

## Health in South Africa 4



## The burden of non-communicable diseases in South Africa

Bongani M Mayosi, Alan J Flisher, Umesh G Lalloo, Freddy Sitas, Stephen M Tollman, Debbie Bradshaw

15 years after its first democratic election, South Africa is in the midst of a profound health transition that is characterised by a quadruple burden of communicable, non-communicable, perinatal and maternal, and injury-related disorders. Non-communicable diseases are emerging in both rural and urban areas, most prominently in poor people living in urban settings, and are resulting in increasing pressure on acute and chronic health-care services. Major factors include demographic change leading to a rise in the proportion of people older than 60 years, despite the negative effect of HIV/AIDS on life expectancy. The burden of these diseases will probably increase as the roll-out of antiretroviral therapy takes effect and reduces mortality from HIV/AIDS. The scale of the challenge posed by the combined and growing burden of HIV/AIDS and non-communicable diseases demands an extraordinary response that South Africa is well able to provide. Concerted action is needed to strengthen the district-based primary health-care system, to integrate the care of chronic diseases and management of risk factors, to develop a national surveillance system, and to apply interventions of proven cost-effectiveness in the primary and secondary prevention of such diseases within populations and health services. We urge the launching of a national initiative to establish sites of service excellence in urban and rural settings throughout South Africa to trial, assess, and implement integrated care interventions for chronic infectious and non-communicable diseases.

## Introduction

South Africa is in the midst of a health transition that is characterised by the simultaneous occurrence of epidemic infectious diseases and a rise in non-communicable diseases, in a population facing a heavy burden of perinatal and maternal disorders, injury, and violence.<sup>1-3</sup> Cardiovascular disease, type 2 diabetes, cancer, chronic lung disease, and depression are the major non-communicable diseases now reaching epidemic proportions in the former socialist states and low-income regions of the world.<sup>4</sup>

The past 15 years of political transition in South Africa have seen a rise in non-communicable diseases, driven by an increase in relevant risk factors in urban and rural areas,<sup>5</sup> and by an ageing population despite the substantial overall reduction in life expectancy as a result of HIV/AIDS. South Africans seem not to have derived all the benefits that were anticipated from progressive health-care policies, such as free primary health care, that were introduced by the first democratically elected government in 1994, partly because of a low quality of health care and an uneven access to services.<sup>6-8</sup> However, it is also because the upstream determinants of ill-health lie beyond the reach of the health sector, such as poverty and insufficient quality education. Furthermore, the prevention and treatment of non-communicable diseases are marginalised in South Africa because of the overwhelming prevalence of communicable diseases such as HIV/AIDS and tuberculosis.

The burden of disease related to non-communicable diseases is predicted to increase substantially in South Africa over the next decades if measures are not taken to combat the trend.<sup>9</sup> An insight into the extent of and risk factors for non-communicable diseases in South Africa is crucial for effective advocacy and action. This report presents a review of the challenge of acute and chronic

non-communicable diseases that confronts contemporary South Africa and makes recommendations to deal with the burden. We have used information from several key sources (panel 1), including the national burden of disease study, Statistics South Africa, the South African demographic and health surveys (SADHS), population-based demographic surveillance systems, and surveillance studies. The design and methods of these studies have been described

## Key messages

- The burden of non-communicable diseases is rising in rural communities, disproportionately affects poor people living in urban settings, and is resulting in an increase in the demand for care for chronic diseases.
- The rising burden of non-communicable diseases is shown by an increasing number of deaths from diabetes, chronic kidney disease, and cancer of the prostate and cervix, and by the increasing proportion of disability-adjusted life years attributed to neuropsychiatric disorders.
- The number of deaths attributable to stroke, chronic obstructive airways disease, and lung cancer has fallen in the past 2 years. We need to understand the reasons for these trends, with a view to informing prevention efforts.
- The rising demand for chronic care for communicable and non-communicable diseases needs an integrated model of care at all levels of the health system, supported by a robust surveillance system.
- We urge the launching of a national initiative to establish sites of service excellence in urban and rural settings to develop, implement, and assess integrated care interventions for communicable and non-communicable diseases.

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**Panel 1: Data sources for non-communicable diseases in South Africa****Vital statistics**

The national statistical office collates and reports data on the basis of the death notifications submitted to the Department of Home Affairs in terms of the Birth and Death Registration Act. Since 1997, the underlying cause of death has been identified with the automated programme developed by US-based National Centre for Health Statistics to apply the rules of the International Classification of Diseases and Health Related Conditions (ICD-10). Death registration coverage in South Africa has improved in the past 15 years and, in the case of adults, has been higher than 80% since about 1997. However, the quality of cause-of-death information is a concern. Extensive misclassification of AIDS deaths to related disorders has been identified, as well as a high proportion of ill-defined causes of death. Nevertheless, age-specific mortality rates have been calculated for selected non-communicable diseases with population estimates from the Actuarial Society of South Africa (ASSA) 2003 demographic and HIV model. Although the actual rates might understate the true level of mortality from these causes, the observed trends are indicative of real changes in mortality rates.

**Agincourt health and sociodemographic surveillance system**

A demographic surveillance system was established by the University of the Witwatersrand in 1992 to track the population dynamics of about 70 000 people living in the rural villages of northeastern South Africa (Mpumalanga province). Some 12 000 households are enumerated every year to monitor all births, deaths, and migrations. Verbal autopsies, with use of a validated instrument, are undertaken on every death recorded and reviewed by clinicians to identify the most probable cause of death.

**South African demographic and health survey**

This national household survey introduced an adult health module that was applied to all adult residents older than 15 years living in every second household sampled. The questionnaire focussed on common chronic disorders and their risk factors. Furthermore, anthropometric measurements, blood pressure, and peak flow measurements were taken. The 1998 South African demographic and health survey was followed by the second survey in 2003.

**The South African stress and health survey**

A national household survey was undertaken in 1999 on the basis of the world mental health survey. A questionnaire was used to collect standardised information about the prevalence of psychiatric disorders and psychosocial data, and information about use of mental health services from about 5000 adults.

**South African national burden of disease study and comparative risk assessment**

The 2000 national burden of disease study reviewed the available mortality data and derived consistent and coherent cause-of-death estimates for South Africa by adjusting for under-registration of deaths and misclassification of causes. Together with available morbidity data, the mortality estimates were extrapolated to derive estimates of disability-adjusted life years, a combined measure of the health loss from premature mortality and time lived with disability. This measure was followed by a comparative risk assessment that reviewed data for the prevalence of 17 selected risk factors in South Africa and estimated the attributable burden associated with each risk factor.

previously.<sup>1,2,5,10–15</sup> We obtained information about the cost-effectiveness of interventions from the Disease Control Priorities in Developing Countries Project.<sup>16</sup>

**Burden of non-communicable diseases**

WHO estimates of the burden of disease in South Africa suggest that non-communicable diseases caused 28% of the total burden of disease measured by disability-adjusted

life years (DALYs) in 2004.<sup>17</sup> Cardiovascular diseases, diabetes mellitus, respiratory diseases, and cancers together contributed to 12% of the overall disease burden, and neuropsychiatric disorders (such as schizophrenia, bipolar depression, epilepsy, and dementia) accounted for 6%.<sup>17</sup> In the context of the growing HIV/AIDS epidemic, these proportions have decreased in recent years although the rates have not. On the basis of the DALYs per 100 000 population, WHO estimates place the burden from non-communicable disease in South Africa as two to three times higher than that in developed countries, and similar to that in some other sub-Saharan countries and central European countries that fall into the highest burden quintile. These diseases are on the increase in rural communities in South Africa, they disproportionately affect poor people living in urban settings, and are driving a rise in the demand for chronic disease care.<sup>2,18</sup>

Evidence from the Agincourt study emphasises the emergence of non-communicable diseases, including differences by sex in rural South Africa.<sup>2</sup> Mortality related to these diseases was well established by the early 1990s, with age-standardised death rates per 100 000 population of 209 in men and 172 in women for 1992–94. Figure 1 shows that although mortality decreased in 1995–97, it increased in tandem with the HIV/AIDS epidemic, reaching levels of 270 and 180 per 100 000 population for men and women, respectively, by 2002–05. The increase was significant for men (rate ratio 1.29 [95% CI 1.05–1.59];  $p=0.013$ ) but not for women (1.04 [0.83–1.32];  $p=0.710$ ). Examination of the leading causes of death in men and women aged 50–64 years and 65 years and older draws attention to the rise in deaths from vascular disease, notably in women aged 65 years and older (table).<sup>2</sup>

The distribution of non-communicable diseases displays socioeconomic disparities, with the heaviest burden for poor communities in urban areas. A study of age-standardised mortality rates in Cape Town shows a social gradient in which people living in the poor subdistrict of Khayelitsha have 856.4 deaths per 100 000 attributable to such diseases compared with rates of 450–500 per 100 000 in the wealthy northern and southern subdistricts of Cape Town (figure 2).<sup>19</sup> This disparity in mortality also applies to other fatalities, such as deaths from injuries, HIV/AIDS, and other communicable diseases, for which a two-fold to three-fold difference exists.

The rising morbidity and mortality related to non-communicable diseases have major implications for the delivery of acute and chronic health-care services. The Agincourt study estimated that the burden of disorders requiring chronic care increased disproportionately relative to disorders requiring acute care.<sup>2</sup> This development emphasises the need to scale up the delivery of primary health-care services to meet the expanding demand for chronic care.

## Risk factors

Demographic change is one of the major factors of the increase in non-communicable diseases in low-income countries, largely owing to the increase in the number of older people who are at greatest risk of developing chronic diseases. The 2001 South African population census reported that 7·3% of the population were aged 60 years and older. The child population aged 0–14 years is expected to grow by 10% from 1985 to 2025, whereas the population aged 60 years and older is projected to rise almost three-fold, growing by 189%.<sup>20</sup> The number of people aged between 35 years and 64 years is also predicted to increase, despite the effect of HIV/AIDS.<sup>20</sup> Leeder and colleagues<sup>21</sup> project that even without changes in the risk-factor profile or the mortality rates from cardiovascular disease, the demographic changes will result in a doubling of the number of cardiovascular deaths in South Africa by 2040.

Many non-communicable diseases share common risk factors such as tobacco use, physical inactivity, and unhealthy diet that translate into cardiovascular disease, diabetes, and cancer. The South African adult population has high levels of these risk factors, and large proportions of the burden of disease can be attributed to these potentially modifiable risk factors.<sup>22–24</sup> There are distinct differences between sexes, with smoking and alcohol use being more common in men and obesity more common in women. Despite little data to track the prevalence of these risk factors, a reduction in tobacco smoking of 13% in men and 3% in women was detected between 1998 and 2003, but no change in people younger than 25 years.<sup>10,11,25</sup> Furthermore, little change was recorded in obesity or alcohol use during this period. In childhood and adolescence, paradoxically, obesity and stunting coexist—both of which increase the risk of non-communicable diseases in adult life.<sup>6,26</sup> In a combined sample of children and adolescents, the prevalence of obesity was 4%, overweight 17·2%, underweight 9%, and stunting 11·4%.<sup>27</sup>

National prevalence data show that shifts in dietary intake are occurring with increasing momentum, particularly in black people, who constitute more than three-quarters of the population. Fat intake has increased in black people living in urban settings from 16·4% to 26·2% of total energy (a relative increase of 59·7%), whereas carbohydrate intake has decreased from 69·3% to 61·7% (a relative decrease of 10·9%) in the past 50 years. A shift towards a diet similar to that in developed countries is also apparent in people residing in rural areas.<sup>3</sup>

Some populations are susceptible to non-communicable diseases because of genetic and other ethnic factors—eg, familial hypercholesterolaemia occurs in one of 200 Afrikaners, resulting in early cardiovascular disease in affected individuals.<sup>28</sup> The South African Indian community is more insulin resistant than are other ethnic groups, and therefore at increased risk of type 2 diabetes and ischaemic heart disease.<sup>29</sup>

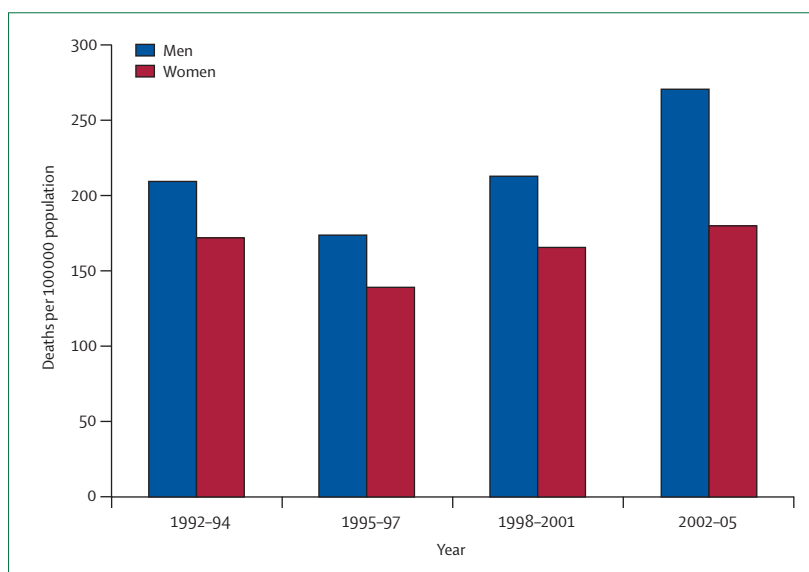


Figure 1: Age-standardised mortality rates for non-communicable diseases by sex, in Agincourt subdistrict, 1992–2005

Adapted from data in reference 2.

## Social determinants

The WHO Commission on Social Determinants of Health has focused global attention on the social and economic factors, such as poor living environments and social exclusion, that result in poor health.<sup>30</sup> Although more research is needed to clarify the links between these determinants and non-communicable diseases, the effect of living in poverty, low socioeconomic status, unemployment, and social conflict on people's mental wellbeing is clear, and contributes to the perpetuation or exacerbation of poverty.<sup>31</sup> Beaglehole and Yach<sup>32</sup> have drawn attention to the role of globalisation in promoting non-communicable diseases through direct effects on risk factors such as tobacco, alcohol, and nutrition, as well as indirect effects on national economies and health systems.

A recent analysis of country variation in stroke has shown that the poorest countries have the highest burden of disease despite the prevalence of known cardiovascular risk factors increasing with income level.<sup>33</sup> Analysis of data from South Africa has similarly shown an increase in the prevalence of hypertension and obesity with increasing wealth, but quality-of-care indicators, such as the control of hypertension and asthma, were negatively associated with wealth, thus suggesting an important role that improved health services might have in reducing health inequities.<sup>34</sup> These data also showed that exposure to some risk factors such as light tobacco smoking and indoor smoke was inversely associated with wealth, thus reiterating concerns that risk factors for non-communicable diseases might become greatest in poor people. Despite the need for better information, the Commission argues that there is sufficient evidence for governments and society to take action on the basis of

		1992-94		1995-97		1998-2001		2002-05	
<b>Men aged 50-64 years</b>									
1	Vascular disease*	13 (19%)	HIV/tuberculosis	20 (22%)	HIV/tuberculosis	34 (27%)	HIV/tuberculosis	80 (29%)	
2	Neoplasms†	6 (9%)	Assault	8 (9%)	Vascular disease*	11 (9%)	Other NCDs‡	21 (8%)	
3	Other NCDs‡	6 (9%)	Other cardiac disorders§	8 (9%)	Neoplasms†	8 (7%)	Vascular disease*	19 (7%)	
4	HIV/tuberculosis	4 (6%)	Other NCDs‡	7 (8%)	Other NCDs‡	7 (6%)	Other cardiac disorders§	16 (6%)	
5	Chronic liver disease¶	3 (4%)	Vehicle accidents	6 (7%)	Chronic liver disease¶	5 (4%)	Neoplasms†	14 (5%)	
Total	..	70	..	93	..	124	..	275	
<b>Men aged ≥65 years</b>									
1	Other cardiac disorders§	16 (18%)	Tuberculosis	19 (11%)	Neoplasms†	30 (13%)	Neoplasms†	32 (11%)	
2	Tuberculosis	10 (12%)	Vascular disease*	15 (9%)	Tuberculosis	24 (10%)	Vascular disease*	31 (11%)	
3	Vascular disease*	7 (8%)	Other cardiac disorders§	13 (8%)	Vascular disease*	24 (10%)	Other cardiac disorders§	25 (9%)	
4	Neoplasms†	4 (5%)	Neoplasms†	9 (5%)	Other NCDs‡	18 (8%)	Other NCDs‡	20 (7%)	
5	Vehicle accidents	3 (3%)	Other NCDs‡	8 (5%)	Other cardiac disorders§	13 (6%)	Tuberculosis	18 (6%)	
Total	..	87	..	168	..	232	..	287	
<b>Women aged 50-64 years</b>									
1	Vascular disease*	7 (20%)	Vascular disease*	5 (8%)	Vascular disease*	15 (16%)	HIV/tuberculosis	46 (26%)	
2	Chronic liver disease¶	5 (14%)	HIV/tuberculosis	4 (7%)	Female genital neoplasm	7 (8%)	Other cardiac disorders§	15 (8%)	
3	Other cardiac disorders§	5 (14%)	Neoplasms†	4 (7%)	Malaria	6 (7%)	Vascular disease*	12 (7%)	
4	Female genital neoplasm	3 (9%)	Other cardiac disorders§	4 (7%)	HIV/tuberculosis	4 (4%)	Female genital neoplasm	9 (5%)	
5	Accidental injuries	2 (6%)	Female genital neoplasm	3 (5%)	Other cardiac disorders§	4 (4%)	Neoplasms†	8 (5%)	
Total	..	35	..	61	..	93	..	178	
<b>Women aged ≥65 years</b>									
1	Other cardiac disorders§	14 (13%)	Vascular disease*	24 (13%)	Vascular disease*	38 (15%)	Vascular disease*	45 (16%)	
2	Vascular disease*	11 (10%)	Other cardiac disorders§	20 (11%)	Other cardiac disorders§	25 (10%)	Other cardiac disorders§	33 (11%)	
3	Female genital neoplasm	7 (7%)	Neoplasms†	11 (6%)	Neoplasms†	19 (8%)	Female genital neoplasm	19 (7%)	
4	Tuberculosis	5 (5%)	Diarrhoea	10 (5%)	Female genital neoplasm	18 (7%)	Neoplasms†	13 (5%)	
5	Neoplasms†	4 (4%)	Female genital neoplasm	9 (5%)	Diarrhoea	12 (5%)	Tuberculosis	10 (3%)	
Total	..	106	..	187	..	247	..	291	

Adapted from data in reference 2. NCDs=non-communicable diseases. \*Cerebrovascular disease, ischaemic heart disease, and hypertensive disease. †All malignant neoplasms, excluding those of female genital organs. ‡Includes disorders not included in other categories, such as anaemia, dementia, chronic obstructive airways disease, asthma, peptic ulcer disease, etc. §All circulatory system diseases excluding hypertensive disease, ischaemic heart disease, and cerebrovascular disease. ¶Excludes all infectious causes.

**Table: Five most common causes of death in men and women aged 50-64 years and 65 years and older in Agincourt subdistrict, 1992-2005**

three principles: to improve the conditions of daily life, to tackle the inequitable distribution of power and wealth, and to strengthen the ability to monitor population health.

### Specific diseases

#### Neuropsychiatric disorders

The South African Stress and Health Survey (SASH), undertaken in 1999, was the first prevalence study of mental disorders derived from a nationally representative sample of South African adults. It showed that 8.1% had an anxiety disorder, 4.9% a mood disorder, 5.8% a substance misuse disorder, 1.8% an intermittent explosive disorder, and 16.5% any of these disorders.<sup>35,36</sup> The 2003 SADHS reported that 21.4% of men and 6.9% of women aged 15-64 years had problems related to alcohol consumption.<sup>11</sup>

No national studies have addressed the prevalence of psychiatric disorders in children and adolescents. Kleintjies and colleagues<sup>37</sup> developed estimates for the prevalence rates of such disorders in the Western Cape on

the basis of local, national, and international prevalence. The estimated unadjusted prevalence was 17.0% for any mental disorder, 5.0% for attention-deficit hyperactivity disorder, 8.0% for major depressive disorder and dysthymia, 11.0% for generalised anxiety disorder, 8.0% for post-traumatic stress disorder, and 3.0% for intellectual disability. These data are relevant because 75% of people in the USA with a psychiatric disorder had an age of onset younger than 24 years, 50% younger than 14 years, and 25% younger than 7 years.<sup>38</sup> The lifetime prevalence in South African high-school students (aged 13-18 years) was 49% for alcohol consumption, 31% for tobacco smoking, 13% for cannabis use, 12% for heroin intake, 12% for inhalants, and 6% for methaqualone use.<sup>27</sup> Data from Cape Town high-school students suggest significant increases ( $p \leq 0.01$ ) between 1997 and 2004 for past month of cigarette use for boys (from 23.0% to 31.5%) and cannabis for both boys (from 3.1% to 17.2%) and girls (from 1.9% to 5.2%).<sup>39</sup>

About 90% of people who commit suicide have a psychiatric disorder at the time of their death.<sup>40,41</sup> Suicide

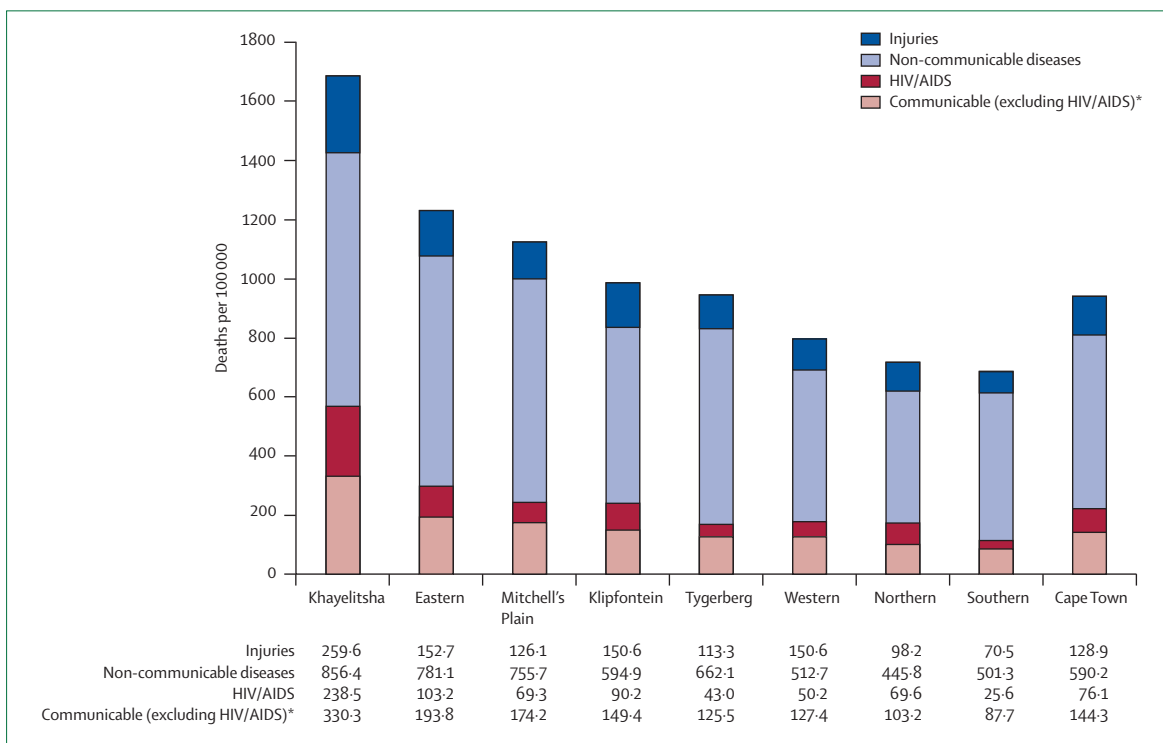


Figure 2: Age-standardised mortality rates for broad cause groups by subdistrict, Cape Town 2006

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accounts for 10% of all injury deaths,<sup>42</sup> which extrapolates to between 5514 and 7582 deaths per year, and for between 110 280 and 151 646 suicide attempts per year.<sup>43</sup> Attempted suicide in the previous 6 months was reported by 17.3% (95% CI 15.1–19.4) high-school students in South Africa.<sup>27</sup> Mental disorders are related both to non-communicable diseases and to other health challenges such as HIV, tuberculosis, and injury, and are discussed in other papers in this Series.<sup>44,45</sup> Mental disorders can increase the risk for all these diseases, which in turn increases the risk for mental disorders.<sup>46</sup> Psychiatric disorders are expected to increase in South Africa with the rise in the prevalence of social risk factors such as poverty, conflict, and displacement.<sup>47</sup>

### Cardiovascular disease and diabetes

Cardiovascular disease is characterised by the persistence of pretransitional diseases (eg, rheumatic fever and idiopathic cardiomyopathies), the dominance of hypertensive disease and stroke, and the emergence of obesity and diabetes. Heart failure is an important reason for presentation to hospital, and is largely the result of non-ischaemic causes of hypertension, idiopathic cardiomyopathy, and rheumatic heart disease.<sup>48</sup> Ischaemic heart disease remains fairly uncommon in most of the black population, accounting for only 10% of patients presenting to hospital with heart disease.<sup>48,49</sup> Although the prevalence of subclinical atheroma (measured by the ankle brachial index) is

similar to that in populations in developed countries, the average total cholesterol remains low in most of the black population of South Africa.<sup>50,51</sup> The favourable total cholesterol profile in association with the very high levels of the protective HDL cholesterol in more than 80% of black South Africans is thought to be the reason for the fairly low prevalence of ischaemic heart disease in the population.<sup>14,52</sup>

The emergence of risk factors for atherosclerotic vascular disease in both urban and rural communities of South Africa has been noted for several decades.<sup>53</sup> Population-based surveys of the early 1990s showed a high prevalence of hypertension (14–33%), diabetes (4.8–6%), and smoking (8.4–52%), with 13–31% of the adult population having at least one risk factor for atherosclerotic vascular disease.<sup>13,14</sup> Surveys done in the 2000s in Limpopo and Mpumalanga provinces not only confirmed the high population prevalence of hypertension, diabetes, and smoking, but also showed the high prevalence of overweight or obesity affecting about 50% of the adult female population.<sup>5,54</sup> Evidence from the INTERHEART study<sup>55</sup> shows that the five most important risk factors for myocardial infarction operate similarly in different ethnic groups and geographical locations worldwide. Therefore, interventions to reduce these risk factors and thereby diminish the prevalence of cardiovascular disease are likely to be as effective in South Africa as they have been in Europe and North America.

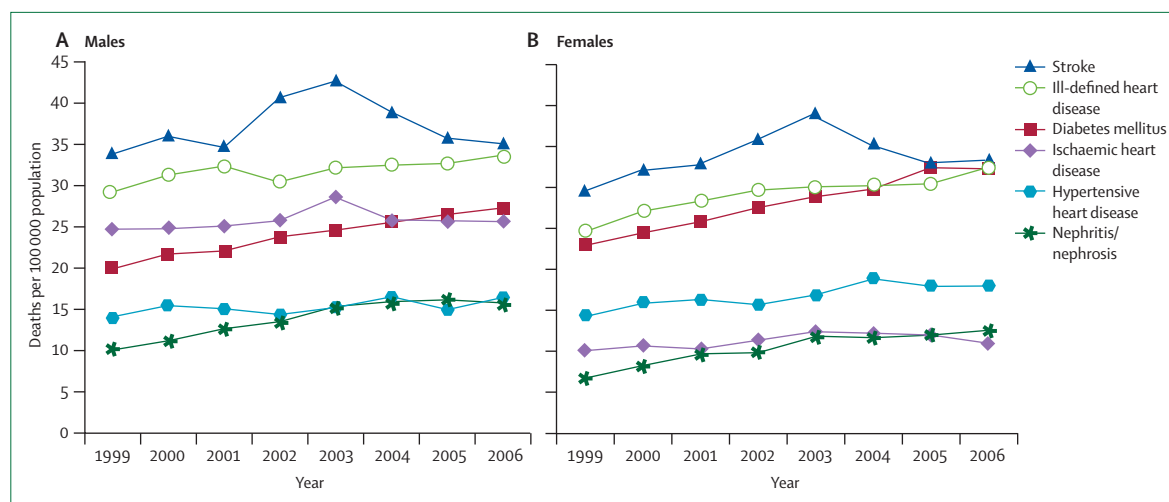


Figure 3: Death rate per 100 000 population from cardiovascular and related diseases in 15–64-year-old male (A) and female (B) South Africans, 1999–2006

HIV infection paradoxically affects cardiovascular risk factors and circulatory disease within populations and individuals. Within populations, HIV infection is associated not only with an overall shortening in life expectancy,<sup>56</sup> but also with a reduction in body-mass index of 1.9 kg/m<sup>2</sup> and a fall in the systolic blood pressure of 3 mm Hg.<sup>12</sup> By contrast, hospital-based series suggest an increased incidence of inflammatory circulatory disorders including macrovascular arteritis, pulmonary hypertension, cardiomyopathy, and tuberculous pericarditis in individuals living with HIV/AIDS.<sup>57–63</sup> The use of antiretroviral treatment containing protease inhibitors and nucleoside reverse transcriptase inhibitors is associated with an increase in insulin resistance, dyslipidaemia, and lipodystrophy. These atherogenic complications of antiretroviral therapy could become a serious problem in South Africa once patients are receiving antiretroviral treatment for longer periods. Mitigating factors are the youth of patients with a favourable cholesterol profile and less exposure to protease inhibitors.<sup>64</sup>

Heart disease, diabetes, and stroke together constitute the second most important cause of death in adult South Africans.<sup>1</sup> Data released by Statistics South Africa for 1999–2006 suggest that by 2003, premature adult deaths (15–64-year-olds) from stroke increased by 28% and by 17% from ischaemic heart disease, but decreased in subsequent years (figure 3).<sup>65</sup> By contrast, sustained increases were seen for diabetes (38%), hypertensive heart disease (20%), ill-defined heart diseases (23%), and kidney disease (67%) from 1999 to 2006 (figure 3). These increases in mortality have prompted several calls for action to prevent the impending epidemic of cardiovascular and metabolic disease in sub-Saharan Africa.<sup>53,66</sup>

### Chronic respiratory diseases

The major non-communicable chronic respiratory diseases in South Africa are chronic obstructive

pulmonary disease (COPD), asthma, occupational lung diseases (including occupational COPD, the pneumoconioses, and occupational asthma), and lung cancer. The burden of these diseases is not well documented in South Africa.<sup>67</sup> On the basis of self-reported medical history, the 2003 SADHS survey reported an asthma prevalence of 7.8% in men and 8.5% in women.<sup>22</sup> A sentinel study undertaken in Cape Town and confirmed elsewhere has shown that asthma is more common in urban than in rural populations.<sup>68</sup> A study based on an oil refinery environment in Durban reported an asthma prevalence of 50% in children.<sup>67</sup>

The SADHS did not show any significant time trends in COPD on the basis of symptom reporting and medical diagnosis of chronic bronchitis and emphysema from 1998 to 2003.<sup>22,23</sup> The prevalence of emphysema was 2.0% in men and 2.6% in women, and for chronic bronchitis 2.3% and 1.9%, respectively. The fairly high prevalence in women is striking because they smoke less than men do. Although the SADHS might not have diagnostic precision, the trends are consistent with other data and suggest that additional factors such as use of biomass fuels and gender susceptibility could contribute to the burden of COPD in women.

Data released by Statistics South Africa for 1999–2006 suggest that by 2003, premature adult deaths from COPD increased by 24% and from asthma by 31%, but decreased in subsequent years (figure 4).<sup>65</sup> By contrast, consistent falls of 10% were recorded in cancers of the trachea, bronchus, and lung. These data show a reversal of the rising trend in mortality due to chronic respiratory diseases.

Respiratory non-communicable diseases have many risk factors that might interact pathophysiologically in a complex manner to cause respiratory disease. These factors include personal and environmental tobacco smoke, burning of biomass fuels (indoor and outdoors), malnutrition, occupational and environmental pollution,

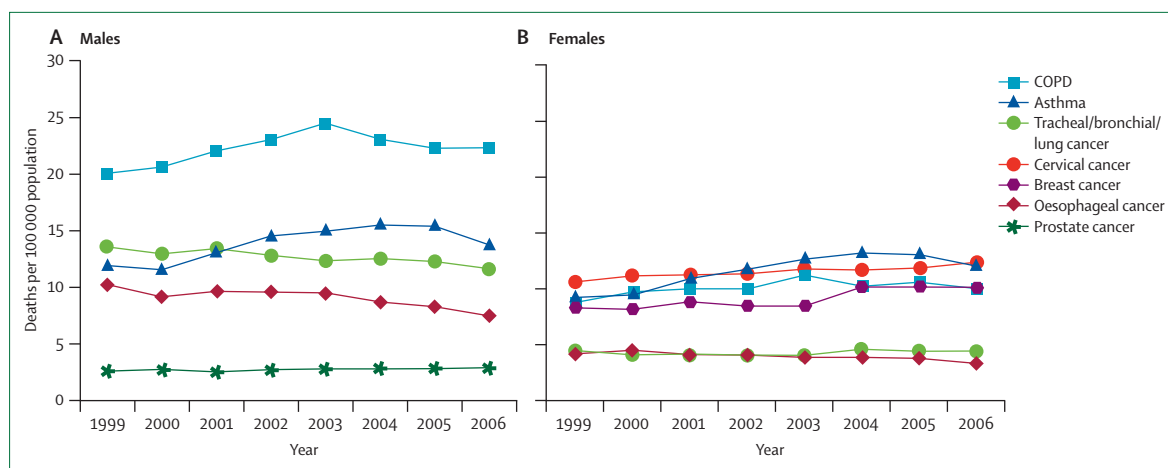


Figure 4: Death rate per 100 000 population from selected respiratory diseases and common cancers in 15–64-year-old male (A) and female (B) South Africans, 1999–2006

COPD=chronic obstructive pulmonary disease.

prenatal factors, and genetic predisposition, and contribute to the burden of COPD in South Africa.<sup>69,70</sup>

Post-apartheid South Africa is becoming rapidly industrialised and, as such, occupational exposures contribute substantially to the burden of non-communicable diseases. Industrial hygiene control and regulation of the mining industry has greatly reduced the incidence and severity of silicosis. Many miners who were exposed to high dust concentrations in mines and then repatriated to their villages of origin have had significant morbidity from silicosis and tuberculosis.<sup>67</sup> A surveillance study from 1997 to 1999 showed that occupational lung disorders were common and drew attention to the increase in occupational asthma, although pneumoconioses still ranked first, indicating that South Africa's industrial health profile is still that of a low-income country.<sup>71</sup>

## Cancer

The International Agency for Research on Cancer has estimated that almost 40 000 deaths from cancer (58 000 cases) occur in South Africa every year,<sup>72</sup> with substantial heterogeneity in cancer distribution between population groups.<sup>73</sup> In men, the leading causes of deaths were lung cancer (comprising 13% of all cancer deaths), Kaposi's sarcoma (11%), and oesophageal cancer (11%). In women, the leading three causes of death were cancer of the cervix (20%), breast (15%), and Kaposi's sarcoma (6%). The pathology-based cancer registry has recorded a decrease in the incidence of cancer of the oesophagus, but a substantive increase has been noted in HIV-associated Kaposi's sarcoma.<sup>25,73</sup>

Changes in the prevalence of HIV-induced immunosuppression and common exposures such as tobacco consumption, coupled with the introduction of expanded immunisation programmes for hepatitis B virus, have major implications for the incidence and distribution of

cancer in South Africa. The incidence of Kaposi's sarcoma is increasing in line with the rise of HIV.<sup>74</sup> If HIV trends follow those of other African countries, then at least 8000 new cases of Kaposi's sarcoma would be expected in South Africa every year.<sup>75</sup>

The introduction of immunisation against hepatitis B virus by the new democratic government in 1994, as part of the expanded programme of immunisation of children, is likely to result in a reduction in the incidence of hepatocellular cancer. From published pathology-based cancer registry reports, hepatocellular cancer in children aged 5–14 years seems to have fallen slightly from a cumulative rate of 2.9 per 100 000 in 1988–93 to 1.2 in 1994–98 in black boys and from 2.0 to 0.9 in black girls. For non-black boys the rate decreased from 1.6 to 1.2 per 100 000, and for non-black girls from 0.8 to 0.2 per 100 000.<sup>74</sup> Although the trends are encouraging, more time is needed to establish the long-term effectiveness of this vaccination programme. A major limitation of these data is that hepatocellular cancer is not always diagnosed by means of histology.

Human papillomavirus (HPV) vaccination of women and girls before the onset of sexual activity would make an important difference in the prevalence of this disease; a 40% reduction in the lifetime risk of cervical cancer is expected if coverage reaches 70%.<sup>76</sup> Experience from Australia has shown that HPV vaccination can be readily implemented in schoolgirls aged 12–13 years with coverage exceeding 80%, predicting a 92% reduction in the age-standardised incidence of HPV 16 infection by 2050.<sup>77</sup> In the absence of an effective Papanicolaou test screening programme, HPV vaccination would offer an attractive alternative. However, the vaccine is expensive and thus unaffordable for many low-income countries, including South Africa. Local models of long-term effectiveness of HPV vaccination in the context of other screening regimens, such as the recently developed

fast-track HPV test, are needed.<sup>78</sup> Furthermore, HPV vaccination would require the development of a pre-adolescent health platform. Such a platform would be a unique opportunity to offer parallel services to young people—eg, booster vaccination against hepatitis B and tetanus, possible anti-HIV vaccination in the future, antihelminthic medication, nutritional assessment, and education about drug, tobacco, and alcohol use, pregnancy prevention, and sexuality in general.<sup>79</sup>

Whereas data from 1960 suggest that the mortality rate from lung cancer has been steadily increasing,<sup>80</sup> recent trends suggest a fall in deaths from tracheal, bronchial, and lung cancers (figure 4). Mortality rates for people aged 15–64 years dropped by 10% between 1999 and 2006. The falling trend also applies to oesophageal cancer, which has dropped by 25% from 1999 to 2006. By contrast, mortality rates from prostate cancer have increased by 12%, breast cancer by 21%, and cervical cancer by 16%.

### South Africa's response to the challenge of non-communicable diseases

Responses to the burden from non-communicable disease have featured in the policy changes since 1994. In 1996, the Directorate of Chronic Diseases, Disabilities, and Geriatrics was established and developed several interventions at legislative, policy, health-service management, and community levels to prevent and control non-communicable diseases.

South Africa has been a global leader in development and implementation of appropriate legislation for tobacco control. The Tobacco Products Control Act of 1993 has created one of the most effective policies of this type worldwide.<sup>6</sup> The Act protects children and adolescents by banning advertising and assures the rights of non-smokers to a smoke-free environment. Additionally, the tax on tobacco has been increased every year as part of the policy for reducing use. South Africa is one of the few countries that has added information about smoking on the death notification form, enabling the attributable burden of tobacco over time to be monitored.<sup>81</sup> These actions are thought to have brought about the falling tobacco consumption in South Africa, by encouraging existing smokers to quit and discouraging non-smokers to start smoking.<sup>6</sup>

We could speculate that the apparent stabilisation or decrease in death rates of the number of smoking-related cardiovascular and respiratory diseases and cancers could be an early sign of effectiveness of the antismoking legislation; the fall in the rate of lung cancer could be consistent with an increase in quit rates among current smokers, as was reported elsewhere.<sup>82</sup> However, an alternative explanation is that the decrease in the number of deaths from lung cancer is the result of a changing race composition of the population by age group. At older ages, the proportion of black Africans is higher than it was previously, which might account for the decrease in lung cancer because black Africans have a

lower rate of smoking than do white and coloured people. The control of alcohol use through legislation has had little effect in reducing the rates of alcohol misuse.<sup>83</sup> The Liquor Act (Act 59 of 2003) was formulated mainly to reduce the socioeconomic effect of alcohol misuse in South Africa, to promote the development of a responsible and sustainable liquor industry, and to prohibit advertising of alcohol to children.<sup>6</sup> Alcoholic beverages are heavily priced through taxes that increase every year. Other control measures include restricted trading hours and an age limit for the legal purchase of alcoholic beverages.

An important achievement has been the promulgation of the Mental Health Care Act (2002), which is consistent with international human rights standards and is based on a thorough consultation process with a range of stakeholders. The Act has served as a key instrument of reform of mental health care within general health services, and for facilitating community-based care. There is a need to step up implementation of the legislation, to adopt a national mental health policy, and to translate policy into service delivery.<sup>84</sup> Mental health is a crucial issue that is embedded in many related challenges such as poverty, unemployment, social support, HIV/AIDS, and crime and violence.

The Department of Health published a national guideline for the management and control of non-communicable diseases in 2006.<sup>85</sup> This document and several additional disease-specific guidelines for clinical management and control of such diseases were developed through wide consultation, and their recommendations are compatible with international best practice. They provide information for the management of common diseases according to interventions of proven cost-effectiveness at all levels of care.<sup>86,87</sup> The barrier in the implementation of the guidelines has been insufficient dissemination and lack of monitoring and assessment for the management and control of chronic diseases.<sup>7</sup>

The South African Department of Health finalised a set of national policy guidelines for mental health in 1997.<sup>88</sup> National policy guidelines have been developed for child and adolescent mental health,<sup>89</sup> and mental health and substance misuse are addressed in the national policy guidelines for adolescent and youth health.<sup>90</sup> Mental health service norms have been developed for serious psychiatric disorders,<sup>91</sup> for community mental health services, and for children and adolescents.<sup>92</sup> The national Department of Health is taking steps to develop a revised and comprehensive set of national policy guidelines for mental health in South Africa. This process must be completed in the near future, so that policy guidelines can inform service development to reduce the substantial gap between needs and services that exists in this country.

The Agincourt study suggests that the burden of disorders requiring chronic care increased disproportionately compared with those requiring acute care over the past 15 years.<sup>2</sup> Chronic diseases and risk



factors are infrequently diagnosed and inadequately treated, resulting in a high number of cases of uncontrolled hypertension, diabetes, hyperlipidaemia, and chronic respiratory diseases in both the public and private health systems.<sup>6,7</sup> Clinicians and nurses working at primary care clinics often do not have the skills to deal comprehensively with non-communicable diseases<sup>93</sup> or they have the capacity to manage only a subset of such diseases. Thus opportunities to provide comprehensive services and to identify other non-communicable diseases that their patients might have are missed.

Several models of community-based interventions for the control and management of non-communicable diseases exist in South Africa. They include the Community Health Intervention Programme (CHIPS), the Woolworths Health Promotion Programme, the Soul City Health Promotion Programme, the Promoting Healthy Lifestyles in Khayelitsha Project, and the Vuka South Africa: Move For Your Health Initiative of the National Department of Health. Puoane and colleagues<sup>6</sup> have described these community-based programmes and their objectives in detail. Their effect on the course of non-communicable diseases, however, remains to be established.

Several non-governmental organisations (NGOs) are concerned with the prevention of non-communicable diseases, including the Cancer Association of South Africa, the National Council Against Tobacco, and the Heart and Stroke Foundation of South Africa. Links between governmental, non-governmental, and community-based agencies working in this area are weak and do not have a shared vision. The national Department of Health has developed policies for non-communicable diseases that are guided by WHO. The provincial programme managers, however, are working largely in isolation, unable to engage with the health-service managers or the health-information section in the national department, and unable to fully make use of the NGOs and other agencies outside the department. Overall, there is insufficient multisectorial coordination and drive towards a concerted programme of action for non-communicable diseases in South Africa.

### Identification of priorities for the next 15 years

The rising incidence of deaths from non-communicable diseases in rural areas and the increasing pressure on health-care services from acute and chronic diseases suggest that South Africa's response to non-communicable diseases has, so far, had little effect nationally (with the exception of tobacco control).<sup>6,7</sup> Achievement of a reduction in mortality and improvement in acute and chronic care for patients with non-communicable diseases will need a new approach to health-systems development. It will need to consider the rapidly growing burden of these disorders, respond to the substantial investments needed in district and primary health-care systems, and address the complex,

intersectoral factors of an already evolving epidemic of non-communicable diseases and risk factors.<sup>2,5</sup>

On the basis of current evidence, the potential for a sustained rise in burden from non-communicable diseases is strong. The burgeoning morbidity and mortality from HIV/AIDS and tuberculosis has probably suppressed the rise of non-communicable diseases. Once the public health sector's accelerated roll-out of highly active antiretroviral therapy takes effect, deaths from HIV/AIDS and tuberculosis should fall, leading to a rise in life expectancy accompanied by an expanding burden of non-communicable diseases.<sup>94,95</sup> Data from the Agincourt subdistrict for an earlier, pre-HIV period (1992–94), when life expectancy was about 70 years for women, clearly show the prominence of deaths from vascular events, notably stroke, in economically productive age groups (table).<sup>2</sup>

South Africa is not alone in facing the complex challenge of shifting from an acute care model to a chronic care model that is better suited to managing the growing burden of non-communicable diseases.<sup>96</sup> Yet the scale of the challenge posed by this combined and growing chronic infectious illness (driven by HIV/AIDS) and non-communicable diseases has few parallels to other countries, and demands an extraordinary response that is within the capacity of South Africa to achieve.

Large investment in primary health-care systems is justified to manage the rising burden of non-communicable diseases, which already impose a large burden on clinical services.<sup>54,97–99</sup> On the supply side, these investments include greater accountability of services to local communities, enhanced sensitivity of providers to local conditions and beliefs, and provision of care to populations within defined catchments. On the demand side, effective local services can address complex problems of patient access, off-set the financial burden of adult chronic illness, and restrict unnecessary use of expensive private care.<sup>87,100,101</sup> The Disease Control Priorities Project concluded that “it is highly cost effective to develop a well-functioning general primary-care system, encompassing local-district hospital levels, which can address up to 90% of health-care demand in low-income countries”.<sup>102</sup>

The Innovative Care for Chronic Conditions Framework provides a robust platform for much needed further development of the South African health-care system.<sup>87,103</sup> Several factors are crucial when this framework is applied to difficult local circumstances. Foremost is the shift from a provider-centred to a patient-centred approach and efforts to strengthen self-management. This approach needs a sustained partnership with the patient, efforts to support behaviour change and adherence to long-term medication, and the need to harness family and community resources. Reliable systems of clinical support, referral, and record-keeping are essential. Such systems are uncommon features of present care and delivery in South Africa but yet they are central to building effective chronic care

systems. Across districts, community awareness and primary prevention can be strengthened by actively linking with community institutions such as schools, churches, mutual benefit societies (eg, stokvels, burial societies), NGOs, and local government, and targeting key risk factors such as obesity, substance misuse, smoking, and maternal and infant nutrition.

The requirement for more responsive behaviour by health professionals is constrained by a long-standing system of centralised decision making, with permission to act needing decisions from several levels of a hierarchical chain of control. Service managers who have authority do not have insight into local needs, are geographically distant, and can be hard to reach. The widespread practice of restricting clinical expertise (mainly doctors) to hospitals needlessly undermines the efforts of local health workers to provide quality community-based care; it also imposes heavy costs on patients, with the poorest people inevitably being lost to follow-up.<sup>100</sup> The imminent introduction of clinically skilled mid-level health workers, and family practitioners responsible for comprehensive district care, offer an opportunity to change the South African health-care system.

The Ministry of Health after the leadership of Thabo Mbeki is giving priority to the prevention and treatment of HIV/AIDS in children and adults. Treasury allocations are substantial, and the effort to bring HIV/AIDS, tuberculosis, and associated diseases under control will dominate South African health care for years to come. With improved treatment regimens, a society well aware of HIV/AIDS, and more cohesive political leadership, the management of chronic infectious diseases in the public sector should improve substantially. The extent to which management of infectious diseases will affect non-communicable diseases needs to be investigated in view of the case that has been made for so-called integrated chronic care systems.<sup>87,104,105</sup>

Integrated systems of chronic care are not yet mainstream. Experience from the integration of reproductive health and family planning, or preventive and curative aspects of child and maternal care, is mixed.<sup>106,107</sup> The integration of services for tuberculosis and HIV is expected to be highly cost effective, but constant attention to quality is important when diverse interventions are introduced.<sup>86</sup> Examples of integrated care, focused on non-communicable diseases in addition to HIV/AIDS and tuberculosis, come from the Hlabisa district of KwaZulu-Natal.<sup>8,98</sup> These examples draw attention to the potential for effective delivery of integrated care from local clinics, using medicines included in the essential drug list, provided that thorough training of nurses or other mid-level workers is coupled with consistent clinical support. Generally, the experience emphasises the need to adjust legal frameworks so that a broader range of tasks can be done by non-physician health workers. A national programme of research and

development would be invaluable for formulating integrated packages of care, clarifying the steps to introducing them, testing how well such packages function, and establishing the cost and health gains from the integration of services. As previously noted, “the requirements for effective, decentralised provision of HAART [highly active antiretroviral therapy], and those needed for competent local management of chronic non-communicable diseases, are closely aligned”.<sup>2</sup>

The unusual trajectory of highly unequal development in South Africa has produced a context in which people who are most prone to non-communicable diseases and risk (eg, grandparents and older people), are centrally involved in raising grandchildren as a result of the devastating effect of HIV/AIDS on their own children. Thus the indirect, non-health benefits of accessible and effective care for non-communicable diseases—in securing households, maintaining livelihoods, and supporting child development and schooling—are of great importance for future generations. They underline the close link between strengthening the national health-care system and future social and economic development.

In advocating for a national research and development agenda to address delivery platforms and the provision of integrated chronic care, an extensive programme of operational research into the specifics of managing particular diseases and risk factors is necessary. This approach will inform training of health professionals, guide clinical support including context-appropriate guidelines and protocols, and is an essential input to estimate the effect and costs of interventions so as to plausibly inform South African health and development policy.

There are key population-level interventions of proven cost-effectiveness that are well suited to low-income settings such as South Africa (panel 2).<sup>86</sup> They address cardiovascular disease,<sup>108,109</sup> diabetes, cancer, COPD, smoking, and alcohol misuse. Predictions of overall costs and effect of service-based interventions are, however, prone to miss their mark in the absence of well functioning delivery platforms. One should therefore be circumspect about applying international cost-effectiveness metrics to present South African conditions.<sup>102</sup> Population-wide interventions that are largely independent of the health system—eg, taxes on tobacco and alcohol—should prove robust.

Leadership and effective coordination of services are needed to ensure that efforts to prevent non-communicable diseases will succeed. Epping-Jordan and colleagues<sup>96</sup> and Beaglehole and co-workers<sup>99</sup> recommend that countries adopt a stepwise approach in developing a national plan of action. With recognition of resource constraints, they propose an evidence-based approach to identify interventions that are immediately feasible and likely to have the greatest effect. Led by government, such a plan has to harness the private sector and NGOs and should

link with key sectors beyond health. Strengthened vital registration and an effective national surveillance capability are needed to monitor future trends in mortality, risk, and disability, and to assess progress on any planned actions. Countries such as Thailand, that are recognised as having a high-performing health system, invariably place emphasis on generating local data and evidence for action.<sup>110</sup> Similarly, coverage of services, access to care (and exclusions when these occur), patient retention, and continuity of care are all key concerns that should be monitored by facility and district managers. Some form of national surveillance platform would be a powerful way in which to monitor and assess programmes within clinics, and for assessing service coverage and its effect.

### Conclusions

Evidence of a rise in mortality and morbidity from non-communicable diseases in all strata of South African society is compelling. These findings represent the most advanced end of the range of rural and urban sub-Saharan transitions. Further, there is good evidence regarding the rise of vascular disorders—including hypertension, stroke, and ischaemic heart disease—elsewhere in east and west Africa,<sup>111,112</sup> suggesting that complex health transitions are underway in several settings. The widely held perception that the burden of disease in sub-Saharan Africa is composed largely of communicable diseases is thus flawed.

After the advent of democracy in 1994, the South African Government has taken several measures to address the evolving epidemic of non-communicable diseases. So far these efforts have not been effective in preventing the rising burden from these diseases. We urge the creation of a national initiative to establish sites of service excellence in urban and rural settings across South Africa. Founded on durable provincial and district level partnerships between service and academic communities, the initiative would be pivotal in the effort to reshape health systems and set new standards of care.<sup>113</sup> Funding could be through a consortium led by the Ministry of Health and Medical Research Council, together with longstanding contributors such as the Health Systems Trust and involving well regarded funders that, since 1994, have included the Atlantic Philanthropies, Henry J Kaiser Family Foundation, agencies such as the UK Department for International Development, and others.<sup>114</sup>

With the argument for remodelling of services and care systems being a compelling one, such an initiative could provide a means for innovative public-sector programming; a service-linked base to establish training, supervision, and support needs; and the opportunity to trial, assess, and implement integrated interventions that emphasise prevention (appropriate packages, their costs, and effects). Construction of this initiative as a truly national effort that is embedded within the provincial systems that are responsible for

#### Panel 2: Recommendations of priority population-level interventions to the national Department of Health for the prevention of chronic diseases in South Africa

- 1 Maintain and extend tobacco-control activities, especially for young people, and encourage quitting by means of counselling and nicotine replacement therapy
- 2 Monitoring, assessment, and enforcement of occupational health and anti-alcohol legislation
- 3 Food-control legislation with public education for reducing the salt content of food and for substituting 2% of trans fat with polyunsaturated fat
- 4 Promotion of physical activity in schools, workplaces, and the built environment
- 5 Electrification of households to reduce exposure to biomass pollutants and reduce the burden of COPD
- 6 Prevention and control of tuberculosis through enhanced notification and contact tracing to reduce the burden of COPD
- 7 Use of multidrug regimens (eg, the polypill containing aspirin,  $\beta$  blocker, ACE inhibitor, diuretic, and a statin), and an absolute risk approach to prevent stroke, chronic kidney disease, hypertensive heart disease, and ischaemic heart disease
- 8 Assess the cost-effectiveness of rolling out the HPV 16/18 vaccination in view of emerging, cheaper HPV screening technologies
- 9 Strengthen the district-based primary health system, with sites of service excellence, and integration of the care of chronic diseases and their risk factors
- 10 Develop a national surveillance system for all chronic diseases

COPD=chronic obstructive pulmonary disease. ACE=angiotensin converting enzyme. HPV=human papillomavirus.

service development and delivery—for which there is no precedent—would allow a systematic approach to strengthening of health systems and help with scalable learning from cross-site experience. Moreover, service-academic partnerships are needed to capitalise on new so-called close-to-patient technologies and approaches (eg, home-based glucose testing, blood pressure monitoring, and counselling) that recognise the centrality of individual behaviour and community-based health promotion, and exploit local initiative and home-based care opportunities.<sup>101,115</sup>

Although revitalisation of health systems should be the primary focus, a nationwide chronic care initiative will need to build robust partnerships with community-based institutions if the potential for prevention and promotion is to be realised. These initiatives could range from schools as sites of health promotion, to champions in local government, to vigorous engagement with local media; women's groups, faith-based groups, and associated income-generating efforts could all have influential roles. We recognise complex challenges

inherent in the South and southern African development context, including access to healthier staple foods and the pressure on food security (including availability of agricultural inputs) in view of the profound economic downturn globally, and the need to address continuity of care despite the high levels of labour migration affecting working-age men and increasingly women.<sup>116</sup>

#### Contributors

BMM assembled the team of authors and wrote the first draft of the report with DB. BMM wrote the first draft of the sections on cardiovascular disease and diabetes, and South Africa's response to the challenge of non-communicable diseases. AJF wrote the first draft of the section on neuropsychiatric disorders. UGL wrote the first draft of the introduction and the section on chronic respiratory diseases. FS wrote the first draft of the section on cancer. SMT wrote the first draft of the sections on new analyses of the Agincourt data, identification of priorities for the next 15 years, and the conclusion. DB wrote the first draft of the sections on new analyses of the age-specific death rates by disease. All authors have contributed to the final draft of the report.

#### Conflicts of interest

We declare that we have no conflicts of interest.

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