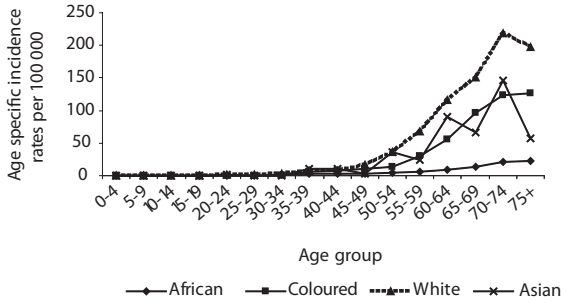

Figure 13: Age-specific incidence rates for colorectal cancer in males, South Africa 1999

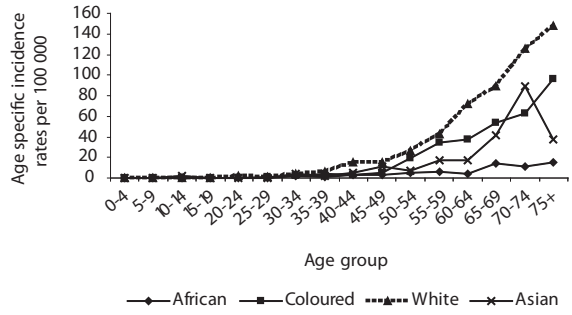

Figure 14: Age-specific incidence rates for colorectal cancer in females, South Africa 1999[19]

In 1999, colorectal cancer was the second leading cancer in white males and females. Asian and coloured males had similar ASRs with the lowest rates reported in African males.[19] The incidence rates in the white population (ASR 25.4/100 000 in males and 17.5 in females) were more than eight times the rates found in African males (3.0) and females (2.3).

Colorectal cancer incidence increases with age. Before age 40 years, the risk is higher among individuals with genetic predisposition or predisposing conditions, such as chronic inflammatory bowel disease.[102] In a 15-year study conducted at Groote Schuur Hospital, 47 colorectal cancer patients younger than 30 years were reported, with a higher incidence among the coloured population.[103]

Age-specific incidence rates for colorectal cancer by population group are illustrated in Figs. 13 and 14. An increasing risk in younger Africans may be the result of changing lifestyle and diet, resulting in a narrowing of the incidence gap observed in elderly South Africans. At young ages the incidence and death rates of the African, white and coloured population groups are almost the same (Fig. 6a, Figs. 13 and 14). At older ages there is a nine-fold difference in incidence in the older groups (in males 75 years and older: ASR 198 in white, 127 in coloured, 57 in Asian and 22 in Africans). However, there is very little difference in incidence in the younger age groups (in males 40-44 years: ASR 8 in coloured and white males, and 3 in Africans). This was also observed in terms of age-specific death rates (Fig. 6a).

Colorectal cancer rates in Asian, coloured and white South Africans are intermediate between those reported in developed and developing countries. NCR rates in Africans were two- to three-fold lower than those reported in other African countries, such as Africans in Zimbabwe (7.4 in males and 6.7 in females in 1994-1997). However, rates in Asian South Africans were 2.5 times higher than in Bombay, India, probably reflecting different diets and lifestyles led by these groups.

3.10.1 Lifestyle factors

Diet-related risk factors and physical inactivity

The risk of developing colorectal cancer is determined by local environmental conditions within the bowel.[104] Diets high in calories, rich in animal fat and poor in vegetables and fibre are associated with increased risk while physical activity is known to be protective.[105,106] About 10% of colorectal cancer burden in males and 20% in females in South Africa can be attributed to high body mass, 3% to low fruit and vegetable intake, while higher proportions, 26% and 28% of colorectal cancer burden in males and females, respectively, can be attributed to physical inactivity (Table 12.4). The joint effects of these risk factors on colorectal cancer have yet to be determined.[27]

Tobacco and alcohol

Some case-control studies investigating the effect of smoking on colorectal cancer have shown a positive association in males, with ORs ranging between 1.5 (95% CI: 1.1, 2.1) and 1.7 (95% CI: 1.3, 2.3) for smokers smoking more than 20 pack-years and rectal cancer. Among non-smokers exposed to cigarette smoke, a 50% increased risk was observed (OR 1.5, 95% CI: 1.1, 2.0).[107] However, other studies have shown no effect and colorectal cancer does not appear to be associated with smoking. Evidence for a causal relationship between alcohol and colorectal cancers has not yet produced consistent results.

Other risks

Ulcerative colitis, Crohn's disease, and therapeutic pelvic irradiation are other known risk factors for colorectal cancer. Crohn's disease increases the risk of colorectal cancer three-fold.[108] Studies on the association of nitrate (in public water supplies) with colorectal cancer show an increased risk for nitrate exposure levels averaging more than 5 mg/L over a period of 10 years among susceptible populations, such as subpopulations with low vitamin C intake (OR 2.0, 95% CI: 1.2, 3.3) and high meat intake (OR 2.2, 95% CI: 1.4, 3.6).[109] Other risk factors that were significantly associated with high risk of colon cancer include intestinal bacteria *Bacteroides vulgatus, Bacteroides stercoris, Bifidobacterium longum* and *Bifidobacterium angulatum*. Lactobacillus SO6 and *Eubacterium aerofaciens* are associated with low risk while total lactobacilli were found to be inversely related to risk.[5,110] Certain inherited conditions like hereditary polyposis coli are known to predispose persons to large bowel cancer, but the frequency of these conditions in the South African population is unknown.

3.11 Bladder cancer

Bladder cancer is the ninth most common cancer worldwide and accounts for two-thirds of all urinary tract cancers. About 336 000 new bladder cancer cases are reported worldwide every year.[96]

In South Africa, bladder cancer occurs most frequently in males with a risk three-fold higher than in females. In 1999, bladder cancer was the fifth most common cancer in males (3.5% of all cancer cases) with an ASR of 8.2/100 000. In females, it ranked eleventh with an ASR of 2.4.

In 1999, bladder cancer was the third leading cancer in white males with the highest ASR of 23.7 and a lifetime risk (0-74 years) of 1 in 35. In both coloured and Asian males, bladder cancer ranked fifth in 1999. In 1999, the incidence rate in African males (ASR of 1.5 and a lifetime risk of 1 in 527) was about 16 times lower than that observed in white males. The pattern in females was similar to that in males. White females had the highest incidence rates (6.3), followed by coloured (2.8) and Asian (1.8) females with African females having the lowest rates (0.8).[19]

The prognosis is good for this cancer and hence bladder cancer ranks much lower in terms of deaths. Bladder cancer was the 12th leading cause (2.2%) of cancer deaths in males and the 16th leading cause (1.0%) of cancer deaths in females. Age-standardised mortality rates were about four-fold higher in males (4.7) than in females (1.2). The highest age-standardised death rates were observed in coloured males (9.6), followed by white males (8.7), Asian males (4.0) and lowest in African males (2.4). Death rates were very low in African and Asian females.
Bladder cancer is characterised by marked differences in histology between African and white South Africans. In Africans, 36% of bladder cancers are squamous cell carcinomas (SCC) and 41% transitional cell carcinomas (TCC). Among whites, 2% are SCC and 94% are TCC.[5]

African males compare well with males from other African countries with low rates of 1.9 in 1997[94] and 1.5 in 1999[19] compared with Uganda (2.9 in 1993-1997) and Setiff in Algeria (4.0 in 1993-1997). Incidence rates in Africans in Harare (7.1 in males and 8.5 in females in 1994-1997) are several-fold higher than those in Africans in South Africa and most other African countries, with similar incidence in males and females. Incidence rates in South African Asians are high

and are four times those reported in Bombay, India. Incidence trends for this cancer appear to be increasing moderately or steadily in many parts of the world, including Europe, Asia, and America, except for Columbia where an average decrease of 35% was reported in both sexes.[98]

3.11.1 Lifestyle factors

Tobacco

Cigarette smoking is the most important risk factor for bladder cancer and shows a linear increasing relationship with the number of cigarettes smoked per day and the duration of smoking. In developed countries, 65% of all bladder cancer cases in males and 30% in females are attributable to tobacco.[5,96] Provisional results from the South African CRA study indicate that about 18% of bladder cancer in males can be attributed to tobacco.[27]

Epidemiological studies (that controlled for confounders) showed that the risk of bladder cancer is significantly increased in male smokers (OR 6.6, 95% CI: 3.1, 13.9). The strength of the association depends on the histological type, with the risk higher for TCC (OR 9.1) than other histologies (OR 4.4), as well as the duration and magnitude of smoking relative to non-smokers. Relative to never-smokers, those smoking less than 20 cigarettes/day had a relative risk of 5.4, while those who had smoked for 20 years or more had a relative risk of 7.6. A higher risk (OR 16.5) was observed among smokers who had smoked for more than 40 years.[5,112,113]

Nutrition

A diet rich in vitamin A and carotenoids has been associated with a decreased risk of bladder cancer.

3.11.2 Infections

There is a strong association between bladder cancer and infection with urinary schistosomiasis, based on evidence from clinical series, correlation studies, and case-control studies[5]. Most of the evidence is based on the larger proportion of SCC occurring concurrently with the presence of Schistosomiasis infection and the younger age (average 44 years) at diagnosis with bladder cancer. ORs of 15 (95% CI: 2.0, 114) and 6.5 (95% CI: 1.5, 29) (not adjusted for confounding factors) have been reported in Zimbabwe. After adjusting for confounders, including tobacco smoking, age, province of origin, education and occupation, relative risks of 3.9 (95% CI: 2.9, 5.2) and 5.7 (95% CI: 3.7, 8.7) were reported.[5,113]

3.11.3 Occupation

Some other known risk factors for bladder cancer, which have not been investigated in Africa, are related to occupation. These include rubber and dyestuff industries, exposure to aromatic amines, polychlorinated biphenyls, polycyclic aromatic hydrocarbons, formaldehyde, asbestos, leather manufacturers, and painters.[5]

3.11.4 Genetic factors

Several studies have demonstrated an increased risk of bladder cancer associated with glutathione S-transferase 1 (*GSTM1*) polymorphism. *GSTM1* is involved in conjugation of reactive chemicals such as nitrosamines. The relative risk associated with the null genotype of *GSTM1* ranges between 2.99 (95% CI: 1.0, 9.0) and 6.97 (95% CI: 1.34, 45.69).[114,115]

3.12 Stomach cancer

Stomach cancer was the most common cause of cancer mortality worldwide in 1980, but incidence and mortality has declined dramatically in recent years.[116] Stomach cancer is now about the fourth most common cancer in the world, with high incidence rates reported in Japan. However, incidence is lower in Africa possibly because of the rapid fatality rate and poor diagnosis of this cancer.

In South Africa in 1999, stomach cancer ranked sixth in males accounting for 2.6% of all male cancers reported to the NCR. The ASR has remained constant over time at about 6.0/100 000 in males. The risk of developing stomach cancer in males was three times that in females. The incidence of stomach cancer was highest among coloured males (ASR 16.3) where it ranked third, followed by Asian males (ASR 12.8) where it ranked fourth. African males and females had the lowest rates.[19]

The age-standardised death rate was also highest in coloured males (27.0) followed by Asian (23.7), white (17.3) and African (7.4) males. Stomach cancer death rates were high in coloured and Asian females (13.6 and 13.8, respectively) and lower in white and African females.

Incidence rates for stomach cancer are higher in developing countries with particularly high rates reported in Brazil and Mali.[111] In Mali, incidence rates for stomach cancer (17.3 in males) were more than three times higher than the overall rates in South African males in 1999. Rates in African females in Harare, Zimbabwe, (10.3) were more than 9 times the rates reported for African females by the NCR (1.4). The very low rates in the South African population are probably a result of underreporting. Incidence rates in Asian females in South Africa, however, were almost three times the rates reported for Indian females in Bombay.

3.12.1 Infections

Several studies have shown that infection with the bacteria *Helicobacter pylori* is one of the main risk factors for the development of stomach cancer. Infection with this organism causes chronic active gastritis, eventually leading to chronic atrophic gastritis, a key precursor of stomach cancer.[116] Infection rates as high as 80% have been reported in South Africa; however, it is important to note that most infected people will remain asymptomatic and will not develop gastric cancer. Conversely, gastric cancer can occur in the absence of *H. pylori*.

3.12.2 Lifestyle factors

An increased risk for this cancer has been associated with the consumption of smoked, pickled, and preserved foods. Low fruit and vegetable intake is another important risk factor, with about 24% of stomach cancer burden attributed to this (Table 12.4). High intake of antioxidants and refrigeration of food are protective factors. Decreasing infection with *H. pylori*, improvements in diet and domestic refrigeration have been responsible for the decreasing incidence of this cancer worldwide, but high salt intake, alcohol consumption and smoking remain important causes of stomach cancer.[116]

3.13 Melanoma

Melanoma is the third most common skin cancer worldwide after BCC and SCC of the skin. Melanoma comprised 2.6% of all male cancers in South Africa during 1998 to 1999. South African males had an ASR of 5.6/100 000 in 1999, with a lifetime risk of 1 in 150 of developing melanoma. Males had a 52% greater risk of developing melanoma than females. Melanoma comprised 2.4% of all the cancers reported in females, with an ASR of 4.2.[19]

Melanoma was more prevalent among white males comprising about three-quarters and females about two-thirds of all melanoma cases over the period 1998-1999. In 1999, melanoma was the third and fourth leading cancer in white females and males, respectively. The ASR was highest in white males (20.9), with a lifetime risk of 1 in 43, which is 16 times greater than the risk in African males. Rates were also highest in white females, with an ASR of 16.7.

Melanoma incidence rates in white South Africans are among the highest in the world, second only to Tasmania where rates as high as 27 and 28.7 in females and males, respectively, have been reported.[111]

Melanoma, as a cause of cancer deaths, ranked 19th, accounting for 1% of all cancer deaths in South Africa 2000 (Table 12.1). Age-standardised death rates were highest in white males (6.6) and females (4.8) and very low in all other population groups.

3.13.1 Lifestyle factors

The major risk factors for melanoma are exposure to the sun, a fair skin, and naevi (freckles). Ethnic origin and climate play important roles. Early age at first exposure to sunlight in fair-skinned population groups, as well as cumulative sun damage, are important risk factors.[5]

3.14 HIV/AIDS and cancer

Clusters of Kaposi's sarcoma (KS) emerging in the United States among homosexual males in conjunction with *Pneumocystis carinii* pneumonia in the late 1970s led to the discovery of acquired immune deficiency syndrome (AIDS) by the US Center for Disease Control.[21] There is little evidence, however, that the human immunodeficiency virus (HIV) plays a direct oncogenic role in the development of cancer. HIV is rather thought to promote the development of cancer through its effect on the immune system.[94]

Despite the high prevalence of HIV infection in South Africa, information on its association with cancer is sparse. A recent study examined the relationship between HIV and some common cancers in South Africa. In the control group, the prevalence of HIV infection was 8.3% in males and 9.1% in females. Significant excess risks associated with HIV infection were found for KS (OR 21.9, 95% CI: 12.5, 38.6), non-Hodgkin lymphoma (OR 5.0, 95% CI: 2.7, 9.5), vulvar cancer (OR 4.8, 95% CI: 1.9, 12.2) and cervical cancer (OR 1.6, 95% CI: 1.1, 2.3), but not for any of the other major cancer types examined, including Hodgkin's disease, multiple myeloma and lung cancer. The relative risks for KS and non-Hodgkin lymphoma associated with HIV infection were substantially lower than those found in Western countries.[117]

3.15 Kaposi's sarcoma

3.15.1 Descriptive epidemiology

Before the onset of HIV/AIDS, KS was endemic in parts of sub-Saharan Africa, such as Uganda and the Democratic Republic of Congo, comprising about 9% of cancers in males. KS occurred to a lesser extent in South Africa and was very rare in other parts of the world. With the HIV/AIDS epidemic, KS has become the leading cancer in African countries with high HIV prevalence. Endemic KS affects predominantly the skin of the lower limbs and is primarily a disease of the elderly. In the epidemic form of KS, the lesions are usually multiple and may affect any area of the skin as well as internal organs, with incidence peaks also in the younger, sexually active age groups.

In Zimbabwe and Uganda, the incidence of KS has increased 20-fold in recent years and is now the most common cancer in males and the second most common cancer in females.[5,76] Incidence rates for African males in Harare, Zimbabwe, increased from 31.3 in 1990-1993 to 50.9/100 000 for the period 1994-1997.[5] The second highest incidence rates in males occurred in Malawi (49.9), where data that are more recent are available for 2000-2001, followed by Uganda (37.7) for 1993-1997. In females, the highest incidence rates were reported for Malawi (31.7 in 2000-2001), followed by African Zimbabweans (21.6 in 1994-1997).

In South Africa, a three-fold increase in the number of cases occurred between 1993 and 1995,[32] and a 62% increase was observed between 1996 and 1997. The lifetime risk increased from 1 in 1001 in 1996 to 1 in 496 in 1999. This is in keeping with the increases seen in Uganda and other central African countries at the beginning of the HIV epidemic.[5] In Uganda, KS alone caused a 15% increase in cancer incidence. An increase in the incidence of KS in South Africa has been noted in previous NCR reports,[94,32] and this incidence, although low, continues to rise. In a recent report from a hospital in rural KZN, KS was one of the leading cancers.[118] Incidence rates for KS depend on and reflect clinical practice and the extent to which affected individuals are biopsied and their specimens sent to laboratories, since these are the only source of registry data in South Africa.[19] More recent incidence data are needed to monitor trends.

The ASR of KS was 2.2 for all males and 1.2 for all females in 1999.[19] Africans constituted more than 90% of all cases reported. Among African males KS ranked 13th in 1998, comprising 3.4% of all cancer cases, while in 1999 it ranked seventh, comprising 4.4% of all cancers. A bimodal pattern in the age-specific incidence rate was observed with a first peak at young ages (35-39 in males and 25-29 in females) and a second peak in the older 70-74-year age group. Rates in African males increased from 1.8 in 1997 to 2.8 in 1999, with a lifetime risk of 1 in 385. In African females the ASR was 1.5, with a lifetime risk of 1 in 834. Rates were much lower in the other population groups.

3.15.2 Infections

HIV

The close association between KS and immune suppression (whether post-transplant, because of cancer chemotherapy or HIV-induced) suggests that KS is under tight immunological control.[5,119] Two case-control studies in Johannesburg found elevated risks between HIV infection and the development of KS (see section 3.14 HIV/AIDS and cancer).[117,120]

Human Herpes virus 8

Human herpes virus 8 (HHV-8) has been causally linked to the development of KS,[121,122] but its mode of transmission, association with other cancers, and interaction with the human immunodeficiency virus type 1 (HIV-1) is largely unknown. HHV-8 infection in immunocompetent individuals is usually asymptomatic, however, KS occurs frequently in immunodeficient individuals, particularly patients with HIV/AIDS,[123] as well as immunosuppressed transplant recipients.[124]

Seroprevalence to HHV-8 varies worldwide. Prevalence is lowest in Asia, the United States, and Western Europe, higher in Southern European and Middle Eastern Mediterranean populations, and highest in Africa, where KS was endemic pre-HIV/AIDS. In South Africa, 35% of rural,[125] and about 30% of urban[126] African adult hospital patients were found to be HHV-8 seropositive. HHV-8 antibodies were more frequent among African compared with white blood donors (P <0.001).[126]

In a study among African patients with cancer who were interviewed in Johannesburg and Soweto,[126] the authors found the seroprevalence of anti-HHV-8 antibodies to be high and specifically associated with KS, particularly at high titres. Among the 3 293 patients with cancers other than KS, the standardised seroprevalence of antibodies against HHV-8 did not differ significantly from the standardised seroprevalence among African blood donors. The prevalence of antibodies against HHV-8 increased with increasing age (P <0.001) and an increasing number of sexual partners (P = 0.05), and decreased with increasing years of education (P = 0.007). HIV-1 infection did not appear to have an effect on the presence of anti-HHV-8 antibodies. Prevalence of antibody to HHV-8 was 30% in HIV seropositive and 33% in seronegative subjects.[126] This suggests that the effect of the two viruses on risk is independent (and more or less multiplicative) in the causation of KS. The effect of HIV is probably through immunosuppression, by allowing HHV-8 to escape control and increase viral load.[5]

KS was the only cancer among the 17 types studied that was associated with a high seroprevalence of antibodies against HHV-8. Among the 51 patients with KS, the standardised seroprevalence of antibodies against HHV-8 was 83%, which was significantly higher than the prevalence among those without KS (P <0.001). For the other specific types of cancer, including multiple myeloma (108 cases) and prostate cancer (202 cases), the variation in the standardised seroprevalence of antibodies against HHV-8 was not statistically significant. At a given intensity of fluorescence of anti-HHV-8 antibodies, KS was more frequent among HIV-1-positive patients than among those who were HIV-1-negative (P <0.001).[126]

In Africa, sexual transmission of HHV-8 is important in adolescents and young adults. Vertical (mother-to-child) transmission does not appear to occur. Antibodies to HHV-8 are transmitted transplacentally so that most children born to seropositive mothers have antibodies present at birth, but titres drop rapidly thereafter. HHV-8 seropositive mothers with high antibody titres are about twice as likely to have HHV-8 seropositive children, as mothers with low titres, suggesting some form of person-to-person transmission may be at play.

Other non-sexual routes of transmission are also important.[126] Risk factors for HHV-8 include birth in a rural area and a low standard of education, suggesting that factors related to poverty may contribute to transmission of the virus. The age (or the route of infection) at which infection occurs could affect the subsequent risk of KS.[126]

3.16 Cervical cancer

3.16.1 Descriptive epidemiology

Cancer of the cervix is the second most common cancer in women worldwide, and the leading female cancer in the developing world.[96,98] Cancer of the cervix was declared an AIDS-defining condition in 1993. In Africa, where there is high incidence of both cervical cancer and HIV infection, there is good data showing an increased incidence of invasive cervical cancer with the HIV epidemic. Since 1960, a moderate increase in cervical cancer was reported for all age groups in Uganda.[111] Data from the NCR[19] on cervical cancer have so far not shown any significant increases in cervical cancer, especially in younger age groups that are more susceptible to HIV infection. HIV prevalence has increased since 1999, and data from the NCR that are more recent would be important to determine whether there is an increase in cervical cancer incidence rates in these young at-risk age groups. However, underreporting in vulnerable groups remains a problem.

In South Africa, cervical cancer had consistently been the leading cancer in females in terms of incidence and death. In 2000, cervical cancer was still the leading cause of cancer deaths in women, accounting for 17.2% of all female cancer deaths. However, of all cancer cases reported in 1999, cervical cancer was the second leading cancer after breast cancer in terms of incidence in females, accounting for 17%.[19]

Age-standardised incidence rates for all females dropped from 34.4 in 1998 to 29.7/100 000 in 1999, with a lifetime risk of one in 30 (age range 0-74 years), while the age-standardised mortality rate for females in South Africa, was estimated at 20.8 in 2000. In Australia, the ASR is 3.3-fold higher than the age-standardised death rate,[92] while in South Africa it is only 1.4-fold higher. This could be because of minimal incidence rates being reported by the NCR, especially in the African population, or to higher mortality from this cancer in South African females.

African females comprised about 84% (4127) of all cervical cancer cases reported to the NCR in 1999, with a lifetime risk of one in 25. The risk of developing this cancer was more than three times higher in African females than in white and Asian females.[19]

Cervical cancer was the second most common cancer in females (second to oesophageal cancer) reported to the PROMEC Registry for 1996-2000, with an overall ASR of 15.2. The highest incidence rate was reported in Lusikisiki (27.2), followed by Butterworth (21.9), with Bizana (13.4) and Centane (13.5) having very similar rates. Incidence rates in Butterworth increased three-fold in 1996-2000 compared with the 1991-1995 data.[23]

Age-standardised death rates for cervical cancer were also highest in African females (26.9), followed by coloured females (21.7). White and Asian females had relatively low rates (5.5 and 7.6, respectively). The risk of developing this cancer increased with age with the ASR peaking at 136.4 at age 65-69 in 1999. Similarly, in Fig. 7, the age-specific death rates clearly indicate a steady rise in mortality rate from the young age groups (25-34 years) in coloured and African females (this pattern is not so clear for Asian females, possibly because of small numbers in the older age groups). Limpopo and Mpumalanga provinces had the highest age-standardised mortality rates of cervical cancer (Figs. 8 and 9).

Despite the minimum rates reported by the NCR, cervical cancer incidence rates in South Africa are among the highest in the world. In 1999, incidence rates in African females in South Africa (34.9 in 1999) were the fourth highest in Africa, with the highest rates reported for African females in Zimbabwe (53.1 in 1994-1997) and Malawi (53.1 in 2000-2001), followed by Kyadondo, Uganda (40.7 1993-1997).[5,21,111] The incidence rate of cancer of the cervix in African females was also similar to rates observed in the New Zealand Maori population (32.2).[92]

3.16.2 Infections

Human Papilloma Virus

Infection with HPV is now recognised as the main aetiological factor for invasive and pre-invasive cervical neoplasia worldwide. Persistent infection with high-risk oncogenic HPV types (including types 16, 18, 31, 33, 39, 45, 52 and 58) is known to be a necessary cause of cervical cancer.[127-132] The worldwide prevalence of HPV in cervical carcinomas is reported to be 99.7%.[128]

HIV/AIDS

Although a slight association between HIV and cancer of the cervix (OR 1.6, 95% CI: 1.1, 2.3) was found in the case-control study in Johannesburg,[117] a former study appeared to contradict this finding.[133] Nevertheless, a similar relative risk was noted in Uganda[134] (OR 1.6), and in Rwanda.[135,136] Other studies have demonstrated an association between HIV and the increased prevalence of HPV and cervical intraepithelial neoplasia (CIN).[134,137] In an outpatient clinic in Senegal, a three-fold (OR 3.3, 95% CI: 0.9, 12.4) and eight-fold, (OR 7.9, 95% CI: 1.1, 57) increased risk of high grade cervical squamous intraepithelial lesions and invasive cervical cancer, respectively, has been reported in females infected with high-risk HPV and HIV-2 compared to those infected with HPV and HIV1.[138]

3.16.3 Reproductive factors and sexual behaviour

Some endogenous or exogenous factors are believed to act in conjunction with HPV infection to cause invasive cancer. Other risk factors known to be strongly associated with invasive cervical cancer include low social class and reproductive factors and sexual behaviour, such as the lifetime number of sexual partners and early age at first intercourse.[139] Two studies reported an increased risk of developing both squamous cell and adenocarcinomas with increasing duration of use of oral contraceptives.[127,140] A systematic review of 28 published studies examined the relationship between invasive and *in situ* cervical cancer and duration of hormonal contraceptive use, with particular attention to HPV infection; durations of 5-9 years and 10 years or more were associated with a significantly increased risk of developing the cancer (RR 1.6, 95% CI: 1.4, 1.7) and (RR 2.2, 95% CI: 1.9, 2.4), respectively, in all females.[141] For the same durations, RRs of 1.3 (95%

CI: 1.0, 1.9) and 2.5 (95% CI: 1.6, 3.9) were reported for HPV-positive females. Evidence of the relationship between progestogen only contraceptives and cervical cancer is, however, unclear. Furthermore, no evidence has been reported of a strong positive or negative association between HPV-positivity and ever use or long duration of oral contraceptives.[140] The risk of developing squamous cell cervical cancer is associated with high parity and both squamous and adenorcarcinoma cervical cancers increase with early age at first birth.[139]

3.16.4 Lifestyle factors

Tobacco smoking

A two-fold increase in risk of developing squamous cell cervical cancer in those who had been smoking for over 20 years, compared to non-smokers, has been reported.[139] Excess risk for cervical cancer among smokers has been observed in a number of studies even after controlling for other potential confounding factors, such as reproductive factors and infection with HPV.[142]

4 CANCER PREVENTION EFFORTS AND RECOMMENDATIONS

4.1 Cancer control programmes

Cancer is a major public health problem in South Africa, with several social and economic implications. Job loss, economic dependence, social isolation and family tensions often follow the occurrence of cancer.[143] There are direct health-care costs from hospital admissions, drugs and health professional services, as well as indirect costs associated with disruption of productivity by disability and premature mortality.[23] As South Africa undergoes development, the current risk profile will translate into increasing rates of cancer, unless policies are formulated and implemented to ameliorate the detrimental effects of the key risk and lifestyle factors. Implementation of a well co-ordinated and comprehensive cancer prevention and control programme is crucial if activities that contribute to risk reduction efforts are to be successful.[19] About one third of new cancer cases diagnosed every year are preventable by controlling tobacco and alcohol use, moderating diet and immunising against certain viruses. With early detection and treatment, reduction of a further one third is possible.[144]

4.1.1 Primary and secondary prevention

Prevention means eliminating or reducing exposure to known risk factors or cancer-causing agents. The most common approach to cancer prevention is health education or health promotion to empower people with information to change unhealthy lifestyles (primary prevention). Another approach is early detection or screening of seemingly healthy individuals to detect cancer in its early or precursor stages when treatment will be most effective (secondary prevention).

The South African government has put in place new legislation and policies as an effort to reduce cancer. These include the Tobacco Products Control Amendment Act of 1999,[145] the Cervical Screening Programme Policy,[146] and, following the WHO recommendations, immunisation against hepatitis B to prevent liver cancer. To sustain the public health advances that have already been achieved, cancer needs to be dealt with appropriately. Effective implementation of these programmes will go a long way in reducing these cancers. Close monitoring and evaluation of these intervention programmes is therefore essential to measure and ensure successful and cost-effective implementation.

In addition, reducing the transmission of HIV and delaying mortality from AIDS will also play an important role in reducing the dramatic increase in incidence of cancers related to HIV/AIDS. This could be done by improving the treatment of sexually transmitted infections, improving the voluntary counselling and testing services, and providing antiretroviral treatment to pregnant and other HIV-positive persons, and health education in promoting safe sex. A comprehensive HIV and AIDS Care, Management and Treatment Programme[147] for South Africa is currently being implemented and monitored, and efforts to curb the HIV/AIDS epidemic will have a positive impact on cancer of the cervix. Strengthening health promotion efforts aimed at the youth (including safer sex, gender violence, smoking and alcohol abuse) and promoting healthy lifestyles (including diet, physical activity, and reducing alcohol and substance abuse) are important strategies likely to reduce the burden of cancer in South Africa.

4.1.2 Tobacco control legislation

Recent years have seen the introduction of tobacco control legislation including severe restrictions on advertising, health warnings on tobacco products and the banning of smoking in public places. In addition, excise taxes for tobacco products have been

increased, and between 1994 and 1999, real excise taxes on cigarettes went up by 149%. These taxes have been extremely powerful in reducing cigarette consumption. Figures from the South African National Council Against Smoking indicate that legal sales of commercial cigarettes have fallen every year since peaking at 40 billion in 1990.[148] Therefore, it can be optimistically expected that South Africa is past the peak of its tobacco consumption epidemic, and that tobacco-related cancers will begin to decline in time.[38]

In contrast, little effort has been made to curb alcohol abuse. Total adult per capita pure alcohol consumption was estimated to be 10 ℓ in 1995 and 12 ℓ in 2000, and has increased by over 50% since 1970.[149]

4.1.3 Cervical cancer screening

The high mortality burden caused by cervical cancer among the poor indicates an inadequacy in the provision of primary care to these communities. Therefore, it is essential to ensure that females in poor areas are screened for cervical cancer so that this mortality can be reduced.

Trends in cervical cancer incidence rates have been significantly reduced in countries where effective cervical cancer screening programmes were implemented, particularly in developed countries.[98] In New South Wales (NSW), Australia, both age-standardised incidence and mortality rates fell by about 40% over the period 1991 to 2001, mainly because of the introduction of population screening. In 2001, 60% of all NSW females aged 20-69 years were screened for cervical cancer every two years.[92]

The South African cervical cancer screening policy and the cervical cancer-screening programme that have been implemented since 2001, aim to reduce the incidence of this disease.[146,150] This is done primarily by detecting and treating the pre-invasive stage and reducing the morbidity and mortality associated with the cancer. Ultimately, this will reduce the excessive expenditure of limited health funds that are currently being spent on the treatment of invasive cancer of the cervix. Three free smears per lifetime are recommended for the programme, commencing after age 30 years and with a 10-year interval between each smear. The ultimate goal is to reduce the incidence of cervical cancer by 60%.[150] However, there are concerns that this programme has not been implemented uniformly across the country.

The programme has not yet been put into practice in primary and secondary health centres in the former Transkei region of the Eastern Cape, because of shortage of staff and equipment. According to Somdyala *et al*.,[23] capacity development to improve skills and efficiency of health professionals is an essential first step. Provision of basic equipment for pap smears at all clinics, followed by provision of relevant follow-up facilities, and specialists for cases that require further investigations are also essential. A screening evaluation programme should also be established with links to cancer registries. Most importantly, females need to be informed of the importance of this programme.

In low-resourced countries that are faced with challenges, such as few laboratories or cervical cytology of poor quality, efforts are being made to develop other accurate and affordable tests to pick up cervical cancer at an early stage. A new technique, the visual inspection of the cervix following acetic acid staining (VIA), is being investigated, and it could be conducted by specially trained health workers. A review of studies conducted on VIA between 1982 and 2002 suggested, "VIA has the potential to be a cervical cancer screening tool, especially in low resource settings."[151]

Other approaches that are currently underway in an effort to control cancer of the cervix include the development of HPV DNA screening tests and HPV vaccines to help control the infection. In a study of 2 944 cervical samples from South African females, Kuhn *et al*.[152] concluded that HPV DNA testing programmes might be easier to implement than cytological screening, and that this approach should be considered for screening in low-resource settings. The WHO, however, considers that the test requires sophisticated technical resources and is therefore not yet ready for routine application with a national cancer control programme.

4.1.4 Treatment

The objectives of treatment are to cure, control symptoms, prolong useful life, and improve the quality of cancer survival. In South Africa, cancer treatment is often centralised at the main referral hospitals, meaning that patients in rural areas have to travel long distances to reach treatment facilities. This has negative physical and emotional effects resulting in low compliance to treatment. A better cancer management programme may improve compliance.[23]

4.2 THE CANCER ASSOCIATION OF SOUTH AFRICA

Hospices and organisations, such as the Cancer Association of South Africa (CANSA), can play an important role in the community. Counselling and support programmes help cancer patients and relatives come to terms with the illness. However, provision of support programmes is still needed in many rural areas.

CANSA is a registered non-profit organisation founded in 1931 by a group of volunteer doctors concerned about the incidence of cancer in the country. The organisation has since grown throughout the country and provides a range of services from education, prevention and advocacy work, to facilitating research, treatment, and care and support for cancer patients, survivors and their families.[153] CANSA relies on private and corporate donors as well as its own fundraising initiatives.

Historically, CANSA support was mainly for biomedical cancer research, but since 2003 it has remodelled its programmes to increase focus on health promotion and advocacy. Their research support is also geared towards informing public health, interventions, programmes and advocacy.

4.3 CANCER SURVEILLANCE

Globally, cancer surveillance plays an important role in informing the development of cancer control programmes and monitoring their success.[154] Data from the better-performing cancer surveillance programmes, by means of recommended population-based cancer registries, have been published in the WHO series of *Cancer incidence in five continents*.[5] The picture emerging from this work shows many gaps in our knowledge about the burden of cancer in Africa. Scientific forums around cancer and cancer management have expressed a need for cancer registries in Africa to do more than to report cancer incidence.

One of the recommendations of the National Cancer Control Programme (NCCP)[155] was that data on cancer registry incidence and cancer mortality should form the basis of monitoring and evaluating the progress in cancer control in South Africa. The importance of cancer surveillance in monitoring the extent of the increase in cancer incidence caused by HIV/AIDS is important. Accurate information on cancer incidence, prevalence and mortality, however, is essential for this process and further research is required to improve national cancer mortality and incidence estimates.

One of the challenges of the SA NBD study was the lack of recent complete and reliable mortality data. The study grappled with the inadequacies of the vital statistics, and had to use multiple sources of information to derive coherent and consistent estimates for the level and causes of mortality for the year 2000. As data that are more recent became available, these initial estimates were revised and improved.[16] Unfortunately, at this stage, estimates of years lived with disability (YLDs) and cancer disability adjusted life years (DALYs) for South Africa are still based on extrapolations from the global burden of disease study.[156] Accurate national incidence data, as well as information on the severity and the duration of the disease, are essential in order to improve estimates of the extent of the cancer burden. These data can be used as a benchmark to monitor change and for identifying priorities.

In the absence of any legislative framework of disease reporting, pathology laboratories around the country have voluntarily sent data to the NCR since its inception. This ongoing national collaboration across private and public sectors is remarkable.[19] Demographic data and tumour information are sent to the NCR for each cancer patient. Ethical guidelines are being developed to receive and hold this confidential information in keeping with concerns on privacy. Nevertheless, incomplete submission of data remains one of the limitations of this voluntary and passive surveillance system, with accurate incidence rates depending on the quality of data submitted to the NCR. Pathology laboratories should insist that basic demographic details of patients are properly completed. This would greatly enhance the epidemiological value of the data.

The incidence rates reported by the NCR are minimal rates and could be improved with the implementation of a more comprehensive data collection system, such as a population-based cancer registry. Such registries record information from all sources (pathology, mortality reports and clinical information). The establishment of population-based cancer registries in each of the nine provinces is regarded as one of the essential components of the Department of Health's NCCP. However, trained personnel and adequate funding are essential to ensure the long-term sustainability of these registries.[19] Increased efforts should concentrate on establishing comprehensive co-operative regional registration systems. Collaboration of regional registries and pooled analysis of data to reflect national trends has been followed successfully in several countries.[19] Another strategy to improve cancer incidence estimates would be that cancer becomes a reportable condition by law.

Monitoring cancers by population group would enable the NCR to further extend and evaluate the effectiveness and equity of access of the cervical cancer and tobacco control policies. Monitoring disease across different population groups is critical to measure the equity of efforts in different parts of the country, as well as that of health outcomes in the different groups. However, about two-thirds of the collected data in 1998, and three-quarters in 1999, did not report on the population group of cases, making it difficult to discern important cancer incidence patterns by population group.

South African "racial" terminology devised by previous Apartheid legislators was unscientific and often used without justification in medical research. However, because of this classification, different population groups have been subjected to environments that have played an important role in determining their lifestyle, socio-economic condition, residence and access to health care. These differences have played an important role in the cancer patterns observed in different population groups. NCR data are therefore analysed by population group as a proxy of a combination of dietary, lifestyle and socio-demographic factors to provide clues about cancer aetiology. It appears to be the only viable option in discerning important epidemiological sub-groups and access to health care - both vital indicators of the performance of the health system.[32]

4.4 CANCER RESEARCH INITIATIVE OF SOUTH AFRICA

The important CANSA/MRC workshop held in February 2004 evaluated the future of cancer research in the country and resulted in a proposal for the creation of a multi-disciplinary, multi-organisational group called the Cancer Research Initiative of South Africa (CRISA). The initiative suggested combined efforts of the two organisations to promote and expand cancer research. Administrators and cancer researchers met to discuss the way forward for effective cancer research in South Africa, and a joint research initiative was developed to co-ordinate, focus and extend existing cancer research appropriately.

CRISA aims to improve the health status of South Africans by promoting a national, comprehensive and sustainable cancer research system that will develop capacity and knowledge in the following areas: primary prevention, secondary prevention, treatment, palliation, and monitoring and evaluation.

Scientific research that includes aetiological and epidemiological studies should generate flagship projects, which will add value to advocacy strategies that are aimed at influencing policy development and intervention programmes at government, private and public levels.[157] Some of the outcomes of the discussions included a rapid assessment and prioritisation of the key strategic issues, a synopsis of current research (presented in a matrix form based on process and cancer type in Table 12.6), an environmental analysis, and the development of a proposed research structure together with its draft mission statement. CRISA progress will be driven by its Steering Committee.

Table 12.6. Integrated cancer research matrix (Adapted from Albrecht[157])

	Breast	Cervix	Prostate	Lung	Colorectal	Oesopha-geal	Liver	Kaposi's	Lymphoma	Mouth, oropharynx
Ranking as cause of cancer death	4	3	7	1	6	2	5	Not listed	12	10
Process: Primary Prevention	Genetic coun-selling	HPV vaccine	-	Anti-smoking	Genetic coun-selling	Health pro-motion	HBV Vaccine Anti-aflatoxin measures	Health pro-motion Safe sex	Health pro-motion Safe sex	Health promotion Anti-smoking
Secondary Prevention	-	PAP smear	PSA	-	-	Brush biopsy	-	-	-	Screening by Dentists
Treatment	Clinical Trials Drug discovery	Smit Tube Drug discovery	Drug discovery Hormone trials. Distinction between aggressive, non-aggressive types of surgery	Drug discovery	Drug discovery	Drug discovery Radiation schedules	Drug discovery Radiation schedules	Drug discovery Radiation schedules	Drug discovery Radiation schedules	Drug discovery Radiation schedules
Palliation	-	Search for cost-effective schedules	-	-	-	-	-	-	-	-
Burden of disease	+	+	+	+	+	+	+	+	+	+
Advocacy	-	-	-	-	-	-	-	-	-	-
Audit	-	Bloch study Only 20% have had Pap smear	-	-	-	-	Peanut butter incident in children			

+ Incidence data from NCR, mortality data from MRC Burden of Disease Research Unit

- Research gap

5 CONCLUSIONS

Cancer is not only a major public health problem but also has widespread social and economic impacts. Changing lifestyles, particularly among the African population, combined with population ageing and the increasing prevalence of HIV have placed South Africans at greater risk of developing cancer.

Promoting healthy lifestyles (including diet, physical activity, reducing smoking, alcohol, and substance abuse) is an important strategy to reduce the large burden of cancer in South Africa. The tobacco control intervention is having a demonstrable effect on tobacco consumption that will translate into reducing the future number of cancers. However, it is important for the programme to be monitored and maintained. In addition, promoting safe sex is essential in reducing the transmission of HIV and other sexually transmitted diseases, and along with improving the integrated management of childhood diseases and immunization, these remain clearly important strategies in South Africa.

Research on the causes of some of the most important cancers, including cancers of the oesophagus, cervix and skin, should be undertaken. Methods of reducing exposure to the sunshine, including health promotion efforts, should also be investigated.

Monitoring cancer incidence and mortality is important in detecting changes in cancer patterns that might occur because of changes in environmental conditions and increases in cancers associated with new diseases. It also serves to detect new cancers and to measure the effectiveness

of currently implemented cancer control programmes in our country. Monitoring the number of AIDS-related cancers, especially KS and non-Hodgkin's lymphoma, should be a priority. Another priority is monitoring the prevalence of tobacco use and the tobacco-attributable burden of cancer. With appropriate resources, cancer registries would be able to meet these challenges.

Close monitoring and control of cancer of the cervix is essential, and it is hoped that long-term, effective implementation of cervical cancer screening programmes and early intervention will reduce its high incidence and mortality. The need for screening for oesophageal cancer in poor areas of high risk should also be investigated. Breast cancer incidence is high and appears to be increasing, and the cost-effectiveness of a screening programme for women over 50 years[158] should be analysed.

The magnitude of cancer as a health problem is estimated from limited sources. The voluntary and limited nature of data reporting to the NCR affects the timeliness and completeness of reporting of cancer incidence data. A pathology-based registry remains a problem when a large proportion of the population, mainly rural African, has limited access to diagnostic facilities. Despite these limitations, most of the cancer policy guidelines are based on NCR data. Re-establishment of population-based cancer registries and making cancer a reportable condition are recommended to improve the quality and accuracy of the national cancer incidence data.

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CHAPTER 13

OSTEOPOROSIS
IN SOUTH AFRICA

Stephen Hough[a]

1. INTRODUCTION

Recent developments in osteoporosis involve a reassessment of our conceptual understanding of its definition and approach to diagnosis, as well as technological advances in acute and long-term management. The latter includes the introduction of new anabolic agents like teriparatide and strontium ranelate to treat patients with severe fracturing osteoporosis, more evidence-based data from randomised controlled trials (RCTs) on the efficacy and safety of known bone-active agents, and new techniques like percutaneous kyphoplasty to manage acute vertebral fractures.

This report will not attempt to provide an extensive review of osteoporosis. Instead, it will define the osteoporosis problem from a South African perspective, and then largely concentrate on recent developments in the field.

2. EPIDEMIOLOGY

Osteoporosis is a common and costly disease, which affects one out of every four postmenopausal Caucasian women.[1-3] It is also serious and 20% of all hip fracture victims die within one year of the event. Even more disconcerting is the fact that less than 50% of patients are able to live an independent life following a hip fracture, most requiring institutionalisation. In South Africa, the acute care costs of a hip fracture amounts to about R50 000 per patient. In 1992, the annual cost of osteoporosis in the United States exceeded $20 billion. Vertebral compression fractures are also associated with an increased morbidity and mortality. Moreover, the incidence of all osteoporosis fractures is clearly on the rise.[4-6]

In developed countries, spinal osteoporosis is about 4-6 times, and hip fractures 2-3 times more common in women than in men. In developing countries, including South Africa, the incidence of hip fractures in men approximates that of women. Although reasons for this remain poorly understood, it does underscore the clinical importance of osteoporosis in males.

Accurate epidemiologic data on fracture incidence in different ethnic populations in South Africa are not available. The bone mineral density (BMD), which is currently regarded as the diagnostic criterion for the disease (*vide infra*), appears to be comparable among white, Asian and mixed race/coloured populations in the country. Osteoporosis is therefore thought to occur with equal frequency among these groups, although no fracture data exist.

Osteoporosis is thought rarely to affect blacks, and Solomon[7,8] has reported hip fractures to be ten times less prevalent in these populations. However, these data are more than 30 years old, and do not take into account recent developments that include urbanisation, cannot be extrapolated to vertebral and other fractures, and need to be verified. Osteoporotic fractures are also much less prevalent in Afro-Americans in the USA, where the observation is readily explained, based on an approximate 15% higher BMD in this population compared to Caucasians. Recent studies by Daniels *et al*.,[9] Nelson *et al*.,[10] and Conradie *et al*.,[11] suggest that the BMD in black and white South Africans do not differ substantially – at least not to the extent where a tenfold difference in fracture prevalence can be readily explained. Clearly, more work on both BMD and fracture prevalence in different populations in this country is urgently required.[12]

3. DEFINITION OF OSTEOPOROSIS

3.1 Conventional definitions of osteoporosis

Osteoporosis was historically defined on a histological and radiological basis. In the mid-nineties, the World Health Organization (WHO) adopted a largely densitometric definition, regarding osteoporosis as a systemic skeletal disease characterised by a low bone mass and

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micro-architectural deterioration of bone tissue with a consequent increase in bone fragility and susceptibility to fracture.[13] Since bone mass is thought to account for up to 70% of the variance in bone strength in *vivo*, and is the only variable that can be accurately determined, its measurement (as BMD) currently embodies the practical basis for the diagnosis of osteoporosis.[14]

While the four diagnostic categories of the WHO classification[13] (Table 13.1), which defines osteoporosis as a BMD of at least 2.5 standard deviations (SD) below the average for a 30-year-old Caucasian female, have provided a practical basis for identifying those at risk of sustaining a fracture, we need to take cognisance of its limitations, namely i) a single BMD measurement lacks sensitivity and up to 50% of patients with a known osteoporotic fracture may have a normal BMD, ii) the WHO criteria are based on data obtained from white, postmenopausal women, employing dual energy x-ray absorptiometry (DEXA) of the axial skeleton (spine and hip), and cannot be extrapolated to other populations (blacks, males, young individuals) or other techniques for measuring BMD (e.g. QCT, ultrasound), iii) causes of a low BMD other than osteoporosis (e.g. primary hyperparathyroidism, osteomalacia) are not considered, iv) extra-skeletal risk factors for fracture (e.g. propensity to fall) are not addressed, and v) qualitative bone changes are not assessed.[4]

Table 13.1. WHO criteria for osteoporosis in women[13]

Normal	BMD or BMC within 1SD of the young adult reference mean
Low bone mass	BMD or BMC 1-2.5 SD below the mean of young healthy women
Osteoporosis	BMD or BMC >2.5 SD below the mean of young healthy women
Severe (established) osteoporosis	BMD or BMC >2.5 SD below the mean of young healthy women and the presence of one or more fragility fractures

3.2 New definitions of osteoporosis

Although still recognising the importance of BMD, the most recent National Institutes of Health consensus statement defines osteoporosis as, "a skeletal disorder characterised by compromised bone strength that results in an increased risk of fracture".[1] The concept of bone strength has evolved to integrate those traditional measures of bone quantity (e.g. BMD) with more recently examined components of bone quality, namely i) macro-architecture (bone size and geometry), ii) micro-architecture (cortical thinning, porosity; trabecular size, number, connectivity), iii) bone turnover, and iv) material properties of bone (e.g. mineralisation, micro-fracture, collagen cross-linking) (Table 13.2).[6,15-18]

Table 13.2. Determinants of osteoporotic fractures

• Bone quantity	
-BMD	
• Bone quality	
-Macro-architecture	• Bone geometry/size
-Micro-architecture	• Cortical: porosity, thinning • Trabecular: size, number, connectivity
-Bone turnover	
-Material properties	• Mineralisation, micro-fracture, collagen cross linking
• Propensity to falls	

4. BMD-INDEPENDENT DETERMINANTS OF BONE STRENGTH AND FRACTURE

Although bone quality is difficult to assess clinically, a number of BMD-independent risk factors for osteoporotic fracture are now recognised, and these can aid the physician in identifying those at risk (Table 13.3). Age is one of the best-known risk factors, independent of BMD, and various changes in bone quality have been proposed to explain this observation. Up to 80% of the variation in peak BMD is determined genetically. However, a genetic predisposition to fracture, independent of BMD, has recently been documented. Polymorphisms in a number of genes (e.g. those encoding the oestrogen receptor, collagen and growth factors) have been proposed to explain this observation. Ethnicity affords another example, and I have alluded to the fact that the small differences in the BMD of black and white populations in this country are unlikely to explain the several-fold difference in fracture prevalence between groups.

In large osteoporosis drug trials, involving the bisphosphonates (FIT, VERT), selective oestrogen receptor modulators (MORE) and calcitonin (PROOF), a history of vertebral fractures was shown to increase the risk of a subsequent fracture three- to five-fold. Moreover, these studies revealed no correlation between changes in BMD and the degree of fracture risk reduction following drug therapy. A low body mass and bone toxins (glucocorticoids, alcohol, and tobacco) are other examples of BMD-independent determinants of bone strength. A high bone turnover is known to cause trabecular perforation and decreased interconnectivity, which markedly increase the likelihood of fracture, independent of BMD. Recently, animal studies have suggested that a chronically suppressed bone turnover may also predispose to fracture, but data in patients are lacking. Finally, the importance of extra-skeletal factors should not be ignored – falls, especially falling sideways, are incriminated in more than 80% of femoral neck fractures.

Table 13.3. BMD-independent determinants of bone strength and fracture

• Age
• Genetic susceptibility
• Ethnicity
• History of previous fracture(s)
• Low body mass
• Bone turnover (high/?low)
• Propensity to falls
• Bone toxins (glucocorticoids; alcohol, tobacco).

5. DIAGNOSTIC CRITERIA VS. INTERVENTION THRESHOLDS

The diagnostic categories developed by the WHO for postmenopausal Caucasian women should not be regarded as intervention thresholds for all.[5] The need to treat should not depend on the establishment of a largely BMD-based diagnosis alone but, similar to other chronic diseases of lifestyle, should also be determined by: i) the patient profile (age, life expectancy and general health, ongoing clinical risk factors, propensity to fall, etc.); ii) the nature of the disease (presence of fragility fractures, abnormal bone turnover, severity and rate of bone loss, etc.); and iii) the cost-effectiveness and side-effects of available treatment.

The assessment of BMD-independent risk factors is particularly important in those cases where BMD values are not markedly decreased (i.e. not within the so-called osteoporosis range of ≥ 2.5 SD below peak BMD), yet the patient is clearly at risk. Certain forms of the disease, for example glucocorticoid-induced osteoporosis (GCOP), are known to fracture at higher BMD values than postmenopausal or senile osteoporosis. An intervention threshold of ≥ 1.5 SD below peak BMD has been recommended for GCOP, whereas the British Rheumatology Society recommends bone active drugs in all subjects over the age of 65 years who receive glucocorticoids for longer than three months, irrespective of the bone mass. A known fragility-fracture – probably the single strongest predictor of future fractures – constitutes another indication for treatment, regardless of the BMD.

In this regard, the principles of osteoporosis management do not differ fundamentally from those of most other chronic degenerative diseases. For example, although diagnostic cut-off values for an increased blood pressure or plasma cholesterol have been clearly established, intervention thresholds and the nature of therapy are determined by very similar co-morbid factors. Clearly, health-care workers, as well as medical-aid funders, need to take cognisance of this paradigm shift in our approach to the management of patients with osteoporosis.

6. NON-PHARMACOLOGICAL MEASURES TO IMPROVE BONE STRENGTH AND PREVENT FRACTURES

These include a balanced diet rich in dairy products, physical exercise (30-minute walk, 3 times per week), limiting alcohol intake (not more than 7-10 drinks per week), the avoidance of smoking and bone toxic drugs, and the prevention of falls.[1-4] Particularly in older patients, the comprehensive assessment of falls and appropriate preventive measures may be more important than pharmacological intervention to reduce the risk of fractures. Risk factors include:

i) Muscle weakness (the term "sarcopenia" was coined to emphasise the importance of this risk factor) and disturbances in balance and gait should be assessed, and exercise programmes implemented.

ii) Medication, particularly sedatives and major tranquillisers, is the single most important reversible risk factor for falls in the elderly. Antidepressants, antihypertensives, hypoglycaemic agents, and alcohol may also predispose.

iii) Other important potentially reversible risk factors include postural and postprandial hypotension, visual impairment, vertigo and drop attacks.
iv) Environmental safety should be ensured. Up to 40% of falls are accident or environment-related (slippery surfaces, poor lighting, high-heeled shoes, etc).
v) Previous falls (especially sideways falls) should be assessed and use of external hip protectors considered.

7. DRUGS USED TO TREAT OSTEOPOROSIS

These are conventionally classified as antiresorptive agents and those which stimulate bone formation. Some drugs have complex actions on bone. A comprehensive review of these drugs is beyond the scope of this report, which will largely focus on recent developments in antiresorptive therapy and on the introduction of new anabolic agents to treat osteoporosis.

7.1 Antiresorptive drugs/supplements

Calcium and vitamin D

Calcium supplementation and prophylactic doses of vitamin D (400-800 IU per day) cause a modest (approximately 25%), but significant, improvement in BMD and reduction in risk of vertebral and non-vertebral fractures. These nutrients are, however, less effective in patients with advanced, fracturing disease. All patients at risk should receive additional calcium, either in their diet or as a supplement. Vitamin D supplementation is recommended, especially in the elderly, the institutionalised, and those with a negative calcium balance and secondary hyperparathyroidism who are at risk of sustaining a hip fracture. Evidence for the routine use of pharmacologic doses of vitamin D, as well as the use of vitamin D metabolites (e.g. calcitriol), is unconvincing. Their use in the management of osteoporosis is further limited by the risk of hypercalcaemia and hypercalciuria, and the need for regular monitoring.

Hormone therapy

Hormone therapy (HT), employing oestrogen plus progestin (EPHT) or oestrogen alone (EHT), was previously regarded as the gold standard for the prevention and treatment of osteoporosis. Although initially based on data from observational studies, the large randomised controlled Women's Health Initiative (WHI) recently demonstrated a significant reduction in vertebral (35%), hip (33%) and total fractures (25%), with EPHT and EHT.[19,20] These benefits were, however, outweighed by an increase of 40% in strokes (EPHT and EHT), 50-100% in thromboembolism (EPHT and EHT), 26% in breast cancer (EPHT only) and 26% in cardiovascular events (EPHT only). Although the absolute number of patients adversely affected (as opposed to the relative risk) was small, total mortality unchanged, and prolonged exposure (> 5 years) required to result in most side effects, this study disproved a cardio-protective effect of EPHT as well as EHT, previously suggested by observational data. HT remains the only effective treatment for troublesome vasomotor and urogenital symptoms of the menopause. It may also alleviate emotional lability, but does not prevent Alzheimer's disease and may in fact increase the incidence of dementia in the elderly.

Hormone therapy remains a cost-effective method for preventing and treating osteoporosis. Unlike many antiresorptive drugs, HT appears to be highly effective in low-risk subjects, including those with only a modest decrease in BMD. Rapid, "catch-up" bone loss, however, occurs after HT is discontinued. Given the potential adverse extra-skeletal effects of HT following prolonged use, it is best reserved for the relative short-term (< 5 years) stabilisation of bone strength in patients younger than 60 years – ideally, in those who also have troublesome menopausal symptoms. Once stopped, consideration should be given to its replacement with an alternative agent.

The male menopause is presently receiving increasing attention. However, a discussion of the topic is beyond the scope of this report. Suffice it to say that in the symptomatic male a serum testosterone level below 8 nmol/ℓ is generally regarded as an indication to treat. Serum levels beyond 15 nmol/ℓ do not warrant intervention, whereas levels between 8 nmol/ℓ and 15 nmol/ℓ usually require further assessment (e.g. serum LH, FSH) before a decision on therapy can be made. However, very little evidence-based data on the efficacy or safety of testosterone treatment exist, and many physicians prefer to treat hypogonadal male osteoporotic patients with drugs like the bisphosphonates or teriparatide (*vide infra*).

Selective oestrogen receptor modulators (SERMS)

Raloxifene is a SERM, which has oestrogen agonist actions on the skeleton and lipid profile, yet acts as an oestrogen antagonist on the breast and endometrium. In the MORE study on 7 705 postmenopausal women, raloxifene decreased vertebral fractures by 49% after four years,

despite a very modest increase in BMD of only 3%. Although the risk of non-vertebral fractures was not altered, re-analysis of the MORE data demonstrated a significant 47% decrease in non-vertebral fractures in those patients with severe (SQ grade 3) vertebral fractures.[21] Raloxifene decreased the risk of vertebral fractures in osteoporotic and osteopenic patients. Raloxifene has been shown to decrease the risk of breast cancer by 62-84% and has no effect on the endometrium. Adverse events include an increase in thromboembolism, hot flushes, and leg cramps. Unlike EPHT, raloxifene does not increase the risk of cardiovascular disease, and may in fact be cardio-protective in patients at high risk of cardiovascular disease. While studies, such as the RUTH and CORE, continue to generate data on raloxifene, trials on other SERMS, including lasofoxifene and arzoxifene, are underway.

Bisphosphonates

The amino-bisphosphonates (alendronate, risedronate, pamidronate, zoledronate) are analogues of pyrophosphate, which decrease bone resorption by reducing osteoclast recruitment and function, and inducing osteoclast apoptosis, resulting in a 5% to 8% increase in spinal BMD and a 3% to 6% increase in femoral BMD. The antiresorptive effects of the bisphosphonates are ascribed, at least in part, to their ability to inhibit rate-limiting enzymes (e.g. FPP-synthase) in the mevalonate pathway. Large RCTs employing alendronate and risedronate have documented a significant 40% to 60% reduction in risk of both vertebral and non-vertebral (including hip) fractures. Bisphosphonates are also effective in the treatment of glucocorticoid-induced and male osteoporosis.[22-25]

Fracture reduction is a function of increased BMD and reduced bone turnover. The latter effect presumably explains the reduced fracture risk demonstrated within six months of starting risedronate therapy. Unlike HT, bisphosphonates persist in the skeleton for months to years, which results in a prolonged action. Large differences exist among the bisphosphonates in their ability to suppress FPP-synthase activity, their binding affinity to bone tissue, and their accumulation in the skeleton. These factors ultimately determine the degree of suppression of bone turnover. The first ten-year's experience of alendronate treatment for osteoporosis was recently published.[22] Although the increase in BMD was most pronounced during the first few years of therapy, the reduction in fracture risk appeared to persist. Over-suppression of bone turnover after prolonged administration has raised concerns in animal experiments that employ large doses of bisphosphonates, but this is not supported by current clinical data, although further studies are required.

Bisphosphonates are poorly absorbed from the gut and may cause upper gastro-intestinal side effects. Daily dose regimens have largely been replaced by once-weekly schedules, and much research is currently focussing on the development of regimens, which range from monthly to even once-a-year administration.

Calcitonin

This naturally occurring hormone has a rapid, but short-lived antiresorptive effect. Injectable and nasal spray preparations are available in this country. Fracture efficacy data are largely limited to the PROOF study,[26] employing 1 255 osteoporotic women, which showed a negligible increase in BMD, yet a 36% reduction in new vertebral fractures with a dose of 200 IU calcitonin daily – no significant decrease in fracture risk was, however, observed with 100 IU or 400 IU per day. Calcitonin has a central, opiate-mediated analgesic effect, which is recommended for the management of painful acute vertebral fractures. Until more evidence-based data on fracture efficacy become available, its long-term use should be reserved for those patients who cannot tolerate other antiresorptive agents.

7.2 Anabolic agents

While the mainstay of current therapies for osteoporosis is the antiresorptive agents discussed above, these drugs reduce but do not eliminate fracture risk, and do not restore lost bone structure. Anabolic agents have the potential to increase BMD, restore micro-architecture, and restore fracture risk to a greater extent than the antiresorptives. Fluoride was the first anabolic agent to be used in the treatment of osteoporosis. Although a marked increase in BMD followed the administration of fluoride, this never related to a significant decrease in fracture risk. Growth hormone, IGF, and more recently the lipid lowering statins have been proposed, but bothersome side effects and inability to target these agents to the skeleton have limited their use. Anabolic steroids and calcitriol may have modest anabolic effects on bone, but their utility is also limited by adverse effects. More recently, strontium ranelate and parathyroid hormone (PTH) have emerged as promising osteo-anabolic agents.

Teriparatide (PTH1-34)

Intermittent, low-dose PTH administration causes rapid stimulation of bone formation resulting in a marked increase in bone mass, size and strength, as well as improvement in trabecular micro-architecture and cortical geometry. Following a few smaller studies, the results of a large randomised placebo-controlled trial involving 1 637 women with postmenopausal osteoporosis were recently published.[27] Compared with placebo, daily subcutaneous injection of HPTH (1-34), for as little as 21 months, increased lumbar BMD by 9% to 13% and femoral BMD by 3% to 6%, and reduced the risk of spinal and non-vertebral fractures by 65% and 40%, respectively. Favourable results of PTH on BMD and biomarkers of bone turnover have also been reported in male and glucocorticoid-induced osteoporosis.[28-31]

Side effects of teriparatide have been limited to occasional nausea, headaches, and leg cramps. Mild hypercalcaemia occurs in up to 10% of patients receiving 20 μg PTH daily and serum uric acid levels may increase by 20%, but renal stones and clinical gout are not thought to be more prevalent. Of some concern is the tumourigenic potential of PTH. Long-term studies with high-dose PTH, administered to 6-week-old Fisher 344 rats, have demonstrated a dose-related increased risk of osteogenic sarcoma.[32] This effect is consistent with life-long exposure, in a growing rodent, to high-dose PTH and is unlikely to have relevance to human bone physiology. Shorter or lower dose exposure to PTH has not resulted in the development of osteosarcomas or other bone tumours. All primate studies have failed to show a similar association and osteogenic sarcomas do not occur with increased frequency in patients with primary hyperparathyroidism or from any of the clinical trials performed in over 2500 patients treated with PTH (1-34) for up to three years. It is, therefore, reasonable to conclude that PTH is safe in human subjects, although on-going safety data need to be collated.

Teriparatide has recently become available in South Africa. Given its high cost, the manufacturer and local funders approached the National Osteoporosis Foundation (NOFSA) to provide guidelines on its use, resulting in the publication of a position paper.[33] While many potential indications for its use may exist (e.g. very low prevalent BMD, high fracture risk), NOFSA recommends that teriparatide should be reserved for patients with severe, established osteoporosis. This involves either:

(1) a low BMD and two or more prevalent fractures, or

(2) failed antiresorptive therapy, after adhering to adequate antiresorptive therapy for at least 12 months, with the patient experiencing either i) an incident fragility fracture, or ii) an unacceptable rate of bone loss (e.g. a decrease in vertebral BMD of $\geq$ 5% per annum) as documented in two or more consecutive follow-up BMD measurements.

A number of contra-indications have been suggested, as well as the recommendation that 20 μg teriparatide per day be used for no longer than 18 months. All patients should be subjected to a full clinical and laboratory work-up to confirm a diagnosis of osteoporosis and to rule out other causes of a low BMD (primary hyperparathyroidism, osteomalacia). This should also rule out causes of secondary osteoporosis, which may require treatment in own right, evaluate the severity of the disease, and assess compliance and adherence to prior antiresorptive therapy for osteoporosis. Given recent reports that concurrent use of PTH and potent antiresorptive drugs like alendronate may ameliorate the anabolic effects of PTH,[29,30] concomitant treatment with teriparatide plus antiresorptive agents is not recommended. Careful clinical and laboratory follow-up of all subjects are required and following completion of the 18-month course of teriparatide therapy, treatment with a potent antiresorptive agent, like a bisphosphonate, is recommended to preserve bone mass gained.

Strontium ranelate

Strontium ranelate has been shown to increase osteoblast proliferation and collagen synthesis, and to decrease osteoclast replication and activity *in vitro*. Bone histology has confirmed the dual action of this drug, increasing bone formation and decreasing resorption. Animal studies show an increase in BMD, bone size and strength following strontium ranelate administration. Two large RCTs have recently been published.[34-36] The SOTI trial employed 1 649 women, average age 69 years, with either osteoporosis or osteopenia.[35] After three years, strontium ranelate significantly increased biomarkers of bone formation and decreased parameters of resorption, resulting in an increase in lumbar BMD of 14%, and a 41% to 52% reduction of new spinal fractures. Quantitative bone histology revealed no evidence of a mineralisation defect.

The TROPOS trial studied 5091 elderly (76-yr) women with an average femoral neck T-score of –3.1, for three years.[36] Femoral BMD increased by 8% and the incidence of hip fractures was reduced by 36%. Both the SOTI and TROPOS trials demonstrated excellent adherence to therapy

(83%) and no significant adverse effects. Strontium blood levels can be readily measured to monitor therapy. This drug, clearly holding much promise, will probably be launched in South Africa during 2006.

8. ACUTE MANAGEMENT OF SYMPTOMATIC VERTEBRAL FRACTURES

Traditional management of the acute painful vertebral fracture consists of analgesia, bed rest with physical support (such as a corset) and gradual mobilisation. There is, however, no consensus as to the best treatment.[37] Strong analgesics, such as the opiates, should be used for short periods only. Non-steroidal anti-inflammatory drugs have been shown in some studies to suppress bone formation and fracture healing. Tricyclic antidepressants (to lower pain threshold and perception) and some muscle relaxants may predispose to falls. Calcitonin has central analgesic properties and two recent studies have reported the use of intravenous bisphosphonates in patients following acute vertebral fracture. Results, although encouraging, require further study.

Prolonged physical immobilisation and the use of a corset are generally discouraged since these are thought to promote bone loss and muscle wasting. The use of specialised corsets, which cause abdominal compression and an improvement in posture, however, may provide a viable option. Employing such a new spinal orthosis, a recent RCT documented a significant 40% decrease in pain, an 11% decrease in the angle of kyphosis and, surprisingly, a 73% increase in back extensor strength and a 58% increase in abdominal flexor strength.[38] Transcutaneous electrical nerve stimulation (TENS), intercostal nerve blocks, acupuncture, and implanted devices employing the "gate theory" of chronic pain control offer acceptable alternatives.

Vertebral kyphoplasty

Conventional therapy of vertebral fractures allows the bone to heal in its fractured or deformed state. This may result in chronic pain, impaired mobility, pulmonary dysfunction, a decrease in overall quality of life and early mortality. Balloon kyphoplasty involves the percutaneous placement of an orthopaedic balloon inside the fractured vertebral body. The balloon is inflated, elevating the vertebral endplates and creating a cavity. After the balloon is removed, the cavity is filled with bone cement, usually polymethylmethacrylate, thereby stabilising the fracture that facilitates immediate mobility.[39-41]

Although more than 50 000 patients have apparently been treated worldwide, and the technique is also available in South Africa, published experience is limited and a recent review could only document two uncontrolled prospective studies and a number of case reports.[37] Significant pain relief and improved mobility was apparent within one to two days in up to 80% of patients. Complications appear to be uncommon, and were more prevalent when the bone cement was directly injected into a vertebral body without first creating a balloon cavity, but include leakage of cement into the paravertebral tissue, compression of the spinal nerve roots and pulmonary embolism.

Only patients with severe pain and loss of mobility who have not responded to conventional therapy should be considered. Timing of the procedure remains controversial; while some advocate kyphoplasty within the first two weeks following a fracture others suggest conservative treatment for at least six weeks. The latter certainly seems more rational. Other causes of pain must be excluded and only recent fractures are amenable to kyphoplasty. Total compressed vertebrae cannot be reduced, and it has been suggested that the affected vertebra should retain at least one third of its original height for the procedure to be successful. CT, MRI or isotope bone scans are employed to select those most likely to benefit from vertebroplasty.

Balloon kyphoplasty appears to be a safe and effective treatment to stabilise acute vertebral fractures, reduce pain, restore the bony anatomy and effect early mobilisation. However, no evidence-based data on the long-term effects of this procedure are available, in particular the incidence of new vertebral fracture near the cemented vertebra. Further RCTs are required before this technique can be recommended for the routine treatment of the acute vertebral fracture syndrome.

In conclusion, it is clear that a broadened conceptual understanding of the definition of osteoporosis has resulted in a more rational approach to its diagnosis and management. More evidence-based data on the efficacy and safety of known antiresorptive drugs employed in the prevention and treatment of patients with osteoporosis is reassuring. The availability of potent, safe osteo-anabolic agents offers much promise, even for those with advanced disease, particularly in South Africa.

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CHAPTER 14

STROKE
IN SOUTH AFRICA

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1. INTRODUCTION

Stroke is the second commonest cause of death worldwide,[1] with two-thirds of these deaths occurring in developing regions of the world, such as sub-Saharan Africa (SSA). The burden of stroke does not only lie in the high mortality but the high morbidity also leaves up to 50% of survivors chronically disabled.[2] The incidence of stroke in developing countries is also expected to rise in the future as the populations undergo what has been referred to as the "health transition."[3] At present, the major health burdens in SSA are infectious diseases, including HIV/AIDS, and diseases related to poverty and malnutrition. However, urbanisation is predicted to increase the risk factors for vascular disease and hence lead to a sharp increase in stroke, such as is found in developing countries.

The pattern of vascular disease changes during this transition; in its early stage stroke is likely to be more common than heart disease.[3] However, stroke is a heterogeneous condition consisting of different types (cerebral haemorrhage and cerebral infarction) and subtypes of infarction (broadly classified as large vessel and small vessel infarcts); the relative importance of these changes depending on the risk factor profile prevalent in the population, and hence the stage of the population in the health transition. The causes of the various stroke types and subtypes differ, as does their management. Therefore, it is important to understand the profile of stroke and the common causes within a population, and appropriately equip the health service to deal with population-specific needs.

Accurately understanding the burden and nature of stroke in the population therefore allows one insight into where the population is along the health transition, and allows for appropriate health service planning for acute services and 1º and 2º prevention. In South Africa, this task is complicated by our different population groups and socio-economic structure. Not only does the relative importance of risk factors for stroke and cardiovascular disease differ between population groups globally,[4,5] but as a result of socio-economic and past political influences we have population groups that, in general, reflect different stages of the health transition.

While a great deal is known about stroke in the high-income countries, very little, if anything, is known about the burden and nature of stroke for most of SSA. In South Africa we can probably extrapolate fairly accurately from the findings of stroke studies done elsewhere that included whites and to some extent Asians, but we are totally reliant on doing our own studies to obtain accurate data on coloured and black South Africans. Fortunately, since the last edition of this report, several studies have advanced our knowledge of the burden and nature of stroke in South Africa. Our present knowledge is reviewed in this chapter. We will then briefly highlight what is being done to advance the treatment and prevention of stroke in the country, and end with the state of current and future research on stroke in South Africa.

2. BURDEN AND NATURE OF STROKE IN SOUTH AFRICA

2.1 Burden of stroke

The burden of stroke on a population includes the mortality, the prevalence, the incidence, and the long-term outcome of patients.[6] Ideally, one would also like to know what the cost or economic burden of the disease is in terms of its impact on the health service directly, and on the individual, family and community, both directly and indirectly, financially, and psychosocially. Unfortunately, very little is known about the socio-economic impact of stroke in South Africa and we have not considered this aspect further, although some investigators are researching this important issue.

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2.2 Mortality of stroke

Traditionally, mortality figures are derived from vital registration data. However, the HIV/AIDS epidemic has caused dramatic changes in demographic features and mortality profiles.[7] As a result, a more complex model has been devised to estimate causes of death, including stroke. From these 'Initial burden of disease estimates for South Africa, 2000',[7] stroke was found to be the fourth most common cause of death, accounting for 6% of all deaths in 2000. Estimations showed more females (18 184) than males (13 930) died of stroke, and the overall age-standardised mortality rate for stroke was 124.9/100 000. Stroke is thus the most important non-communicable disease which causes death in females, compared to ischaemic heart disease in males.[8] Population group-specific figures are not available.

Vital registration is limited, if available at all, for most of SSA.[1] To overcome this void in health information, demographic health and surveillance sites (DSS) have utilised the verbal autopsy, a tool that consists of a questionnaire completed during a retrospective interview of individuals who are able to describe what happened during the hours, days or months preceding a death. A most likely cause of death is inferred from this information, either by physicians or by computer algorithms.[9]

The MRC/Wits (Agincourt) Rural Public Health and Health Transition Research Unit, using verbal autopsies, found stroke caused 5.5% of all deaths in a rural population of 63 000 in Limpopo Province between 1992 and 1995. The sensitivity and specificity for stroke in this study was 87% and 97%, respectively.[10] Stroke was the commonest cause of death in the 55-74-year-old age group. While in the 35-54-year-old and ≥ 75-year-old age groups, it was the second commonest cause of death after assault and congestive heart failure, respectively. The overall crude stroke mortality rate was 127/100 000 (95% CI, 93 to 160).

Based on England and Wales in 1993, where the age-adjusted mortality rate (per 100,000) was 122 in males and 115 in females,[11] stroke mortality in South Africa is at least as high, if not higher. (Obviously, a direct comparison must be made with caution, as the South African figures are not age-adjusted to Segi's world population in this case, and the figures for England and Wales are adjusted. However, as the South African rural population demographic structure is typical of a developing country population, one might expect the mortality figures to increase on adjustment).[12,13] However, a high mortality may reflect either a high incidence of stroke or a high case fatality rate or both.[14]

2.3 Prevalence of stroke

It is useful to know the prevalence of stroke in a population (i.e., the number of people with stroke in the community at any one time) in order to help plan health services. In high-income countries, stroke prevalence studies are usually conducted using telephone or postal surveys. However, in South Africa identifying people with stroke at home, particularly outside urban areas, is fraught with difficulty.

The Southern African Stroke Prevention Initiative (SASPI) has recently published the first stroke prevalence study from South Africa. The study was conducted in the Agincourt demographic and health surveillance site in Limpopo, with a population of 70 000. During the Unit's annual door-to-door census of the population in 2001, the census fieldworkers were trained to ask two additional screening questions for stroke. They requested each household informant to name every individual over the age of 15 years in the household, and then asked whether the named person(s) 1) ever had weakness down one side of the body, and 2) ever had a stroke. If the answer to either or both questions was positive, then a neurologist or one of two clinicians trained in stroke assessment, accompanied by an interpreter, visited the individual in his or her home and assessed whether or not the individual had had a stroke. The diagnosis of stroke was based on the World Health Organization definition and people with transient ischaemic attacks were excluded. If the person had had a stroke, then they were fully assessed clinically and their blood pressure was taken.

The crude prevalence was 300/100 000 (95% CI, 250 to 357)[15] after a correction was made by sex and 10-year age band for those not examined who screened positive. Labour migration added an element of complexity to the study as one would expect in any prevalence study in rural South Africa. Stroke prevalence was higher in females, 348 (95% CI, 276 to 436), than males, 246 (95% CI, 181 to 323). The age-standardised prevalence using the Segi standard population was 290.[13]

Of particular interest is the comparison of the prevalence of all strokes with the prevalence of stroke survivors 'needing help with at least one activity of daily living' and comparing this with similar data from Tanzania and Auckland, New Zealand. Overall, rural stroke prevalence in South Africa is about three times lower than in New Zealand and more than double that in Tanzania. But,

despite fewer people with stroke in the community, the prevalence of people 'needing help with at least one activity of daily living' was higher in South Africa than in New Zealand (200/100 000 compared to 173).[15] This is a significant finding because this group of people need the most help and places the greatest burden on the family, community, and health services.

2.4 Stroke incidence and case fatality

While stroke prevalence studies are useful, they have shortcomings in that they under-represent cases that die soon after the stroke, and people with very mild strokes who recover quickly and may not be included in a survey months or years later. Yet both groups may utilise health services and add to the overall disease burden. Neither stroke mortality, nor stroke prevalence, studies provide accurate data on the nature of stroke types and subtypes, and the exact cause of the stroke, all of which are best assessed within hours or days after the onset of a first-ever stroke. So the best epidemiological studies of stroke are community-based incidence studies of first-ever-in-a-lifetime stroke, with long-term follow up of case fatality.[6]

No community-based stroke incidence studies have ever been done in Southern Africa because of the difficulty of performing them.[16] There have been urban hospital-based studies from South Africa and Zimbabwe that have attempted to estimate stroke incidence in the region. However, there are many reasons why people may not be admitted to hospital with stroke and often people who are admitted represent a particular spectrum of stroke patients, possibly more severe cases.[17] These studies provide valuable information regarding the nature of stroke in the community, and are discussed later (see Table 14.1). International criteria now exist for acceptable methodology for comparable stroke incidence studies.[17,18]

There are also no case fatality data for stroke in South Africa from community-based studies. The only case fatality data available come from hospital-based urban stroke registers. All three registers (two South African and one from Zimbabwe) found very similar stroke case fatality, ranging between 33% and 35% at one month following the stroke.[19-21] But because stroke is a heterogeneous condition, it is important to know the case-mix and stroke types if possible. Rosman[19] found the case fatality to be 22% at one month for cerebral infarction and 58% for cerebral haemorrhage in Pretoria.

In a recently published study with longer follow up in The Gambia, Walker *et al.*[22] found hospital-based all stroke case fatality to be 27% at one month and 44% at six months.

3. NATURE OF STROKE

Stroke is a heterogeneous condition made up of three pathological types: cerebral infarction, cerebral haemorrhage and subarachnoid haemorrhage. Cerebral infarction or ischaemic stroke is then further divided into various subtypes, such as intracranial small vessel disease, large-vessel atherosclerotic disease, and embolism from the heart.[6] These types and subtypes differ in terms of cause, outcome and treatment.[14]

The proportions of the various stroke types and subtypes change within populations as they undergo the health transition. For example, early in the transition, when the prevalence of hypertension is high, but smoking, blood cholesterol and atherosclerotic disease are low, cerebral haemorrhage forms a greater proportion of all strokes.[23,24] However, later, as the other risk factors become more common, and cerebral atherosclerosis increases, there is a decrease in the rate of cerebral haemorrhage and an increase in the rate of cerebral infarction. The causes of ischaemic stroke also change. For example, early in the transition, cardio-embolic stroke may be related to a high prevalence of rheumatic heart disease, and later this may be superseded by ischaemic heart disease.[24]

3.1 Stroke types and subtypes in South Africa

To accurately understand the true nature of stroke community-based incidence studies are needed with early brain imaging and investigations of risk factors and cause. Unfortunately, these studies require large budgets and take years to plan and develop. Hospital-based stroke registers with overlapping case ascertainment, entering consecutive stroke patients admitted to hospital, and all patients who develop stroke while in hospital, where patients are assessed by clinicians experienced in the subtlety of stroke diagnosis, typing and management, add greatly to our knowledge of the nature of stroke within the population. There have been three such studies published from South Africa, one from Zimbabwe and a further three registers are either in progress or have recently been completed. Table 14.1 compares the findings of stroke type and subtype from the published studies that used brain imaging. Matenga's[21] study from Zimbabwe included a larger number of patients in the Harare stroke study, but only the patients in this substudy were scanned and are therefore included in the Table.[25] All the studies are either exclusively urban or in the case of Hoffmann's[26-28] studies predominantly urban.

Table 14.1. Comparison of pathological stroke types and subtypes from hospital-based stroke studies

				Stroke type (%)			Ischaemic stroke subtype (%)				Comments
Study (site/author/year)	**n**	**Population group/s**	**Scan rate (%)**	**CH**	**CI**	**SAH**	**LV**	**SV**	**CE**	**Other/ unknown**	
Kalafong/Rosman/1986[19]	116	Black	79	33	66	n/i	47	31	21	1	Recurrent and first-ever-in-a-lifetime strokes included.
Harare/Matenga/1986[25]	100	Black	100	31	67	2	-	-	19	-	100 consecutive patients with presumed stroke studied. Seven were found to have non-stroke lesions.
Medunsa/Joubert/1991[20]	304	Black	82	26	71	3	-	1	46	-	All first-ever-in-a-lifetime strokes.
Durban/Hoffmann/ 2000[26-28]	1000	White : 781 Asian : 104 Black : 100 Coloured : 14 Uncertain : 1	100	5	95	0	26	26	12	35	Register based on referrals to author's practice, i.e., personal series. Very detailed investigations and focus on cognitive assessment of patients. See section on HIV and stroke.

CH: cerebral haemorrhage; CI: cerebral infarction; SAH: sub-arachnoid haemorrhage; LV: large vessel; SV: small vessel; CE: cardio-embolic; n/i: not included

The three ongoing or recently completed stroke registers are: the University of Cape Town and Groote Schuur Hospital database, the Johannesburg Hospital Stroke Register, and the Tintswalo Hospital Stroke Register. The first two urban registers will provide cross-population group comparisons of the nature of stroke during a time of rapid health transition and high HIV/AIDS prevalence, and the Tintswalo Hospital Stroke Register will provide the first glimpse of the profile of stroke in a rural hospital in South Africa. All three registers have similar methodology to aid in future comparisons.

Table 14.1 shows that cerebral haemorrhage occurs in about 30% of black stroke patients and it is tempting to infer that this is in keeping with the anticipated impact of the health transition and subsequent hypertension in the absence of much atherosclerosis. One has to be cautious in the interpretation of hospital-based series, however, as cerebral haemorrhages have a more dramatic clinical presentation and are therefore more likely to be admitted to hospital and then to be imaged. The low proportion of cerebral haemorrhage in the Durban Stroke Register may reflect the population groups included, but as 5% would be low anywhere in the world, it more likely reflects the pattern of referral to the register.

It is very difficult to interpret the differences in stroke subtypes found in the series shown in Table 14.1. Not all studies provided sufficient detail on ischaemic stroke subtypes to complete the Table. From earlier studies, it is also not clear how small and large vessel disease was defined. Patients with small vessel or lacunar strokes often experience very mild strokes and may not have been admitted to hospital. This may also have added to the low percentage of small vessel strokes in the Medunsa Stroke Register (Table 14.1).

The prevalence of extracranial carotid disease, measured by Doppler or indirectly implied by the presence or absence of carotid bruits and pulses, is generally low in studies of black South Africans (<1-4%)[20,29,30] and higher in series with a large proportion of white South Africans, e.g. 25% in the Durban Stroke Register.[26]

Patients entered into the Durban Stroke Register were investigated in detail, and the focus of the study was on higher cortical deficits following stroke. Hoffmann[27] reached the conclusion that cognitive impairment is present in the majority of stroke types and may be the sole presentation of stroke even when unaccompanied by long-tract signs.

Although multiple population groups were included, all 100 black stroke patients were young,[28] and there is insufficient published data to compare stroke subtypes across groups and make inferences regarding the health transition.

Two studies have specifically considered TIA or stroke in young South Africans. Between 1981 and 1991 Giovannoni and Fritz[31] investigated 75 young (< 45 years old) TIA patients seen at the Johannesburg Hospital TIA clinic and compared them with older patients in terms of risk factors and cause of their TIA. They found that the younger patients were more likely to have migraine and valvular heart disease, and the older group were more likely to have hypertension, ischaemic heart disease, peripheral vascular disease and a previous smoking history. Although the commonest aetiology in both groups was atherosclerosis, younger patients were also more likely to have conditions such as fibromuscular dysplasia and mitral valve prolapse, and to use the oral contraceptive pill.[31]

Hoffmann[28] analysed the 320 young (15-49 years) stroke patients in the Durban Stroke Register and found that race and endemic disease were important determinants of the underlying cause and risk factor profile. Whites presented with the more traditional risk factors, such as hypertension, hyperlipidaemia, alcohol abuse and smoking, while blacks more often had had an infection in the two weeks prior to the stroke. The TOAST classification of 'other' stroke causes, included HIV-associated stroke in 20%, tuberculosis vasculitis, neurocysticercosis, syphilis, bilharzia, Takayashu's disease, a large number of coagulopathies, and dissection and cerebral venous thrombosis.[28]

3.2 Stroke risk factors in South Africa – in people who have had strokes

Stroke risk factors are divided into those that are modifiable and those that are not, such as sex. Increasing age is a major unmodifiable risk factor for stroke in all studies, whether in developed or developing countries. Of importance, though, is that data from hospital-based studies suggest that age-specific stroke incidence is higher in younger (35-54-year-old) age groups in South Africa than in high-income regions.[19,21]

Hospital-based studies have found the following prevalence of modifiable stroke risk factors in people admitted with stroke:[19,20,26]

hypertension in patients with cerebral infarction 32-76%,
hypertension in patients with cerebral haemorrhage 76-93%,
diabetes mellitus 3-10%,
hypercholesterolaemia <2-10% (although the definition used is not given in the study by Hoffmann,[25] and 10% is at least double the finding of any other study),
atrial fibrillation 1-7%,
cigarette smoking 15-28%, and
previous stroke or transient ischaemic attack 2-7%.

In the SASPI study of stroke prevalence in rural South Africans, hypertension was again the most common risk factor: hypertension 71%, diabetes mellitus 12%, cigarette smoking 9%, and current alcohol use 20%.[30]

3.3 The impact of human immunodeficiency virus (HIV) on stroke in South Africa

There is no accurate way of knowing what the impact of HIV has been on stroke in South Africa. Anecdotally, many clinicians mention increasing numbers of young HIV-positive stroke patients in our hospitals, and there are many reasons why someone who is immunosuppressed with HIV may present with a stroke (e.g., as a result of tuberculous meningitis, toxoplasmosis affecting cerebral blood vessels or even cardiac disease).[32] HIV has been associated with coagulation abnormalities, such as Protein S deficiency, but this does not seem to be an important cause of stroke in our population and in a case series from Chris Hani Baragwanath Hospital. Mochan *et al*.[33] found the causes of stroke in HIV-positive stroke patients to be similar to those in HIV-negative stroke patients.

So does HIV itself actually cause or independently increase the risk of stroke? It certainly causes an intracranial small vessel vasculopathy,[32] and an extra-cranial large artery 'vasculitis' of sorts,[34,35] but only one study has fairly convincingly found HIV to be an independent risk for stroke.[36]

There have not been many prospective series published during the 'HIV-era' in South Africa. The Durban Stroke Register found 20% of young black stroke patients to be HIV positive and have HIV-associated stroke,[28] but in the older rural SASPI stroke prevalence study only 2% of stroke patients were thought to be HIV positive.[15] In both studies, these figures probably reflect the HIV prevalence in the general population; what is needed is a case-controlled study to answer the question.

Of more immediate concern, though, is the impact that an increasing burden of stroke is likely to have on the country's middle-aged and elderly population. In a population affected by HIV, where many families have lost their parents, that role is then taken on by grandparents. This group is at most risk for stroke and vascular disease.

3.4 Summary of the burden and nature of stroke in South Africa

Stroke mortality is already high in South Africa, and although stroke prevalence is not yet at developed country levels in rural areas, the prevalence of people requiring help with activities of daily living is already higher than that found in high-income countries. These findings suggest that we are well into the health transition and that stroke is adding significantly to the burden of disease facing our health service. However, knowing about stroke mortality and prevalence is not enough, and we certainly do not know nearly enough about the nature of stroke in the community in South Africa. We need high quality community-based stroke incidence studies with accurate assessment of stroke type, subtype, risk factors and causes, and long-term follow up to inform us about risk factors, causes, true stroke burden and outcome, and to help us develop appropriate treatment and prevention strategies.

4. THE TREATMENT AND PREVENTION OF STROKE IN SOUTH AFRICA

4.1 Treatment of acute stroke

There have been major advances in the treatment of acute stroke in recent years.[15] Fundamental to these advances have been the use of thrombolysis in ischaemic stroke, protocol driven multi-disciplinary care in stroke units, and development of national guidelines to assist in protocol development and standardisation of care.[15] Since the last edition of this report, the South African Stroke Management Guidelines have been published under the auspices of the South African Medical Association and edited by Professor Vivian Fritz.[37] The South African

Hypertension Guidelines also specifically deal with the management of hypertension in stroke patients.[38]

There is currently only one academic stroke unit, which is located at Groote Schuur Hospital, Cape Town, established by Professor Alan Bryer, and a second provincial unit at the GF Jooste Hospital in Cape Town. However, the South African Government has accepted the Stroke Management Guidelines, which are now policy, and the intention of government is that every province will have at least one stroke unit.

4.2 Treatment and prevention of stroke in South Africa

The key to advancing the treatment of stroke and improving primary and secondary prevention is enhanced public and health practitioner awareness or education. This role has been taken on by the Southern African Stroke Foundation (SASF). The SASF, under the leadership of Professor Vivian Fritz, has promoted stroke awareness through the annual stroke awareness week, using multiple media modalities, pamphlets, fun activities and various other events. Doctors, nurses and allied professionals have been educated through congresses, workshops, continuing education meetings, television programmes and print media.

The SASF is therefore a fundamental part of both the 'mass' and 'high' risk strategies for lowering risk for stroke. The high-risk strategy involves the more costly identification and treatment of people at high risk for stroke (e.g., those with high cholesterol, high blood pressure and those who have had a stroke). The 'mass' strategy is less costly, but requires huge numbers of the population to change their lifestyle and, for example, eat less salt and exercise more, and so lower their risk.

The SASPI prevalence study has recently highlighted the very poor level of secondary prevention in our rural stroke patients. Of 103 stroke patients, only one person was taking daily aspirin, and of the 73 who had hypertension, only eight were on treatment and only one was controlled.[30]

The importance of good treatment and prevention strategies was recently highlighted with the publication of the Oxfordshire Community Stroke Project / OXVASC follow-up study. This study demonstrated that a 40% age-specific drop in stroke incidence over 20 years is possible in a population, almost certainly due in large part to the impact of preventive strategies.[18,19,39]

5. CURRENT AND FUTURE STROKE RESEARCH IN SOUTH AFRICA

Although we cannot claim to be aware of all stroke research activities underway in the country, major research activities planned, recently completed or currently underway include:

- Hospital-based registers at Groote Schuur, Johannesburg Hospital and Tintswalo Hospital.
- Southern African Stroke Prevention Initiative (SASPI) – a multi-disciplinary collaborative study between the University of the Witwatersrand, University of Warwick and University of Edinburgh (and others). Work takes place in the MRC/ Wits (Agincourt) Rural Public Health and Health Transition Research Unit, Limpopo Province. Topics being researched are the prevalence of vascular risk factors, qualitative research regarding perception of health and illness, the socio-economic impact of stroke, and other components mentioned in the text. Planned future projects include a stroke incidence study, the development of a long-term cohort study and interventions to reduce stroke/ vascular disease.
- UCT/ Wits/ Swedish Collaboration (Sida-Sarec): A study for the development of a community-based stroke care model for use in urban and rural South Africa.
- Cardiovascular disease research funded study to assess the role of discharge planning post-stroke. This is based at GF Jooste Hospital and will be followed by a community study to assess post-stroke outcome.
- The development of acute stroke management protocols appropriate to various levels of care in South Africa (SASF).
- Research to clarify the impact of HIV on stroke and help guide the management of HIV-infected patients is continuing in a number of centres.

6. CONCLUSION

Stroke is the forerunner of vascular disease in the epidemiologic or health transition, and all evidence suggests that South Africa is well into the transition. It is a devastating condition with high levels of disability and case fatality. Yet stroke is readily prevented. It is not, however, a uniform, one-size-fits-all disease. It is a heterogeneous condition made up of different types and subtypes, each with its own profile of risk factors and causes and management. Furthermore, the types and subtypes are not uniformly represented across all sections of the population. If we are to develop

appropriate strategies to treat and prevent stroke in South Africa, we need to find out more about stroke burden and nature in order to develop locally relevant interventions and facilities capable of handling these conditions. The benefits have been shown to be enormous. If we fail, we will be facing a rapidly increasing burden of stroke adding to our health service burden.

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CHAPTER 15

POPULATION AGEING AND HEALTH CHALLENGES IN SOUTH AFRICA

Jané Joubert,[a] Debbie Bradshaw[b]

POPULATION AGEING

Population ageing, or demographic ageing, refers, in simplistic terms, to the process by which the older population (60 years or older)* become a proportionally larger component of the total population. Population ageing is an outcome of a population's demographic transition from higher to lower levels of fertility and mortality. In some populations, international migration plays a role too. During this process the age structure of the population changes from a broad-based pyramid shape with high proportions of children to a more columnar shape with increased proportions of middle-age and older persons.

Population ageing has been described as a key demographic feature of the 20th century. The United Nations termed it "one of the most distinctive demographic events" of the previous century, and stated that it will remain an important population issue throughout the 21st century.[1] In 1950, the world housed an estimated 205 million older persons, 606 million in 2000, and in 2050 the number is projected to increase to 2000 million. This reflects a tripling of the older population over each of two consecutive 50-year periods.[1]

Although initially experienced by the more developed countries, population ageing is now a global phenomenon, experienced in virtually all countries of the world. Population ageing has become a well-publicised phenomenon and public concern in the more developed nations, but is commonly less publicised and less of a public concern in the less developed regions. This relative lack of concern observed in much of the less developed world is ironic for two reasons: first, in the year 2000, that part of the world was home to 62% of the world's older persons, and, secondly, the world's older population is growing at a much faster rate in the less compared to the more developed regions, which means that the older population will be increasingly concentrated in the less developed regions.[1, 2]

SOCIAL POLICY IMPLICATIONS OF POPULATION AGEING

As the younger-older balance in a population changes, the numbers and relative proportions of older persons increase, and such changes in a society's age composition affect various social and economic circumstances and structures in that society. Concerns often raised by population ageing are those related to a society's social security systems and patterns of resource distribution. These concerns include intergenerational support systems, workplace pension funds, retirement policies, social welfare assistance, health insurance/medical aid funds, and health-care provision.[1]

In many developed countries population ageing is a gradual process occurring over many decades and following considerable socio-economic development, thus allowing for planning, policy development and resource allocation. However, in many developing countries population ageing is much more rapid, and is occurring on relatively larger population bases. Often, populations are ageing in developing countries before any significant socio-economic development has taken place, thus making planning, policy development and resource allocation a more difficult task than in developed nations.[1,2]

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* *We acknowledge the growing awareness that terms such as 'older persons', 'the elderly' and 'older population' represent an inadequate generalization that may conceal considerable diversity in persons belonging to a broad age group, often spanning 20 to 40 years of life. However, to enable international comparison, some chronological demarcation of age categories is required (Kinsella & Velkoff, 2001). As currently promoted and utilized by the United Nations and the World Health Organization, the term 'older persons' or 'older population' will be used, referring to persons 60 years or older. Some publications have used 50, 55 or 65 years as cut-off points. If references are made to these cut-off points, it will likewise be indicated in the text.*

Demographic ageing, as fertility and births decline and populations begin and continue to age, often occurs in tandem with changes in the disease profile arising from socio-economic transformation in a society. Generally, the prominent causes of death change from those associated with infant and childhood mortality to those associated with older age; from a prominence of infectious, nutritional and maternal conditions to chronic and degenerative disease and other lifestyle-related disabilities.[3-5] In this way, as a population ages there will be changes in its health needs with a greater demand for chronic care. Furthermore, as longevity increases in a population, the prevalence of chronic disease, disability and frailty increases through a tendency of declining physiological, physical, mental and cognitive functional capacities in ageing individuals.[6,7] An ageing population, therefore, has an increasing number of people who need health and related care, and this is generally associated with rising demands on the health-care system.

A prominent feature in almost all countries is that women on average live longer than men; therefore older women greatly outnumber older men. This is mainly because mortality rates in men commonly are higher than those in women across the life span. This gender imbalance may hold important implications for social support and public planning, since older women generally are more likely to be widowed than men are. They are more likely than men to experience domestic violence, tend to be less educated than men, have less formal work experience and tend to have less access to private income sources. Furthermore, compared to men, they are more likely to experience discrimination in access to inheritances, social security measures, and political power and health. As a result of these cumulative disadvantages older women are more likely to be financially under-resourced, and to suffer disabilities and disease in older age than are men.[1,8]

DEMOGRAPHIC TRENDS IN SOUTH AFRICA

Fertility

Persistent lowered fertility brings about declines in births, which, in turn, result in declining proportions of children and a corresponding increase in the proportion of older persons. Therefore, when persistent low fertility is leading to a decline in the size of successive birth cohorts, a population will start ageing. This process is called ageing from the base of the population structure.[9-12]

South Africa's total fertility rate (TFR) is estimated to have been in decline from at least the early 1950s when it was at a level of 6.1 live births per woman.[13] Current national levels are estimated at 2.5,[14] which is higher than that in developed countries, some of which have fallen below replacement level of 2.1. However, in regional terms, South Africa is already at a very low level compared to that of Africa as a continent (5.0), and individual neighbouring countries, such as Angola (7.2), Botswana (3.9), Mozambique (5.9) and Swaziland (4.4).[1] Persistent declining fertility in South Africa has recently resulted in a demographically-significant turning point where the number of annual births has started to decline, leading to a decline in the size of successive birth cohorts. Persistent fertility decline is a concern to South Africa as there will be a progressive decrease in the availability of kin upon whom future cohorts of older persons can rely for various forms of support. Such support includes financial and subsistence support, as well as assistance with health care and activities of daily living.

Mortality

Mortality's role in the process of population ageing is a somewhat more complex one, since mortality reduction usually at first leads to a rejuvenation of a population as infant and child mortality rates are reduced by the treatment of infectious and parasitic disease. As a population moves in time through different stages of its demographic transition, declines in mortality in older ages only at a later stage contribute to population ageing, this time leading to ageing from the top of the population age structure.[2,15,16]

Historic mortality data in South Africa suffer considerable incompleteness, but it is estimated that child and infant mortality rates declined gradually from at least the 1950s until the early 1990s. Mortality data of the 1990s, however, were marked when age-specific death rates started showing increases in infants and children, and an uncommon, severe increase in young adult mortality.

Estimates show that mortality levels in older adults have stayed fairly constant over the past two decades, and that it will remain fairly constant over the next two decades.[14] These estimates indicate that the South African population has not yet started ageing from the apex of its age structure. However, analyses of demographic indicators have shown that the recently increased levels of mortality in infants, children and young adults have had a temporary accelerative effect on population ageing, hence creating a mortality-related ageing from the bottom and middle of the age structure.[17] Furthermore, decreased mortality levels in the population younger than 60 years, prior to the 1990s, implies increased life expectancy at younger ages and increased numbers of persons surviving into older ages. The social implications of increasing numbers of older persons were mentioned earlier.

AIDS-specific mortality holds several important concerns in the context of population ageing and older persons. These concerns include acceleration of the ageing process for about two decades, while, so far, very limited planning has yet been done to accommodate the needs of a growing older population. In addition, AIDS-specific mortality diminishes a crucial support-base (i.e. the children) of a sizeable proportion of older South Africans, and research has shown that the epidemic has brought added household, care-giving and social-nurturing responsibilities to many of the country's affected older persons.[18-20]

The AIDS epidemic has the potential to affect older persons' health and well-being in various direct and indirect ways. These include the following: physical and mental stress, anxiety and burnout from care-giving strains and a greater burden of household work; HIV infection through hands-on care-giving activities; and financial demands on older carers' income or savings related to the health-care costs of their sick offspring, the provision of material support to their AIDS-ill children and their dependants, funeral costs of deceased relatives, and suffering the loss of current and future financial support which the ill child or deceased would have provided.[21-23] These conditions and situations can increase older persons' risk of disease, injury, disability and diminished well-being themselves.

It is not that easy for scientists to make causal inferences about the impact of care giving on carers' health, but some studies do show an association between care giving and negative mental and physical health consequences.[24,25] These studies concentrated mainly on the context of informal care for older persons, but the associations found in the just-mentioned studies suggest that AIDS carers may also experience negative health outcomes.[26] However, these could have stronger associations because of the relative newness of the disease and its management, including the often adverse social climate surrounding HIV and AIDS. Later studies have indeed shown that among AIDS carers the stress of care giving is directly associated with greater depressive symptomatology[27] and with more pronounced symptoms of poor health.[26]

Migration

International immigration and emigration of people, especially working-age people, into and out of South Africa is an important demographic and socio-economic issue, but we were not able to find reliable data on such migration movements. Internal migration may affect demographic ageing of regional or local populations where, for example, a specific area is an artefact of the 'homelands' system and houses relatively large numbers of children and older persons, while working-age people emigrate in large numbers (compare the municipality areas of Jozini in KwaZulu-Natal and Thulamela in Limpopo). This phenomenon can also be seen where an area has limited employment opportunities but offers attractive retirement settings (the town of Hermanus). In contrast, towns such as Mthatha or Stellenbosch offer study and employment opportunities for thousands of young and working-age people, while no particularly attractive or large-scale retirement settings are offered.

At the familial or household level, internal migration may affect older persons; this can be either beneficial, when older persons are in receipt of remittances from working relatives, or disadvantageous, when they lose their traditional care-giving base as children emigrate. At the community and local level, it is suspected that the older population can be negatively affected through a weakened local workforce resulting in a diminished pool of tax payments. This, in turn, may reduce access to health, welfare or recreation infrastructure and resources in the form of, for example, clinics, health personnel, pension pay-points, social workers, luncheon clubs and formally organised cultural events.

POPULATION AGEING IN SOUTH AFRICA

Population 60+ as a proportion of the total population

The 2001 population census found that 7.3% of the total population were 60 years or older.[28] This proportion may be perceived as low, or at least considerably lower than the 2000 proportions of some developed nations, such as Italy (24.1%), Greece (23.4%) and Japan (23.2%), but it is higher than the proportions of almost all other African nations in 2000, with the exception of the two island populations of Mauritius (9%) and Reunion (9.9%). South Africa's 7.3% was noticeably higher than the 5.1% for the African continent as a whole, but displayed similar levels of ageing as those in such nations as Brazil (7.8%), India (7.6%), Mexico (6.9%), Samoa (6.8%) and Vietnam (7.5%). The average proportion for the Southern African region in 2000 was 5.7%, and neighbouring countries' proportions ranged from 4.5% in Angola and Botswana to 6.5% in Lesotho.[1] Fig. 1 illustrates that, despite the demographic impact of HIV/AIDS, the South African proportion is projected to increase over the next two decades, and that by 2025 more than one person in ten will be 60 years or older.

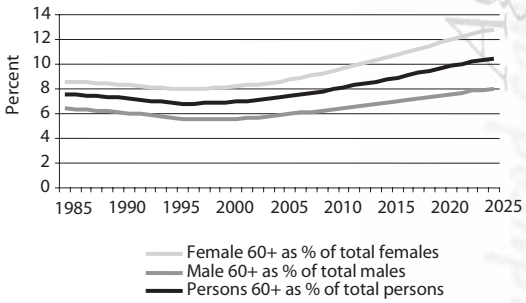


Figure 1: Older persons as a proportion of the total population, 1985-2025
Source: ASSA2002

Numbers of older persons

The above data has an important role to play in a discussion of population ageing, but percentages alone cannot portray the momentum of growth in the older population.[29] Although the proportion of the older population will increase moderately over the projection period, the absolute size is projected to increase by 112%, from 2.47 million in 1985 to 5.23 million in 2025, i.e. a doubling over the course of 40 years. Census 2001 counted 3.28 million older persons.[28] In the year 2000 South Africa had the second highest number of older persons on the African continent, only surpassed by the older population of Nigeria (5.42 million), while dwarfing the numbers in Reunion (71 000) and Mauritius (104 000), the nations with the highest and second highest proportions, respectively, in Africa.[1] The projected numbers in Fig. 2 below correspond well with the census count, and show that the total number of older persons is expected to increase more rapidly over the next two decades than over the past two decades.

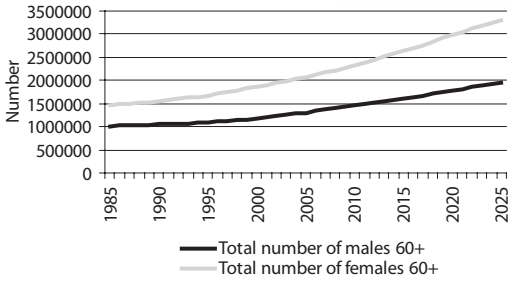


Figure 2: Total number of older males and females, 1985 - 2025
Source: ASSA2002

The growth in numbers is expected to occur in each five-year age group for both older men and women, as shown in Fig. 3. In older women, a considerable growth is projected in all the specified age groups, with each one being projected to more than double during the 40-year period. The total number of women 60+, for example, is projected to increase by 126%, compared to the total number of females 15-59 and 0-15, that are projected to increase by only 74% and 3%, respectively. Although the increase in the total number of older men is projected to be of a smaller magnitude than that of older women, it is still expected to nearly double during the projection period, from 1.02 million to 1.94 million. In the same period, the number of males 15-59 and 0-14 will increase by 83% and 8%, respectively.

These figures reveal that population growth in the older cohorts will be considerably more rapid than in the cohorts younger than 60 years old. As health typically declines and frailty and disability usually increase with advancing age, the near doubling of the oldest-old age group (80 years or older) is of particular concern. The increase in this group suggests an increase in the demand for long-term care, chronic care, frail care and end-of-life care. These, in turn, suggest an increased demand for appropriately trained health-care staff and informal carers to manage such demand.

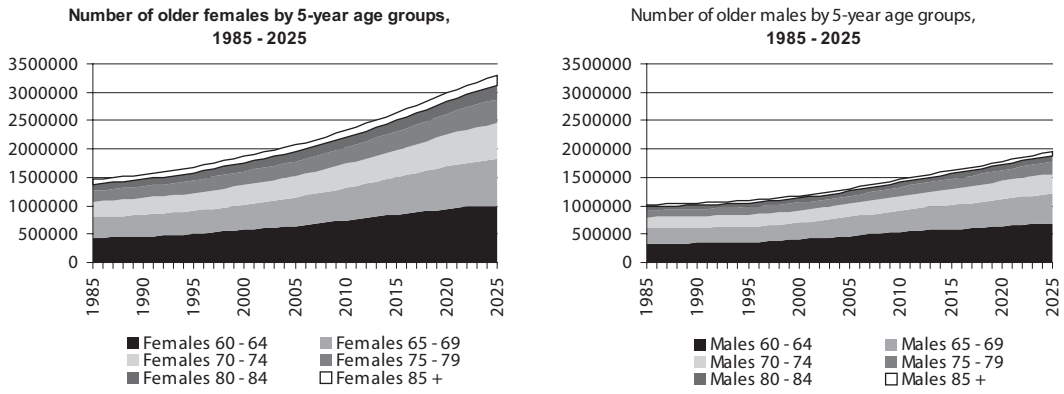


Figure 3: Number of older females and males by specified age groups, 1985 - 2025
Source: ASSA2002

Sustained feminisation of population ageing

Older women are not only projected to continue constituting a majority of the older population over the next two decades, but this trend is expected to increase. For example, in the 60+ population, the sex ratio is currently 0.63 (i.e. 63 men for every 100 women). Expressed as a proportion, 61% of the total current population 60+ are women. Two decades from now, this proportion is expected to increase to 63%. Consistent with global trends, the female share within the older South African population increases with age, as shown in the oldest-old population where currently 69% of the population 80+ years are women.

Growth rates

The annual growth rate of the 60+ population is estimated to have increased from around 1% in the late 1980s to 2.3% in 2005. This growth rate is now estimated to be four times higher than that of the population as a whole, and the difference between these rates is projected to increase for most of the next 15 years.[14]

Needs for support

In calculating dependency ratios, through crude generalisation, it is presumed that all persons over 65 years and those under 15 years are likely to be 'dependent' in some sense on those 15-64 years, the latter being perceived as the economically-critical age group who provide some sort of support, directly or indirectly, to persons in the other age groups. However, the indicator's value is limited as not all persons over 65 and less than 15 years require support, and not all persons 15-64 years old provide support. Despite its limitations, the dependency ratio is often used as a helpful indicator of the level of potential support needs in a society.[1]

As the kind of support needed by the older (65+) and youth (<15) cohorts in a population may differ, it is useful to distinguish between the 'youth', 'older age' and 'total' dependency ratios. Fig. 4 shows the trends of these ratios over the past and future two decades in South Africa, indicating that the youth dependency ratio is projected to decrease substantially over the next two decades, whereas the older-age dependency ratio is projected to increase.

For planners it is important to note that the composition of the ratio has undergone and will continue to undergo important changes over the projection period, i.e. that the balance between the youth component and the older-age component is changing. From 1985 to 2025, it is estimated that the youth dependency ratio will decline by 70%, while the older-age dependency ratio will increase by 16%. Given the rather sharp fertility declines from 1985 to 2000, it is estimated that the older-age dependency ratio will increase by 45% between 2000 and 2025. This indicates the extent of the need to plan for the kind of support and security generally needed by older cohorts, and, conversely, indicates the declining dependency needs of the youth population.

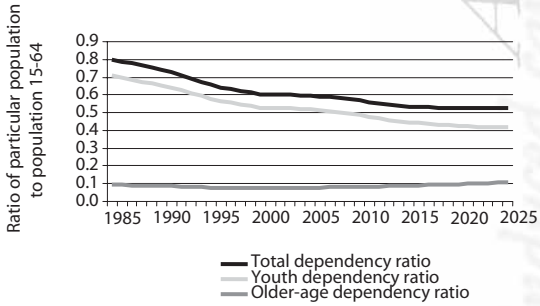


Figure 4: Total, youth and older-age dependency ratios, 1985-2025
Source: ASSA2002

Population group differences

Diverse ageing patterns are clear among the country's historically defined four population groups* as shown in Fig. 5. It needs to be kept in mind that independent analyses of the census results suggest an underestimate of children younger than 5 years, an overestimate of children aged 10-19 years, an underestimate of men relative to women, and an underestimate of whites. However, the pyramid shape of the 2001 black African population age structure is characteristic of demographically young populations, and signifies large numbers of children and a small number of older persons relative to the population younger than 60 years old. The age structure of the white population group has a narrower base and wider apex compared to that of the black African age structure, indicating that whites constitute a demographically older group. The Asian age structure is in an intermediate position between those of the whites and coloureds, and that of the coloureds, in an intermediate position between those of the Asians and black Africans.

Based on Census 2001, among whites about double the proportion (15.9%) are older persons (60+ years) compared to Asians (7.8%), black Africans (6.4%) and coloureds (6.4%).[30] Ageing is therefore most pronounced in whites. However, when the data are presented as the total number of older persons in the country, Black Africans made up the largest proportion, i.e. 69%, compared to white, coloured and Asian older persons, who made up 21%, 8%, and 3%, respectively.

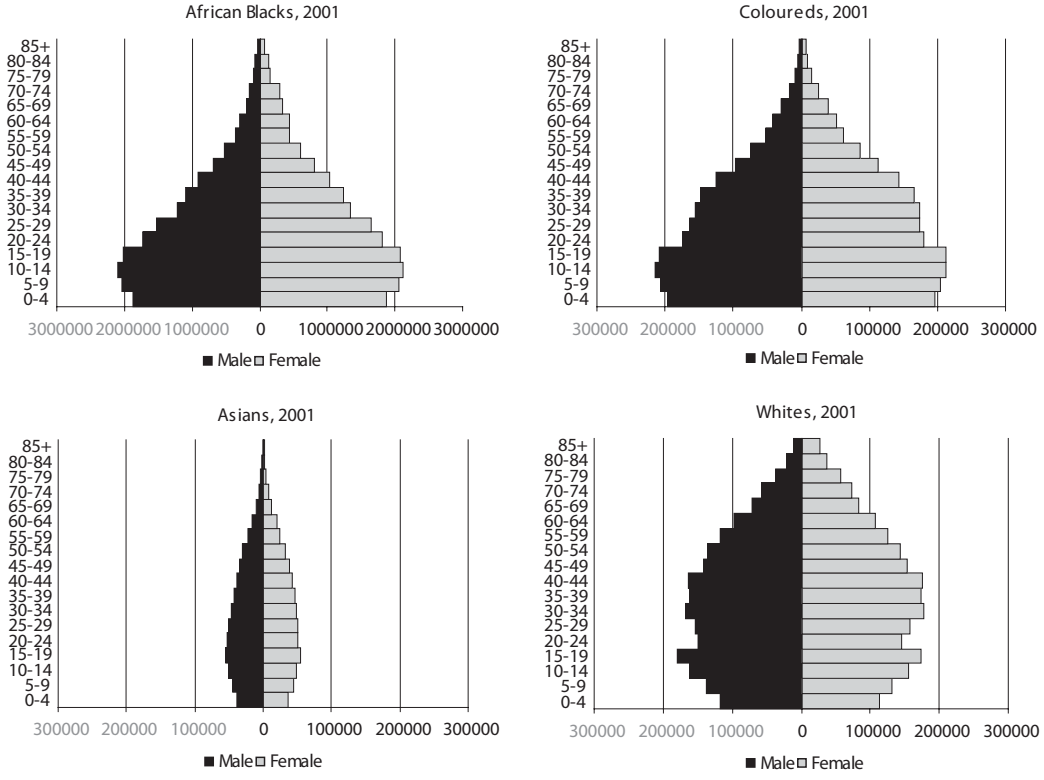


Figure 5: Age structures of South Africa's four population groups
Source: Statistics South Africa, Census 2001[28]

* *The population group classification is in accordance with the Population Registration Act of 1950. This classification has been used to highlight issues that may portray effects of historical disparities, and we do not subscribe to this classification for any other purpose.*

When considering both the number of persons >64 years and those <15 years, the 'dependency' ratios per population group differ considerably. Census 2001 data show that the highest ratio was among black Africans (62.2), followed by coloureds (53.4), whites (43.1) and Asians (39.2). These differences reflect the differences among age structures, which in turn are a reflection of the different stages of each population group's fertility and mortality transition years.[31]

Provincial differences

Census 2001 shows variation in the proportions of older persons per provinces, with the Eastern Cape, Northern Cape and Western Cape having the highest proportions, and Gauteng, Mpumalanga and KwaZulu-Natal having the lowest (Fig. 6). All provinces have a pattern of older females than older males, which is a common demographic phenomenon because of women's higher life expectancy at birth. However, given the multiple, often lifelong gender disadvantages experienced by numerous older women arising from biases of gender, widowhood and old age, the gender imbalance may have an impact on the social and material well-being of older women.[32,33] It is therefore important to note the consistently higher proportions of older women in the female provincial populations compared to the proportions of older persons in the total provincial population (Fig. 6). There is also a need to note the high levels of 'dependency' from older persons and children in Limpopo (82) and the Eastern Cape (76), showing particularly high 'dependency' ratios, followed by KwaZulu-Natal (65) and Mpumalanga (65).[30]

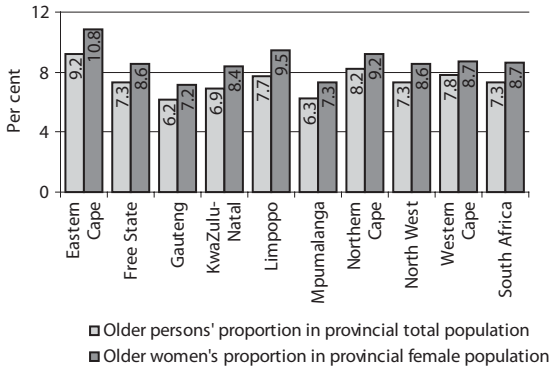


Figure 6: Older persons as a proportion of the total population per province: persons and women, 2001[28]

HEALTH OF OLDER PERSONS

Changing health profiles related to changing age structure profiles

The demographic ageing of populations throughout the world is directly related to fundamental changes in the health and disease patterns within that population, as epidemiological change ensues with a change from the predominance of infectious, parasitic and nutritional disease to the growing weight of chronic diseases of lifestyle (CDL).

The individual ageing process, from a medical perspective, is often associated with disease and disability. This association has been challenged on the grounds that there are many older persons who do not suffer chronic illness or disability, and many claiming to be in good health despite the presence of chronic illness.[34,35] However, this 'medical myth' is supported by morbidity and cause-of-death statistics showing that diseases are usually more common among older than younger people, and that the prevalence of disability and chronic disease increases with advanced age.[34] As in many other countries, mortality statistics in South Africa are an important and often-used source of evidence on the health status of the population, while it is difficult to find reliably measured population-based information about disease, disability and health risks. Given the recent emphasis on reproductive, child, adolescent and maternal health in the country, it is likely to be even more difficult to find reliable representative information about disease, disability and health risks in the older population.

Large mortality burden from CDL in older ages

As described elsewhere in the report, the total population suffers a unique quadruple mortality burden, consisting of the dual infectious/chronic disease burden, with the addition of high rates of injury and HIV/AIDS. In the older population (60+ years), however, the majority of the mortality burden comes from CDL, which were responsible for an estimated 84% of deaths in 2000. Fig. 7 shows the 20 leading causes of death in older men and women, and highlights the significant chronic disease burden in the older population.

Ischaemic heart disease (IHD) and stroke were the two leading single causes of death, with the order for men and women reversed. These two conditions accounted for almost one-third of deaths in the older population. Whereas hypertensive heart disease was responsible for more than double the proportion of deaths among women compared to men, chronic obstructive pulmonary disease accounted for almost double the proportion of deaths among men compared to women. Large numbers of death were from malignant neoplasms. In men, lung cancer was the leading cause of cancer deaths, followed by prostate, oesophageal, stomach, liver and colorectal cancer. In women, breast cancer was the leading cause of cancer deaths, followed by lung, cervix, oesophageal and colorectal cancer.[30]

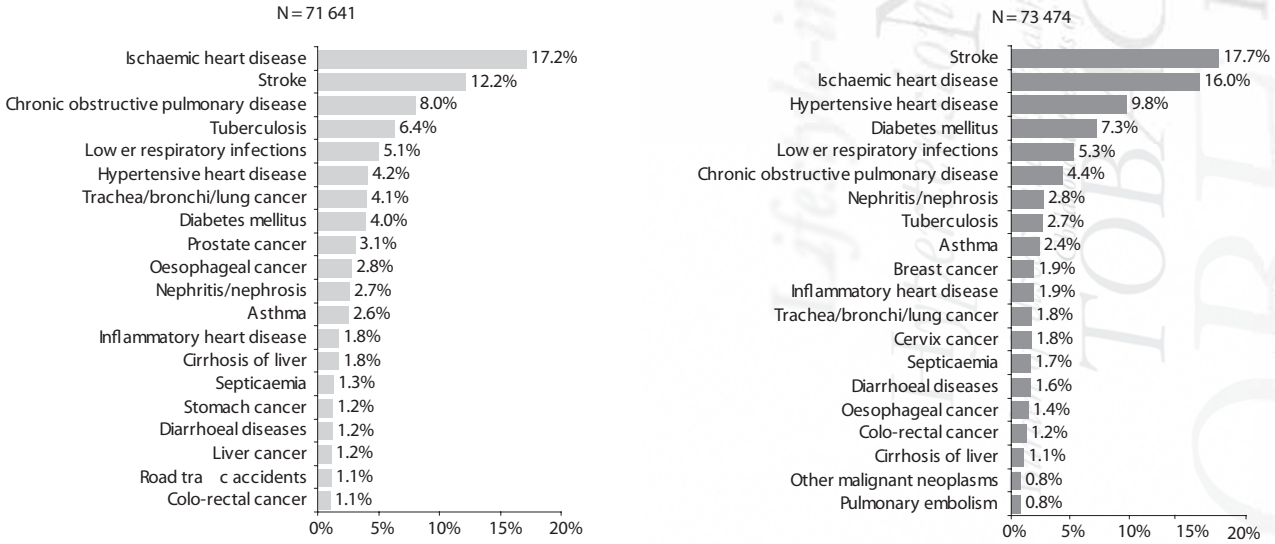


Figure 7: Leading 20 single causes of death in men (left) and women (right) 60 years or older, 2000[46]

Age-specific analysis has shown that CDL also have an extensive mortality impact on segments of the population younger than 60 years. For example, cardiovascular disease, neoplasms, diabetes and respiratory disease claim considerable numbers of people in their 30s, 40s and 50s, as shown elsewhere in this report. Of all CDL deaths in 2000, an estimated 41% occurred in persons younger than 60 years.

Selected chronic conditions

Data from the South African Demographic and Health Survey of 1998 (SADHS 1998) provides selected indicators for adult health and prevalence data of selected types of disability, as collected during the 2001 Population Census, are presented below for the 65+ and 60+ populations, respectively. The findings presented here generally rely on self-reported data; the exceptions were body mass index (BMI) and blood pressure, which were measured by the investigators.

Compared to other age groups, high proportions of persons 65+ had symptoms of asthma and chronic bronchitis. These symptoms were more commonly found in women than men, while self-reported asthma and chronic bronchitis conditions were more commonly found in older men compared to older women (Fig. 8). Of the self-reported other chronic diseases for which national data were found, arthritis, IHD and diabetes were most common in the older population. These three diseases were much more frequently reported in older women compared to older men. Hyperlipidaemia and tuberculosis were more frequently reported in older men compared to women, but the sex differences were less prominent (Fig. 9).[36,37]

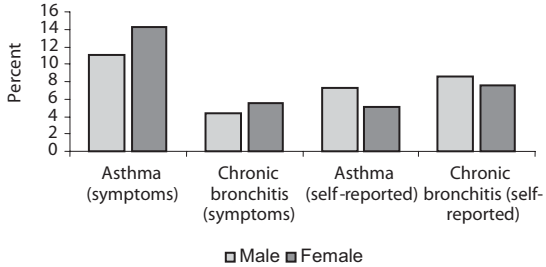
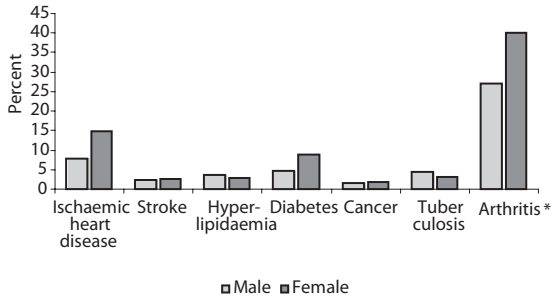


Figure 8: Self-reported chronic lung disease prevalence: Respondents reporting symptoms of asthma and chronic bronchitis, and respondents reporting being told by a health professional that they had asthma or chronic bronchitis[36]



*Arthritis data, based on self-report, not told by health professional, taken from CASE, 1994[38]

Figure 9: Other self-reported chronic disease prevalence in the population 65+, as told by a health professional to the respondent

Selected risk and lifestyle factors for chronic disease

It is widely acknowledged that being overweight or obese is associated with an increased risk of disease. The adverse metabolic effects include raised blood pressure, altered blood lipid profiles (raised triglycerides and cholesterol levels), and the development of insulin resistance; these, in turn, are related to a range of chronic diseases.[39] In the population 65+ years old, 43% of men and 60% of women had excess body weight with a BMI ≥25 kg/m^2 (Fig. 10).[36] This implies that large proportions of this population are at risk of a range of associated chronic conditions – including IHD, hypertensive disease, ischaemic stroke, type 2 diabetes, osteoarthritis and several cancers[39]* – and the associated limitations in survivors. A recent United States study among 7 132 adults, 70 years and older, has indeed found that obese men and women were more likely to develop a physical limitation that kept them from performing daily tasks than their non-obese counterparts.[40] This study concluded that finding effective ways to reduce obesity among older persons could have a "major" impact on disability rates in the older population.

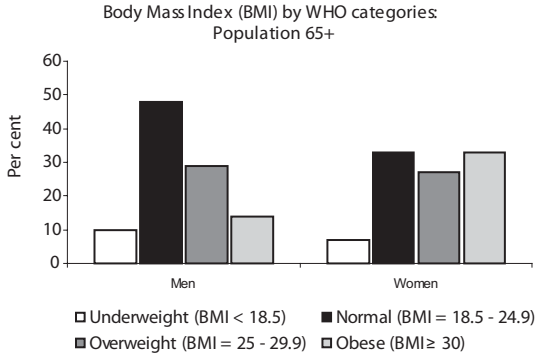


Figure 10: Measured body mass index in the population 65+ 36

Findings emanating from SADHS 1998 showed very high levels of hypertension prevalence in the population 65+ years old, with 52% of men and 60% of women having had a blood pressure reading of ≥140/90 mmHg. In each sex the prevalence was far more than double that in the total adult population (≥15 years). Compounding these high prevalence rates, only 38% of hypertensive men 65+ years were aware that they had the condition, less than one-third were taking a medication, and a mere 14% had their condition under control. Awareness and treatment levels in women 65+ were to some extent more satisfactory than in men, though far from ideal, while the levels of control were equally dissatisfactory (Fig. 11).[30,36,37]

Evidence exists that high blood pressure causes an increased risk of IHD, stroke, hypertensive heart disease and other cardiovascular and renal diseases.[39] In 2000, the former three conditions were the three leading causes of death in older persons. The proportion of these conditions that were attributable to hypertension in the 60+ population has not yet been published in South African studies. Although it is not possible to say whether the increased risk of developing such conditions are related to having high blood pressure before or after age 60 years, the high levels of hypertension in the older population, combined with poor levels of awareness, treatment and control of the condition, need improved attention and intervention.

* *Increased age-specific levels of underweight at older ages, on the other hand, are also a concern.*

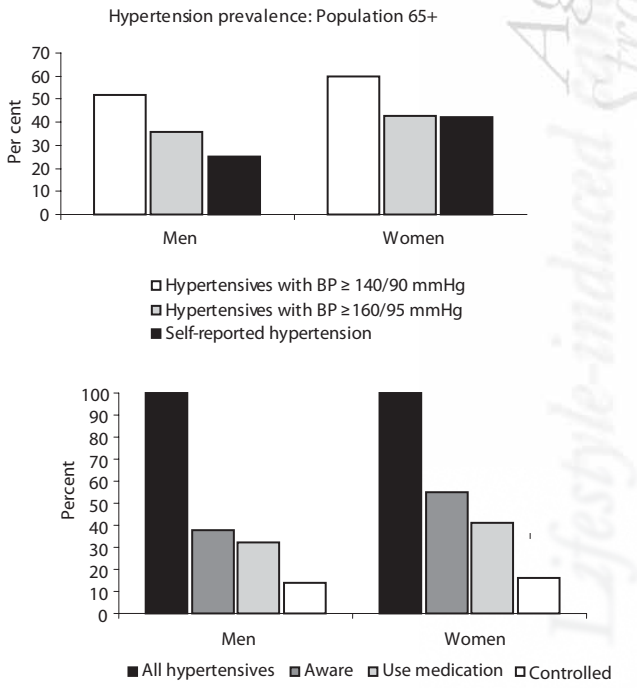


Figure 11: Measured prevalence, and self-reported awareness, treatment and control of hypertension in the population 65+[36]

In the population 65+ years, 35% of men and 7% of women reported smoking tobacco products daily at the time of the 1998 SADHS.[36] These proportions were not much lower than the 37% of all adult men and 9% of all adult women ≥15 years smoking tobacco daily. Given the adverse health effects of environmental tobacco smoke (ETS), it is worrying that over one-fifth of all men 65+ years and over a quarter of all women of the same age were likely exposed to ETS by sharing a household with smokers. A considerable proportion of men (43%) were exposed to dust and fumes in the workplace (Fig. 12), and the mean duration of exposure to workplace dust and fumes for both men and women was 18 years.[30,36,37]

Existing evidence that smoking causes substantially increased risk of mortality from several cancers, all vascular disease, heart disease, chronic obstructive pulmonary disease and other respiratory diseases[39] may be perceived as less of a concern in the older population considering the usual lag in time before tobacco-associated chronic morbidity sets in. However, many older smokers may live another 10 to 20 years or more, during which the impact may manifest, and it hence seems unwise to exclude the older population from tobacco-related health promotion investments. An additional motivation for not neglecting the older population relates to evidence that the extent of disease burden is consistently higher among groups known to have smoked longest.[39] Among men and women 65+ years who ever smoked cigarettes daily, a mean duration of 38 years in men and 35 years in women was found.[36] The 65+ population thus had the highest mean duration of smoking among all age groups, and although this is most likely simply a reflection of age, the higher disease burden associated with groups who have smoked longest remains a concern.

Figure 12: Self-reported tobacco use and exposure to an unhealthy environment in the population 65+[36]

Intoxication by and addiction to alcohol products each have their direct effects, but, additionally, causal relationships have been found between average intake of alcohol and over 60 types of disease and injury, including cirrhosis of the liver, epilepsy, depression, motor vehicle accidents and other injuries, and several cancers.[39] In the case of some chronic conditions, such as hypertension, stroke, diabetes and IHD, there can be a beneficial effect from moderate intake but a harmful effect from high intake.

Among people 65+ years old about 46% of men and 20% of women reported being current consumers of alcohol. These proportions were higher than were those in all adult men and women 15 years and older. Health risks of alcohol consumption are commonly associated with high consumption levels, but the 1998 SADHS does not provide good data on levels of consumption.[36] However, the dataset includes an assessment of alcohol dependence as assessed through the CAGE questionnaire* Of men and women 65+ years old, 23% and 12%, respectively, reported CAGE alcohol dependence (Fig. 13). The dependence rate for women 65+ was somewhat higher than the average for all adult women (9.9%).[30,36] These levels of alcohol dependency, and the higher rate of current alcohol consumers in the older population than the average adult rate, are matters of concern; possible health hazards relate to mobility issues and the presumed greater consumption of medication in the older population.[30]

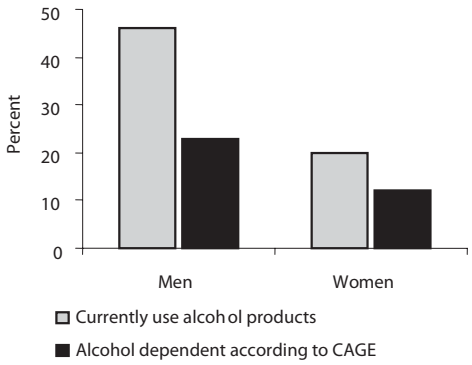


Figure 13: Reported alcohol use and dependency in the population 65 years or older[36]

Disability and mental health

During the 1980s, the WHO noted a distinction in prominent causes of disability between developed and developing countries: disability in developing countries stems primarily from malnutrition, accidents, communicable disease and congenital conditions, whereas in developed countries disability stems mainly from chronic disease such as arthritis, cardiovascular disease, mental illness, metabolic disorders and the consequences of alcohol and drug abuse.[2] Given South Africa's dual epidemiological profile, and the added burden of injuries, it is likely that the population has a diverse and extensive disability burden. The incidence of disability and impairment increases with age,[41] and the numbers of disabled persons are expected to increase as a correlate of absolute population growth.[2] In poor and deprived communities, a lifetime exposure to nutritional inadequacies, unattended or inadequately attended health and injury problems, and a number of environmental risk factors imply that many people enter older age with chronic ill-health and disability.[32,42] Therefore, it is possible, given South African society's particular epidemiological profile and its socio-political past, that disability may be a particularly extensive problem in older South Africans.

Limited representative disability data are available, and a full description of disability in the older population is not possible. However, one study on moderate and severe self-reported disability reported a diverse disability burden in the South African population that spans both the above-mentioned developed and developing country cause profiles of disability. This study also found that the prevalence of disability indeed increases considerably in the older population, with particularly steep increases in older and oldest-old black African respondents.[43] A detailed, representative description of physical limitations, be it severe bodily handicaps or activities of daily living (ADL) and instrumental activities of daily living (IADL) impediments, measured by professional opinion and/or standardised instruments in the older population, would be very useful for research and intervention development purposes.

* *CAGE: C - Has anyone ever felt you should cut down on your drinking? A - Have people annoyed you by criticizing your drinking? G - Have you ever felt guilty about your drinking? E - Have you ever had a drink first thing in the morning (an eye-opener) to steady your nerves or to get rid of a hangover?*

The 2001 population census collected data on selected types of disabilities, i.e. sight, hearing, communication, physical, intellectual, emotional and multiple disabilities. In the population 60+, about 16% reported having a disability. The most common disabilities in this older population were sight and physical disability. The census data furthermore show that the prevalence of disability increases with age: about 13% of persons aged 60-69 reported disabilities compared to about 17% of persons aged 70-79, and over a quarter of persons age 80+ (Fig. 14).

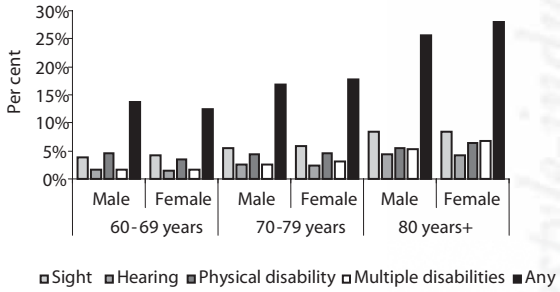


Figure 14: The prevalence of selected disabilities in the population 60 years or older, by selected age bands and sex[28]

The Global Burden of Disease Studies has shown that mental health problems, including neuro-psychiatric conditions, are a leading cause of reduced quality of life worldwide.[44] Although mental health problems are not an inevitable outcome of the individual ageing process, various life changing events and losses over the lifetime may lead to mental health disorders, and is it not uncommon that older age brings about many stressors, such as decreasing functional capacity and social isolation that may increase mental ill-health.[41,45] A considerable increase in the number of older persons with mental illness can be expected because of population ageing and the significant increases in the number of older persons.[41]

The initial South African burden of disease study has highlighted the lack of population-based data on mental health in South Africa.[46] There is a vast need for appropriate instruments to obtain objective measures of physical health functioning, activities of daily living, mental health functioning, cognitive functioning and psychosocial functioning in older persons. There is also a need to investigate the extent of elder abuse that may result in physical harm, but which is likely to affect the psychosocial well-being of older persons more extensively.[37] Additionally, there is a need to assess the extent to which physical and mental health services, assistive devices and technology, and support services are available to older persons.

ACCESS TO HEALTH AND RELATED CARE

Similar to the scarcity of reliable population-based information about disease, disability and health risks in the older population, there is limited data about geriatric service provision and utilisation. A recent South African government report to the United Nations Second World Assembly on Ageing states that older persons have free access to primary health care at over 3500 primary health-care clinics; that recipients of social grants receive secondary health-care services free of charge at public hospitals; that three geriatric departments exist in the country; and that a range of health promoting guidelines, some specific to older persons, others inclusive of older persons, as well as relevant information communications have been produced by the Department of Health.[47] Age-in-Action, the country's main non-governmental organisation, with an exclusive interest in older persons, has offered valuable programmes and services to the older population over the past years. With financial support from the Department of Social Development and a number of private organisations, these services include a toll-free national help-line (HEAL) for reporting elder abuse and neglect, and training programmes for community care to frail and disabled older persons, older caregivers of HIV/AIDS relatives, and recreational activities and physical exercise in older persons.[48]

The value of these services to the older population is acknowledged, but evidence exists that transforming health care in South Africa has not all been positive for poor and older citizens, and, in particular, has resulted in the marginalisation of geriatric services. Examples include the trimming of some well-established services for the poor and uninsured; budgetary reductions at Groote Schuur hospital have resulted in limiting joint replacements from 350 per year in 1993 to 60 per year in 2003; numerous community nurses have been redeployed from geriatric services to assist, for example, in child immunisation programmes; the integration of preventive, curative and rehabilitative needs of older clients into general sessions at community clinics; and the re-direction of funds for dietary supplementations for older persons to programmes concerned with children and pregnant and lactating women.[49-51]

Research studies among older persons have shown dissatisfaction with the content and quality of health care at the primary level, including an inefficient appointment system, long waiting times, and apparent lack of interest of staff in health problems of older clients.[52,53] A qualitative study among 240 older persons in both rural and urban areas of three provinces revealed that the quality of public health-care services they had received was a major concern among older persons. This study referred among other things to shortages or unavailability of medication, unavailability of assistive devices, and perceived lack of thoroughness, respect and sharing of information in the health personnel who attended to them.[54-56]

HEALTH CHALLENGES OF POPULATION AGEING

Demographic change in South Africa has produced a rapidly ageing population that is expected to continue ageing at a rapid rate for at least the short- to medium-term future. The projection figures illustrate that we have entered an era with steep increases in the number of older persons and much slower growth in the cohorts younger than 60, resulting in little growth in the total population. This is particularly marked for women who comprise a significantly larger number of the older population. Of particular concern is the near doubling of the oldest-old (80 years or older) age group. While these projections require that there be acknowledgement of, and dedicated planning for the growing numbers and proportions of older persons with its related social and economic implications, it currently seems that the serious consequences of population ageing are not adequately planned for and responded to by government. Such plans need to incorporate both mainstream and special needs of older persons. The demographic projections pose clear challenges to the health sector. Not only is there a need to plan for the increase in the numbers in older persons but there is also the need to recognise and plan for an expected increase in chronic morbidity and disability.

It is likely that having more persons who are older than ever before, implies increases in the prevalence of chronic disease, disability and frailty.[6,7,57] Increased numbers of older persons and increased levels of chronic ill-health, frailty and disability are expected at a time when geriatric care at public facilities have been reported to deteriorate; when only 13% of persons 65+ have access to a medical aid fund; and when escalating costs render private care out of reach for the majority of the country's older persons. These challenges are occurring at a time when de-institutionalisation is promoted in frail, mental and disabled care services, while neither formal nor informal home-care programmes are sufficiently in place to absorb the demand created by de-institutionalisation.[30]

The mortality data show clearly the huge burden from CDL in the older population, and the morbidity and risk factor data show the large proportion of older persons affected by selected risk factors for chronic disease. Other chapters in this report have shown the burden of CDL and the prevalence of risk factors in younger segments of the population. These highlight the importance of having strategies and policies in place, on the one hand, to manage chronic illness and prevent complications in the older population, and, on the other hand, to prevent disease through reduction of risk factors. The latter will require the implementation of preventive health measures in the younger and unaffected older population. While it is acknowledged in a recent Lancet series that countries with stressed health systems may be faced with a difficult task to create solutions to address the escalating demands of chronic disease and their common risk factors, it is also reported that every country, regardless of the level of its resources, has the potential to make improvements in preventing and controlling chronic disease.[58] South Africa, like other developing countries, has been highlighted as being in a unique demographic moment, before the numbers of older persons increase, where more attention needs to be focused on efforts to ensure healthy ageing and, in particular, minimising the rise in cardiovascular disease.[59] The declining number of births and the significantly slower rate of increase in children than in older persons over the next two decades should provide a fiscal opportunity that must be targeted on reducing health demands of the ageing population.[59] If you "save" a life by preventing a case of IHD, the person will not disappear and never come to a clinic. Instead, the person will appear at a clinic a few years later with cancer or arthritis or some other CDL. Indeed, preventing disease might actually increase health-care costs (or demands) in the long term. Prevention is required, not to save money, but because it is the best way to enhance the overall health of the population. In other words, you give people an extra few years of high quality life.

Despite the country's commitments to research through international efforts, such as the World Health Organization's Minimum Data Set on Ageing and the Madrid International Plan of Action on Ageing, and despite the references to research in local policy documents, such as the draft South African Policy for Older Persons and the Older Persons Bill, there is a lack of recent, complete morbidity and mortality data, accompanied by a paucity in research about older persons' health status and

health needs. Particularly lacking are data around the cognitive, mental and physical functioning in older persons, and measures of post-reproductive sexual health. Continued high-level political will and sufficient resources are required for a comprehensive research plan on ageing. Some of the issues that should be included are: healthy ageing over the life span; age-friendly health care and service delivery; dynamics of individual ageing in the South African context; and demographic, economic and social dynamics and implications of population ageing. In turn, these issues point to the important need to train sufficient numbers of health promotion scientists, population scientists, geriatric care professionals and gerontologists.

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CHAPTER 16

POLICY DEVELOPMENTS SINCE 1994 FOR CHRONIC DISEASES

BY THE NATIONAL DEPARTMENT OF HEALTH

Christelle C Kotzenberg[a]

1. INTRODUCTION

South Africa has witnessed considerable changes over the last ten years as we celebrate a decade of democracy. This period is significant for non-communicable diseases (NCDs, Note: terminology used for chronic diseases of lifestyle), which previously received scanty attention in the public health sector.

Health can be described in many ways and goes beyond medicine and the scope of the health-care system. It includes changes in the labour market, changes from a social-economic and political perspective, and biological, behavioural and psychosocial processes that operate from gestation to old age. All have potent influences on health outcomes and chronic disease risk factors, situations of families with children, consumption patterns and access to health care. People's circumstances and life habits contribute to illness, injury and other forms of ill health. Most illnesses need more than medical solutions, and this includes political and social changes.

The demographic transition, globalisation and development have brought about a new disease profile, an epidemiological transition, which is especially noticeable in the developing world. Firstly, there has been a decline of infectious diseases, an upsurge of new infections (HIV and AIDS), and the re-emergence of "old" infections (i.e. TB, cholera, malaria). Secondly, there is the emergence of NCDs and marked changes in consumption patterns of food, alcohol and tobacco, as well as increased sedentary lifestyles. These risk factors are causing an alarming increase in the development of chronic diseases of lifestyle, which unfortunately cannot be cured by pharmaceuticals and chemical tools only, although they can be prevented.

South Africa is said to have a quadruple burden of disease: Health-care requirements are greater than available resources, necessitating cost-containment and cost-effective measures relevant to health systems reform. However, additional resources are required to provide for the health needs of the population.

2. ORGANISATION OF THE HEALTH SYSTEM

Although NCDs are among the most common and most costly health problems, they are also among those that are most preventable and treatable. The public health system delivers health on three different levels – the primary level, through a district health system, which includes municipal health services; the secondary or hospital level; and the tertiary level, which includes highly specialised services and technology.

3. CONCEPTUAL FRAMEWORK OF THE ORGANISATION OF THE HEALTH SYSTEM

An organisational framework should be developed within the framework of an existing constitution, which is very clear about the competencies of the three different spheres of government, as well as the structures of governance and its integration in South Africa. The following are important provisions of the constitution:

- the need for corporate governance; and
- decentralisation of powers and functions to the most appropriate level.

[a] *Cluster Manager: Non-Communicable Diseases, DOH, Pretoria*

The overall vision of the integrated health system is to ensure:

- health promotion and protection of social security, i.e. support to the social grant system, and free health services
- justice, fairness and solidarity
- dignity
- independence
- participation/partnerships.

The vision reflects the fundamental values and underlying beliefs of most South Africans.

The National Health Act, 2003 (Act No 61 of 2003), also makes a definite contribution to the organisation of the health system, by prescribing certain structures, their functions, obligations, rights and duties.

A support system, within and outside the formal health system, is essential for the promotion of good health. It was soon realised that the success of health-care delivery is influenced by social support systems and voluntary organisations that can plan and work together.

The principles of a unified health system are:

- appropriate defined roles for each sphere of government
- coordination of policy making
- coordination of services (range and levels)
- monitoring and evaluation of health services and health status.

In 1996, the Directorate: Chronic Diseases, Disabilities and Geriatrics was activated when the first director was appointed. This was the beginning of a period of progress in the prioritising of NCDs in the Department, but also in the provincial departments of health. For the first time provinces appointed persons who were responsible for NCDs. This was a milestone in the organisation of long-term care delivery in the health system.

In December 2003, a cluster for NCDs was instituted and a cluster manager appointed. This was a major achievement after many years of motivation to prioritise NCDs within the health sector, and an acknowledgement and demonstration of the vision of the political leaders regarding health care in South Africa.

4. GOVERNANCE/MANAGERIAL PROCESS

It is also possible to separate the responsibilities of political accountable (governance) bodies from management and technical structures and committee structures. The Government has three levels of responsibility towards the public health sector (see point 5), which are: financing health care, responsibility as a service provider, and that of a regulator. The overall governance of the health system is based on the following principles:

- cooperative governance
- of having a patient-centred strategic vision
- to focus on the core business of the system or programme
- to be customer-focused and quality-driven
- of developing people and multidisciplinary teams
- of successful collaboration and cooperation, and
- to implement positive changes and improve the governance position of the public health sector overall, and the health programmes specifically.

5. THE ROLES AND RESPONSIBILITIES OF THE THREE SPHERES OF GOVERNMENT

5.1 The National Department of Health

This National Department is responsible for national policymaking, developing norms and standards, developing national legislation, monitoring and evaluating national policies, international liaison, and providing those services, which should be provided nationally because of economies of scale.

5.2 The Provincial Departments of Health

These provincial departments are responsible for provincial policymaking, drafting provincial legislation, rendering provincial and regional services (largely hospital-based services), which should be provided provincially or regionally because of economies of scale.

5.3 Local sphere

The governing body for the district, known as the District Health Authority (DHA), makes policy decisions on matters that affect the local community. The DHA should ensure that:

(i) adequate and effective consultation with communities takes place; and

(ii) that they are accountable to the communities that they serve for the decisions that they make.

The management structure of the Departments of Health, and to a lesser extent the CDL programme, is divided into junior managers, middle managers and senior managers. These managers function at technical level, programme level and policy level (see Fig. 1). The intellectual capital required by managers at the different levels is not different from any other programme. They require technical skills to accomplish the mechanisms of the particular job, talent, competencies, education, innovation, problem solving, and the ability and knowledge to understand, coordinate and integrate the programme activities. To attract or even find human capital with the technical and the intellectual capital for this specific broader discipline is difficult, since people have not specifically been trained in the management of NCDs.

6. GOVERNMENT'S LEVELS OF RESPONSIBILITY

6.1 Financier of health care

The Public Finance Management Act, 1999 (Act No 1 of 1999) stipulates in detail the rules and regulations related to financial management.

The total budget for the National Department of Health in 2003/04 was about R8.5 billion. The revised allocation of the budget for the Cluster: NCDs (Disease Prevention and Control) 2003/04 was R258 048 000 of which R213 070 000 was spent. The Cluster consisted of eight units of which the Directorate: Chronic Diseases, Disabilities and Geriatrics received the largest slice ± R19 million. This is not the only money spent on NCDs. Other programmes also contributed, e.g. hospital services, pharmaceutical services, and health promotion, but these are hidden in their total budgets.

6.2 Service provider

There are 3 560 clinics in the country and ± 100 hospitals, the latter providing long-term care for people diagnosed with NCDs.

The Government provides and finances preventative, curative and rehabilitative services to ± 80% of the population:

- all primary health care throughout the country is free of direct costs to the consumer. In 1999, the Primary Health-Care package was adopted, including the management of NCDs.
- at hospital level, a fee for service, sliding scale system is implemented, according to the income of the patient
- all health care is free for persons with disabilities, as well as for children < 6 years, and pregnant and lactating mothers, inclusive of any long-term care for NCDs.

In an effort to support professionals in rural areas, a telemedicine programme was initiated. At present, the total number of telemedicine sites is 57.

6.3 Regulator

Health care in South Africa is regulated by numerous acts, strategies and regulations, of which the most relevant ones for this section are:

- The Constitution of South Africa Act, 1966 (Act No 108 of 1996), which refers to the right to equality, freedom, security of the person, privacy, and access to basic health care.
- The National Health Act, 2003 (Act No 61 of 2003), which governs the entire health sector.
- The Medicines Control Act, amendment.
- The Pharmacy Act, amendment.
- The Mental Health-Care Act, 2002 (Act No 17 of 2002).
- The Nursing Act, amendment.

7. NATIONAL HEALTH-INFORMATION SYSTEM

A national health-information system was developed, with a link to the district health-information system, in pursuance of an effective and efficient national health policy. The system originally did not include indicators of NCDs, but since 2004 these have been included. Yet the system focuses very much on morbidity, with mortality and qualitative data lacking.

The system needs to be adapted for the programme to benefit from information on health, and the different requirements of the programmes and other relevant departments need to be included.

Surveillance of NCDs has its own difficulties because of the very personal nature of the questions related to behavioural risk factors, the difficulty in measuring incidence and the fact that data are mostly self-reported and difficult to verify.

The selection of priority diseases is difficult because it should incur a substantial public health burden, which in itself is difficult to prove without available data.

8. STRATEGIES TO ACHIEVE INTEGRATED/COORDINATED CARE

When discussing integration/coordination of the long-term care of NCDs, we refer to two types of integration/coordination:

1. integration/coordination between the programme for chronic diseases (service) and other health and social programmes (services); and
2. integration/coordination between the different components within the programme.

To successfully integrate and improve the performance of any programme, linkages between the independent actors/resources should be formalised, and structures to provide an organised system should be coordinated. Once this has taken place, full integration to provide a package of long-term care can be implemented.

Integration/coordination is necessary to access the identified source of provision without difficulty, and personnel can be utilised in a more efficient way by combining roles and providing continuum care.

The elements that are referred to for integration/coordination are:

- finance
- administrative responsibilities, and
- organisation of care.

Because South Africa has a semi-federal system, integration/coordination between the chronic disease programme and other services is difficult. Each level of service will have its own budget. Functions that are decentralised for integration at a lower level do not necessarily guarantee reallocation of funding and other resources, which then very often are claimed as an unfunded mandate. In putting together service packages, a shared vision and goals are needed to encourage productive dialogue between different services and especially to agree on the sharing or pooling of financial (and other) resources. Simply merging funding streams will not suffice. To ensure a successful funding system for long-term care, it needs to be separately identifiable, which is not the case in our health system at present. Different programmes are very often planned autonomously, making integrated/coordinated implementation impossible.

To integrate administrative responsibilities does not create major problems because administrative processes, procedures, directives, etc. are the same at different levels and in different government services. What does create problems is where different criteria, norms and standards are used in processes, procedures, directives, etc. However, this does not pose a major risk to the system other than the difficulty to coordinate plans, programmes, etc., effectively and may confuse patients.

Each service will organise care to fit in with the specific system. Similar to other developing countries, the previous disease pattern in South Africa has influenced the health system to deal with acute and curable diseases. Globally, the disease burden has changed towards chronic disease, however, health systems have not changed. There is confusion between service delivery systems and service delivery models. This has hampered the integration/coordination of chronic diseases into the primary health-care system. The example that can be cited here is everybody agrees the integrated care-delivery system at primary level (district health system) is the best practice. Service providers do not understand that different care-delivery models are needed for acute/curative care, for chronic care, and for long-term care. Therefore, the incentive to provide long-term or chronic care at primary level is not always certain, and may be perceived as a conflict of interest. Over the past eight years, much improvement can be reported; however, the high turnover of staff has required an ongoing education/training process to maintain this improvement.

Another major challenge with integrating/coordinating the different services is the referral system, especially as far as long-term care is concerned. The referral system is not continuous and interrupted, and therefore not very effective. This means that the system does not go through all the levels of care and inappropriate health-care workers sometimes see the patient.

A referral system for the long-term care of patients allows care providers to:

- discuss alternative care with the patient and family, and to obtain consent/agreement and acceptability based on informed decisions;
- assess patients' readiness for referral;
- inform and prepare the care provider to whom the patient is being referred;
- send a referral form to the primary-care site that will take over the care of the patient;
- provide written or pictographic instructions regarding medication, the purpose for use, and the dosage;
- observe the understanding of the caregiver and/or patient of the usage of medication;
- inform the patient and/or caregiver of follow-up care, appointments, details on the patient-retained card, etc.;
- advise on any specific care, e.g. nutrition, hygiene, infection control, mobility;
- give contact details of the referral role players, as well as the primary role players;
- provide pharmaceutical supplies and dietary supplements as required;
- provide sick-leave certificates, social assistance forms, etc.;
- arrange transport for patients to their home on discharge, and to the referral care providers; and
- accept patients at a recognised referral facility when being referred from community level. Health-care facilities currently do not accept people who are referred by community health workers, which is a major problem that should be corrected.

Another major challenge is that the health district boundaries and other social sector district boundaries at local level are not identical. Therefore, to promote better integration and coordination they were forced to resort to legislation (National Health Act, 2003 (Act 16 of 2003).

To integrate the different components of the programme is straightforward because of duplication at all levels in most of the provinces, e.g. prevention, promotion, treatment and care. These components function as separate cost centres.

9. LESSONS LEARNED IN DEVELOPING A LONG-TERM CARE PROGRAMME FOR CHRONIC DISEASES

- Cultural sensitivity is important.
- Volunteers (support groups) are an important resource, and should be utilised.
- Effective long-term care requires more than adding additional interventions to an existing system.
- To improve care and compliance, families should be trained and educated.
- Incorporating long-term care into the existing primary care infrastructure may be efficient and cost effective, considering different models to provide and finance these services.
- The burden of chronic diseases can be reduced and prevented ONLY if health-care leaders are committed to do so.
- The instability of systems makes implementing good policy in most areas very difficult.
- Long-term care is considered a low priority in many developing countries.
- The skills and knowledge which health professionals need at primary level to diagnose and treat chronic NCDs are similar to what they will need at provincial level. Nurses in South Africa lack knowledge and skills to deal with NCDs.
- When approaching national and provincial governments with proposals for long-term care service development, it is important to remember that cost-effectiveness is a top priority for most policy-makers.
- To mobilise recourses for "new" services, it has been proven beneficial to work with NGOs, the private sector and committees (PPIs).

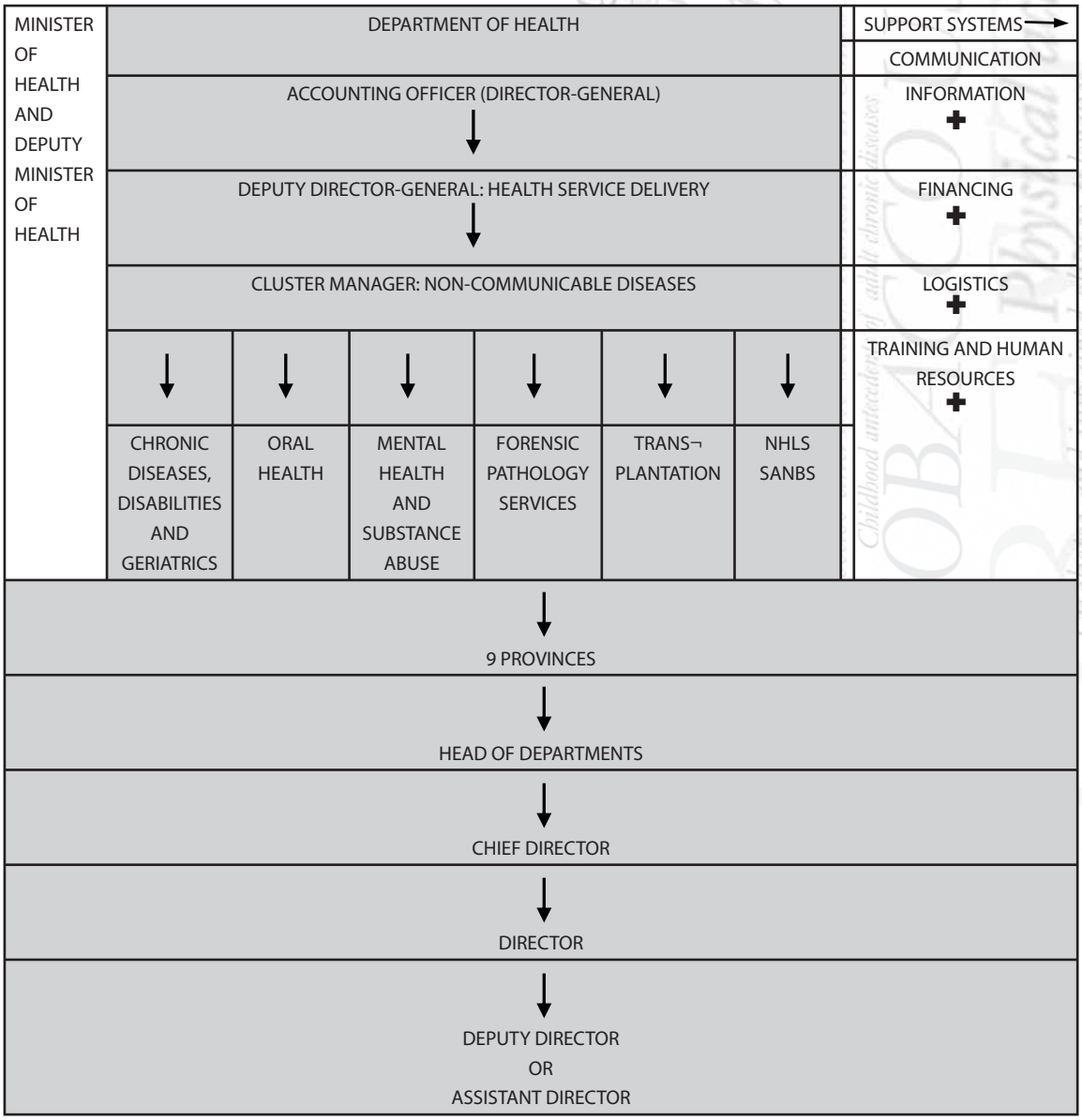

Figure 1: Health System and Governance Model (NCDs)

CHAPTER 17

HEALTH SERVICES RESEARCH IN SOUTH AFRICA
FOR CHRONIC DISEASES OF LIFESTYLE

Krisela Steyn,[a] Naomi S Levitt[b]

1. MODEL FOR PREVENTING AND MANAGING CDL IN POPULATIONS

The model for successfully preventing and managing chronic diseases of lifestyle (CDL) involves two complementary approaches. The first is the promotion of healthy lifestyles for the whole population, and the second calls for the early diagnosis and cost-effective management of risk factors and disease. The successful promotion of a healthy lifestyle through inter-sectoral collaboration across organisations in South Africa will reduce the population's risk profile. Effective health service initiatives need to identify those patients with high-risk levels for CDL and those with early manifestations of these diseases to prevent or delay the onset of complications.

2. HEALTH PROMOTION APPROACHES TOWARDS THE ENTIRE POPULATION

2.1 Impact of tobacco legislation

South Africa's tobacco products control act of 1993 and its subsequent modifications in1999 has significantly reduced the prevalence of tobacco use, as well as the amount of tobacco products sold in the country. This will significantly reduce the impact of tobacco-related morbidity and mortality in South Africa. In Chapter 5, Saloojee describes the impact of this national initiative.

2.2 Impact of the Soul City 4 series with hypertension as a theme

The Soul City Institute for Health and Development Communication is a South African non-governmental organisation, which uses the power of mass media for social change.[1] This organisation describes their edutainment activities as follows: "Soul City's approach to health communication is informed by the Soul City model of social change which is an eclectic integration of existing models of social and behavioural change – such as Social Learning Theory, the Theory of Reasoned Action, the Johns Hopkins Steps to Behaviour Change model, Social Network Theory, the Diffusion of Innovation Model, the Stages of Change Model, and the BASNEF Model. Soul City further bases its intervention on the Ottawa Charter of Health Promotion, and maintains a human rights focus."

"The Soul City 4 intervention set out to impact positively on health and social outcomes by addressing the broader social and community environment (e.g. policy implementation, public debate as reflected in the media nationally, community action and collective efficacy, community norms and access to services) and the immediate interpersonal environment (e.g. social norms and peer pressure, support-giving behaviour, as well as interpersonal dialogue and debate) in addition to influencing individual determinants of health (e.g. knowledge and awareness, personal attitudes, self-efficacy, perception of risk, support-seeking behaviour and intention to change) in the behaviour change process."

"The Soul City 4 core multi-media edutainment vehicle consisted of a 13-part prime time television drama, a 45-part radio drama in 9 languages, and three full-colour information booklets of each - one million were distributed nationally. This material has been available since 1999. The vehicle dealt with the following topics: violence against women (domestic violence and sexual harassment); AIDS (including youth sexuality and date rape); small business development and personal savings; and hypertension."

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An extensive evaluation of Soul City 4 was designed to assess the extent to which the series (and its partners) succeeded or failed as a comprehensive health promotion intervention.[2] The evaluation consisted of many interlinked components, which were all contracted to external researchers or research organisations - including the overall evaluation management. The quantitative and qualitative analyses were methodologically rigorous and complied with international standards and data analysis conventions as applied in this particular field of study. The evaluation was supported by an international and local panel of experts with respect to evaluation, communication, and entertainment-education.

The evaluation of the impact of the hypertension theme[3] is based on the following components of the overall evaluation of Soul City 4:

A national survey: baseline (pre-intervention) and post-intervention, data collection comprised standardised, face-to-face interviews conducted on different (but largely comparable) random samples of 2000 respondents for each survey. The samples were statistically representative of the national Soul City target population.

Sentinel Site Study, conducted in two sites; a rural KwaZulu-Natal site and an urban Gauteng site: a survey was conducted and comprised repeated measurements of a panel (or cohort) of respondents in each site (representing Soul City's target audience). There were four measurements - pre-intervention (baseline), two measurements during the time Soul City was on air, and a post-intervention (evaluation) measurement. Standardised, face-to-face interviews were conducted on a sample of 500 respondents per site, with an additional 100 interviews to control the research effect. A standardised questionnaire was used in the National Survey and Sentinel Site Surveys, with the panel questionnaire adapted slightly to take the study design and specific study objectives into account.

National Qualitative Impact Assessment: data collection comprised 31 qualitative focus group interviews, and individual interviews conducted among Soul City's target audience. Approximately two-thirds of the fieldwork was conducted in the two Sentinel sites, and the other third was extended to a further four provinces (i.e. fieldwork was conducted in six of the nine provinces). Respondents in the Sentinel sites were part of the panel (cohort) described under the Sentinel Site Study, They were recruited because of similarities in their responses to a selection of items in the Sentinel Site Survey. Respondents in the other four provinces were selected based on exposure to Soul City. A further 30 semi-structured interviews were conducted with community members representing leadership, services and civil society in the two Sentinel sites. Respondents were recruited in their organisational or leadership capacity, and participated because of their availability.

The results of the evaluation included increased knowledge and/or awareness of the following:

- High blood pressure (BP) can seriously harm people if not treated properly.
- You [do not]* only need to take medication for high blood pressure until you feel better.
- You can[not]* feel if you have high blood pressure.
- Where to have one's BP checked.
- People should ask health workers to check their BP every time they visit a clinic or hospital.

Knowledge about adopting a healthy lifestyle to treat and prevent hypertension.

No evidence of change was observed in the following two items:

- High BP cannot be treated; there is nothing you can do to make it better.
- If you have high BP, you need to take medication every day.

Responses from people who did, and did not have contact with a health worker about high BP during exposure to Soul City suggest that Soul City was an effective substitute for face-to-face communication between people and health care providers regarding accurate knowledge on hypertension.

There was also qualitative evidence suggesting that Soul City is associated with hypertension support-giving behaviour over the evaluation period. However, this observation is not supported by the quantitative results.

Both the sentinel site and national survey data analysis also suggests that exposure to Soul City is associated with positive change in intention and its maintenance (to seek information and to have one's BP checked) and in actual behaviour change (having one's BP checked, and in trying to adopt a more healthy lifestyle). Thus, despite decreases in positive observations from baseline to evaluation measurement generally observed in the national survey data,

** [authors' insertion]*

positive behaviour was significantly associated with exposure to Soul City where respondents *did* display positive/desirable intention and behaviour over the evaluation period.

There was no quantitative evidence of a direct association between Soul City and increased perception of personal risk. Decreases in perception of risk and information-seeking behaviour were observed that might be related to increased knowledge, positive intention and positive actual behaviour associated with exposure to Soul City. Further analysis is necessary to substantiate or refute this hypothesis. Qualitatively, Soul City is associated with increased perception of risk: "new" knowledge that hypertension can affect anyone have been attributed to Soul City."

2.3 Focus of studies: health-care provider, health services structure and related factors

The lessons we learn from tobacco legislation and from Soul City is the impact of appropriately planned multi-sectoral health promotion interventions targeting the entire population. Both interventions were underpinned by broad-based research for identifying the determinants of behaviour needing to be addressed. Furthermore, the target group that needed to be reached was clearly defined and studies were developed ahead of the relevant aspects of the interventions.

3. MODEL OF HEALTH SERVICES RESEARCH

In studying the health services provided for patients with CDL, the information should be considered with respect to the following three interrelated factors:

- Health-care provider-related factors;
- Health-service structure-related factors;
- Patient-related factors.

Published studies on evaluating factors related to the health-care providers usually also address health-care service-related factors. Consequently, this review will focus on these two topics simultaneously, while patient-related factors, where patients with chronic conditions were studied, will be reported in the next section.

3.1 Focus of studies: health-care provider, health services structure and related factors

Since 1994, it has been the National Department of Health (DOH) policy to develop the primary health-care services for all South Africans which at present are seriously inadequate. This has resulted in a reduction of funding for secondary and in particular tertiary care. The latter is perceived to having been over-emphasised previously. Consequently, there has been a shift of large numbers of patients to primary health-care services in the community. Very few studies have evaluated the impact of these changes or assessed the contribution and function of the health-care providers and health service structures in relation to the quality of care patients with CDL have received since 1994.

In Gauteng, Kalk *et al*.[4] conducted a rapid assessment of hospital-based services for four chronic diseases (diabetes, hypertension, asthma, and epilepsy) at eight hospitals through a postal survey in 1994. They concluded that services for chronic diseases at non-academic hospitals in Gauteng were characterised by perceptions of inadequate staff numbers and training, short consultation times (mean duration being 9 minutes), infrequent use of management guidelines and standardised assessments, little patient education with regard to self-care, and low rates of regular attendance and compliance with medication. A folder audit at one hospital revealed that there was a low rate of hypertension control and unsatisfactory rates of acceptable glycaemic and BP control among people with diabetes. In essence, all other studies conducted in the country identified similar problems with the public sector.

3.1.1 Quantitative studies in the public health-care sector

A situational analysis conducted in the Limpopo Province defined specific problems in more detail. In this study in a random sample of 24 clinics in the six districts and six hospitals in 2002,[5] professional nurses (n=62) and doctors (n=6) who were involved in the management of chronic diseases were interviewed. In addition, two assistant directors from the Information Management section and the Epidemiology section were interviewed about the flow of information from facility level to the Provincial DOH. A clinician questionnaire elicited information about the criteria used to diagnose hypertension and initiate treatment, first-line drug choices for hypertension care, familiarity of health workers with the hypertension management guidelines, as well as training in the management of patients with hypertension.

The data from the Limpopo report[5] are discussed in some detail to identify the main themes found in the results of this and other studies reported in this Chapter.

The knowledge of the staff, particularly the professional nurses, regarding hypertension management was less than optimal. For example, less than half of the staff knew that patients needed to sit for 5 minutes before having their BP measured or that hypertension needs to be treated at lower BP levels in patients with diabetes or those with target-organ damage, compared to other patients. Only 12.9% of the staff had received training for the management of hypertension during the previous two years and all of the study participants felt that they would benefit from additional training to manage patients with hypertension. Questions regarding the availability of formal guidelines for managing hypertension revealed that there were five different types of guidelines available in the different clinics. The Hypertension Guidelines of the National DOH were available in 93.1% of facilities. The Primary Health Care formulary was available in only a few of the hospitals, while the Primary Clinical Care manual was found in very few of the clinics. The staff described the many guidelines as being confusing and even contradictory at times. The need for a single set of guidelines for primary-care settings was clearly identified.

Patients with newly diagnosed hypertension were frequently referred to hospital for initiating treatment. More than half the patients were provided with some advice about lifestyle modification to control hypertension. Routine investigations, such as weight measurements, urinalyses, and eye examinations were not done routinely in all patients.

The staff members were asked about problems they experience with managing hypertension. Their responses were categorised as those relating to patients, staff, and to administrative issues. Most complaints related to patients' non-compliance with prescribed medication (66.2%) and a few commented on the patient's lack of compliance with lifestyle modification. Staff-related problems that were identified were staff shortages (47.7%) across all facilities, breakdown of communication among different staff categories, the lack of social workers to deal with patient problems, and particularly a shortage of ophthalmic nurses. Administrative problems included antihypertensive medication shortages (38.5%), late deliveries from hospital dispensaries (18.5%) and lack of functional equipment, such as baumanometers or broad BP cuffs. Of the facilities, 38% had non-functional or broken baumanometers, while 59% never had these equipment services.

Availability of recommended antihypertensive medication was checked across all facilities. Hydrochlorothiazide (73%) and atenolol (47%) were available at most clinics. Reserpine, a cheap drug, was only available at 37% of clinics, while methyldopa, an expensive drug, which has many side-effects and is not recommended, was available at 73% of the facilities.

A report focusing on the knowledge, attitudes, and practices of staff caring for patients with diabetes in Cape Town was published in 1997.[6] Very few staff had any in-house training in diabetes care after their basic training, yet their knowledge about chronic diabetes complications was reasonable. However, there were critical gaps in their knowledge of the signs and symptoms of diabetic emergencies. This study also found that about 50% of the staff interviewed reported inter-staff communication problems involving doctors, primary health-care nurses and registered nurses, and about 75% reported that communication problems between the staff and patients impeded optimal chronic disease care.

A study of the quality of diabetes care among 34 nursing staff at 10 semi-rural and 12 rural clinics in the Alfred Nzo District, Eastern Cape, revealed major impediments to good diabetes care (Bantubani unpublished data). A questionnaire on diabetes care and a checklist were used to record the availability of equipment and medication required at primary-care clinics. Fifty-nine percent of these nurses were not confident that their knowledge of diabetes care was adequate to provide good care for their patients. Indeed, the nurses demonstrated poor knowledge on the management of diabetes; this confirmed that the majority were not sufficiently competent to treat patients with diabetes. The monitoring of glycaemic control depended totally on urine glucose dipsticks, with only about 40% of clinics having a glucometer to test blood glucose levels. The measurement of HbA_1c was not available at any of the clinics. The regular examination of patients with diabetes was inadequate, particularly with respect to surveillance of the feet. This examination is essential to prevent the development of foot ulcers and eventually leg amputations. According to 53% of the nurses, this is attributable to the fact that facilities for clinical examinations at their clinics are limited. Most clinics had the following equipment available to monitor diabetes: urine glucose strips, a mercury baumanometer with a standard cuff, stethoscope, tape measure, height measure and a scale. However, equipment for measuring blood glucose levels was not always available, as was a broad

BP cuff for patients with large arm circumferences. Snellen charts to test eyes were only available in about 50% of clinics. Metformin was the only diabetes drug available at all the clinics, with glibenclamide supplied at between 70% and 83% of the clinics. Insulin was unavailable at any rural clinics and at 60-80% of the semi-rural clinics. Patients had to travel to the nearest hospital to receive insulin, which they could often not afford. There were no dedicated diabetes clinics at 21 of the 22 primary-care clinics, and therefore patients with diabetes were seen along with all others. Only 27% of the clinics had diabetes treatment guidelines available, while 12% had posters on diabetes or hypertension. The diabetes posters were written in English, a language not spoken by most patients in this region.

A validated questionnaire was used by Talip *et al*.[7,8] to evaluate the knowledge and practice of doctors and nurses regarding healthy lifestyles, with a focus on nutrition, physical activity and smoking cessation. A random sample of 61 doctors, 149 nurses, and nine health promotion officers working in the public community health centre (CHC) sector was surveyed. The overall knowledge score of the health professionals for the three aspects of a healthy lifestyle was low, with 6% scoring < 40%, 40% had mediocre scores (40%-59%), 48% had scores between 60%-79% and only 6% scored more than 80%. Doctors had higher scores than nurses. The health professionals identified mass media as their main source of information on smoking (36%) and physical activity (27%), while 33% identified textbooks as their main source of nutrition information. Lack of time, poor patient compliance, and language were frequently cited as barriers to health education. Most health professionals indicated that they did not have access to, or consult with experts on physical activity or smoking cessation. Only 18% reported that they were aware of any smoking cessation services in the community. Furthermore, only 39% indicated that they often have access to dieticians, compared to 26% who indicated that they actually consult dieticians. Further analyses of the knowledge tests indicated that while health professionals had sufficient knowledge on broad-based information (e.g. 'eat[ing] less fat') their practical knowledge for counselling patients was very limited. These data clearly suggest that culturally appropriate material should be developed to support health professionals to provide practical, detailed information to their patients who are in need of lifestyle modification counselling.

Smoking during pregnancy can have a dire impact on the pregnancy, and the infant. In the South African coloured community, smoking rates of 47% have been reported for pregnant women. Seventy-five midwives working in five South African cities, providing antenatal care for pregnant coloured women completed questionnaires regarding smoking cessation.[9] Midwives' overall attitudes towards giving smoking cessation advice during pregnancy were positive. They perceived this as part of their responsibility as they were convinced of the health benefits of smoking cessation for both mothers and babies. They felt powerless when pregnant women showed lack of appreciation and interest as well as resistance to health education on smoking. They consequently felt their lack of knowledge and education about adequate smoking cessation intervention and their lack of counselling skills as important barriers to successful intervention among pregnant women who smoked. Those midwives who know more about the dangers of smoking to the mother, the pregnancy, and the unborn child more frequently provided smoking cessation advice to pregnant women compared to those with lower levels of knowledge about the dangers of smoking.

3.1.2 Qualitative studies conducted in the public health-care system

Qualitative studies are particularly valuable to assess the personal experiences of study participants regarding the topics being investigated.

In 2003, two qualitative studies were conducted using semi-structured interviews with a purposeful sample of doctors, professional nurses and pharmacists for hypertension and diabetes management in the public health-care sector in Cape Town to gain insight in the determinants of hypertension and diabetes care delivered to patients with these conditions.[10,11] Both these studies showed that health-care providers perceived diabetes and hypertension care as important issues. Yet, the quality of care that was provided for these two conditions was not optimal. Staff experienced their working conditions as extremely demanding. The barriers included increasing patient numbers, dramatic budget cuts and acute staff shortages. Staff, particularly nurses, felt inadequately trained and not capable of handling what was expected of them. Frequently, the necessary equipment and sufficient medication were not available at the clinics and staff felt that the authorities were not addressing these problems in an effective way. This resulted in progressive

disorganisation in the primary health-care setting and high levels of staff frustration and morale.

One doctor summarised his position as follows, "We are controlled by the government, as a doctor you cannot do what you think might be best. You will just have to use what the government is giving you."

The barriers experienced in the clinics hampered health workers using the diabetes and hypertension guidelines, investing time in educating the persons, and screening for complications. Frequently, patients spoke a different language to that of the health-care providers. The latter also expressed their dissatisfaction with patients' non-compliance with treatment regimens. They acknowledged that patients experienced many barriers to being compliant, and felt that education was essential to improve patient compliance. However, their patient education attempts were not perceived to be effective. Most health-care providers did not adjust their health messages to the patient's readiness to change. Furthermore, their communication approach with patients was quite prescriptive and not patient centred. Such an approach has been shown to be counter-productive and often evokes resistance in patients.

The National DOH has expended much energy formulating many management guidelines for common chronic conditions since 1994. This has been done in collaboration with many experts in the field of the particular condition under scrutiny. These guidelines were distributed widely in the public health sector without a systematic educational intervention, a prerequisite for change in the practice of health-care providers.[12,13] Daniels *et al*.[14] investigated the attitudes of health professionals in primary care to assess their responses to receiving the guidelines, and to determine their attitudes to guideline implementation in an urban setting. The authors used focus group discussions, in-depth interviews, and clinical observations. It was found that there was no systematic process of implementation of the guidelines and that staff consulted these infrequently. They had negative feelings about the lack of consultation and the introduction of the guidelines without formal preceding educational sessions. The content of the guidelines were sometimes in conflict with their usual practice and were found to have limited local applicability. Some aspects of the guidelines did not take cognisance of the limited local resources and would increase their already excessive workload. The health professionals felt that if they had been consulted, the guidelines might have been more appropriate for their setting. They also reported time constraints and an ever-increasing patient load. They felt that their communication with patients was not effective, particularly about lifestyle modifications and was influenced by the education gap between patients and doctors. There also was a dearth of appropriate educational material for patients.

These data suggest that the adoption of guidelines would be improved if the barriers identified are addressed and the passive dissemination of guidelines was accompanied by appropriate consultations and support for the staff using the guidelines.

The majority of patients with type 2 diabetes in Cape Town who attend primary-care community health centres have poor glycaemic control. Despite this finding, insulin is rarely prescribed although this was indicated in patients with maximum oral glucose-lowering agent therapy. Haque *et al*.[15] conducted focus group discussions and in-depth semi-structured individual interviews with 46 doctors providing care for patients with type 2 diabetes to identify the barriers to initiating insulin therapy in the primary-care public sector setting. Barriers that were identified related to the doctor's lack of knowledge or experience with introducing insulin at outpatient settings. The doctors reported that undergraduate training focused on managing diabetic emergencies and not the ongoing care of patients in these settings. Many were concerned that patients do not have sufficient knowledge and understanding of the disease to use insulin safely, and feared events of hypoglycaemia. Language barriers also hampered sufficient communication with patients. This lack of confidence resulted in patients who needed insulin occasionally being referred to a hospital for their first treatment. Doctors reported that patients were reluctant to begin insulin treatment, and feared needles and the pain of injections. Poor socio-economic conditions of public sector patients exacerbated doctor's fear of hypoglycaemic events, and they thought that glucometers were beyond most patients' means. Older patients were seen to be unable to manage insulin therapy. Excessive workload, short consultation times and rapid turnover and lack of continuity of care by the same doctor were barriers identified by all doctors, as was occasional inadequate supply of insulin. Different guidelines were available at the clinics and doctors were distrustful of the conflicting messages. The constraints on ordering glycated haemoglobin, because of expense, and consequently relying on a single random blood glucose, further increased doctors' concern for initiating insulin treatment.

Another study was conducted in the Western Cape to assess attitudes and practices of doctors regarding smoking cessation during pregnancy.[16] Semi-structured, one-to-one interviews were held with doctors providing antenatal care for pregnant women who smoke. They tended to underestimate the magnitude of the risk of smoking during pregnancy, and thought that other pressing priorities in antenatal care, especially HIV infections, should receive their attention. They often felt pessimistic about their ability to influence the smoking behaviour of pregnant woman, especially in poor disadvantaged women who face multiple barriers to health-enhancing behaviour. They were also unaware of the guidelines, which offer clinicians brief, structured approaches to counsel pregnant women on smoking cessation. However, most doctors were open to adopting new approaches or tools that could assist them in improving their communication with pregnant women about smoking. Perceived barriers to provide these interventions included a lack of counselling skills and educational resources. They also experienced spending too little time with patients, and having a high stress level because of staff and budget cuts in public sector hospitals and consequently poor working conditions.

3.1.3 Research in the private and non-governmental health-care services

A descriptive study was undertaken by Bradley[17] in the three major 'black townships' of Cape Town, namely Langa, Gugulethu and Khayelitsha among 22 general practitioners (GPs) to assess the quality of care and current clinical practice for diabetes care. This assessment was evaluated in terms of the Guidelines for the management of type 2 diabetes published by the DOH in 1977. The data collection comprised questionnaires, and a record review of 51 patients with diabetes was done in three of the practices.

The median time that the GPs had been practicing in the townships was five years and most dispensed medicine to their own patients. The median number of patients seen per month was 600. The data revealed that the GPs saw relatively small numbers of patients (< 30 per month) with diabetes and that a large proportion of the patients with diabetes attended both the private GPs and the public sector services where medication was provided free of charge. A number of GPs stated that if patients did not belong to a medical aid/scheme they were encouraged to attend the local public sector primary-care facilities because of financial constraints.

At many practices, staff trained by the GPs performed a number of measurements on the patients and also provided some nutrition education. None of the GPs was using the DOH diabetes management guidelines. Between 73% and 86% of the GPs reported measuring BP and doing capillary blood glucose and glucose urine analyses every three months. Annual HbA_1c measurements were reported by 34% of the GPs and 23% reported doing annual examinations of the feet and eyes. The GPs reported that they achieved target blood glucose levels in 82% of their patients. The record review of the patients indicated that these procedures were recorded considerably less frequently than GPs reported. The actual level of blood glucose control recorded in the patient record was between 17% and 29%, highlighting that GPs had an unrealistic understanding of the level of blood glucose control achieved at their practices. Furthermore, their overall level of service provision did not comply with the management guidelines for diabetes care published by the DOH. Half of the GPs identified having limited communication skills with their patients and felt they needed more training in this regard. They also felt strongly that inadequate culturally appropriate patient training material was available for patients with diabetes.

Work conducted at the University of the Western Cape has been focusing on the role that community health workers (CHWs) could play in extending the care that of the public sector health professionals provide for patients with chronic lifestyle diseases. This is of great importance, as the national DOH has accepted the principle to use trained people from the community as CHWs to extend the reach of doctors, nurses and other allied health professionals.

Sengwana *et al*.[18] conducted focus group discussions with 17 CHWs who were members of the community and working at the non-governmental organisation (NGO) Zanempilo. They were asked about their beliefs and attitudes on hypertension. In addition, interviews were conducted to assess their knowledge about causes, prevention, and control of the condition. The findings suggested that the CHWs were unclear about the causes of hypertension, and they found it difficult to grasp that people without risk factors, such as obesity, could be hypertensive. They believed that traditional medicines and home-brewed beer were effective treatment for the condition, and they were suspicious of prescribed antihypertension medication that needed to be used long term. The CHWs reported that patients perceived that the pharmaceutical agents were often associated

with severe complications. Furthermore, CHWs reported that people with traditional beliefs from the black township communities had difficulty with the concept of a 'chronic condition'. People usually visited both western doctors and traditional healers looking for a 'cure' for their conditions. Consequently, they concluded that western drugs requiring ongoing use are not effective.

On evaluating the height and weight of 44 of the CHWs in the same setting, all but two were overweight, obese or severely obese.[19,20] In addition, these CHWs with limited knowledge of hypertension (as described above) who were expected to educate the community about chronic diseases of lifestyle, perceived moderately overweight women as attractive and associated with dignity, respect and confidence. Puoane and Bradley[19] also showed that the food preparation methods of the CHWs were unhealthy and excessively large portions of food were usually served. They added oil to maize porridge and vegetables in the preparation, and used various kinds of salt and sodium-containing condiments to improve taste. The nutrition knowledge of the CHWs was extremely limited. They were scared of doing physical exercises, as they feared losing weight which might cause people to think that they have HIV/AIDS. The stores in their townships mostly provided cheap and unhealthy fatty foods (including tripe, sausages, chicken skin, pig's feet, and fat cakes) with very little vegetables and fruit. The latter were also relatively expensive. The street vendors also sold very fatty meat at modest prices.

These data show that the CHWs in this urban township had minimal knowledge of chronic diseases and their risk factors, had many misconceptions on management of these conditions, and their environment was not conducive to promote a healthy lifestyle.

3.2 Focus of studies: patients attending primary health-care services

The study of patients with chronic conditions have received much more attention than the study of health-care providers or the factors related to the health service functioning.

3.2.1 First demographic and health survey 1998

The largest study conducted in adults, 15 years and older, in South Africa is the first national demographic and health survey (DHS 1998).[21] An adult health module was developed for this survey, and data were collected in a random sample of 13 826 urban and non-urban adults in all the provinces. The questionnaire inquired about visits to a range of health-care facilities during the last 30 days.

Of the total population, 18.6% and 13.3% attended either the public or the private sector health-care facilities respectively during the previous 30 days.[21] Table 17.1 shows the proportion of those who attended such facilities and were dissatisfied with the services they received, as well as the reasons for their dissatisfaction. The long waiting times at CHCs were the most common reason for dissatisfaction, while staff who were offensive was reported by 22% of these people. It is interesting to note the similar number of people dissatisfied with CHCs and traditional healers.

Table 17.1. Proportion of users dissatisfied with services at health-care centres and the reasons for dissatisfaction[21]

	Public Sector		Private Sector		
	Community health centre %	Clinic/ Hospital %	Doctor %	Chemist %	Traditional healer %
Dissatisfied	12.1	11.7	5.9	3.8	13.8
Reasons: Long waiting times	41	26.1	8.2	14.9	27.4
Staff offensive	22.7	16.6	9.3	9.8	16
Short consultation	7.6	12.3	22.3	4.4	29.9
Did not see a doctor	9.4	14.7	4.0	n/a	n/a

The use of prescribed drugs for common chronic conditions in the DHS 98 is described by Steyn *et al*.[22] for the research team of the South African DHS.

Table 17.2 provides the socio-demographic determinants of people taking prescribed drugs for common chronic conditions as identified by logistic regression analysis. This showed that women, wealthier and older people, as well as those with medical insurance

used drugs for chronic diseases more frequently compared to men, younger or poor people, or those without medical insurance. The African group used these drugs less frequently than other ethnic groups. Even though this group has less chronic diseases than other South African groups, this pattern of drug use may identify an inequitable distribution of drug use for chronic disease.

Table 17.2. Logistic regression analysis of socio-demographic variables and taking prescribed drugs for common chronic conditions

Socio-demographic characteristics	Number of observations	Odds ratio	95% Confidence interval
	Using drugs = 1285	Not using drugs = 12406*	
Asset index (Quintiles)			
Poorest group	2252	1.00	-
Second poorest	2827	1.21	0.83 - 1.75
Middle group	2908	1.64	1.17 - 2.31
Fourth poorest	3030	2.72	1.83 - 4.04
Richest group	2674	3.01	1.96 - 4.63
Education (number of years)			
None	1929	1.00	-
1 - 7	4015	1.19	0.96 - 1.49
8 - 12	6888	1.09	0.83 - 1.44
> 12	859	0.76	0.500 - 1.14
Age group (years)			
15 - 24	3918	1.00	-
25 - 34	2699	3.82	2.09 - 6.96
35 - 44	2386	9.75	5.60 - 16.97
45 - 54	1784	30.28	17.22 - 53.25
55 - 64	1450	43.63	24.97 - 76.23
≥ 65	1454	51.21	29.41 - 89.17
Population group			
African	10384	1.00	-
Coloured	1761	1.49	1.12 - 2.00
White	1089	1.84	1.33 - 2.57
Asian	457	2.41	1.71 - 3.38
Geographic setting			
Urban	7678	1.00	-
Rural	6013	0.86	0.66 - 1.12
Gender			
Men	5691	1.00	-
Women	8000	1.47	1.26 - 1.71
Medical Aid			
Membership	2018	1.00	-
Non-membership	11673	0.75	0.58 - 0.96

Table 17.3. Prevalence of reported use of drugs for chronic conditions and listing of prescribed drugs for six categories of common chronic conditions (asthma and chronic bronchitis, diabetes, hyperlipidaemia, hypertension and other drugs for atherosclerosis or stroke-related conditions) in South Africa in 1998

	Men	Women	Total
Total Number	**5671**	**8155**	**13826**
% Who reported taking prescribed drugs regularly	12.5	18.4	15.9
% Of participants where themselves or family paid for their drugs	34.2	33.1	33.4
% Of participants where medical aid covered most of the cost of their drugs	29.1	25.9	27.6
% Of participants who received most of their drugs from public sector health facilities	34.3	38.5	36.9
% Who had listed drugs for one of the common chronic conditions	8.0	11.4	10.0
% With Asthma & Chronic Bronchitis drugs (AT Code = R03)	2.0	1.6	1.8
% With Diabetes drugs (AT Code = A10)	1.4	2.0	1.7
% With Hyperlipidaemia (AT Code = C10A)	0.3	0.3	0.3
% With Hypertension (AT Codes = C02/3, C07/8/9)	4.1	6.8	5.7
% With Atherosclerosis- and Stroke-related drugs (AT Codes = B01AC, C01A/B/D/A)	1.0	1.0	1.0
Number of prescribed drugs *	**845**	**1705**	**2550**
% Asthma and Chronic Bronchitis drugs *	22.8	10.9	14.9
% Diabetes drugs *	11.6	12.6	12.3
% Hyperlipidaemia drugs *	1.8	1.2	1.4
% Hypertension drugs *	50.5	66.4	61.0
% Atherosclerosis- and Stroke-related drugs	10.5	7.9	8.8
Number of persons with drugs for common chronic conditions †	452	930	1382
% With one listed drug †	37.2	31.7	33.6
% With two to three listed drugs †	44.7	47.0	45.9
% With four or more listed drugs †	18.1	21.3	20.5
Number of persons using diabetes drugs ‡	76	163	239
% Who knew what condition the drug was taken for ‡	90.3	89.6	89.8
% Who said they could name the drug ‡	56.8	54.6	55.3
% Who named at least one appropriate drug ‡	55.0	48.8	50.8
Number of persons using hypertension drugs §	230	558	788
% Who knew what condition the drug was taken for §	81.4	89.3	87.0
% Who said they could name the drug §	56.9	54.9	55.1
% Who named at least one appropriate drug	54.6	52.8	53.7
Number of persons using Asthma and Chronic Bronchitis drugs ||	110	131	241
% Who knew what condition the drug was taken for ||	75.2	75.1	75.1
% Who said they could name the drug ||	48.4	55.2	51.9
% Who named at least one appropriate drug ||	43.3	53.0	48.5

* † ‡ § || Denotes the number used as the denominators for the reported percentages

Table 17.3 shows the prescribed drug use for asthma and chronic bronchitis, diabetes, hyperlipidaemia, hypertension and other drugs for atherosclerosis or stroke-related conditions. Most people taking drugs for chronic diseases received these free of charge at public sector facilities. These sectors provide health care for 80% of the population. The least number of people had medical insurance, which paid for their drugs. Men used drugs most frequently for hypertension, asthma or chronic bronchitis, while in women it was for hypertension and diabetes. Although most patients said they knew the condition for which they were taking the drugs, less than half could name a minimum of one correct drug for their condition. Additional analyses of those patients who were taking drugs for their hypertension, who know what the drug was for, and who could name at least one correct drug to lower BP had significantly higher levels of BP control than those with hypertension who could not correctly name their medication (Steyn, unpublished data). This clearly

shows that patients who are sufficiently empowered to know their antihypertension medication were better controlled than those who are not. This difference needs further investigation to understand the factors affecting BP control in these patients.

The pattern of individual drug use for the different conditions revealed that the prescribing patterns for the six common chronic conditions in many cases did not comply with the recommended best medical practice.

Of all the participants taking chronic medication, 1.8% had regular prescribed medication for asthma and/or chronic bronchitis recorded (Table 17.3). This accounted for 17.5% of the people taking prescribed medication regularly. More asthma drugs were paid for by the private sector than by the public sector. The inhalants, particularly, were used more frequently by the private sector patients.

Additional analysis of the asthma and chronic bronchitis medication showed that systemic salbutamol accounted for 27% of asthma drugs used, while only 10.9% was salbutamol inhalers. The second most frequent drug recorded is theophylline (20%) followed by aminophylline (10%) and beclomethasone (10% of drugs used for asthma and chronic bronchitis). The first-line drug suggested for asthma is an anti-inflammatory inhalant, such as beclomethasone, which ensures that the underlying pathology is best controlled. From these data it is clear a large proportion of drugs prescribed for asthma are not according to the recommended guidelines of the DOH or the expert guideline recommendations for asthma management.

The finding that only 1.7% of the adults had listed drugs for diabetes is surprising and suggests a serious degree of undertreatment of this condition. The predominance of the use of oral hypoglycaemic agents is not surprising and is in keeping with type 2 diabetes being the dominant form of diabetes in the country. Sulfphonylurea was commonly used, but may not always have been the appropriate monotherapy since most type 2 diabetic patients are overweight or obese. Insulin, the sole therapy for type 1 diabetes and increasingly used in type 2 diabetes, comprised 20% of the hypoglycaemic agents used.

A mere 37 (0.3% of all the participants) persons recorded using drugs for hyperlipidaemia. Furthermore, only 1.4% of the chronic disease drugs was prescribed for hyperlipidaemia. This is a remarkably low rate of treatment as it has been estimated that about 4.5 million South Africans have hyperlipidaemia imparting risk for atherosclerosis-related conditions, such as angina and heart attacks. Treating people with extremely high levels of total cardiovascular disease (CVD) risk has been shown to be highly cost-effective. This includes people who have suffered a heart attack or stroke and those who have familial hypercholesterolaemia. It is estimated that in South Africa about 90 people survive a heart attack per day. Unfortunately, the essential drug list (EDL) for public sector primary health-care services in South Africa does not include any medication for this condition, despite the fact that the patent for HMG-CoA reductase inhibitor, Simvastatin, has lapsed and a much cheaper generic version is available.

While national guidelines for the management of hypertension in the primary health-care setting have been developed and launched, the findings of the survey suggest that these are not being widely implemented. This is reflected in the poor level of control of hypertension that was achieved across the country in the first South African DHS (Chapter 8). Diuretic agents are recommended as the first-line drug for all patients with hypertension. However, diuretics accounted for only 43% of the antihypertensive agents used. Reserpine is the cheapest second-line agent suggested in the guidelines but only about 5.5% of the anti-hypertensive medication contained reserpine. The guidelines do not recommend methyldopa for hypertension, except for pregnant women. This agent is expensive and has many side effects, but still accounted for 14.8% of all antihypertensive medications used. This was used more frequently by women and in the public sector. In 1998, no generic ACE-inhibitor was available in South Africa and it was a surprising finding that these expensive agents were used with equal frequency in the public and private health-care sectors.

The use of aspirin after an atherosclerosis- or stroke-related event has been shown to save lives. In 1998, less than 1% of the study population was using aspirin. The high mortality rates found for CVD in South Africa suggests many South Africans who have suffered a heart attack or stroke would benefit from regular aspirin use to reduce the risk of repeat events.

3.2.2 Hypertension care

The following studies focused on patients with hypertension. The first study reviewed the treatment of patients with hypertension in the private sector.[23] The data were available from a private drug utilisation review consultancy, called Quality Health Services, and used by a wide range of medical schemes in South Africa. Edwards *et al*.[23] reviewed the prescribing patterns and assessed the effectiveness and cost-effectiveness of the treatment of 11 696 patients cared for by 3 503 private practitioners. The level of BP control achieved was 34.7% with a BP below 140/90 mmHg and another 42% with higher levels but below 160/95 mmHg. At the time of the study (1993-1995) the recommended target BP for hypertension control in South Africa was 160/95 mmHg. The most frequently prescribed drug class was ACE inhibitors (32%). Beta-blockers accounted for 21% and calcium antagonists for 14% of all prescriptions. Thiazide and related diuretics, the recommended first-line treatment, alone accounted for 7.8% of the prescriptions. However, a further 13.8% of prescriptions contained diuretics in combination with other drug classes. Diuretics of all classes, taken alone or in combination, were used by 33.9% of patients. These data showed that almost half of the prescriptions were for the newer and more costly antihypertensive drugs, although at that time, their effectiveness in reducing long-term complications was still unproven. Furthermore, the pattern of prescriptions did not conform to those recommended by the South African Hypertension Society's management guidelines, another example of private practitioners' lack of compliance to prescribing according to therapeutic guidelines.

Two studies were conducted in the public CHC sector to assess hypertension care for predominantly coloured patients.[24,25] Lunt *et al*.[24] studied 1 098 patients with hypertension during a 12-month period at one CHC. More than half the patients were 65 years or older and 82% female. The level of control achieved was much poorer than that found in private patients reported above, with only 14.5% with BPs below 140/90 mmHg and 28.8% with higher levels but below 160/95 mmHg. Women had significantly higher rates of BP control than males. These patients' rate for defaulting was 19.4%, thereby attending less than the expected number of visits to collect medication or see clinic staff. The compliance rate, defined as the proportion of patients who were expected to have collected drugs at all 12 visits, was high (76.9%) and loss to follow up over the 12-month period was 8.1%. The data suggest that poor levels of BP control were achieved in a group of patients who had relatively high rates of compliance.

In a smaller study at another CHC, Steyn *et al*.[25] found similar levels of poor BP control; 41.6% of patients had BPs at 140/90 mmHg or above. The patients had little knowledge of either the consequences of hypertension or the actions needed to ensure that complications were prevented. Home remedies were suggested by 31% of patients as effective antihypertensive medication. Most patients were satisfied with the treatment they received, but 30% requested the return of the dedicated hypertension clubs that had previously operated at this CHC. Other complaints recorded were long waiting times (47%), doctors who did not examine them adequately (37%), and insufficient medication supplied to last until their next appointment (15.5%). Urine and eye tests had been conducted infrequently during the previous 2 years. Conditional logistic regression models indicated that patients who expressed the need to make proposals to the clinic staff about their care had better BP control than those who did not. This suggests that higher levels of patient participation and patient-centred care may result in improved levels of BP control at the CHC.

Similar studies at three CHCs and private GP practices in the townships of Guguletu, Cross Roads and Langa in Cape Town, investigated the determinants of hypertension care in 403 black patients with hypertension. Preliminary analyses suggest that the overall burden of CVD risk factors was high in these patients.[26] Hypercholesterolaemia was found in 50%, diabetes (random glucose and/or taking antidiabetic medication) in 18%, excessive alcohol use (positive Cage questionnaire) 32%, smoking tobacco in 11%, and levels of BP control were inadequate. It is therefore not surprising to find high levels of target organ damage[27] with 44% of patients showing left ventricular hypertrophy on ECG, 15% having renal insufficiency (serum creatinine > 100 µmol/ℓ) and 4% of women and 1% of men having proteinuria (urine Alb/Creat ≥ 34 mg/mmol). These data also show that despite attending primary-care facilities for hypertension care, good levels of BP control were not achieved. Regression analyses found that a higher level of education and a positive Cage score (excessive alcohol use) was associated with poor levels of BP control. Analyses of the physical activity patterns revealed that higher levels of work related physical activity were associated with better BP control in both men and women.

3.2.3 Diabetes care

In 2000, files of 335 patients with diabetes attending the Universitas hospital diabetic clinic in Bloemfontein were reviewed to assess their diabetes and related CVD risk factor control.[28,29] The median HbA_1c was 9.4% and only 14% of patients had an optimal level of 7% or less; demonstrating a poor level of diabetes control. Factors related to poor diabetes control were younger age (p=0.0599), male sex (p=0.044), longer duration of diabetes (p=0.00008) and a high insulin dosage (p=0.0088). This study shows how difficult it is to achieve the levels of control suggested by diabetes treatment guidelines. Associated CVD risk factors were also frequently diagnosed in these patients, i.e. hypertension was found in 68.9%, while only 37% of them had a controlled BP. Those with longer duration of diabetes had poorer levels of BP control. Fifty percent of the patients had recorded lipid profiles, while 13.6% were on lipid-lowering agents, and only 28% had a total cholesterol level of under 5.1 mmol/ℓ. The review highlights the multiple risk factors found in these patients and suggests that their global CVD risk level will be exceedingly high.

A similar retrospective study of folders of patients with diabetes in five Cape Town CHCs revealed that diabetes care was inadequate as were patient attendance and the identification of treatable complications.[30] Only 35% of patients attended regularly finger-prick blood glucose values were recorded for 98.4% of all visits and BP at 74.1% of visits. Urinary dipstick results were recorded at 84.6% of visits. However, fundoscopy was recorded in only 6% and examination of the feet at only 4.7% of visits. Fewer than half the visits resulted in a change of management and polypharmacy for conditions other than diabetes was frequent.

A subsequent study was conducted in which 240 patients with diabetes had a clinical examination, 1-year retrospective record reviews, and an interview in three Cape Town CHCs. This revealed the common occurrence of complications, such as retinopathy, peripheral neuropathy and elevated albumin-creatinine ratios, largely unrecorded in the previous year's notes, in addition to suboptimal glycaemic and BP control. It is also a matter of concern that over half of the participants felt they were not treated with respect by the staff.[31]

There are limited data, based on examination of patients' knowledge and experience of diabetes and its complications. This is concerning, for example Huddle and Kalk[32] pointed out that lower limb amputations are about 20 times more common in diabetic compared to non-diabetic populations.

In the Eastern Cape, Matwa[33] conducted in-depth interviews and wrote field notes in response to observational studies with 15 patients with diabetes drawn from the Umtata hospital diabetic clinic. The question, "Please tell me what it is like to have and live with diabetes and as a diabetic person, how do you take care of your feet?" was asked in isiXhosa. The observations involved watching the process of participants cutting their toenails, using instruments that they were familiar with, as well as observing appropriateness of footwear, cleanliness of the feet and the presence of other abnormalities, such as corns, calluses, deformities and ulcers or amputations. Most of the participants could recognise the symptoms of hyperglycaemia, such as excessive thirst, drinking plenty of fluids, polyuria, hunger, and general malaise. Many females suffered vulval pruritis and vaginal discharge with hyperglycaemia. Only a few patients knew the symptoms of hypoglycaemia or knew what to do when these symptoms were present. For men impotence was a major concern. The participants demonstrated limited knowledge of chronic diabetic complications; lower limb amputations, ulcers, blindness, and stroke were mentioned by 5 participants and only one mentioned stillbirths or abortions as an association of diabetes. Only 6 participants understood the importance of diet as a part of the treatments for diabetes, but all understood the importance of complying with their medical treatment. One participant used traditional medicines to control her diabetes. Only three participants mentioned the importance of exercise in the prevention of complications and only three patients expressed fear of complications of diabetes. Feelings of worthlessness were more pronounced among impotent men who could not fulfil their masculine role in their families. Five participants associated diabetes, ulcers, amputations, and impotence with witchcraft; hence, traditional ways of treatment were sought. Participants had little trust in the western medication for diabetes as no permanent cure was effected. They did not think the medicine was effective if they did not pay for it, as it was part of the Xhosa culture to pay for traditional medication before it was deemed effective.

A lack of finances for travelling to clinics was found to be an impediment to regular clinic visits. The rural clinics frequently did not have the required antidiabetic medication, thus patients had to travel to the nearest hospital, which they could ill afford, to receive their medication. They complained about the equipment for testing blood sugar mostly being out of order, and that hospital staff were too busy to discuss and teach patients

about diabetes. Fear of loss of employment also kept patients away from regular clinic visits.

Overall, this analysis revealed limited knowledge of diabetes and negative experiences in the internal and external environments of the persons with diabetes, as well as poor foot-care knowledge and practices. Traditional beliefs also impeded optimal diabetes care.

De Heer conducted a similar study in the coloured community in Cape Town. People with diabetes with and without foot complications were interviewed in depth. The major findings were limited knowledge about foot care, low perceived risk for their feet unless they had already experienced a foot complication and generally negative feelings about their diabetes. Their understanding of diabetes and foot complications indicates a strong 'Western' model and thus acceptance of the causation provided by the health professionals.

Another study conducted in the Eastern Cape, among 60 patients with diabetes, attempted to understand their practices and perceptions of verbal and written messages provided at six randomly selected primary health-care facilities in the Buffalo City region.[34] The methods used included a questionnaire to determine patients' practices regarding diabetes, exit interviews to assess their perceptions about the messages given by health professionals when interacting with patients, content analysis of a poster on diabetes provided by the DOH of the Eastern Cape, and focus group discussions to explore their views about the content of good messages. Most patients understood that they should use their antidiabetic drugs daily; however, 63% of them supplemented their treatment regimen with different remedies, mostly from traditional healers. Poor adherence was given to the recommended diet for diabetes. Fruit and vegetables were not consumed by 58% and 45% of patients, respectively, during the last week. Acute complications and their management are poorly understood by the patients. Most patients 62% ascribed sweating, restlessness and double vision to high blood sugar and only 38% suggested low blood sugar as the cause of the symptoms. When asked what actions to take with these symptoms only 33% suggested eating sweets or jam.

The exit interviews showed that most of the patients could recall and understood the health education messages provided by the health professionals, however they did not seem to put the advice into practice. The content analyses of the diabetes poster with 6 pictures suggesting symptoms of diabetes revealed that patients misunderstood the pictorial representation of the symptoms of diabetes about half the time. Those who could read the Xhosa subscripts of the pictures did better. These findings clearly indicate the problems of conveying the clinical presentation of diabetes to illiterate patients with pictures. The analyses of the focus group found that patients preferred not only posters that explained the factors leading to the diagnosis of diabetes, but also ones that would teach them how to manage the condition and the prevent complications. They preferred messages to be easy to understand, short, clear, interesting and should suggest actions. The writing should be bold, culturally appropriate and the pictures explicit for illiterate people to understand. The focus group participants stated that traditional healers were now observed in the clinics and they requested that there should be a guide for the patients regarding traditional medicines.

A smaller study at the Church of Scotland Hospital in KwaZulu-Natal was conducted by Khoza and Kortenboud[35] with 30 diabetes patients to assess factors that may influence compliance. Of the patients 30% reported that financial problems affected their ability to follow the prescribed diet, not surprising when it is considered that 86% were either on a pension or unemployed. The study found that the cost of travelling to hospital was prohibitive and that during the rainy season few patients attended clinic and consequently many patients ran out of drugs between hospital visits. Older persons frequently had multiple drugs prescribed and they reported that many side effects were experienced, and, consequently, they did not take all the drugs, and older people in particular forgot to take their medication. Long waiting times at the clinic were frustrating. Compliance to dietary recommendations was poor and 33% of the patients used alcohol regularly.

In two Tswane hospitals Westaway and Seager[36] conducted interviews with 95 African-speaking patients and 81 Afrikaans-speaking patients with diabetes to identify the underlying dimensions of treatments satisfaction as measured by the Diabetes Treatment Satisfaction Questionnaire (DTSQ). Principal component analyses identified the six factors related to patient satisfaction for both groups. Patient satisfaction was found to be significantly associated with fewer incidents of hyperglycaemia and hypoglycaemia, higher general well-being and better health for the African-speaking patients. For the

Afrikaans-speaking patients, greater patient satisfaction was significantly associated with fewer incidents of hyperglycaemia, general well-being, and better health. These findings were consistent with those reported in the United Kingdom and Sweden and confirmed that the DTSQ can be used in multicultural settings.

An extension of this study in 263 black patients with diabetes attending two hospital outpatient clinics investigated the interpersonal and organisational dimensions of patient satisfaction with diabetes care.[37] In this study the health status of patients were measured by the general and mental health subscales from the 20-item abbreviation of the Rand Medical Outcomes Study (SF-20).[38] Detailed analyses of the patients' satisfaction scales identified 19 items falling into two major categories, which accounted for 71.6% of the variance of patient satisfaction. The first category comprised items reflecting interpersonal dimensions of patient satisfaction. The major items were 'providers who let me talk', 'providers who listen to me', 'supportive providers', 'considerate providers', friendly providers, helpful providers, and encouraging providers. The second category comprised items reflecting service characteristics, and was interpreted as the organisational dimension of patient satisfaction. The major items included were waiting times, availability of a seat in the waiting area, availability of a toilet in the waiting area, follow-up service, and cleanliness at the clinic. The interpersonal subscale was significantly related to mental health, whereas the organisational scale was significantly related to both mental and general health.

According to the analyses of the SF-20 data 50% of patients were in the poor general health category and 28% were in the poor mental health category. Poor mental health was associated with high levels of HbA_1c suggesting poor glycaemic control. Not one of the patient satisfaction subscales was significantly related to age, gender, marital status education, or employment status. In addition, they were not associated with HbA_1c, BMI, or BP control. Finally, this analysis suggested that patients in poor general health are less satisfied with the organisational quality of their care than are patients in good general health; in contrast, patients in poor mental health were less satisfied with the interpersonal quality of their care than do those in good mental health.

3.2.4 Diabetes and hypertension care

In the Cape Peninsula, a study was conducted in 18 CHCs reviewing the care received by 923 patients with hypertension and 455 patients with diabetes. Despite all these patients attending the clinics for management of their condition, only 33% of the patients with hypertension had a BP below 140/90 mmHg and of the patients with diabetes only 21.3% had a BP below the recommended level of <130/85 mmHg. For those with diabetes only 42% had a random blood glucose level below 11.1 mmol/ℓ, and 76% had a HbA_1c level ≥1% of the upper limit of normal. These findings clearly indicate a poor level of control of these chronic disease risk factors. Furthermore, most patients have multiple CVD risk factors and consequently a high level of CVD risk. The data also demonstrate that the treatment of the other CVD risk factors is inadequate. Co-morbid conditions occur often and a significant level of target organ damage is identified.

Patient knowledge about these conditions, their treatment and their complications was extremely poor. Only about 20% could correctly name at least one drug that had been described for them for either hypertension or diabetes. Many patients frequently forgot to take their prescribed medication. Without understanding the need for medication and what difference regular treatment makes to long-term outcome, it is difficult for patients to be motivated to use their medications regularly. Very few could identify the necessary actions required to prevent emergencies developing and for preventing severe acute and long-term complications. The requirements for the necessary lifestyle modifications for good control of hypertension and diabetes are poorly understood.

An audit of the folders of these patients revealed that the records kept did not reflect good routine patient care for hypertension and diabetes. This could either be because the notes were incomplete or that the required actions had not taken place. The poor level of BP and blood glucose control observed in these patients make it particularly worrying that their records also showed limited assessment for target organ damage. This suggests that despite attending the clinics, the patients were not receiving the quality of care necessary to improve BP and blood glucose control, and thus prevent the target organ damage that would lead to major morbidity and premature mortality (Steyn & Levitt, unpublished data).

These data clearly emphasise that the optimal chronic disease care model focussing on the role of the patient along with that of the health-care system has not been achieved in the community health clinics in the Cape Peninsula. Bodenheimer[39] stated, "An effective

chronic care model is achieved when a prepared, proactive practice team interacts with an informed, activated patient".

3.2.5 Care of other chronic conditions

In the Agincourt field site in Mpumalanga, a study was conducted by Thorogood *et al.*[40] This examined the prevalence of risk factors and the experiences of interventions in stroke survivors in order to identify barriers to secondary prevention in this rural setting. Of 103 stroke survivors, 71% had hypertension, however only 8% were taking anti-hypertensive medication. Of these patients, 91% had sought help, which involved allopathic health care for 79%, 42 patients had sought help from traditional healers and churches, while another 13 people only sought help from those sources. In-depth interviews were conducted with 35 stroke survivors to assess the impact on their families and their health-seeking behaviour. Barriers to secondary prevention included costs of treatment, reluctance to use pills, difficulties with access to drugs, and lack of equipment to measure BP. A negative attitude to allopathic care was not an important factor.

Tobacco smoking rates in South Africa are highest in the coloured population. This extends to women during pregnancy with the consequent negative impact on both the mother and the baby. In preparation for developing an intervention, two studies were conducted by Petersen[41] to identify pregnant coloured women's knowledge, practices and beliefs regarding smoking during pregnancy. These cross-sectional surveys were conducted on 796 pregnant coloured women in public sector antenatal clinics in six South African cities using a questionnaire. The results revealed that 45.9% of the subjects smoked during the pregnancy, 14.7% had quit and 39.4% were non-smokers. A significantly higher proportion of non-smokers and quitters (compared with smokers) were found to have education beyond primary school (7 years of schooling). The results also suggest that smoking is positively related to lack of financial support from a partner, and smoking is less common among those who are married or living with a partner. Furthermore, more quitters than smokers had family members who were perceived as emotionally supportive during pregnancy. Women who did not plan their pregnancies were more frequently smokers compared to quitters or non-smokers. Smokers also used alcohol more frequently. It is therefore not surprising that smokers have elevated rates of infants with foetal alcohol syndrome.

The women who smoked tended to conceal their smoking status or the amount they smoked. This is mainly to avoid criticism from clinic staff and society. Of the smoking women, only 21% said that they had never attempted quitting and 10% said they do not intend quitting, suggesting that, the vast majority of the smoking pregnant women would like to quit. However, they felt their knowledge was limited and the techniques of quitting were not known to them. The magnitude of the harm to theirselves, their pregnancies, and their babies was also not known to the smokers. Only 55% of the smokers said that they talk freely to the midwife about their smoking, 33% said they never talk to the midwives about their smoking and 28% said they were to afraid to ask midwives questions regarding their smoking. Among the quitters 7% said they intend smoking again after the pregnancy.

Of the smokers, 74% were either in the preparation or action stage phase of quitting smoking. All these women were mostly satisfied with the services they received at the antenatal clinics and they felt strongly that the midwives were the right people to provide them with smoking cessation intervention. This study along with those described earlier will form the backbone of information on which to base the development of a culturally appropriate intervention to be evaluated.

An additional study conducted by Petersen[41] involved in-depth interviews with 12 pregnant coloured women to confirm some of the findings reported above from the quantitative survey. These revealed that the women had a poor knowledge of the harm caused by smoking and passive smoking to their pregnancy. Although women expressed an interest in quitting, they lacked the self-efficacy to speak to midwives about smoking; they feared being harshly judged. The concept of an 'unworthy woman' identified the essence of how women who smoked felt in their relationship with the midwives.

Although a national policy for cervical screening has been formulated, these services have failed to reach many poor women. A household survey by Bradley *et al.*[42] was conducted in predominantly black African women living in low-income townships of Cape Town to ascertain the characteristics of women who reported never having been screened. Of the 664 women who participated in the study 45% reported that they had been screened. Those who had not received a pap smear were older, poorer, less educated and unemployed or working in the informal sector. They tended to live in non-permanent

dwellings without partners. They did not know anybody who had been screened for cervical cancer and had not recently sought care for other ailments, or used contraception.

4. INTERVENTIONS

Despite the information available on the status of the management of chronic diseases of lifestyle, very few intervention studies have been published or conducted during the past decade to evaluate means of improving the poor level of care that is currently provided for these conditions.

The National DOH has formulated a national cervical cancer screening policy for primary-care facilities in the pubic sector. The Cervical Health Implementation Project (CHIP), a collaborative initiative of the Women's Health Project, the Women's Health Research Unit, and EngenderHealth, was undertaken in three pilot districts in Gauteng, Limpopo and Western Cape provinces during January 2001 to May 2003.[43] The purpose of CHIP was to identify implementation challenges; and make appropriate recommendations for the effective implementation of the national cervical cancer screening policy.

An assessment of the health worker and management capacity to implement cervical screening services evaluated for CHIP found that health-care providers at primary-care level were not aware of the cervical screening policy, or were resistant to implementing it. They were also not adequately equipped with relevant knowledge and skills to implement screening services. Limited management capacity to plan, co-ordinate, and monitor screening services was an important impediment to delivery of screening service. The study demonstrated that it is possible to expand the availability of screening services by training health workers to understand the rationale for the national screening policy, and to equip them with knowledge and skills to provide screening. The project published a 2-volume manual to address gaps in health worker and management capacity. Volume I: A Guide for Programme Managers provides overall guidance for programme managers wanting to set up screening services in the South African context.[44] Volume II: A Guide for trainers is targeted at trainers of health-care providers at the primary-care level.[45]

The mainstay in cervical cancer prevention is ensuring timely diagnosis and treatment of women with pre-cancerous lesions (HSIL results). A pilot project to evaluate implementation of the cervical screening policy in three provinces of South Africa found that women's access to treatment for HSIL is hampered by weak referral systems, poor linkages between levels of care, and limited availability of treatment facilities.[46] The study found that for a selected period of evaluation, only 14 of 28 (50%) women with HSIL accessed treatment within 6 months; 9 were lost to follow-up before they got treated, while 4 waited up to 9 months for an appointment.[46] Though numbers are small, the observations are worrying because this highlights that retaining women in the system after a pap smear is a problem. The study attributed these problems to the following weaknesses in the health system:

Multiple and unnecessary levels of referral – the pathway from clinic to treatment facility can be long and tortuous. This discourages retention in the programme.

Limited geographical and economic access – some women had to travel long distances to get treatment because services for treatment of pre-cancerous lesions are mainly located in specialised, urban academic hospitals.

Poor tracking and monitoring systems – this, compounded by poor or absent linkages between levels of care meant that once women left the primary-care level, there were no mechanisms in place to keep track of them.

Unless efforts are made to strengthen referral pathways and linkages between levels of care and to decentralise services for the treatment of precursor lesions available beyond academic hospitals, the goal of cervical cancer prevention will probably not be achieved.

A cluster randomised controlled trial was conducted in private general practices in the Cape Peninsula in order to evaluate an educational outreach package for doctors in order to reduce the severity of asthma in children.[47] Children (n=318) who were attending 43 private practices in Mitchell's Plain outside Cape Town with moderate to severe asthma were entered into the study. The 21 practices randomised to the intervention group received 30-minute educational outreach visits by a trained pharmacist and were given materials describing and facilitating key interventions to improve asthma care. The educational outreach consisted of eight key messages (based on barriers to good practice, identified in a nearby community). The messages were based on the use of a treatment algorithm related to the severity of the asthma, appropriate inhaler therapy with use of homemade spacers, good follow-up, and encouragement of parents to avoid smoking near asthmatic children. The control group received a copy of the then current South African childhood asthma guideline. The main outcome measure was asthma severity measured in a community-based survey administered through schools using the frequency of symptoms and a severity scale. At follow-up 271 children from all the practices were evaluated. There was a substantial decline in reported symptoms over one year in both the intervention and controls groups. The difference in

decline was significantly greater in the intervention group (0.84 points on a 9-point scale; p=0.03). This educational outreach programme improved asthma care for children in the community and should be a model for promoting better management of the condition.

A quasi-experimental design was used by Van Zyl and Rheeder[48] to evaluate a physician education programme in two similar diabetes clinics in Kalafong Hospital near Pretoria. At baseline, a patient folder audit was done to assess frequency of patient visits, quality of patients care and duration of the consultation per patient. The intervention included an interactive training programme for doctors and a structured consultation schedule for the next year's visits of the patients. The training consisted of quarterly non-compulsory meetings including theoretical knowledge transfer as well as discussion of practical aspects of outpatient diabetes care. The intervention material was based on the Society for Endocrinology, Metabolism and Diabetes of South Africa (SEMDSA) Guidelines for the management of type 2 diabetes. The topics for the training sessions included glycaemic control in type 1 and type 2 diabetes, prevention and diagnoses of foot problems, eye problems, risk reduction of macrovascular disease, microalbuminuria and educating patients on diabetes self-care. Each topic was covered immediately before the structured consultation schedule called to the doctor to focus on the specific topic. The structured consultation schedule for the doctor's activities changed the previous independent approach to a structural treatment plan for one year. This was accompanied by a standardised easy-to-complete clinical record form. Each patient was scheduled to attend the clinic quarterly, with a different focus at each visit. The timing of the visit was less frequently scheduled than in the past. The first visit focused on proper foot examination and home care by the patient. HbA_1c was also done. The second visit focused on patient education on their medication and the need to take drugs regularly. A dietician assessed their BMI and provided counselling on diet and obesity management and other cardiovascular risk factors and lifestyle. A urine test for micro-albuminuria, a lipid profile, serum creatinine, and HbA1c were done at the third quarterly visit. The fourth visit focused on eye problems, including visual acuity and direct fundoscopy and referred if required. An ECG was also done at this visit. Finally, an audit of patient records were done to assess the frequency of process measures recorded. These included a foot examination, an eye examination, a urine test for albuminuria, dietary counselling, an HbA_1c test, and a lipid profile. The number of clinic visits during the year, any hospitalisations during the year and the current therapy. The duration of all the clinic visits was also recorded. The main outcome measure was the level of the HbA_1c test.

After the intervention period the HbA_1c level of patients at the clinics improved, however the intervention clinic improved more although the differences between the two clinics were not statistically significant. With regard to the process measures, the intervention clinic scored significantly better than the control clinic. The mean number of visits decreased significantly at the intervention clinic, while they remained the same at the control clinic. However, the duration of the visits at the intervention clinics were longer than those at the control clinic were. Clearly, a better quality of care was provided at the intervention clinic where the required processes of patient care were practiced. Overall, diabetes patient care improved at both clinics and contamination of the intervention between the two clinics at the same hospital must be considered as a cause for the lack of significant differences observed between intervention and control clinics.

At a CHC in Cape Town, a before-and-after intervention study was conducted to evaluate the impact of introducing treatment guidelines for hypertension and by restricting availability of less cost-effective drugs on overall hypertension treatment costs and BP control.[49] Of the patients attending a CHC, 1 084 with hypertension were entered into the study if they had at least two prescriptions for lowering BP during a one-year period. During the following year, an intervention was instituted by applying the 1990 Groote Schuur Hospital guidelines for the treatment of hypertension. This involved a stepped-care approach in which the objective was to control BP with the least expensive treatments and minimum number of drugs. The recommended steps were: 1) to use as first-choice, hydrochlorothiazide, amiloride, propranalol or reserpine; 2) combine two first choice drugs; 3) add a vasodilator (hydralazine or verapamil); and 4) add enalapril or captopril in addition to the other drugs or in place of the vasodilator. Step 4 recommended drugs that were much more expensive. The doctors at the clinic agreed to change to more cost-effective drugs whenever possible. In all cases, treatment decisions were taken by the attending doctor, and treatment changed only where thought to be clinically justified.

After one year, a mean of 1.7 active drugs were prescribed per patient visit. The most frequently prescribed drugs were thiazide-like diuretics (44.8%), centrally acting agents (28.4%) and beta-blockers (13.2%). The mean monthly drug costs per patient decreased significantly by R1.99 (24.2%) from R8.24 to R6.25 between the first and last prescription for each patient. This was attributable to reduced prescribing of the more expensive drugs being withdrawn from routine use, and a 51.1% increase in prescribing of the most cost-effective drugs. The overall annual cost-saving of the changes for this CHC was estimated at R75 150. Blood pressure control did not change significantly.

This study for the first time illustrated the potential for improving cost-effectiveness of hypertension care in primary health-care settings.

A nurse led chronic disease service based on diagnostic and clinical protocols based on essential drugs and appropriate technology in a resource-poor area of South Africa in the Hlabisa district in KwaZulu-Natal was evaluated by Coleman *et al*.[50] The convenience of management for the patient was highlighted. The control of hypertension, type 2 diabetes and asthma was achieved in 68%, 82%, and 84% respectively. The management of CDL of 79% of patients who came from areas served by village or mobile clinics was transferred from the district hospitals to such clinics. Patient-reported adherence to treatment increased from 79% to 87% (p=0.03) over the 2 years that the service was operating. This study provides a model of CDL care that could be applied to very resource-poor areas with outlying clinics.

A quality improvement cycle was initiated at Khayelitsha CHC in 1996 that included four components. Three-monthly visits as opposed to monthly visits, and an annual summary sheet were introduced, a clinic guideline for the clinical nurse practitioners developed, and an educational package (Zakhe Programme, Boehringer Mannheim) to be administered by the clinic nurse was introduced. The results of the cycle showed that 11 of the 12 standards for structure were achieved, e.g. presence of scale for weight measurements, and sphygmomanometers with a range of cuff sizes. In contrast, only one of the standards for success, (i.e. 90% of patients weighed at the last clinic visit) met the agreed level of performance. Three of the six standards for outcome were achieved though two of the three probably reflected a poor level of detection and not good quality care (e.g., less than 10% of patients had retinopathy detected). Because of this cycle, there were a number of improvements in the processes of care and the staff planned to continue to improve the care provided.[51]

The poor level of implementation of therapeutic protocols found in many primary-care CHCs and the inadequate patient record keeping have been identified as an impediment to good care for diabetes and hypertension in the CHCs in the Western Cape. This prompted the development of three structured patient records based on the published management guidelines for diabetes and hypertension. The three guidelines developed and piloted by the research team of the Chronic Diseases of Lifestyle Unit of the MRC in close collaboration with CHC staff consisted of a diabetes, a hypertension and a combined diabetes and hypertension guideline for this group of patients.[52] The CHC staff had clear ideas about the format and content of the structured record. The preferred design features were simplicity of use, a single sheet with tick boxes to reduce recording time and clarity to allow easy visualisation of previous consultations. The form was designed to record routine visits and procedures over a one-year period. Non-routine visits for other medical condition were recorded in the usual notes to avoid cluttering the structured record. The instrument in A4 format was placed into the folder with the existing notes for photocopying on completion. Several process indicators that could influence optimal management were included. These were the detection of risk factors, screening for complications, the establishment of treatment goals, therapy defined by the guidelines and participation in patient education to encourage modification of risk factors. Result indicators were blood glucose, BP, BMI, and urinalysis. Space was also provided to the results of HbA_1C, serum creatinine, lipid, ECGs, and chest radiograph. Structural factors related to the organisation of care were not addressed.

The effectiveness of these structured records with prompts was tested in a randomised controlled trial in 18 CHCs in the Cape Peninsula. The introduction of the structured records with prompts at the nine intervention clinics was accompanied by educational session by two clinician experts in hypertension and diabetes care. The logistics of the introduction of the records were extensively discussed with the staff at the clinics, supply lines for the records and incorporation on the inside of the front page of the patient folders were negotiated. The experts visited all the intervention clinics on a number of occasions during the year. Despite these initiatives, after one year there was no difference in the control of either diabetes or hypertension in the intervention clinics compared to the control clinics (Steyn & Levitt, unpublished data). At the time of the RCT the CHC were undergoing major restructuring, experienced an acute shortage of staff and staff morale was very low. At many clinics, it was found that the structured records with prompts were never introduced in the patient's folders. In-depth interviews with the clinic staff after the survey revealed that there were serious staff shortages, major budget cuts and the freezing of essential vacant posts. This occurred in the face of ever-increasing numbers of patients who were no longer seen at the tertiary-care institutions. Patient loads were enormous and consequently staff expressed feelings of anger and frustration. The introduction of any additional activities was considered futile under the given circumstances (Everett, unpublished data). Furthermore, staff felt that the structured records with prompts could not replace the usual folder notes and consequently required additional work for them and unnecessary duplication. Some doctors were clearly reluctant to relinquish their system because they were familiar with it and it had evolved over time to suit their peculiar

requirements. The majority of the staff did not continue using the structured records at the end of the research project. Further, the staff perceived the structured records to have minimal or no impact on the care of their diabetes and hypertension patients.

Many lifestyle-related risk factors predispose to the development of hypertension. The most important nutrition-related risk factor is a high intake of sodium and a low intake of potassium, calcium, and magnesium. When recently evaluated in Cape Town, all persons working in a large municipal organisation were found to consume high levels of sodium and insufficient potassium, calcium and magnesium.[53] This finding was followed by the conduct of a randomised controlled trial using food usually consumed by the black people living in the townships around Cape Town. The intervention consisted of such foods specially modified by the food industry to reduce sodium and increase potassium, calcium and magnesium. The foods were bread, soup powder, soup cubes, maas, and low-sodium salt enriched with potassium. The trial involved 78 persons randomised to special or normal food. The primary outcome measure was BP measured electronically as well as by ambulatory 24 hr recorders. Analyses of the data indicated that the systolic BP was significantly lower (6.2 mmHg, P=0.021) in the intervention group compared to the control group. However, between the two groups the diastolic BP was not significantly different. These findings are supported by the BP reductions measured by 24 hour ambulatory BP monitoring with the day wake systolic BP 5.1 mmHg (P=0.036) lower in the intervention group than in the control group. The wake diastolic BP was 2.7 mmHg (p=0.072) lower in the intervention group than the control group (Charlton, unpublished data).

5. STUDIES ON SCREENING OR RESEARCH TOOLS FOR HEALTH SERVICE EVALUATIONS

A number of small studies have been conducted with the exclusive purpose of developing tools to support health service attempts to improve care for patients or in keeping with CDL in South Africa.

In a rural district of KwaZulu-Natal, Gill *et al*.[54] created a chronic diseases register over a 6-week period for 2 455 patients. This was done using the technique of electronic data linkages and capture-recapture techniques. The conditions entered were hypertension, diabetes, asthma, and epilepsy. Basic patient details were recorded into EpiInfo software from the main hospital clinic at Hlabisa, as well as ten peripheral clinics. The register was created using electronic data linkage of lists from the main hospital, the peripheral clinics, and repeat prescription cards. This allowed the description of the patient load for the four conditions showing that of all the patients in the register 62% had hypertension 16% epilepsy, 13% asthma, and 12% diabetes. Matching by name, age and diagnosis among the various sources of data proved feasible, although a small degree of overlap was found, suggesting that this easy and inexpensive method can be used in resource scarce settings to create a chronic diseases register for a given region.

Additional work by the same group focused on identifying the cost-effective methods to assess diabetic control in resource-poor settings.[55] They examined the reliability of random venous or capillary blood glucose testing, random urine glucose testing, and a current symptom history in predicting a high HbA_1c level in 235 type 2 diabetes patients. They found that the strongest association with HbA_1c was found with random venous blood glucose tests results. For a cut-off point of HbA_1c above 8%, for random venous plasma glucose of ≥ 14 mmol/ℓ (present in 47% of subjects), specificity was 97.1%, sensitivity 56.8% and positive predictive value 98.9%. Therefore, when resources are short, random glucose testing will detect a significant proportion of those with the worst control with a high degree of specificity enabling staff to modify treatment safely.

Capillary blood glucose or urine testing with reagent strips identified fewer patients accurately, who need treatment modification. A symptom history of polyuria/nocturia was insufficient to replace biochemical testing.

The performance of South African laboratories for accurately testing HbA_1c was evaluated by an External Quality Assurance scheme.[56] A number of laboratories and methods do not meet the required analytical standards. South African laboratories should adopt measures similar to other regional and national initiatives to significantly improve laboratory performance and bring about harmonisation of HbA_1c assays.

The measurement of patient compliance to prescribed lifestyle and drug treatment for chronic conditions remains a challenge. A high BP therapy scale was developed and validated in the USA to assess compliance with hypertension management.[57] The questionnaire used to create this scale was modified to suit the local setting and vernacular of patients, translated into Xhosa, and tested in a group of 98 black patients with hypertension attending public sector CHC in Cape Town.[58] To validate the scale for use in a South African primary health-care setting item analyses were conducted to determine internal consistency of the modified scale. The resulting compliance scores were compared to the actual level of BP measured in these patients. The evaluation led to

modification of the scale to ten items and it was found that poor levels of compliance predicted higher diastolic BPs and that medication non-compliance tended to predict higher systolic BPs.

6. CONCLUSIONS

The data presented in this chapter show that a significant number of studies were conducted, which addressed the health service provision for chronic diseases of lifestyle in South Africa since 1994. Many of the studies were small, but the overall picture that emerged has clearly identified those aspects of chronic disease care that should receive attention from health-care policy makers.

These factors encompass structures, logistics, and organisational aspects of health-care services, which will require modification beyond purely chronic disease care. Staff shortages, poor staff morale, severe overcrowding, and a lack of specific planning to cater for the different needs of patients with chronic conditions have been identified. With respect to staff-related issues inadequate knowledge for the management of chronic diseases, conflict between different cadres of staff in inappropriate communication styles of staff with patients are all contributing to poor chronic disease care. In as far as patient related factors that contribute to poor chronic disease care, non-compliance, lack of patient empowerment, lack of patient knowledge and lack of effective lifestyle modification all contribute.

Despite many positive aspects of the initiation of the restructuring primary health-care services in South Africa during the last ten years these findings highlight how much more needs to be done to improve patient care for those with CDL.

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CHAPTER 18

OVERVIEW AND CONCLUSIONS: A PERSPECTIVE ON DEALING

WITH CHRONIC DISEASES OF LIFESTYLE IN SOUTH AFRICA

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1 OVERALL SUMMARY

The data presented in this Report reveal that the majority of the South African population has moved extensively along the epidemiological transition towards a disease profile related to Western lifestyle. However, the diseases of poverty, which are related to infections and maternal disease, still contribute significantly to the overall burden of disease in the poorer sector of the South African population, as do high rates of HIV/AIDS and trauma. The Actuarial models of projecting AIDS and chronic disease mortality for 2010 leave no doubt that the contribution of chronic diseases of lifestyle (CDL) to the burden of disease in South Africa cannot be ignored despite increasing rates of AIDS. In addition, the projections on the age structure of South Africans suggest that by 2025 one in ten persons will be 60 years or older. This will also lead to an increased burden of CDL.

The epidemiological transition is driven by the adoption of unhealthy lifestyles, which relate to tobacco use, unhealthy nutrition, and lack of regular aerobic physical activity. The use of tobacco has declined markedly since 1994 when the new democratic regime came to power in South Africa. This is probably because of the strict tobacco control legislation that was introduced and improved over the last decade. Although excellent progress has been made towards reducing the use of tobacco products, improved implementation of the many aspects of the tobacco products control legislation should reduce smoking rates even further. It is also necessary to improve the legislation on those aspects that currently allow the tobacco industry to devise ways to promote their killing products. People who are currently addicted to nicotine by smoking tobacco products or using snuff (smokeless tobacco) are poorly catered for in the primary health-care setting in the country. Significant levels of snuff use were identified in black women. The high smoking rates during pregnancy, particularly in women from the coloured group, contribute significantly to complications of pregnancy that can be avoided if they were supported in quitting using tobacco.

In addition to smoking during pregnancy, other factors such as under-nutrition have also been shown to predispose to higher rates of low birth weight babies. These findings were more common in the poorer sector of the society. Precursors to hypertension and diabetes have been shown in these low birth weight children as early as five years of age.

The ongoing nutrition transition is also clearly illustrated by the data presented concerning children, adults and older people. Those people who follow a typical westernised lifestyle consume a diet with few, if any, elements of a healthy prudent diet. Instead, their diet is high in fat, particularly saturated fat, sugars and refined carbohydrates. Inadequate amounts of vegetables and fruit are consumed, and low levels of vitamins and essential trace elements. In addition, high levels of sodium and low levels of potassium, calcium and magnesium seem to contribute to hypertension. In the black African community, the westernised diet was found in the urban settings more frequently than in rural ones. This is not the case for the other groups in the country. Men consume alcohol far more frequently than women do.

Sufficient physical activity to impart health benefits is undertaken by less than half the South African population. Even in children, inadequate amounts of physical activity frequently occur. Some groups of children watch television as much as 3 hours per day, and, in conjunction with this, tend to be more overweight than others are. It should therefore not be surprising that about 17% of children in the country are overweight or obese. At the same time as many as 19% are stunted because of insufficient food intake. In South Africa's first Demographic and Health Survey (SADHS) conducted in 1998, more than half of the adult women were found to be either overweight or obese.

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With high rates of risk factors for hypertension (i.e., obesity, excessive alcohol use, and high sodium and low potassium intake), it is not surprising that about a quarter of South Africans have hypertension. The same risk factors and the typical western diet were also found to be related to higher than expected rates of diabetes, particularly in the black African population, and abnormal blood lipid levels, most frequently in the white and Indian community, but not infrequently in the black African community. In addition to the well-known risk factors for cardiovascular disease (CVD), the degree of urbanisation was also found to be an independent predictor of patients having hypertension or diabetes. There are less data on the prevalence of diabetes and lipid levels compared to those risk factors that can be identified without collecting blood samples in surveys. The costs of population surveys, which include collecting blood samples, are prohibitive and currently the only available data are from a few small local studies that were conducted some time ago. There is a real need to conduct more good quality community-based surveys and, ideally, these should be done nationally, such as in the SADHS.

The above-mentioned risk factors for chronic disease frequently co-exist in patients. The synergistic nature of these risk factors exponentially increases their overall level of risk for future events. This increase can frequently be as large as that found in patients who already have suffered a catastrophic event, such as a myocardial infarction, stroke or other forms of target organ damage (TOD). This latter group of patients, with the highest level of overall risk, will benefit the most from secondary prevention. Unfortunately, the data show that even these patients have poor levels of control for CDL risk factors. This disturbing finding illustrates the urgent need for practical screening tools to identify those at highest overall chronic disease risk in the population.

Currently, the only tools available are formulae, such as the Framingham total risk formula,[1] which predicts the probability of a person suffering from a CVD event over a 10-year period. However, two drawbacks exist, the first being that these formulae were developed in mostly Western populations from long-term cohort studies and may not be applicable to people of African descent. Secondly, these formulae require blood testing for CDL risk factors, such as diabetes and hyperlipidaemia. These measures are costly and frequently cannot be afforded by the public health-care services in South Africa. There is consequently a dire need to develop total CDL risk assessment tools that are based on easily and economically measured risk factors. Research on this is urgently needed in developing countries with limited resources.

This report shows that there is a dearth of nationally representative CVD morbidity data in South Africa. The only community-based survey of stroke prevalence is the SASPI study conducted in the Agincourt demographic and health surveillance site in Limpopo Province.[2] No incidence data on either stroke or myocardial infarction exist in the country. Osteoporosis, linked to insufficient calcium intake and lack of physical activity, is a condition where, again, no national prevalence data is available.

The lack of data has resulted in suggestions that the black African population may not respond to the same known risk factors as other populations do and may escape the high rates of CVD that result from the health transition. However, two recent case-control studies have finally removed any doubt as to the susceptibility of the black African people of the country to CDL risk factors. The first is the African data of the INTERHEART study.[3] This study compared patients with their first acute myocardial infarction with age and gender matched controls. More than 80% of the participants were South Africans and the subgroups of black, coloured and European groups were compared to the findings in the overall INTERHEART study conducted in 52 countries. The degree of association for each of the major risk factors with acute myocardial infarction in the African sample is consistent with that found in the global study.[4] Five modifiable risk factors could be attributed to 89.2% found in the people of Africa, most of whom were South African.

Table 18.1. Comparison of CVD Risk Factors between patients with acute myocardial infarctions and control in the Three Ethnic Groups participating in the African countries[3]

Characteristics	Black Africans			Coloured Africans			European/other Africans		
	Controls N (%)	MI Cases N (%)	Odds ratio (95% CI) N (%)	Controls N (%)	Cases N (%)	Odds ratio (95% CI)	Controls N (%)	MI Cases N (%)	Odds ratio (95% CI)
Male gender	218(61.9)	92(63.9)		212(63.9)	192(62.5)		80(76.2)	101(79.5)	
Self report HTN	46(13.1)	71(50.4)	6.99(4.23,11.55)	88(26.5)	126(41.7)	2.31(1.61,3.32)	14(13.3)	43(34.4)	3.90(1.92,7.94)
Diabetes	14(4.0)	33(23.6)	5.79(2.91,11.53)	38(11.5)	71(23.4)	2.53(1.61,3.96)	8(7.6)	30(24.0)	4.04(1.67,9.77)
Current smoker	101(29.8)	37(26.6)	1.14(0.69,1.89)	153(46.2)	193(64.6)	2.34(1.53,3.59)	41(39.1)	65(51.6)	2.73(1.44,5.17)
Current/former smoker	130(38.4)	63(45.3)	1.48(0.95,2.30)	248(74.9)	250(83.6)	1.79(1.20,2.69)	58(55.2)	95(75.4)	2.76(1.51,5.02)
Physical activity	56(15.9)	25(17.7)	1.22(0.70,2.10)	44(13.25)	33(11.2)	0.86(0.52,1.42)	34(32.4)	26(20.6)	0.54(0.29,1.01)
Alcohol	94(27.3)	45(32.4)	1.44(0.86,2.39)	80(24.2)	53(18.0)	0.56(0.37,0.86)	35(33.3)	26(20.8)	0.41(0.21,0.77)
Fruits+Veg daily	132(39.4)	50(37.0)	0.61(0.36,1.06)	118(36.2)	103(35.0)	0.98(0.63,1.53)	50(50.0)	50(43.86)	1.04(0.44,2.47)
Depression	82(23.9)	48(36.9)	1.96(1.26,3.08)	63(19.8)	77(27.3)	1.69(1.13,2.50)	25(25)	43(36.8)	1.76(0.95,3.25)
Stress, Permanent	10(2.9)	12(9)	3.45(1.27,9.36)	16(14.2)	28(9.6)	3.53(1.69,7.37)	9(8.7)	13(10.5)	0.87(0.29,2.62)
Continuous Variables:	Mean (SD)	Mean (SD)	p-value**	Mean (SD)	Mean (SD)	p-value**	Mean (SD)	Mean (SD)	p-value**
Age	50.6(12.0)	53.0(12.3)	0.03	53.5(11.1)	54.6(11.1)	0.21	53.3(10.4)	54.9(10.6)	0.28
BMI	26.8(5.2)	28.4(5.2)	0.003	26.9(5.6)	27.4(5.1)	0.31	26.2(4.9)	27.2(5.0)	0.14
WHR	0.90(0.081)	0.92(0.085)	0.01	0.92(0.072)	0.96(0.069)	<0.0001	0.92(0.081)	0.98(0.089)	<0.0001
Total Chol. ^	4.42(1.12)	4.50(1.18)	0.58	5.29(1.19)	5.53(1.27)	0.03	5.29(1.45)	5.33(1.25)	0.85
HDL Chol^	1.16(0.46)	0.99(0.45)	0.0006	1.14(0.42)	1.03(0.32)	0.004	1.10(0.46)	0.93(0.29)	0.01
LDL Chol^	2.57(0.92)	2.82(0.97)	0.04	3.27(1.02)	3.66(1.15)	<0.0001	3.07(1.08)	3.42(1.02)	0.04
Apo A1	1.20(0.33)	1.08(0.31)	0.0002	1.22(0.29)	1.11(0.24)	<0.0001	1.27(0.35)	1.12(0.25)	0.0018
Apo B	0.753(0.24)	0.851(0.24)	0.0012	0.942(0.26)	1.04(0.28)	<0.0001	0.941(0.29)	1.06(0.31)	0.0056
Apo B/Apo A1 ratio	0.681(0.33)	0.855(0.37)	<0.0001	0.811(0.27)	0.982(0.31)	<0.0001	0.838(0.48)	0.963(0.25)	0.0147

^From non-fasting blood sample, post-infarct in cases (and varying time after initial chest pain)

Table18.2. The stepwise multiple logistic regression analyses of the relationship between known risk factors and ischaemic heart disease, and other atherosclerosis related target organ damage. (Risk factors that contributed to the area under the ROC curves are shown.)[5]

	Odds ratio	95% CI	P value
Ischaemic heart disease (89 cases; 356 controls).			
Area under the ROC curve = 0.9268			
Family history of myocardial infarction	17.29	5.48 to 54.51	< 0.0001
Hypertension (BP ≥ 140/90 mmHg and/or treatment)	8.38	3.66 to 19.17	< 0.0001
Family history of hypertension	4.33	2.21 to 8.52	< 0.0001
Ratio of HDLC:LDLC ratio ≤ 20%	2.82	1.24 to 7.22	0.0157
Type 2 diabetes (fasting glucose ≥7 mmol/L and/or treatment)	2.99	1.19 to 6.68	0.0184
Hypercholesterolaemia (TC ≥ 6.5 mmol/L)	2.53	0.92 to 6.89	0.0692
Tobacco pack years	1.02	0.99 to 1.04	0.1407
Secondary regression analyses (356 controls)			
Left ventricular hypertrophy (49 with, 307 without LVH)			
Area under the ROC curve = 0.7159			
Hypertension	4.27	2.25 to 8.08	< 0.0001
Family history of myocardial infarction	3.87	0.57 to 26.09	0.1652
Men compared to women	3.19	1.07 to 9.51	0.0386
Family history of diabetes	3.07	0.98 to 9.63	0.0543
≥ Gr 2 retinopathy (109 with, 247 without retinopathy)			
Area under the ROC curve = 0.8104			
Family History of stroke	6.61	1.13 to 38.71	0.0369
Hypertension	5.64	3.23 to 9.86	< 0.0001
Type 2 diabetes	4.16	1.29 to 13.40	0.0175
Family history of diabetes	2.96	0.90 to 9.78	0.0742
Age > 55 years	2.33	1.35 to 4.03	0.0024
HDLC < 1.2 mmol/L	1.80	1.05 to 3.11	0.0348
Tobacco pack years	1.02	0.99 to 1.04	0.1459
Men compared to women	0.59	0.30 to 1.18	0.1393
Peripheral vascular disease (51 with, 305 without PVD) Area under the ROC curve = 0.7873			
Hypercholesterolaemia	8.63	2.74 to 27.15	< 0.0001
Hypertension	4.09	2.11 to 7.93	< 0.0001
Family history of diabetes	3.22	0.92 to 1.33	0.0681
Age > 55 years	2.47	1.25 to 4.93	0.0106
HDLC < 1.2 mmol/L	1.67	0.82 to 3.39	0.1568
HDLC:LDLC ratio < 20%	0.22	0.06 to 0.84	0.0275
Renal TOD (61 with, 295 without renal TOD)			
Area under the ROC curve = 0.6983			
Family history of stroke	3.37	0.74 to 15.44	0.1182
Hypertension	3.14	1.69 to 5.82	< 0.0001
Men compared to women	1.89	0.84 to 4.26	0.1218
Age > 55 years	1.57	0.87 to 2.81	0.126
Tobacco pack years	0.96	0.92 to 1.00	0.0092
Hypercholesterolaemia	0.31	0.07 to 1.39	0.1275

TOD=target organ damage; ROC=receiver operator characteristic; BP=blood pressure; HDLC=high-density lipoprotein cholesterol; LDLC=low-density lipoprotein cholesterol; TC=total cholesterol; PVD=peripheral vascular disease

The risk factors were current/former tobacco smoking, self-reported hypertension and diabetes, abdominal obesity measured as the waist-hip ratio, and the lipoprotein apo B/apo A-1 ratio. Four of these risk factors can be determined by taking a medical history and measuring waist and hip circumferences of patients who attend primary health-care services. Table 18.1 compares the risk factor profile for the three ethnic groups and reveals that they are at different stages of the epidemiological transition; the black African group is at an earlier stage and the other groups at a later stage.

The second study, conducted by Loock *et al*.,[5] compared black African patients who had suffered a myocardial infarction or angina with a control group matched for age and gender living in the same township outside Pretoria. Table 18.2 shows the results of the regression analyses of the relationship between known CVD risk factors and IHD and other related target organ damage.

These data, collected about two decades earlier than the INTERHEART study, show that an association existed between IHD and the major CVD risk factors and CVD-related family histories in urban black South Africans. Furthermore, the same risk factors and CVD-related family histories were shown to be associated with target organ damage of the eyes, kidneys, peripheral vessels, and with LVH also in the control group, who were free of IHD.

These findings finally challenge the notion that black people of Africa are "immune" to the development of IHD as was believed by many clinicians in the past. The low IHD rates reported in black people of Africa could be ascribed to previously low prevalence rates of the known IHD risk factors. Alternatively, observations could have been made during the extended period of recently raised levels of risk factors, and before the development of extensive atherosclerosis that is necessary for IHD and related target organ damage to emerge.

Of the chronic diseases, neoplasms are the second most common cause of death in the country. The data from cancer registries represent the only national objectively measured morbidity data for any chronic disease. Among the poorer and wealthier sectors of society, the pattern of cancers differs significantly and, in part, can be ascribed to different risk factor patterns in these groups. The data show that in addition to the chronic disease risk factors mentioned above, exposure to indoor smoke from solid fuels, aspects of undernutrition contribute to the high rates of oesophageal cancer in poor men and that unsafe sex and multiple partners predispose to cervical cancer in poor women.

The high rates of chronic respiratory diseases in the country are also not surprising in view of the high rates of risk factors reported. Some national morbidity data on chronic bronchitis and asthma, based on symptom complexes collected by questionnaires in the SADHS in 1998, indicate that these conditions contribute significantly to the burden of disease in the country.

The presented data illustrate that the chronic disease conditions and risk factors are infrequently diagnosed and inadequately treated, resulting in high levels of uncontrolled hypertension, diabetes, hyperlipidaemia and chronic respiratory diseases. The level of chronic disease control was found to be better in the private than the public sector. However, even in the private sector CDL control leaves much to be desired. Clearly, much improvement is required if better prevention and control of CDL is to be achieved in the population, particularly with respect to the premature CDL in people who represent the workforce and are under age 65 years.

The initiatives of the National Department of Health (NDOH) in establishing chronic disease care on the health agenda of the new ANC government since 1994 are also described. Much progress has been achieved in this time, and national and provincial strategies as well as practical tools, such as therapeutic guidelines for the care of patients with CDL and their risk factors, have been formulated. The patient centered approach for chronic disease care is central to the planning of the NDOH. While the National Department of Health formulates policies and develops practical tools, the Provincial Departments of Health have to implement and operationalise health care for patients with CDL within the constraints of their budgets. Elsewhere in the document, the wide-reaching national policies on nutrition and physical activity are described, as well as the success that has been achieved with the tobacco products control legislation.

The review of research related to the primary health services for CDL in South Africa shows that the implementation of national policies and many other structural and human resource factors has many deficiencies for the care of patients with CDL. The data identify patients with poor levels of control of chronic diseases and illustrates shortcomings in factors related to the patients, their health-care providers and the structures of the health-care services in both the public and private sectors. The lack of patient-centred care seems to be a central factor resulting in passive patients who do not see themselves as active participants in their own care. Those patients who seem to be more active in their care were found to have better levels of hypertension control than those who do not. Furthermore, the health services at primary care level are still squarely based on an acute care model. The health-care sector in South Africa has been particularly exposed to the effects of the 'brain drain' that is occurring in the country. Consequently, there is a shortage of staff while

health-care providers were found to be frequently frustrated and unmotivated. In many settings, care is provided by staff with inadequate knowledge and experience, and, furthermore, staff trained in chronic disease care are frequently inappropriately used in the health-care services. In the public health-care sector, the community health centres (CHC) are dealing with very large numbers of patients; the structures needed to provide care for patients with chronic diseases and their risk factors on an ongoing basis have seldom been put in place. Very limited time for consultations is available. Patients are required to return monthly to refill prescriptions for medications; long waiting times at the CHC lead to high levels of patient frustration. The drug distribution systems have sometimes failed to provide sufficient drugs on time resulting in the notorious IOU system that requires patients to return to collect their chronic disease drugs. The findings have identified an urgent need to reform the primary-care services to cater for the ever-growing need of the many patients with chronic conditions.

In a recent publication by Leeder *et al*.[6] entitled, 'A race against time', it was shown that people of working age (35 - 64 years) already had increased CVD mortality rates in South Africa in 2000 that were higher than those found in people of similar age in the USA and Portugal. The publication also shows that the projected CVD mortality in South Africa for this age group predicts an increase of 41% between 2000 and 2030. These premature deaths will have a major negative economic impact on the country, simultaneously having to deal with the HIV/AIDS pandemic where even younger people are lost from the workforce.

The preceding chapters clearly illustrate that CDL contribute significantly to the burden of diseases in South Africa, that the conditions and their risk factors are poorly diagnosed and treated, and that this situation impacts negatively on the economic burden of CDL in the country. Despite nationally recognised needs for improved treatment of patients with CDL and their risk factors at population and primary health-care level, adequate diagnoses and treatment are seldom achieved, which highlights the urgent need to address CDL care at these levels.

Unfortunately, the need for health care in South Africa, particularly at primary-care level, faces not only the demands of the traditional acute care model that is needed for high levels of diseases of poverty involving acute conditions, such as infections, trauma, maternal and childcare conditions, but also includes the added requirements of care for chronic diseases. This type of care uses different management modalities than those required for acute care. Countries like South Africa, with multiple burdens of disease, actually require a health-care system that caters for both acute and chronic conditions equally. Such countries are called upon to provide both modalities of care with extremely limited resources. Even highly sophisticated Western countries with higher resource availability for health care are not called upon to provide equally for both acute and chronic conditions. Although much has been achieved in the last decade to formulate the needs of chronic disease care in developing countries, very little international research and policy activities have addressed the taxing question of how poorer developing countries, with multiple burdens of disease, can address both acute and chronic conditions.

2 CONTRIBUTION OF INTERNATIONAL DEVELOPMENTS FOR CDL HEALTH CARE

International recommendations, together with the findings presented in this report, inform us that prevention and treatment of CDL and their risk factors are required across the lifespan. Furthermore, comprehensive CDL intervention requires a multidisciplinary, multi-sectoral patient centred approach that goes far beyond the limited medical model that is required for the care of patients with acute conditions, the latter being the model of current health care in South Africa at the primary level.

Fortunately, much work has been published in the last decade that informs poor developing countries of the requirements for the effective prevention and treatment of CDL. Guidelines have predominantly been formulated by the World Health Organization (WHO). A double-pronged approach is most effective and involves targeting the population as a whole. The first requirement is the prevention of the emergence of CDL risk factors (primordial and primary prevention). This involves motivating the population as a whole to adopt a healthier lifestyle. This is achieved partly through health promotion and partly by modifying the environment by legislation and regulation so that it is more conducive and supportive of healthy lifestyle choices. The second requirement is that people at high risk for the development of CDL must be diagnosed early and treated cost-effectively. This will reduce total CDL risk and help prevent the premature emergence of complications of CDL. Furthermore, an efficient surveillance system is needed to monitor the burden of CDL in the community and to evaluate the success of interventions to reduce its premature onset.[7]

Two critical developments were led by WHO. The Framework Convention on Tobacco Control

is a landmark achievement for WHO, which formulated, for the first time, the requirements of a comprehensive tobacco control policy. This was adopted by the member states of WHO at the World Health Assembly in May 2004. This provided a guideline for the essential elements of tobacco control for all countries.[8] In May 2005, the World Health Assembly, together with the Food and Agricultural Organisation (FAO), adopted the Global Strategy for Nutrition and Physical Activity.[9] This completed the global guidelines in lifestyle modification that focused on the prevention of CDL. The development of practical guidelines by WHO for the implementation of these policies is currently being formulated. The need for prevention and practical recommendations to achieve effective preventive programmes was clearly spelled out by WHO's publication titled, 'Prevention of Chronic Diseases, a Vital Investment', published in 2005.[10] This document includes the STEPS approach to policy development for CDL.[11] In 2003, WHO also published the book, 'Making Choices in Health, WHO guide to cost-effectiveness analyses' by the WHO-CHOICE working group. This publication provides the tools for carrying out cost-effectiveness analyses for many health interventions.

1	PLANNING STEP 1 Estimate population need and advocate for action ↓		
2	PLANNING STEP 2 Formulate and adopt policy ↓		
3	PLANNING STEP 3 Identify policy implementation steps ↓		
Policy implementation steps	Population-wide interventions		Interventions for individuals
	National level	Sub-national level	
Implementation Step 1 CORE	Interventions that are feasible to implement with existing resources in the short term		
Implementation Step 2 EXPANDED	Interventions that are possible to implement with a realistically projected increase in or reallocation of resources in the medium term		
Implementation Step 3 DISIRABLE	Evidence-based interventions which are beyond the reach of existing resources		
THE WHO STEPWISE POLICY FRAMEWORK			

Figure 1: STEPS for Prevention of CDL policy implementation WHO

Four other recent publications also addressed the urgent need to improve CDL care in developing countries, and identified the importance and cost-effectiveness of interventions related to CDL. The first is 'A Race against Time. The Challenge of Cardiovascular Disease in Developing Countries' by Leeder *et al*.[6] South Africa is one of the four countries reported in this publication, therefore making it of particular importance for South African health policy makers. Evidence is provided showing that CVD has a major economic impact in the country and that the management of CVD should therefore be a priority for health policy makers if the projected increase in the burden of chronic diseases is to be averted.

In 1993 the Disease Control Priorities Project of WHO, the World Bank and the Fogarty International Center of the National Institutes of Health in the United States published 'Disease Control Priorities in Developing countries.[12] The many international participants in this project are now working on the second edition of this book.[13] It is edited by Dean Jamison and others who extensively discuss the factors needed for disease control in developing countries. The book identifies a number of CDL-related interventions that are cost-effective in resource-scarce settings, such as South Africa. Steve Tollman *et al*.[14] reviews the many strengths, weaknesses, and requirements of primary health-care services in developing countries. He quotes Starfield who concluded that 'countries with a stronger orientation to primary care indeed are more likely to have better health service levels and lower costs.[15] Tollman *et al*.[14] also review the public and private primary-care settings, and suggest useful private/public partnerships to optimise the ability of the public primary-care setting to provide health care for the poor and thus address the inequities existing in countries like South Africa. The role of community outreach programmes from the

community health centres with dynamic health teams, including community health workers, is discussed. The vexing question of avoiding vertical programmes in primary-care services is addressed, while identifying the different health-care needs for different clusters of conditions and diseases. This chapter warns that a single minded focus on purely cost-effective interventions may ignore issues of inequitable health care and the basic principles of public health in providing for needs identified by communities and improving the health of the poor.

The third publication that can support South African health policy developers in selecting cost-effective interventions for the country is a report by Derek Wanless[16] written for the British Parliament and titled, 'Securing Good Health for the Whole Population'. The report focuses mostly on prevention, the wider determinants of health in England, and on cost-effectiveness of action that can be taken to improve the health of the whole population and reduce health inequalities. The report reaffirms the need for establishing a comprehensive public service for a country to improve health for all and to reduce inequities in health care by focussing on the different needs of different groups in society.

In the textbook, 'International Public Health', Yach *et al*.[17] review the impact of CDL globally and spell out the elements of good CDL management in developing countries in its full multifaceted complexity. Particularly useful with respect to this chapter are the pointers to the successful elements of the Framework Convention on Tobacco control;[8] these can be applied to promoting the global policy on nutrition and physical activity.[9] In the same book Green and Collins[18] spell out the needs for management and planning for public health in developing countries.

WHO has taken extensive steps to develop tools that countries, particularly developing countries, can use to address the requirements of a health service when dealing with CDL. They built on the Wagner model for Chronic Disease Care.[19] The WHO model for 'Innovative Care for Chronic Conditions' (ICCC)[20] summarises these requirements and is illustrated in Fig. 2. The framework illustrates the needs at the levels of patient care, health-care organisation and community participation, as well as at the macro-level of policy and financing requirements. The model identifies the productive interaction between informed, motivated and prepared patients, families, community partners and a prepared proactive and equipped practice teams. The latter implies the availability of appropriate management guidelines, other decision support tools, and essential supplies (including clinical examination supplies, diagnostic tests and medications). The ICCC model also implies continuity and coordination of services between primary, secondary and tertiary care. The third aspect of the ICCC model refers to policy and financing aspects of chronic care.[21] Many of these aspects have been referred to in the publications mentioned above. The ICCC model also indicates the importance of evidence-based behavioural medicine and social science studies; these improve the complex issues of the implementation of interventions that have been shown to be effective after implementation efforts in health services of developing countries.[22]

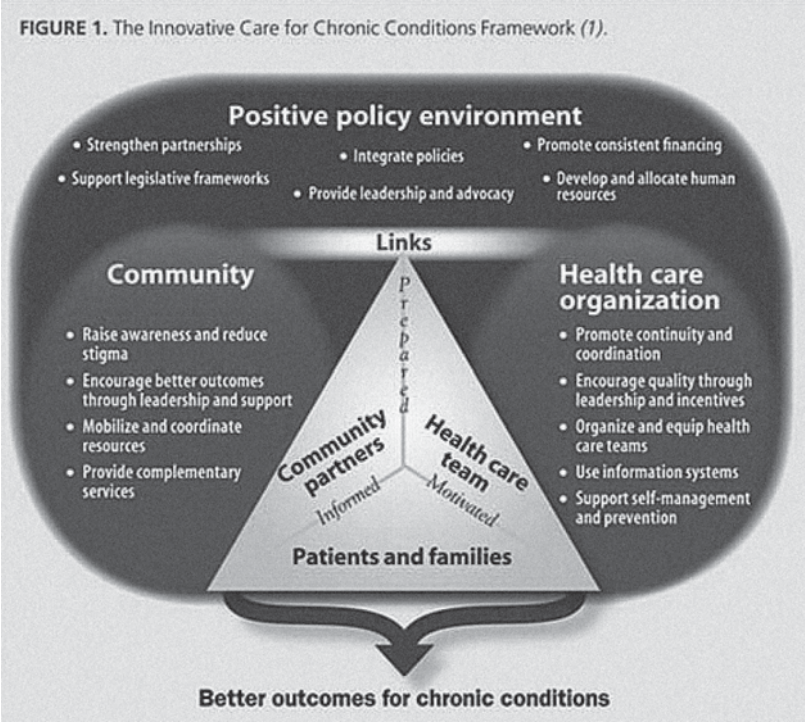

Figure 2: Innovative Care for Chronic Conditions (ICCC) Model

3 MODEL FOR CDL HEALTH CARE IN SOUTH AFRICA

The information provided in this chapter indicates that significant progress has been achieved, particularly with respect to tobacco control, with the primordial and primary prevention initiatives needed to promote a healthy lifestyle for the whole population. The development of primary health-care services has been one of the highest priorities of the National Department of Health since 1994. A long history of inequities in health-care provision between private and public sectors, between the poor and wealthy, and among the different provinces of South Africa have occupied the planners of health services. A focus on the availability and costs of medication has mostly addressed treatment of AIDS, malaria and tuberculosis. The same initiative for cheaper medication for CDL still needs to be put in place. The development of vital registration and an adequate health information system has also received attention, although the development and use of adult health indicators still need to be achieved. Similarly, good primary-care audit systems have not been put in place. These are needed to provide useful local information for primary health-care services to monitor their own progress in achieving good care for patients with chronic conditions.

The National Department of Health has made progress in planning for good clinical care for patients with chronic conditions, and the 5-year strategic plan specifically includes chronic disease care. Essential drug lists for primary and hospital care have been formulated. A long-term care model with support groups for patients with chronic conditions is being promoted. Multiple therapeutic guidelines have been formulated for many conditions. Each of the nine provinces should have a dedicated chronic disease care team. However, at the primary-care level the implementation leaves much to be desired for achievement of optimal care in line with the WHO's ICCC model. An ongoing critical evaluation and reformulation of the primary health services in the nine provinces of the country is needed to implement the ICCC model, while also attending to acute conditions. Fig. 3 is a proposed model for a National Chronic Disease Care for the country.

1° Prevention Target Group: WHOLE POPULATION	• Promote Healthy Lifestyle: tobacco, exercise, nutrition • Motivate public to seek appropriate screening													
2° Prevention Target Group: PEOPLE WITH RISK FACTORS AND CHRONIC DISEASES Diagnosis and treatment	CONDITIONS INTER-RELATED AND OFTEN CO-EXIST													
	TOBACCO & ALCOHOL ADDICTION	HYPERLIPIDAEMIA	OBESITY	HYPERTENSION	DIABETES	CVD, STROKE & HEART ATTACKS	CANCER	CHRONIC LUNG DISEASE	MENTAL HEALTH	DISABILITY & REHABILITATION	GERIATRICS / GERONTOLOGY			
HEALTH SERVICE DEVELOPMENT	• Organisational structure of primary health-care services to provide for both chronic and acute conditions • Adequate staffing levels • Staff training in chronic diseases care utilization of staff • Equipment • Cost-effective locally appropriate management guidelines • Drug delivery system • Compliance by activated patients and health-care team • Long-term care • Evaluation adult health indicators health information system													

MULTIDISCIPLINARY RESEARCH	PARTNERSHIPS (including PUBLIC / PRIVATE)	QUALITY ASSURANCE

Figure 3: MODEL FOR NATIONAL CHRONIC DISEASES PROGRAMME FOR SOUTH AFRICA

3.1 PREVENTION STRATEGIES TARGETING THE POPULATION AS A WHOLE

The success that has been achieved in tobacco control with good legislation has provided an excellent example of what can be accomplished in the country. The government provides the necessary legislation while the non-governmental organisations concerned with tobacco use, particularly the National Council Against Smoking (NCAS), are vigilant in identifying where the tobacco industry is attempting to find ways to promote their lethal products. The extensive use of the media to alert the public to infringements of the law and the necessity to improve current legislation has also been extensively used by NCAS. Ongoing vigilance by all tobacco control groups and a stricter implementation of current and planned legislation will be necessary to achieve a further reduction in tobacco use.

The excellent suggestions made by Yach *et al*.[17] – to use the models developed for successful tobacco control for improving the implementation of the global policy for nutrition and physical activity – should be seriously considered now that the Health Promotion Directorate of the National Department of Health are developing national strategies for the promotion of healthy lifestyles for South Africa. Their planning to date has had a distinct multi-sectoral and multi-disciplinary approach, which much increases their chances of success. However, caution is required to ensure that all interventions used have been tested and shown to be effective.

The promotion of healthy food with sufficient fruit and vegetables, especially for the poorer sectors of society, remains a priority and may need to be addressed by considering subsidies for healthy foods, or at least the removal of sales taxes. The cost of fruit and vegetables in poorer townships is high and their availability in these settings is frequently less than much unhealthier food from street vendors and spaza shops.

The level of salt in many staple foods in South Africa is much too high, and cheap alternatives with low sodium levels need to be developed. The regulation of the amount of sodium in bread and other processed food needs attention from the National Department of Health.

The labelling of food products is currently receiving attention from the National Department of Health. However, there is much to confuse consumers, particularly those with low levels of literacy. Culturally appropriate ways to assist such people in making healthy food choices still needs to be developed and tested for all sectors of the population. There is also confusion with many symbols on food products from more than one NGO. There is, for example, the Heart Mark of the South African Heart Foundation and the Mark from the Cancer Association of South Africa. The National Government may have to facilitate the standardisation of the healthy food marks on products by the various organisations and ensure that solid scientific criteria are maintained by NGOs in selling the use of these marks on products to the food industry.

The promotion of physical activity is currently receiving much attention nationally. The 'Vuka South Africa' multi-sectoral programme launched in 2005 should contribute significantly. Although physical education stopped being a separate subject at schools since the beginning of 2006, it has become part of a compulsory new subject, 'Life Orientation'. There is some concern that this will provide adequate exercise for children to improve the habits and well-being.[23] There are many poor schools where very few facilities are available for physical activity. School health programmes have been reactivated and the 'health promoting schools' initiative is being supported.

The environment in many settings needs to improve in order to support safe outdoor physical activity for people of all ages. Programmes have been developed for members of the community. One such programme is CHIPS, developed at the Sport Science Institute of the University of Cape Town. It is encouraging that planning is in place to implement such programmes widely across the country. Evaluation of these programmes needs to be built into their dissemination. Town planning and measures promoting physical activity where ever possible need to be carefully considered in order to facilitate increased physical activity in the community, but these aspects have not as yet been widely considered.

Another aspect of supporting the community in making healthy lifestyle choices is the availability of credible and culturally congruent health information and messages appropriate to the target audience's level of education. Unfortunately, no central source of information exists in South Africa where the public can turn to for reliable information on CDL. Instead, the public is exposed to advertising messages from commercial enterprises and reports in the media selected for possible newsworthiness and that frequently focus on health-related controversies. This leaves the public confused and unable to identify well-established factual knowledge and prone to accept as correct whatever the media presents to them.

A further aspect of health information that needs attention is a lack of knowledge that will prompt the public to self-select for screening. In particular, the public needs to be better educated regarding situations where their own family and medical history, including the

presence of risk factors, suggest that they may be at high risk for chronic diseases. For example, an obese person with a family history of diabetes and hypertension should present themselves at health services with a request for CDL risk factor screening. Related to this people need to be educated regarding early signs of disease. This may facilitate the early diagnosis of conditions. Typical examples are the early signs of the presence of cancer, and the symptoms of transient ischaemic attacks which could indicate an extremely high risk of suffering a stroke. Again, such education would help people self-select for screening. Programmes to inform the public should be part of the activities of the National Department of Health's Directorate for Health Promotion. In addition, appropriate NGOs should contribute to public awareness campaigns. Such campaigns typically provide the opportunity for multi-sectoral, multi-disciplinary collaboration.

3.2 DEVELOPMENTS NEEDED FOR IMPROVED CDL HEALTH SERVICES

The most challenging aspect to the development of an effective system of primary health-care in South Africa is to cater for the quadruple burden of diseases in the country. This, in essence, means providing for both acute and chronic conditions with limited resources. The traditional medical model that now forms the basis of primary health care is a typical acute care model, which does not provide for the needs of patients with chronic conditions. Table 18.3 summarises the different needs of care for acute and chronic diseases. There is very little information available on the effective structure and approaches required for health policy makers on which to base planning simultaneously for both types of conditions. The current overwhelming focus on integrated health-care services at a primary health-care level is distinct from vertical programmes with their highly inefficient utilisation of available resources. This has prevented critical thinking regarding the differing needs of patients with acute and chronic conditions. This has led to many primary-care settings placing the two classes of patients in one queue while they wait for health-care providers. It is clear that in overextended services this 'integrated' system results in chronic care patients losing out while health-care providers focus more on the urgent and demanding needs of acute care patients. However, other community health centres where dedicated chronic disease clinics have been introduced are closer to the proposed patient-centred approach. These are frequently run by specially trained nurse clinicians supported by medical practitioners. This model of chronic care is preferred by patients. Careful study of this model is needed to operationalise it in most CHCs across the country.

Table 18.3. COMPARISON OF ACUTE AND CHRONIC HEALTH CARE

ASPECTS OF CARE	ACUTE CARE	PATIENT CENTERED CHRONIC CARE
Goal of care	Cure the condition	Control progression Increase survival and quality of life
Duration of treatment	Limited	Indefinite
The group with the required knowledge base to treat the conditions	The health-care provider	The health-care provider Patients and family Community members
Requirements for disease management	Acute interventions Medical treatment	Often comorbidities present Multiple drugs used Patient self-management with help of others
Provider of care	Clinicians and clinical services	Broad based including NGOs, community and families
Quality of care experienced	Determined in clinical setting	Determined by all groups involved including empowered patients

Another aspect that needs addressing is the almost universal insistence that patients with chronic diseases return monthly to collect their medications. This results in long queues and long waiting times, often from well before dawn. This system should be changed so that, where appropriate, medications are provided for much longer periods. Furthermore, drug delivery systems to all CHCs must be addressed to eradicate the common problem of them running out of drugs for chronic conditions. These improvements will not only reduce the enormous numbers of patients attending CHCs but will also permit the currently overextended staff to deal more effectively with patients when they come to chronic disease clinics. The principal

of patient support groups and the possibilities of using these clinics to establish networks of patients with similar conditions for mutual support still needs to be explored.

The successful treatment of patients with chronic conditions is multifaceted and requires a collaborative approach from all involved. However, in the final analysis, these patients self-manage their condition.[24] The central position of patients in chronic care was summarised by Glasgow *et al*.[25] as follows: 'Patients are in control. No matter what we as health professionals do or say, patients are in control of these important self-management decisions. When patients leave the clinic or office, they can and do veto recommendations a health professional makes'. An understanding of this principle emphasises the need that patient empowerment is central to effective care of chronic diseases. The data in Chapter 17 show that patients in the public sector CHCs tend to be passive and do not participate in interaction with the health-care provider. This is hardly surprising in the context of the political history of South Africa where passivity of the poor and disenfranchised was demanded by the system. The traditional authoritarian style of interaction of health-care providers with patients contributes to the situation, as does the lack of culturally appropriate education tools to support patient empowerment.

The patients with the highest level of CDL risk for developing target organ damage (TOD) or events such as myocardial infarctions and strokes will benefit the most if they are identified and treated aggressively. These patients have already suffered a stroke or myocardial infarction, have other TOD, or suffer from diabetes. The data shown suggest that the poor level of CDL risk factor control found in these patients contributes significantly to the occurrence of further events. This group of patients, who are easily identified, must receive adequate intervention to control their CDL risk factors. This will be the most cost-effective group of patients to treat in the country. Another group of patients that can be treated very cost-effectively are those who have not yet suffered an event as described above but who have many CDL risk factors that synergistically contribute to high levels of total CDL risk.[26,27] The challenge is that these patients are more difficult to identify, firstly, because they are not actively sought within the patient community attending CHCs, and, secondly, because expensive blood tests are required to identify all the risk factors necessary to apply the Framingham total risk assessment formulae. The primary health-care resources are inadequate to do all these blood tests. There is consequently a great need to develop total CDL risk formulae based on easily measurable risk factors. WHO and others are working towards developing such formulae. The South African health policy developers plan to utilise these formulae in order to identify those patients who have high levels of total CDL risk. These patients can then have the necessary blood tests done so as to more fully identify all their risk factors. The number of patients who then require such blood tests will then be considerably fewer and this approach will be a much better use of scarce resources.

A detailed discussion of all groups of patients needing chronic disease care is beyond the scope of this chapter, but some neglected groups need to be highlighted.

- A major group is those addicted to tobacco products. Support for these patients is currently not widely available at CHCs. Effective brief interventions for smokers have been formulated and with proper training of health-care providers can be implemented without excessive demands on the time of health-care providers. A particular focus should be pregnant women who smoke or use smokeless tobacco; this will help to reduce the negative effects on the outcomes of the pregnancy.
- Another group of patients needing more attention are those requiring acute care for strokes and myocardial infarctions. Correct care as soon as possible after presentation is critical in order to improve the outcome of these catastrophic events.
- Cervical cancer screening programmes to identify the commonest cancer in women in South Africa are on the agenda but their implementation nationally needs to be optimised.

The formulation of therapeutic guidelines for many chronic conditions has been a focus of the National Department of Health. This is in line with international developments. The American National Guideline Clearinghouse sponsored by the Agency for Healthcare Research and Quality listed 1650 active clinical guidelines in July 2005.[28] It has been emphasised that even the best evidence-based, disease-specific therapeutic guidelines may lead to unintended consequences, particularly when patients with co-morbid conditions and the elderly are not carefully considered.[29] Non-adherence and medical errors are common in patients treated with many medications and many lifestyle change recommendations. The risk of this increases when cross-cultural communication occurs between health-care providers and their patients.

Furthermore, many therapeutic guidelines are sometimes inappropriate in primary health-care settings with limited resources and the recommendations are not ranked in terms of their clinical value. Data are often presented in a way that the busy clinician cannot quickly access. Because of these various problems, overextended health-care providers working in primary care typically consider the guidelines as unrealistic and tend to ignore them, particularly if suggested medications are not available at CHCs. Despite these limitations, evidence-based therapeutic guidelines remain an essential tool for caring for patients cost-effectively in resource-scare settings. This requires that therapeutic guidelines are formulated in ways that are realistic in primary care, resource-scarce settings. Recommendations must be prioritised in terms of their contribution to effective care for patients with chronic conditions. This prioritisation may be presented in the form of the number of patients needed to treat to have a specific outcome. Costs for the patients and CHC must be considered and individual patients' co-morbid conditions, age, life expectancy and similar considerations must play a part in the implementation of the therapeutic guidelines.

4 EDUCATIONAL AND OTHER NEEDS FOR HEALTH CARE PROVIDERS

The quality of primary health care in South Africa for patients with chronic diseases, particularly in the public sector, is affected by many factors related to the actual providers of health-care. There has been a severe brain drain from the public sector of nurses, doctors and allied health-care professionals out of the country or to the private sector. Frustration of staff in the public sector has been identified as a major area of concern. The number of patients at primary-care CHCs has increased dramatically as patients have been prevented from entering the health-care services at secondary or tertiary levels. This occurred without the necessary facilities, staff quotas and training being put into place. Pleas to higher-level health service administrators have been ignored and urgently needed support has not been forthcoming. Because of this primary-care staff work under untenable circumstances, they have a very low level of morale and the quality of care is falling. Frequently, nurses who are trained in chronic disease care have been moved to different settings in the health-care services. Another problem relating to the health care-providers is the traditional style of health-care providers in interacting with patients is a top down approach leaving little space for patient participation in their own care.

This staff situation is in clear conflict with WHO's ICCC model of 'prepared and motivated health care team' with the necessary knowledge and empathetic support needed to help poor patients to develop self-empowerment to manage their chronic conditions. The need to re-orientate health-care providers has been emphasised as the chronic disease care model has been developed.[30,31] The required changes include new approaches to staff education that move well beyond purely clinical skills and additional training in diet counselling, advice on exercise and smoking cessation. This should include training in: 1) patient-centred care and could include training in motivational interviewing; 2) partnering with patients, communities and other health-care providers to build support for improved care of patients with chronic conditions; 3) quality improvement including the use of locally collected data to monitor progress; 4) information and communication technology skills to establish adequate patient information systems and its effective use for communicating with others involved with chronic disease care; and 5) a public health perspective which moves the workforce from caring for individual patients to planning care for populations of patients, including a systems thinking approach that assesses the need for medical interventions across the whole spectrum from clinical prevention to palliative care.

Another aspect of chronic disease care that needs to be considered is the role of community health workers and community outreach programmes. They have a role to play as part of the chronic disease health-care team. Their interaction with chronic disease patient networks or self-help groups will be central but details still needs to be addressed. The training of community health workers and possible remuneration for their services also needs further clarification.

5 MONITORING AND EVALUATION SYSTEM FOR CHRONIC DISEASES OF LIFESTYLE

Limited information about CDL is currently collected in the country. Routinely collected information is based on mortality data from Statistics South Africa, a national pathology-based cancer registry and one community-based cancer registry in the Transkei. The provincial hospital information systems are available for most large hospitals. In addition, some data are collected routinely at CHCs and collated as the provincial reports, but they provide information only on the number of patients with different conditions attending the CHC. These data are not especially useful, either

for planning services or to document the trends in CDL over time. The largest health survey, the Demographic and Health Survey (SADHS), with a specifically developed adult health module to collect data on CDL and other conditions, provides essential adult health indicators. This survey was initiated in 1998 by surveying about 14 000 adults aged 15 years and older. It is conducted every 5 years; the second survey was conducted in 2004.

Other data collected in South Africa is as follows. SASPREN is a volunteer network of family and general medical practitioners who conduct ongoing surveillance of selected health indicators. As far as CDL is concerned, they collect data on asthma, hypertension, diabetes, acute myocardial infarctions and depression. These data are the only information from the private health-care system, while the data on acute myocardial infarctions are the only regularly collected data on that condition. A South African Health Review is published annually by the Health Systems Trust and contains limited data on CDL. The Health Systems Trust was contracted by the National Department of Health to conduct a survey of primary health-care (PHC) facilities in 1997, 1998 and 2000. In 2000 a random sample of 445 PHC clinics were surveyed across the country. These surveys have not included any information regarding CDL. A national disability survey was conducted in 2000. In 2002 and 2004, a youth tobacco survey was carried out in a random sample of South African schools; elements of this international questionnaire were included in a more general Youth Survey of risk-taking behaviour. With regard to data pertinent to CDL, it recorded use not only of tobacco but also of alcohol.

A number of localized surveys of CDL risk factors have been conducted over the last 15 years in different parts of the country. These surveys are the only ones that collected blood samples from randomly selected participants therefore allowing an estimation to be made of the prevalence of CDL risk factors, such as hyperlipidaemia and diabetes.

Accurate and complete information on the incidence of conditions such as strokes and myocardial infarctions is, in general, notoriously difficult to collect. An adequate CDL (or adult) health information system can only be designed after a critical evaluation of currently available data so as to ensure that appropriate, but not unnecessary, data are collected and that optimal use is made of this data. Furthermore, there is an urgent need to develop a CHC auditing process that will enable each CHC to monitor their performance in treating CDL and their risk factors.

The Chronic Diseases of Lifestyle Unit and its collaborators proposed an extensive list of CDL indicators for the National Department of Health (K Steyn, *et al.,* unpublished data), Chronic Diseases of Lifestyle Unit, Medical Research Council). These indicators would be useful for monitoring CDL patterns and quality of CDL care in the country, and for planning CDL health services. The ease and accuracy with which data can be collected, either from currently available sources or by simple data collection procedures, were also suggested.

From the mortality data of the country, 12 indicators of chronic disease were suggested. These would indicate the contribution of chronic diseases to the overall mortality pattern, the age and gender distribution of chronic disease mortality, and years of life lost because of those diseases. The indicator 40Q25 (the chance that a person reaching the age of 40 dies prematurely before age 65) indicates premature mortality and loss from the workforce; this is due mostly to chronic diseases as those who die of AIDS do so before the age of 40 years Cause-specific mortality for a number of major chronic diseases was also suggested as an indicator.

The Demographic and Health Survey's (SADHS) adult health module was designed to yield 16 chronic disease indicators. Hypertension was chosen as an indicator condition in this survey where lifestyle factors related to blood pressure were identified, the prevalence of risk factors determined and the quality of health care reported. Morbidity patterns related to symptomatology of chronic respiratory diseases were also identified as indicators.

Data for ten chronic disease indicators can be easily collected if the Health Facilities surve, mentioned above, is repeated. The data collected should address the availability of necessary equipment and tests for diagnoses and the medications for the treatment of chronic diseases and their risk factors. The surveyed facilities could also be asked about shortages of drugs. Provincial drug depots can supply data on the use of medications for chronic diseases, and this can provide the required information for four indicators.

The greatest need for information is at the level of the CHC. Planners of primary health care suggest that an in-depth review for a period of two weeks every two years at each CHC would provide data that each clinic and also each region and province could use in order to plan services. These data could then be collated nationally, and would allow the findings at the clinics to be compared with the data generated in the SADHS every 5 years. The Quality of Care Manager at the provincial level can be given the responsibility to coordinate the processes with the district management team's information officer.

Twenty-five chronic disease indicators related to patient care factors, to staff related factors and to structural and logistic factors at the CHC, were suggested by Steyn *et al*. Table 18.4 presents the list of 13 essential national chronic disease indicators suggested by the same authors.

Table 18.4. Thirteen essential chronic disease indicators (Steyn *et al*. unpublished)

Indicator	Definition	Aspect Addressed	Data Source
% Adult daily tobacco smokers	Smoke 1 cig/day by people age 15 and older	Effectiveness of tobacco control programme	DHS every 5 years
% Adolescent daily tobacco smokers	Smoke 1 cig/day by people age 15-19	Effectiveness of preventing the uptake of smoking in youth	DHS every 5 years
% Obese people	BMI > 30	Magnitude of the risk of diabetes and hypertension	DHS every 5 years
% Of people with hypertension who are controlled	BP < 140/90mmHg in adults with hypertension	Effectiveness of chronic disease control programmes (diagnosis and management)	DHS every 5 years
% Of hypertension patients attending public sector primary care facilities who are controlled	BP < 160/90mmHg in patients with hypertension	Effectiveness of management of hypertension control programmes	Tally sheets collated every 2 years in facility audit
% Of diabetic patients attending public-sector, primary-care facilities who are controlled		Effectiveness of management of diabetes control programmes	Tally sheets collated every 2 years in facility audit
25Q40	% Of people who reached age 40 who die before age 65	Premature deaths due to mostly preventable chronic diseases but excluding AIDS.	Mortality data
% Of all deaths attributable to CDL	% Of deaths attributable to CDL	Total CDL mortality burden in South Africa	Burden of disease estimates based on mortality data
% Of all years of life lost attributable to CDL	% of all years of life lost attributable to CDL	Total premature mortality burden	Burden of disease estimates based on mortality data
Age-standardised death rate attributable to cardiovascular causes	Death rate attributable to cardiovascular causes, standardised to WHO population	Impact of CVD	Burden of disease estimates based on mortality data
Age-standardised death rate attributable to cancer	Death rate attributable to cancer, standardised to WHO population	Impact of cancer	Burden of disease estimates based on mortality data
Age-standardised death rates attributable to chronic respiratory conditions	Death rate attributable to chronic respiratory conditions, standardised to WHO population	Impact of chronic respiratory diseases	Burden of disease estimates based on mortality data
Age-standardised death rates attributable to diabetes	Death rate attributable to diabetes, standardised to WHO population	Impact of diabetes	Burden of disease estimates based on mortality data

6 RESEARCH REQUIRED FOR CHRONIC DISEASES OF LIFESTYLE

International research funding for developing countries is largely focused on communicable diseases. However, two international initiatives have recently been initiated to address CDL in developing countries. These are the Initiative for Cardiovascular Health Research in Developing Countries (IC Health) under the leadership of Prof Srinath Reddy, coordinated from India, and the Community Actions to Prevent Chronic Diseases (CAPCoD), which operates under the umbrella of the Oxford Health Alliance. Although neither of these initiatives have large amounts of funding available for research, their particular strength lies in recognising that researchers from developing countries need support from accomplished international researchers in order to develop good research questions and protocols that can procure significant funding from large funding agencies. Consequently, both organisations have spent a significant amount of their resources to provide training and support for researchers from developing country who have approached them with

relevant research questions. IC Health has convened, in addition, workshops around the world with experts from developing countries to identify important research questions in areas of CDL needed for developing countries. This model of research development is very useful to build research capacity in any developing country and should be followed in South Africa.

Another aspect urgently required for research development on CDL in South Africa is to attract promising young scientists to this area. One way to do this is to fund dedicated fellowships, which not only provide a salary for promising researchers to do a PhD but also some additional funding for research projects. An open competition for such fellowships would ensure that high-calibre candidates are attracted. In the last decade, this has been done one time with fellowships for tobacco control, funded by Research International for Tobacco Control, and a fellowship for CDL and nutrition research, funded by the international food company, Unilever. The Medical Research Council's programme of research interns) also places good post-graduate students with established research programmes, providing them with a salary, university fees and some training. Unfortunately, this programme does not provide project money for these students.

PhD or post-doctoral students who work on CDL topics could take part in exchange programmes between universities in South Africa and overseas. This should be developed to address the dearth of well-qualified South African researchers working in the area of CDL. The growing focus on international health at many overseas universities might be taken advantage of to ensure that neglected areas of research in developing countries, such as CDL, are included in their research portfolios.

The many areas of CDL research required in South Africa are highlighted in the different chapters of this technical report and will not be repeated here. However, some major needs are suggested. Research on the development of a comprehensive health information system on CDL is necessary together with the development and evaluation of adult health indicators, as was set out in section 18.5. The optimal use of data already available, such as the Demographic and Health survey, needs refinement. Without the necessary information and evaluation the development of effective services for CDL is not possible.

An urgent need is for research on health services that supports the development of effective primary care, both for acute and chronic conditions. This research should use not only epidemiological methods but also social science methods as insufficient attention has been paid to the cultural diversity of the South African population in the context of health services. This will facilitate the development and testing of interventions that are culturally appropriate and locally feasible have to be. Further development and validation of cross-cultural research tools is another area where further investigation is required. The country urgently needs to know how to spend limited resources to obtain the best health possible for the largest number of patients with CDL. For that reason another important area of health services research is the study of the cost-effectiveness of different interventions. The extensive introduction of national preventive programmes, such as 'Vuka South Africa,' must be monitored to ensure optimal benefits.

In a country with such wide reaching demands on limited health services resources policy makers need to implement the most cost-effective interventions in allocation available budgets. The dearth of health economic studies on chronic disease management precludes the ability to make informed cost-effective decisions. The need for studies on cost-effective interventions for chronic disease should be high on the list of research topics that need development in the country.

7 CONCLUSIONS

Most of the elements of CDL health care modification suggested by WHO's ICCC would equally apply to good HIV/AIDS care for patients and are currently being introduced in South Africa with the massive AIDS epidemic. The latter has indeed forced the health services in the country to address many aspects of the care for chronic diseases in developing the services for patients infected with HIV. This provides an opportunity that should not be missed to establish a chronic disease health-care system for the country. However, there is currently no clear plan to link all chronic disease care in the public sector primary health-care system.

This technical report has documented that CDL and their risk factors are extremely common in South Africa and constitute an important part of the overall burden of disease in the country. The data also show that these conditions are poorly diagnosed and inadequately treated. In contrast to the findings reported in the previous (1995) edition of the technical report of CDL in South Africa significant policy developments have taken place at the level of the National Department of Health. However, the data presented document that the implementation of the national strategy for CDL has not yet been achieved. This technical report has highlighted many of the implementation strategies that need to be addressed as well as the extensive health information on CDL that is

needed to create a primary health-care service that will effectively provide for both acute and chronic diseases. Central to this is the development of a patient centred approach that is essential to good health care for all people in South Africa in the 21st century.

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Ageing
Lifestyle-induced
Stroke
Dyslipidaemia
Hypertension
Nutrition
Burden of disease and the health transition in South Africa
Childhood antecedents of adult chronic diseases
TOBACCO USE
OBESITY
Physical activity
Diabetes and impaired glucose tolerance