Emerging trends in non-communicable disease mortality in South Africa, 1997 - 2010

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Objectives. National trends in age-standardised death rates (ASDRs) for non-communicable diseases (NCDs) in South Africa (SA) were identified between 1997 and 2010.

Methods. As part of the second National Burden of Disease Study, vital registration data were used after validity checks, proportional redistribution of missing age, sex and population group, demographic adjustments for registration incompleteness, and identification of misclassified AIDS deaths. Garbage codes were redistributed proportionally to specified codes by age, sex and population group. ASDRs were calculated using mid-year population estimates and the World Health Organization world standard.

Results. Of 594 071 deaths in 2010, 38.9% were due to NCDs (42.6% females). ASDRs were 287/100 000 for cardiovascular diseases (CVDs), 114/100 000 for cancers (malignant neoplasms), 58/100 000 for chronic respiratory conditions and 52/100 000 for diabetes mellitus. An overall annual decrease of 0.4% was observed resulting from declines in stroke, ischaemic heart disease, oesophageal and lung cancer, asthma and chronic respiratory disease, while increases were observed for diabetes mellitus, renal disease, endocrine and nutritional disorders, and breast and prostate cancers. Stroke was the leading NCD cause of death, accounting for 17.5% of total NCD deaths. Compared with those for whites, NCD mortality rates for other population groups were higher at 1.3 for black Africans, 1.4 for Indians and 1.4 for coloureds, but varied by condition.

Conclusions. NCDs contribute to premature mortality in SA, threatening socioeconomic development. While NCD mortality rates have decreased slightly, it is necessary to strengthen prevention and healthcare provision and monitor emerging trends in cause-specific mortality to inform these strategies if the target of 2% annual decline is to be achieved.


Non-communicable diseases (NCDs) have been recognised as a major cause of disability and death[1-9] for three decades. The 2010 Global Burden of Disease Study[10] estimated that NCD deaths increased from about 8 million in 1990 to 52.8 million in 2010, or 65% of all deaths in that year. A high proportion of the burden occurs in low- and middle-income countries.[10-12] In 2005, Strong et al.[12] suggested a target of reducing chronic disease mortality by 2% per annum, and the high-level United Nations summit on NCDs in September 2011 heralded a global commitment to address the growing burden.[13,14] Countries agreed to adopt nine global targets,[11] including the ’25 × 25’ overarching target of reducing premature mortality from the four main NCDs (cardiovascular diseases (CVDs), including cerebrovascular disease), chronic respiratory diseases, cancers and diabetes mellitus) by 25% compared with their 2010 levels by 2025.

The decline in NCD mortality rates observed in most high-income countries since the 1960s[12,14] has been attributed to decreases in population levels of major risk factors including smoking, unhealthy diet, physical inactivity and alcohol use,[1,2,13,15,16] as well as improved treatment.[12,15] There are limited data on trends in mortality rates in low- and middle-income countries,[16] although it is predicted that NCDs will continue to rise in these countries owing to population ageing and lifestyle changes associated with socioeconomic development and urbanisation.[1,12,16-14]

The initial South African (SA) National Burden of Disease Study estimated that in 2000 NCDs accounted for 41% of all deaths.[18] SA has relatively high levels of risk factors for NCDs.[20] With the exception of reductions in tobacco smoking from 34% in 1995,[21] prior to the anti-tobacco legislation, to 24% in 2009, other NCD risk factors have increased with distinct gender patterns. In 2008, 43% of men and 41% of women had raised blood pressure,[20] 46% of men and 56% of women were physically inactive,[21] and the prevalence of overweight and obesity was 58.5% for men and 71.8% for women.[22,23] The prevalence of raised blood cholesterol was 31% for men and 37% for women, and 5.9% of men and 2.0% of women reported risky alcohol use.

The second National Burden of Disease Study for SA is focusing on trends in deaths and premature mortality from 140 causes of death.[21] In this article we report on deaths from NCDs and examine trends in age-standardised death rates (ASDRs) between 1997 and 2010 nationally and by population group from 2000 onwards.

Methods

Death data obtained from Statistics South Africa for 1997 - 2010 were used for the analysis of NCD mortality.[24] The analysis steps are detailed elsewhere.[25] Briefly, data integrity was assessed using data cleaning processes and validity, and adjustments were made for underreporting. Causes of death were grouped according to the SA National Burden of Disease list, comprising four broad cause groups: HIV/AIDS and tuberculosis; other communicable diseases, plus maternal, perinatal and nutritional conditions; non-communicable...
diseases; and injuries, with 24 disease categories and 140 single causes.[23] In this article stroke is used interchangeably with cerebrovascular disease, renal disease with nephritis and nephrosis, and cancers with malignant neoplasms.

For selected underlying causes of death (UCODs), the data were recoded to address identified inconsistencies based on epidemiological and clinical expertise within the team. These included the selection of diabetes mellitus or epilepsy as the UCOD for cases based on the multiple-competing UCOD reported in part 1 of the death notification form.[27] Cases with diabetes mellitus as the UCOD that had a competing cause reported in part 1 were recoded to: (i) stroke (I60-I69) if stroke was also reported in part 1; (ii) ischaemic heart disease (IHD) (I20-I25) if this was also reported in part 1; (iii) hypertensive heart disease (I11) if this was also reported in part 1; and (iv) nephritis and nephrosis (N00-N08, N10-N12, N17-N19) if hypertensive renal disease (I12) was also reported in part 1. Cases in which epilepsy (G40-G41) was reported as the UCOD with stroke (I60-I69) as the competing cause were recoded to stroke (I60-I69). Cases with hypertension (I10) reported with no other UCOD were redistributed proportionally by age and sex to hypertensive heart disease (I11), hypertensive renal disease (I12), hypertensive renal and heart disease (I13), renal disease (N00-N08, N10-N12, N17-N19), IHD (I20-I25), cerebrovascular disease (I60-I69, G81) and aortic aneurysm (I71), while those with other causes reported were recoded to general ill-defined. Cases with hypertensive renal disease (I12) as the UCOD were combined with other nephritis and nephrosis (N00-N08, N10-N12, N17-N19), while hypertensive heart and renal disease (I13) were combined with hypertensive heart disease (I11).

Deaths with unknown age, sex and population group were redistributed proportionally. Misclassified HIV/AIDS deaths were identified from 18 conditions (none NCDs) based on a regression approach, and underspecified and ill-defined conditions were redistributed according to the strategies developed by the team in consultation with experts.[25] Years of life lost (YLLs) were calculated using 3% per annum discounting[29] and the level 26 West model life-table[31,32] for standard expectations by age. ASDRs were calculated using alternative mid-year estimates[32] and the World Health Organization world standard.[33] Premature mortality from CVDs, cancers, respiratory disease and diabetes mellitus was calculated as the risk of death \( \omega_{x0} \) from these causes between the ages of 30 and 70 years based on the quinquennial death rates \( \omega_m \), such that:

\[
\text{death rate} = 1 - \exp(-5 \sum_{x=30}^{70} \omega_m x)
\]

National trends in deaths and ASDRs are reported by broad cause groups, categories of conditions and single causes. Population group according to previously defined apartheid categories of black African, coloured, Indian/Asian, white and other was introduced into the new death notification in 1998[26] to track health inequalities. Since population group was reported for about 75% of deaths since 2000, it was possible to estimate trends by population group for 2000 - 2010.

**Results**

**NCD mortality**

Of the estimated 594 071 deaths in 2010, 38.9% were due to NCDs (42.6% of females and 35.4% of males). A sizeable proportion (14.7%) of those who died were aged <45 years and 21.5% were aged 45 - 59 years, indicating a considerable number of premature deaths. Premature mortality (30 - 70 years) for CVDs, cancer, respiratory conditions and diabetes mellitus remained level at about 29.0% until 2004, but by 2010 had declined to 26.0%

Based on YLLs, NCDs accounted for 27.8% of the premature burden (30.1% of female YLLs and 25.7% of male YLLs) in 2010. The ASDR for NCDs was level at about 669/100 000 population from 1997, then increased in 2003 to 710/100 000 population before declining again to 634/100 000 population in 2010. A drop from 817/100 000 population (in 2003) to 747/100 000 (2010) for males, and from 631/100 000 population to 560/100 000 for females, was observed. In addition to the differences by sex, Fig. 1 shows differences by population group. The ASDRs for white South Africans were substantially lower than other groups. Small declines were observed for black Africans and whites, with more marked declines for Asians and coloureds since 2000.

Despite decreasing rates, Fig. 2 shows the increasing number of deaths from NCDs since 1997, reaching just over 230 000 by 2010. The decomposition of the change between 1997 and 2010 (Table 1) indicates that the increase is due to population growth and a change in age structure, particularly for females.

Depending on cause composition of NCD deaths changed very slightly, and by 2010, 44.0% of NCD deaths were due to CVDs, 18.0% to cancers, 9.3% to chronic respiratory diseases and 8.0% to diabetes mellitus. For that year, the leading single cause of NCD deaths was stroke, followed by IHD, hypertensive heart

![Fig. 1. ASDRs from NCDs for males (A) and females (B) by population group, SA 2000 - 2010.](image1)

![Fig. 2. Number of deaths from NCDs, SA 1997 - 2010.](image2)
disease and diabetes mellitus (Table 2). For females, cervical and breast cancers ranked in the top 10 causes of death, while lung and prostate cancers were reported for males. Substantial increases in ASDRs were observed for diabetes mellitus, renal disease, prostate and breast cancer, and endocrine, nutritional, blood and immune disorders, while decreases occurred for chronic obstructive pulmonary disease (COPD), asthma and lung cancer. From Table 2 it can also be seen that the overall decline in ASDRs from NCDs was 5% over the 14-year period, or 0.4% per year, much lower than the recommended goal of 2% per year.

**CVDs, diabetes mellitus and renal disease**

Cerebrovascular disease, the leading CVD cause of death, has been the leading cause of NCD deaths over the period. In 2010 it became the second leading cause of total deaths following HIV/AIDS (accounting for 5.1% of total male deaths and 8.6% of total female deaths). Stroke mortality rates were similar for males and females and increased to about 133/100 000, followed by a decline to about 114/100 000 in 2010 (Fig. 3). In contrast, IHD mortality rates declined slightly and male rates were about 1.8 times higher than rates for females in 2010. Hypertensive heart disease and cardiomyopathy showed little change over the period. While hypertensive heart disease was slightly higher for females than males, death rates from cardiomyopathy were 1.3 times higher for males. Death rates from diabetes mellitus and renal disease increased steadily. While death rates for diabetes mellitus were similar for males and females, renal disease death rates were higher for males than females.

ASDRs for CVDs and diabetes mellitus by gender and population group for the years 2000 - 2010 are shown in Fig. 4. Marked declines in CVDs and diabetes mellitus were noted among coloureds and Asians, while there was an increase among black Africans.
### Table 2. Top 10 NCD causes of death for males, females and persons, SA 1997 and 2010

<table>
<thead>
<tr>
<th>Rank</th>
<th>Cause</th>
<th>Deaths, n</th>
<th>Deaths, %</th>
<th>YLLs, n</th>
<th>YLLs, %</th>
<th>ASDRs</th>
<th>Rank</th>
<th>Cause</th>
<th>Deaths, n</th>
<th>Deaths, %</th>
<th>YLLs, n</th>
<th>YLLs, %</th>
<th>ASDRs</th>
<th>%Δ in ASDRs</th>
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<tbody>
<tr>
<td>1</td>
<td>Cerebrovascular disease</td>
<td>90 355</td>
<td>17.5</td>
<td>490 297</td>
<td>15.1</td>
<td>115</td>
<td>1</td>
<td>Cerebrovascular disease</td>
<td>90 355</td>
<td>17.5</td>
<td>490 297</td>
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<td>115</td>
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<tr>
<td>2</td>
<td>IHD</td>
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<td>10.0</td>
<td>254 608</td>
<td>7.8</td>
<td>52</td>
<td>2</td>
<td>IHD</td>
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<td>326 958</td>
<td>10.0</td>
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<tr>
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<td>119 584</td>
<td>3.7</td>
<td>20</td>
<td>3</td>
<td>Hypertensive heart disease</td>
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<td>18 508</td>
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<td>52</td>
<td>4</td>
<td>Diabetes mellitus</td>
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<tr>
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<td>5.9</td>
<td>19 415</td>
<td>5.9</td>
<td>33</td>
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<td>Renal disease</td>
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<td>134 083</td>
<td>4.3</td>
<td>29</td>
<td>6</td>
<td>COPD</td>
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<td>4.5</td>
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<td>116 608</td>
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<td>83 890</td>
<td>2.6</td>
<td>17</td>
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<td>Trachea/bronchi/lung</td>
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<td>83 890</td>
<td>2.6</td>
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<tr>
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<td>91 568</td>
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<td>91 568</td>
<td>2.8</td>
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<td>10</td>
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<td>2.3</td>
<td>91 568</td>
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<td>23*</td>
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<td>2 030 666</td>
<td>62.3</td>
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<td>3 257 404</td>
<td>100.0</td>
<td>634</td>
<td>Total</td>
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<td>3 257 404</td>
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<td>634</td>
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**Males 1997**

<table>
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<tr>
<th>Rank</th>
<th>Cause</th>
<th>Deaths, n</th>
<th>Deaths, %</th>
<th>YLLs, n</th>
<th>YLLs, %</th>
<th>ASDRs</th>
<th>Rank</th>
<th>Cause</th>
<th>Deaths, n</th>
<th>Deaths, %</th>
<th>YLLs, n</th>
<th>YLLs, %</th>
<th>ASDRs</th>
<th>%Δ in ASDRs</th>
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<td>114</td>
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<td>15 573</td>
<td>14.4</td>
<td>199 886</td>
<td>12.8</td>
<td>114</td>
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<td>950 069</td>
<td>60.6</td>
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<tr>
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<td>950 069</td>
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<td>950 069</td>
<td>60.6</td>
<td>509</td>
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</table>

Continued...
Population groups in different stages of the cardiovascular transition\[^{35,36}\] are shown in Fig. 5. While Asians have distinctively high rates of IHD and renal disease, black Africans are in the midst of a CVD epidemic with relatively high mortality rates from cardiomyopathy, hypertensive heart disease, stroke and diabetes mellitus, and can be expected to transition towards IHD as living conditions and behaviours change.

Cancers and chronic respiratory diseases

Fig. 6 shows ASDRs from more common cancers. Cancer death rates for females were generally lower than for males, but the lack of national cancer incidence data makes it impossible to confirm the findings.\[^{37}\] There was a marked decline for oesophageal and lung cancer for males, while prostate cancer increased. For females oesophageal cancer decreased, with little change in lung cancer and a slight increase in breast cancer. In contrast, oesophageal cancer incidence rates for both sexes in rural populations have remained high.\[^{38,39}\] Kaposi’s sarcoma deaths have not been reported, as they were reallocated to HIV/AIDS because of the strong association of this tumour with AIDS. While there has been an increase in the number of deaths due to Kaposi’s sarcoma, it ranked 9th and 10th among cancers for males and females, respectively, in the raw data in recent years.

The overall mortality rate from cancers in 2010 was 114/100 000 (using the International Agency for Research on Cancer standard population as denominator, the rate was 100/100 000). However, cancer death rates differed by population group. In 2010, the cancer death rate for coloureds was 1.8 times higher than that for black Africans for most cancers apart from oesophageal and cervical cancer (Fig. 7). There was a marked population group difference in cancers of the alimentary canal (Fig. 8, C).

Fig. 9 shows trends in death rates from chronic respiratory diseases. Males had a high mortality from COPD (about 60/100 000 population) during the early period, dropping to 48/100 000 population in 2010. The rates were more than double those for females. In contrast, asthma mortality was only slightly higher for males and also declined. Fig. 10 shows that both level of mortality and the gender difference were lowest in whites.

Discussion

Over the past 14 years, NCDs have continued to be a major cause of mortality in SA, despite the country’s profound AIDS epidemic.
NCDs accounted for 39% of deaths in 2010 and for considerable premature mortality. CVDs were the major NCDs, and by 2010 stroke had become the second leading cause of death after HIV/AIDS. Of the approximately 230,000 South Africans who died from NCDs in 2010, 36% had not reached the average life expectancy of 60 years. This study shows that there has been a steady increase in deaths due to NCDs, driven by population growth and a shift in the age structure towards older ages. However, ASDRs for NCDs declined by 0.4% per annum over this period, short of the recommended 2%.

The importance of tracking cause-specific trends has been revealed, and the study shows decreasing stroke mortality from 2003 onwards, as well as declines in IHD, lung and oesophageal cancer, COPD and asthma. The early introduction of tobacco control strategies has probably contributed to these declines, along with other factors. The drop in oesophageal cancer mortality may also be related to urbanisation and dietary changes including shifts from consuming home-grown to commercial maize. [40] In contrast, mortality from diabetes mellitus, renal disease and endocrine/nutritional and blood immune disorders has increased. This is in keeping with the increase in overweight and obesity observed in national surveys,[41,42] urbanisation, and the observation that diabetes mellitus has increased rapidly in all age groups in urban settings.[43] Addressing the increase in obesity is a global challenge, and in the past 30 years, no country has been able to buck the trend.[44] Gortmaker et al.[45] have identified priority actions that focus on policies to improve nutrition and built environments, cross-cutting actions (such as leadership, healthy public policies, and monitoring), and greater investment in prevention.

Some of these findings can be attributed to a strong gender tendency towards women being overweight and obese, and men smoking and drinking.[22,23] Differences among population groups are likely to be driven by socioeconomic differentials. These inequalities are replicated in access to healthcare, screening,
diagnosis and treatment. Many disadvantaged people remain undiagnosed, untreated and at risk of preventable complications. Lack of health insurance results in disadvantaged people suffering higher rates of ill-health than other groups. The higher mortality rates from cardiomyopathy among black Africans compared with other groups may be attributable to underlying low socioeconomic status, environmental factors and historical issues. Findings from Sliwa et al. and other studies on black Africans have established that patients affected by advanced HIV/AIDS tend to develop cardiomyopathies. Alcoholism, poor nutrition and low socioeconomic status have also been cited as factors contributing to cardiomyopathy.

Adopting global recommendations, SA launched a Strategic Plan for the Prevention of Non-communicable Diseases 2013-17 in September 2013. This provides an overarching framework for chronic disease prevention by promoting health and wellness at community and individual levels and strengthening primary healthcare. Building on the comprehensive tobacco control legislation, which appears to be responsible for much of the decline in NCDs, the Strategic Plan has identified key population-wide interventions to prevent and control NCDs through legislation and regulation. Salt use regulations in the Plan and should include improvements in vital registration and population-based surveys to monitor risk factors, their determinants and key intervention coverage. In addition, to monitor primary care programmes, cohort data on chronic disease patients are essential. The use of a standardised clinical summary sheet in patient folders would enable audits based on record reviews as an interim measure. This should be accompanied by a patient-held card, tracking progress on risk factors, which could help to motivate individuals to change health-related behaviours.

**Study limitations**

Several limitations of this study must be acknowledged. Firstly, although there have been considerable improvements, the quality of death certification is still inadequate with a relatively high proportion of ill-defined and misattributed causes. Misclassification of cardiovascular and diabetes causes has been observed, and although adjustments were made based on multiple-cause information, it is possible that a degree of error remains in our estimates. Secondly, despite regular census data being available, there is uncertainty in population estimates, which adds to uncertainty in estimated mortality rates. Thirdly, for the population group differences information was missing for about a quarter of the deaths and needed to be imputed. Nonetheless, face validity of the trends and differentials indicates that these estimates are robust, and SA clearly needs to take further steps to reach the recommended goal of a 2% reduction per annum. Tracking the emerging trends in the death rates is an essential tool to assist with monitoring and modifying the Strategic Plan.

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References


5. Kuh J. Recking the Economic Burden of Non-communicable Disease in the BRICS: Lessons from Brazil, Toronto, Canada. BRICS Information Centre, University of Toronto; 2013.


