



Provincial mortality in South Africa, 2000 – priority-setting for now and a benchmark for the future

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Background. Cause-of-death statistics are an essential component of health information. Despite improvements, underregistration and misclassification of causes make it difficult to interpret the official death statistics.

Objective. To estimate consistent cause-specific death rates for the year 2000 and to identify the leading causes of death and premature mortality in the provinces.

Methods. Total number of deaths and population size were estimated using the Actuarial Society of South Africa ASSA2000 AIDS and demographic model. Cause-of-death profiles based on Statistics South Africa's 15% sample, adjusted for misclassification of deaths due to ill-defined causes and AIDS deaths due to indicator conditions, were applied to the total deaths by age and sex. Age-standardised rates and years of life lost were calculated using age weighting and discounting.

Results. Life expectancy in KwaZulu-Natal and Mpumalanga is about 10 years lower than that in the Western Cape, the province with the lowest mortality rate. HIV/AIDS is the

leading cause of premature mortality for all provinces.

Mortality due to pre-transitional causes, such as diarrhoea, is more pronounced in the poorer and more rural provinces. In contrast, non-communicable disease mortality is similar across all provinces, although the cause profiles differ. Injury mortality rates are particularly high in provinces with large metropolitan areas and in Mpumalanga.

Conclusion. The quadruple burden experienced in all provinces requires a broad range of interventions, including improved access to health care; ensuring that basic needs such as those related to water and sanitation are met; disease and injury prevention; and promotion of a healthy lifestyle. High death rates as a result of HIV/AIDS highlight the urgent need to accelerate the implementation of the treatment and prevention plan. In addition, there is an urgent need to improve the cause-of-death data system to provide reliable cause-of-death statistics at health district level.

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Since the political transformation of 1994 to a non-racial democracy, health policy in South Africa has aimed to redress the inequities of the past by extending access to primary health services. The health sector continues to be divided into a private sector that mainly serves the wealthy and the insured, and a public sector that, with less than half the resources, must meet the needs of the majority of the population. In order to do this, the public health services have been reorganised into 9 provincial departments of health, which are developing the district health services officially introduced by the Health Act of 2003.¹

Health policy is directed from a national perspective, yet provincial and local government need to respond to the

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specific needs of their communities. An essential element for public health planning at these levels is reliable mortality statistics. The importance of cause-of-death statistics was recognised by the post-apartheid government, and over the last 10 years various initiatives to improve the quality of such statistics have been implemented.² These have enabled South Africa to be the first African country to publish statistics of multiple causes of death,³ and with the release of the cause-of-death statistics for 1997 - 2003,⁴ South Africa is the first African country to automate the selection of underlying causes of death. These are remarkable achievements in terms of producing national cause-of-death statistics. However, these statistics are affected by some underregistration of deaths (of geographical and structural origins), and misclassification of causes as a result of poor certification practice on the one hand and a system problem in the case of injuries.⁵ South Africa has consequently been ranked among the countries with poor cause-of-death statistics,⁶ and hence such statistics require careful analysis and interpretation.⁷

The Initial National Burden of Disease Study⁸ for 2000 made use of several data sources, and for the first time provided a comprehensive and clear overview of the causes of death experienced in South Africa. Given the rapidity of the changes in mortality, the ASSA2000 model⁹ was used to estimate the total number of deaths and the number due to HIV/AIDS,



together with the 1996 cause-of-death data,¹⁰ the National Injury Mortality Surveillance System (NIMSS)¹¹ data and other data sources. The recent report on the full death data for 1997 - 2003⁴ was not available when the study was undertaken. Furthermore, as Statistics South Africa has adopted a new encoding strategy, the new data are not comparable with the 1996¹⁰ and 1997 - 2001¹² sample.

The Initial Burden of Disease Study⁸ highlighted the substantial impact of HIV/AIDS as a cause of death in South Africa, and the major health transition that is underway in South Africa. As countries become more developed, the disease profile changes from one dominated by infectious diseases, high child mortality and malnutrition to a predominance of degenerative, chronic diseases.¹³ However, developing countries often experience a double burden, resulting from the simultaneous occurrence of these disease spectra. During the mid-1990s the health transition in South Africa was characterised by an additional injury burden resulting in a triple burden.¹⁴ Shortly thereafter it became clear that the particularly fierce impact of HIV/AIDS had created a 'quadruple burden' of disease, and South Africa's resultant mortality rates are very high when compared with countries of similar income levels and expenditure on health services (see the World Health Report of 2002¹⁵).

The Burden of Disease Study has made use of the sample of cause-of-death statistics issued by Statistics South Africa¹² to develop estimates of the mortality profile in each of the provinces. This task is complicated by the high proportions of deaths classified as 'undetermined unnatural causes' and 'unspecified natural causes'. Furthermore, AIDS deaths are likely to be underrepresented as a result of misclassification to the immediate cause of death. In addition, such a project requires population estimates that are demographically consistent with the mortality estimate. This article presents the major findings of the study, while further details of the methods, analyses and findings can be found in a technical report.¹⁶

Methods

Total number of deaths

The AIDS and demographic model, ASSA2000, developed by the Actuarial Society of South Africa,⁹ has been used to project the overall level of mortality, the population size and the number of deaths due to HIV/AIDS for each province. This is a demographic cohort component projection model that incorporates behavioural and epidemiological dynamics of the heterosexual transmission of HIV. The model was calibrated to reproduce the HIV seroprevalence data from antenatal clinics allowing for the fact that these figures are higher than the prevalence for the whole population. In addition, the model has been calibrated to estimates of the total mortality based on

the death data recorded by the Department of Home Affairs to the middle of 2001, after correcting for underreporting and deaths without identity documents.¹⁷

The model has been superseded by the ASSA2002 model¹⁸ which incorporates more recent empirical data and new scenarios including the provision of highly active antiretroviral therapy (HAART). However, the new model could not be used for this study as it has not been calibrated for provincial estimates. It should be noted that the revised model projects a lower future impact of the HIV epidemic than ASSA2000, but as both models have been calibrated to historical data on overall levels of mortality, the two models produce similar estimates for the deaths in 2000.

Cause of death

A South African National Burden of Disease (NBD) list was developed for the South African NBD study⁸ using the 1990 Global Burden of Disease Study as a basis.^{19,20} The level of aggregation of causes of death influences the ranking of diseases; the aggregation therefore needs to be done according to specific criteria. The Global Burden of Disease study selected the specific diseases or disease clusters listed in the final level of aggregation on the basis of three criteria: the number of deaths due to the specific cause, the level of health service provided for the particular cause, and the prominence of the cause in the current health policy debate. Similar criteria were used in the development of the South African NBD list.

The World Health Organization (WHO) defines the underlying cause of death as 'the disease or injury which initiated the train of morbid events leading directly to death' and the International Classification of Diseases (ICD-10) provides rules for the determination of the underlying cause.²¹ In South Africa, the latest version of this classification, at the 3-character level, is used for coding. However, because of incomplete information on the death notification it is not always possible to identify the correct underlying cause.⁵ Under such circumstances there is a need for modelling to arrive at more realistic estimates of the underlying causes of death.

In the case of AIDS, the ICD-10 classifies a person as having died of HIV as an underlying cause when HIV is present, and the person dies from a subsequent co-morbidity mediated by HIV infection (codes B20 through B24). However, the relatively low reported proportion of HIV-related deaths and the increasing proportion of deaths due to pneumonia and tuberculosis each year suggest that there is misclassification of AIDS deaths to the immediate cause of death. Based on the distinctive age pattern in the increase in death rates, and through robust analysis, expert opinion and review of the literature, Groenewald *et al.* have identified 9 conditions that appear to include AIDS cases.⁷



The cause-of-death data from the 15% sample for the years 2000 and 2001, adjusted for misclassification, were used to estimate the proportion of deaths due to specified natural causes. The ill-defined causes within a disease category were redistributed proportionally within each age and sex group. In addition, the broad group of ill-defined conditions was redistributed proportionally to all the specified natural causes.

The ASSA2000 model was therefore used to estimate the number of AIDS deaths in each province. The number of AIDS deaths classified to other conditions was estimated by examining the increase in the age-specific death rates between 1996 and 2000/2001.⁷ The number of misclassified AIDS deaths was subtracted from the 9 conditions (tuberculosis, pneumonia, diarrhoea, meningitis, other respiratory disease, non-infective gastroenteritis, other infectious and parasitic diseases, deficiency anaemias and protein-energy malnutrition) to estimate the number of deaths due to these conditions that were not directly related to HIV.

The total number of injury deaths was estimated using the proportion of injury deaths observed in the 15% sample applied to the total number of deaths by each age and sex group. The national profile of fatal injuries from the NIMSS data¹¹ was applied to the total number of injury deaths. The national profile was used because of the uncertainty in the variations observed in the NIMSS profile at provincial level.

Measures of mortality

Age-specific rates were calculated using population estimates from ASSA2000. These were used to calculate age-standardised rates by applying the WHO world population standard.²²

Years of life lost (YLL) were calculated using the same method adopted in the South African NBD study, which follows the method of the Global Burden of Disease studies.^{15,23,24} The same standard life expectancy, discounting rate and age weighting, were used to calculate the YLL.

Results

There are clear provincial differences, with a more than 10-year difference in the life expectancy of the Western Cape compared with KwaZulu-Natal (Table I). The provincial differentials in child mortality are more marked than those in adult mortality. The infant mortality rates in the Eastern Cape and KwaZulu-Natal are each more than double the rate in the Western Cape, while the under-5 mortality rates in KwaZulu-Natal and the Eastern Cape, respectively, are 2.5 and 2.3 times the rate in the Western Cape (Table I).

HIV/AIDS

Fig. 1 shows that there is marked variation in the age-standardised death rates due to HIV/AIDS. In 2000, the Western Cape rate (72/100 000) was much lower than rates in the other provinces, while KwaZulu-Natal (574/100 000)

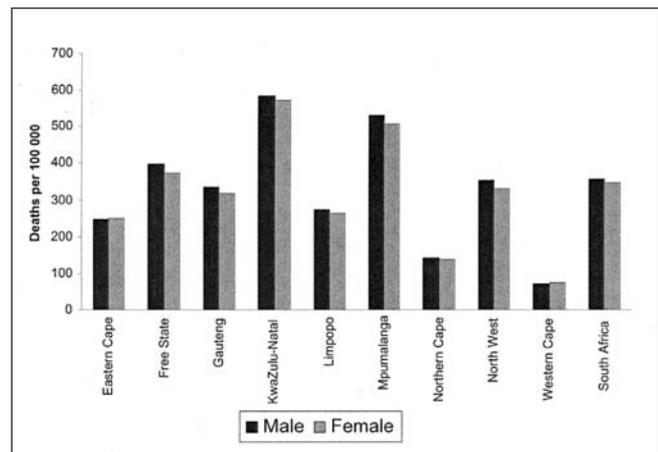


Fig. 1. Provincial estimates of age-standardised death rates due to HIV/AIDS, 2000.

and Mpumalanga (520/100 000) were highest. The age-standardised rates are generally slightly higher for males than for females, an artefact of the age standard used.

Infectious diseases, and perinatal, maternal and nutrition-related conditions

There are marked variations between the provinces in the age-standardised mortality rates due to other pre-transitional causes of death, including other infectious and parasitic diseases, perinatal and maternal conditions and malnutrition (Fig. 2). The Western Cape and Gauteng have much lower mortality rates due to these causes, while the less-developed provinces, viz. the Eastern Cape, Free State, Limpopo and North West, have the highest rates.

Non-communicable diseases

There is surprisingly little variation between the provinces in the overall age-standardised death rate due to non-communicable diseases (Fig. 3). The less-developed provinces

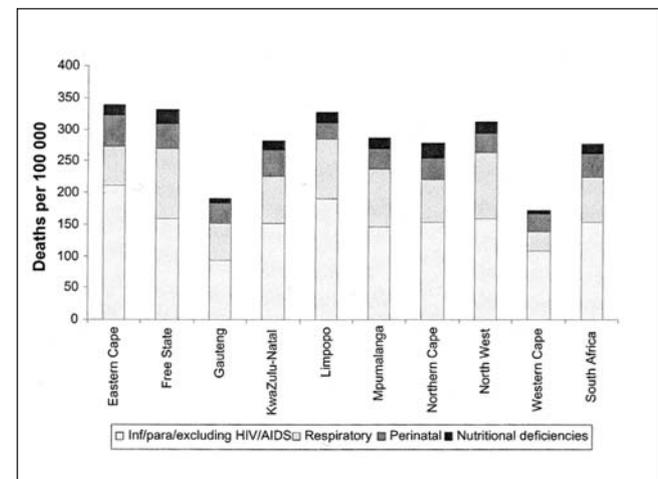


Fig. 2. Provincial estimates of age-standardised death rates due to group I causes excluding HIV/AIDS, 2000.



Table 1: Demographic and mortality estimates for the provinces, 2000*

	Eastern Cape	Free State	Gauteng Natal	Kwa- Zulu- Natal	Limpopo	Mpumala- langa	Northern Cape	North West	Western Cape	South Africa†
Population										
Total	6 897 865	2 862 088	8 765 262	9 211 922	5 277 432	3 054 973	955 010	3 753 128	4 399 414	45 081 010
Deaths										
Total	80 362	36 860	104 971	129 858	53 815	40 008	15 305	45 177	41 555	556 585
Male	41 289	20 619	60 336	66 385	27 410	21 717	9 810	25 246	23 377	303 081
Female	39 074	16 240	44 635	63 473	26 404	18 291	5 495	19 931	18 178	253 504
Child mortality (per 1 000 live births)										
Infant mortality rate (q_0^i)	70.9	61.8	44.4	68.4	51.6	58.9	46.4	55.2	31.7	59.1
Under-5 mortality rate ($5q_0^i$)	105.0	99.0	74.6	116.4	80.7	99.8	68.1	88.5	46.3	94.7
Adult mortality (%)										
Adult mortality ($45q_15^a$)	38.6	42.6	39.3	48.7	39.9	47.5	34.2	42.0	30.8	42.9
Adult male mortality ($45q_15^b$)	45.0	49.3	46.0	54.6	46.7	53.8	40.9	48.8	37.5	49.4
Adult female mortality ($45q_15^c$)	32.2	35.9	32.7	42.8	33.1	41.3	27.5	35.2	24.1	35.7
Life expectancy (in years)										
Life expectancy (e_0)	56.2	55.1	58.0	51.6	57.1	53.1	60.5	55.9	63.4	55.2
Male life expectancy (e_0^b)	53.3	52.4	55.1	49.4	54.3	50.7	57.2	53.1	59.8	52.4
Female life expectancy (e_0^c)	59.0	57.9	61.0	53.8	60.1	55.5	63.9	58.8	67.0	58.5
Age-standardised death rate per 100 000 population										
Total	1 494	1 583	1 435	1 762	1 478	1 724	1 314	1 556	1 174	1 542
Male	1 790	1 856	1 703	2 051	1 784	2 002	1 584	1 828	1 445	1 831
Female	1 283	1 334	1 194	1 549	1 268	1 476	1 082	1 308	946	1 303
YLL per 100 000 population										
Total	24 919	27 253	23 725	32 209	23 678	30 262	19 863	25 963	16 764	26 735
Male	28 482	30 441	26 843	35 145	27 390	33 194	23 314	29 227	20 293	30 462
Female	22 179	23 985	20 593	29 880	20 937	27 420	16 618	22 174	13 465	23 352

* Estimates of the number of deaths refer to the 12-month period that started in mid-2000 and are referred to as 2000.

† Estimates for South Africa are from the South Africa NBD study and differ slightly from the sum of the provincial estimates. Source: ASSA2000.⁹

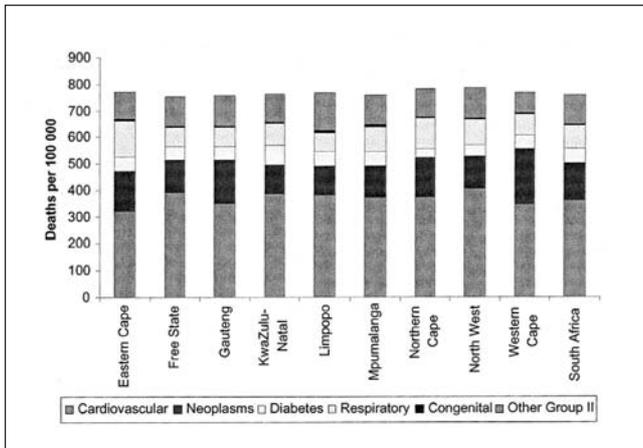


Fig. 3. Provincial estimates of age-standardised death rates due to non-communicable diseases, 2000.

have similar levels to those of the more developed provinces, all at about 750 per 100 000 population. However, there are variations in the death rates for specific conditions, for example the neoplasm death rate is higher in the Western Cape than the other provinces.

Injuries

The overall injury death rate for males is about 3 times higher than the rate for females (Fig. 4). The Western Cape and Gauteng, the most developed provinces, have the highest rates. However, Mpumalanga also has high rates. In the case of males, homicide is the leading cause followed by road traffic accidents, suicides and fires. For females, the leading cause is road traffic accidents followed by homicides, fires and suicides.

Years of life lost

When the age at which death occurred is taken into account, the provincial differences in mortality translate into wider variations in premature mortality (Fig. 5). Based on YLL per 100 000 population the mortality in KwaZulu-Natal is double that in the Western Cape, the province with the lowest premature mortality.

HIV/AIDS, homicide, tuberculosis, diarrhoea, road traffic accidents, and lower respiratory infections consistently feature among the leading causes of premature mortality in all provinces (Fig. 6). HIV/AIDS was the leading cause of premature mortality in all provinces in 2000, but ranges from 14% of total years lost in the Western Cape to 51% of the total in KwaZulu-Natal.

Discussion

This study signifies an important milestone in generating burden-of-disease information at sub-national level. For the first time, cause-specific death rates have been estimated for the 9 provinces, providing essential information to respond to

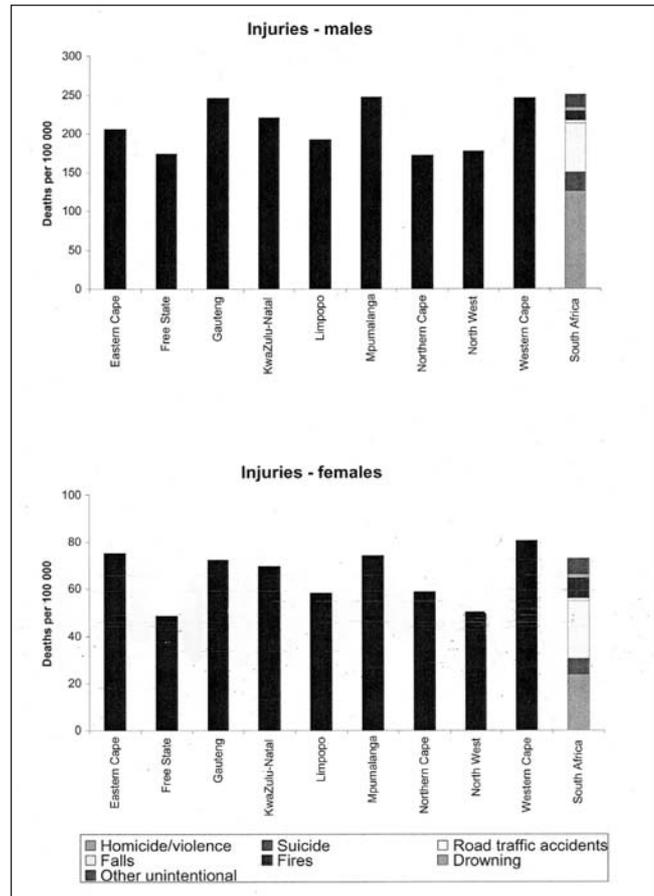


Fig. 4. Provincial estimates of male and female age-standardised death rates due to injuries, 2000.

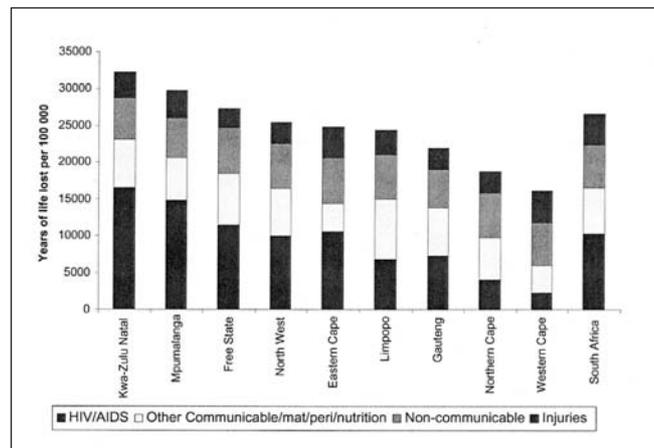


Fig. 5. Provincial estimates of years of life lost per 100 000 population by broad cause group, 2000.

the health needs of individual provinces. Such information is not only essential for the prioritisation and effectuation of health services, programmes and research, but also influences priority setting and implementation in other sectors such as water, housing, safety and security and education. Although

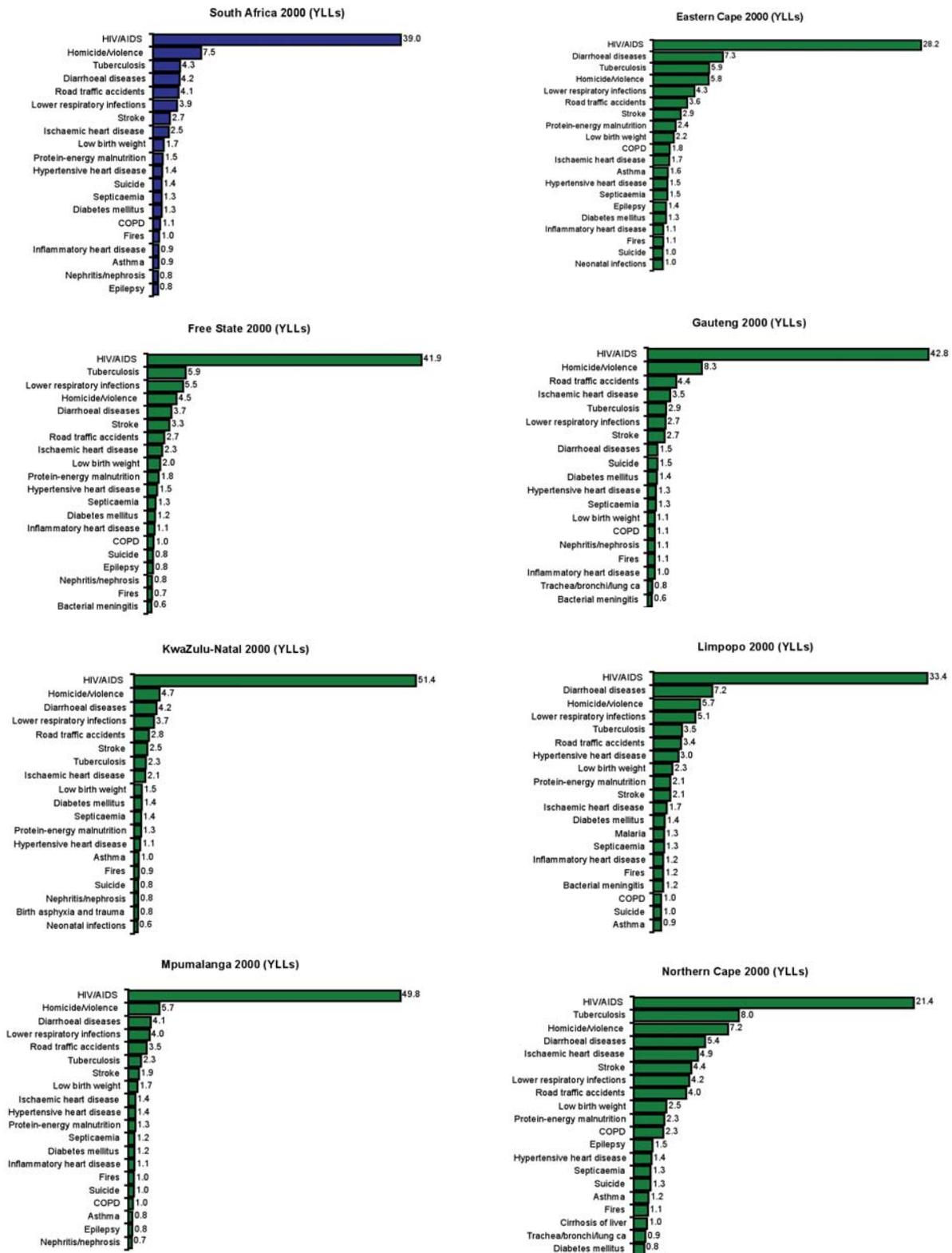


Fig. 6. Top 20 causes of years of life lost (%) for South Africa and the provinces, 2000.

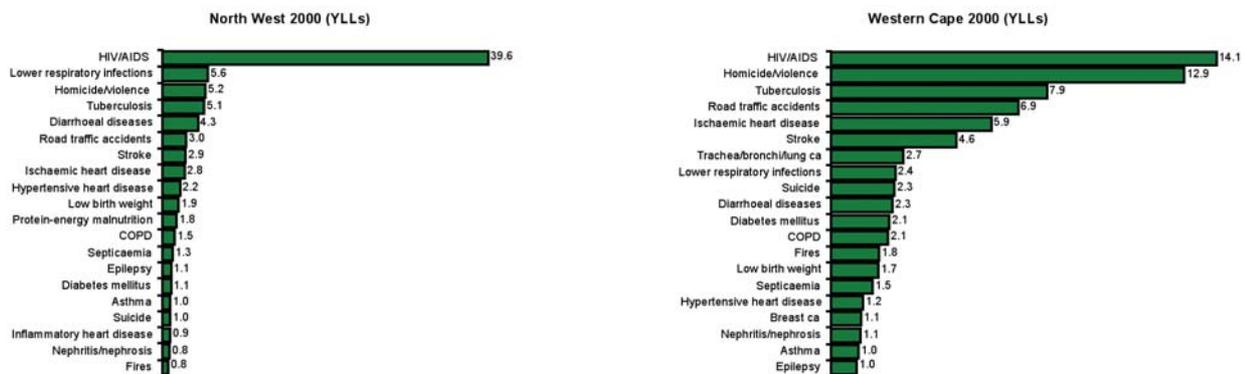


Fig. 6, continued.

South Africa has made great strides in improving cause-of-death statistics, careful analysis is necessary to provide information that can be useful for planning health and other services. These results provide important data for setting priorities and a benchmark against which to monitor the impact of efforts to improve health and reduce health inequalities.

HIV/AIDS is the leading cause of premature mortality for all provinces. Homicide and road traffic accidents, stroke, ischaemic heart disease, hypertensive heart disease, tuberculosis, diarrhoea and lower respiratory infections generally feature in the leading causes of death. The overall mortality rate is highest in KwaZulu-Natal and Mpumalanga, and based on YLL per 100 000 population, is double that in the Western Cape. The differences in mortality rates between the provinces are largely a result of the variations in the HIV/AIDS mortality and variation in the burden due to pre-transitional causes. The latter are more pronounced in the poorer and more rural provinces and are much lower in Gauteng and the Western Cape. In contrast, the overall level of non-communicable disease mortality is similar across all provinces, with the rates in the less-developed provinces as high as the rates in the more developed provinces. However, the cause-of-death profile of non-communicable diseases differs across the provinces. Risk factors such as indoor exposure to smoke, poor access to clean running water, and poor access to health care services may be related to the increased mortality in the poorer provinces, while the emerging chronic diseases associated with obesity, hypertension, high cholesterol and physical inactivity may affect the more developed provinces. The injury mortality rates are particularly high in provinces with large metropolitan areas, and in Mpumalanga.

The differences observed in the provincial mortality profiles may be related to levels of wealth and development, to population group differences and other demographic features of the province, to geographical differences and environmental

exposures, or to access to health services or other basic services. They may, however, also be related to the assumptions and extrapolations that have been necessary in this study. These include reliance on the ASSA2000 model to frame the number of deaths in each province, the redistribution of unregistered deaths and ill-defined causes and the application of a national injury profile. Wherever possible, the plausibility of the estimates has been considered and checked with other data sources. However, it is essential that there be further validation of these estimates against other epidemiological data. Compared with the initial NBD estimates that were extrapolated from the 1996 cause-of-death data, the more recent data have produced very similar results. Subtle differences are found in the exact ranking of some conditions, with stroke and ischaemic heart disease swapping positions, for example, although the estimated proportions of deaths due to the conditions remain very similar. However, there are fewer injury deaths based on the more recent data and the national estimate of the proportion of death due to injuries has been revised down by 7.1%. This reflects a decrease in the injury mortality rate between 1996 and 2000, a trend that has also been observed by Bah.²⁵

Timely and accurate cause-of-death statistics are an essential component of the information needed for planning and monitoring health services and responding to the health needs of the population.⁶ Several aspects still need to be addressed to improve the quality of the data collected in South Africa, including the poor registration of child deaths, the quality of medical certification of the cause of death, and information regarding the manner of death in the case of injuries. In addition, a mechanism to provide health-district level cause-of-death statistics must be established. It is strongly recommended that researchers meet with government officials and policy makers to explore how these improvements can be achieved.

In the meantime, provincial and local-level planners are urged to make use of the findings of this study to guide their



planning, and where necessary, to modify the emphasis of national policies to suit their individual province needs. The quadruple burden experienced in all provinces requires a broad range of interventions including improved access to health care; ensuring that basic needs such as those related to water and sanitation are met; disease and injury prevention; promotion of a healthy lifestyle over the entire life-course; and a reduction of risk factors associated with major contributors to disease burden. As some of the provincial differences can be accounted for by variations in wealth, the need for policies to address poverty and reduce the inequalities in South Africa is highlighted.

HIV infection has spread very rapidly in South Africa, resulting in a pandemic of major proportions that must receive special attention. The ASSA2002 model projected that in 2004 the total number of deaths from all causes would be over 700 000 and that 44% of deaths would be due to HIV/AIDS.²⁶ This highlights the urgent need to accelerate the treatment programme approved by cabinet in September 2003, and the need to bolster the tuberculosis control programmes that are currently not meeting the targeted levels of successful treatment. It also highlights the need to strengthen efforts to prevent the spread of the epidemic, and to ensure that social systems are in place and accessible to support individuals infected and affected by HIV/AIDS.

South Africa clearly faces major challenges to improve the health of the nation. The provincial estimates will serve as a benchmark against which to monitor the success of meeting these challenges.

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