

# Initial estimates from the South African National Burden of Disease Study, 2000

Debbie Bradshaw, Pam Groenewald, Ria Laubscher, Nadine Nannan, Beatrice Nojilana, Rosana Norman, Desirée Pieterse and Michelle Schneider

Burden of Disease Research Unit, Medical Research Council, PO Box 19070, Tygerberg 7505, South Africa. Telephone: +27 (0)21 938 0327; e-mail: [debbie.bradshaw@mrc.ac.za](mailto:debbie.bradshaw@mrc.ac.za); <http://www.mrc.ac.za/bod/bod.htm>

## Background

There have been no previous attempts to undertake a national burden of disease (BoD) study in South Africa.<sup>1</sup> Only about 35 countries worldwide have initiated or completed BoD studies. Analyses of SA's existing mortality data highlighted deficiencies in the death statistics, with under-registration and misclassification.<sup>2,4</sup> In 1996, the latest year for which full cause of death data are available for SA, 14.8% of the deaths were described as 'ill-defined' since exact cause was unknown, and 17.1% as due to 'undetermined injuries', making it impossible to utilise the cause of death data on face value.

Analyses of more recent data, including the sample data for 1997-2001 reported by Statistics South Africa<sup>5</sup>, highlight an improvement in death registration and also show how SA has moved from a triple BoD to a quadruple burden,<sup>6,7</sup> comprising:

- poverty-related conditions
- emerging chronic diseases
- injuries and
- AIDS.

BoD information is an important component of health information for monitoring the health of the nation. In the health sector scarcity of resources makes priority-setting imperative. Detailed BoD information linked with cost-effectiveness analyses inform priority-setting for health sector reform.

### What is 'burden of disease'?

- A comprehensive measure of the health status of the nation by assessing ill health and causes of death
- It includes fatal and non-fatal outcomes,
- A burden of disease study attempts to derive consistent and coherent estimates of all causes of ill-health and death

The National Burden of Disease Study is the first ever national BoD study carried out in SA and is an initial attempt to derive coherent and consistent estimates of the BoD experienced in SA in the year 2000. Estimates are derived from different data sources for the levels and underlying causes of mortality and morbidity. The top 20 diseases are ranked and those contributing the greatest burden are prioritised for seeking cost-effective interventions.

Given the paucity of population based morbidity data, the main focus of this study is causes of premature mortality (years of life lost - YLLs) experienced in 2000. However, the additional burden contributed by morbidity and injury is also estimated in order to determine disability-adjusted life years (DALYs). An

attempt is also made to estimate what the impact of AIDS will be on premature mortality for the year 2010.

Disability-adjusted life years (DALYs): A single measure of BoD, using time to equate death and disability, it comprises years of life lost (YLLs) due to premature mortality and 'years lived with a disability' (YLDs), weighted according to severity of the disability. It is thus a summary measure of population health, combining information on death and non-fatal health outcomes. It effectively measures the future stream of healthy years of life lost due to each incident case of disease or injury. The aim of health interventions is to minimise the number of DALYs, i.e. to promote a longer and healthier life for people.

Of particular relevance for SA and other developing countries is an understanding of the major causes of the burden so as to inform health interventions. This is particularly important given the epidemiological transition arising from the socio-economic transformation, and the limited resource envelop.

## Methods

An adapted version of the 1990 Global Burden of Disease (GBD) list of causes of death<sup>8,9</sup> was developed for the South African National Burden of Disease Study. Overall mortality is divided into three broad groups of causes:

- Group I, pre-transitional causes, includes communicable diseases, maternal causes, perinatal conditions, and nutritional deficiencies. HIV/AIDS is part of Group I but kept separate in this analysis due to the size of the burden it contributes;
- Group II, non-communicable causes; and
- Group III, injuries.

Each group is divided respectively into several major categories of causes of death, such as respiratory infections, cardiovascular diseases and intentional injuries. These categories are further disaggregated into specific diseases or disease clusters.

Estimates from a BoD study usually refer to the burden experienced in some earlier period. In most instances this approach is acceptable since demographic features and mortality profiles are generally slow to alter. However, since the disease burden in SA is undergoing rapid change due to the spread of HIV/AIDS,<sup>7</sup> the usual BoD approach was inappropriate and a modelling approach calibrated to empirical data was adopted. The number of deaths for 2000 was estimated using the ASSA2000 model of the Actuarial Society of SA, calibrated to estimates of child mortality and adult



mortality based on surveys, census results and vital statistics. The model is also calibrated to replicate antenatal HIV seroprevalence survey data for pregnant women who attend public sector clinics.

The non-AIDS cause of death profile was estimated from three sources. Firstly, 1996 cause of death data from Statistics South Africa were used to provide information on the profile for Groups I and II, excluding AIDS. Ill-defined causes within a disease category were reallocated proportionally by age and sex to specified causes within that category. Experts were consulted to refine this reallocation, particularly for cardiovascular diseases, perinatal conditions and congenital abnormalities. Secondly, cause of death information processed by the Department of Home Affairs was used to estimate the overall proportion of deaths due to injuries by age and sex. Thirdly, the UNISA/MRC national injury mortality surveillance system (NIMSS) was used to estimate the profile of causes of deaths resulting from injury.

Premature mortality was estimated using the standard GBD approach to calculate years of life lost (YLLs). Age weighting, time discounting of 3% per annum and standard life expectancies based on the West model levels 25 and 26 (considered to be a maximum life expectancy) were used. For illustrative purposes the extent of burden from morbidity and non-fatal injury was estimated based on the ratios of years lived with disability (YLDs) to YLLs estimated by the World Health Organisation (WHO) for the Afro E region, of which SA is a part, for each of the disease categories. Future impact of HIV/AIDS was estimated for 2010 using the ASSA2000 model and assuming that the relative proportions of other causes remain the same as in 2000 within each age and sex group.

## Results

Key indicators of mortality for SA for the year 2000 are shown in Table I.

**Table I: Mortality and population estimates for South Africa, 2000.**

Indicator	Male	Female	Persons
Infant mortality rate/1 000 live births	62	56	59
Under-5 mortality rate/1000 live births	98	91	95
Total deaths	303 081	253 504	556 585
Adult probability of dying between ages 15 and 60(%)	49.4	35.7	42.9
Life expectancy at birth (years)	52.4	58.5	55.2
Total population	22 067 941	23 013 069	45 081 010

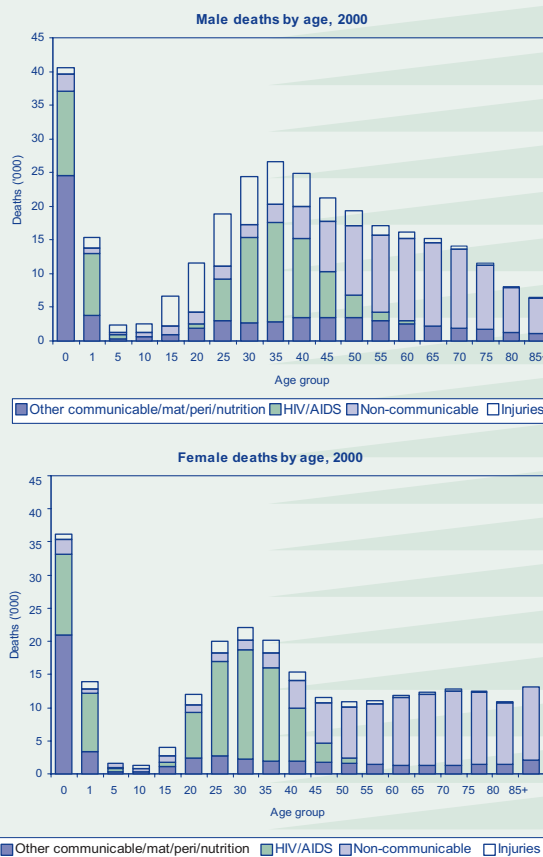
Cause of death profile by broad group is shown in Table II. Non-communicable diseases (Group II) accounted for 37% of the deaths, followed by HIV/AIDS which accounted for 30%.

Patterns for males and females differ: females have more deaths from HIV/AIDS and non-communicable diseases and a lower proportion of injury deaths. Other Group I and Group II diseases are very similar for men and women, while HIV/AIDS accounts for 34% of female deaths and 26% of male deaths. The greatest differences are seen in the proportions of deaths due to injuries - 17% for men and 6% for women.

**Table II: Estimated cause of death profile by sex, South Africa (2000).**

	Male (N = 303 081)	Female (N = 253 504)	Persons (N = 556 585)
HIV/AIDS	26%	34%	30%
Other Group I	21%	20%	21%
Group II	36%	40%	37%
Group III	17%	6%	12%

Age distribution of the deaths is shown in Figure 1. It can be seen that this is significantly influenced by HIV/AIDS, which contributes to high numbers of deaths in infants and young adults. Deaths due to injuries are very high in young adult men. Deaths due to HIV/AIDS and other infectious diseases are extremely high for boys and girls in the perinatal period.



**Figure 1: Age distribution of deaths by group and sex, 2000.**

**Figure 1: Age distribution of deaths by group and sex, 2000.**

The mortality profile reflected in Figure 2 clearly shows the quadruple burden, with HIV/AIDS, chronic diseases, poverty-related conditions and injuries all appearing among the top causes of death. HIV/AIDS is the leading cause, accounting for 30% of all deaths, followed by cardiovascular disease (17%), infectious and parasitic excluding HIV (10%), malignant neoplasms (7%), and intentional (7%) and unintentional injuries (5%). Perinatal conditions, respiratory disease (chronic), respiratory infections and diabetes make up the balance of the 10 leading sub-categories.

There are some noticeable differences between males and females. HIV/AIDS (34% vs. 26%) and cardiovascular disease (19% vs. 14%) account for a higher proportion of female deaths than male. However, injuries, both intentional and non-intentional, account for a much higher proportion of male deaths (11% vs. 3%).



**Figure 2: Cause of death by category, 2000.**

## Premature mortality - years of life lost

YLLs calculated using the age weighting, discounting and standard life expectancy used in the GBD study are shown in Figure 3. The YLL measure does not merely consider the number of deaths, but takes into account the age at which death occurred. It can be seen that there is a striking loss of years of life from HIV/AIDS (38%), and the proportion is higher for females (47%) than for males (33%).

Excluding HIV/AIDS, Group I causes accounted for 25% and Group II causes for 21% of the YLLs, proportions here being very similar for men and women. However, males experience far greater premature loss of life from injuries (22%) than females (8%).

HIV/AIDS is by far the largest single cause of YLLs in both males and females. Just under half all YLLs for females are attributed to HIV/AIDS, and about one-third of all male YLLs. Examination of age distribution shows that it is particularly young female adults who are dying. In females HIV/AIDS is followed in the ranking by diarrhoeal diseases, tuberculosis (TB) and lower respiratory infections.

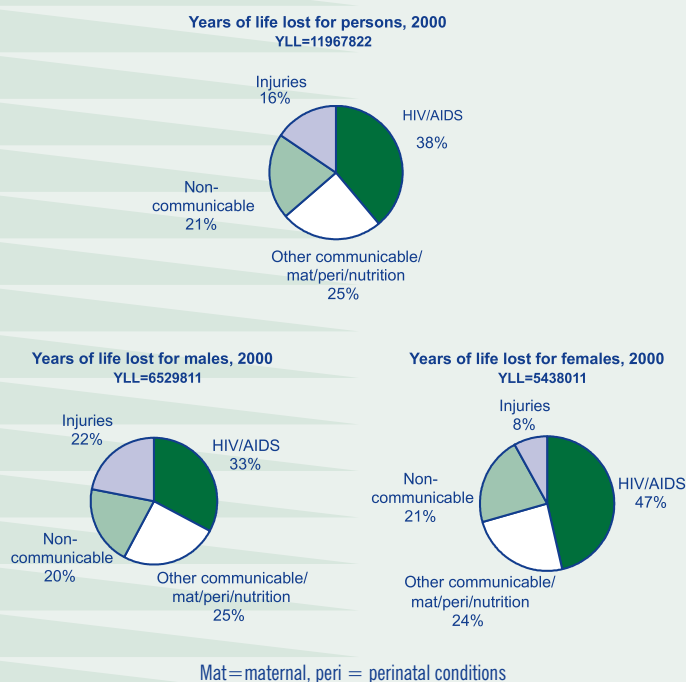


Figure 3: Years of life lost (YLLs) by group, South Africa, 2000.

Homicide/violence is the second largest cause of YLLs in males, followed by TB and road traffic accidents. Homicide/violence accounts for almost double the YLLs due to TB in males.

The top 20 causes of mortality are shown in Table III, again reflecting the quadruple BoD and different patterns for males and females. HIV/AIDS accounts for 30% of all deaths, at least five times more than the next largest single cause of death. Ischaemic heart disease, homicide/violence and stroke are next in ranking, each accounting for almost 6% of deaths. Males have higher proportions of deaths due to homicide/violence, TB and road traffic accidents than females. Females have higher proportions of deaths due to HIV/AIDS, stroke, hypertensive heart disease and diabetes mellitus.

Table III: Top 20 specific causes of premature mortality burden (YLLs) by sex, South Africa, 2000.

Males				Females				Persons			
Rank	Cause of death	YLL	%	Rank	Cause of death	YLL	%	Rank	Cause of death	YLL	%
1	HIV/AIDS	2 148 080	32.9	1	HIV/AIDS	2 517 330	46.3	1	HIV/AIDS	4 665 410	39.0
2	Homicide/violence	756 483	11.6	2	Diarrhoeal diseases	216 488	4.0	2	Homicide/violence	902 592	7.5
3	Tuberculosis	380 789	5.8	3	Tuberculosis	214 488	3.9	3	Tuberculosis	595 277	5.0
4	Road traffic accidents	344 868	5.3	4	Lower respiratory infections	209 240	3.8	4	Road traffic accidents	489 979	4.1
5	Lower respiratory infections	239 770	3.7	5	Low birthweight	180 274	3.3	5	Diarrhoeal diseases	452 827	3.8
6	Diarrhoeal diseases	236 339	3.6	6	Stroke	170 097	3.1	6	Lower respiratory infections	449 010	3.8
7	Low birthweight	213 489	3.3	7	Homicide/violence	146 109	2.7	7	Low birth weight	393 763	3.3
8	Ischaemic heart disease	175 906	2.7	8	Road traffic accidents	145 111	2.7	8	Stroke	318 083	2.7
9	Stroke	147 986	2.3	9	Ischaemic heart disease	108 531	2.0	9	Ischaemic heart disease	284 438	2.4
10	Suicide	123 822	1.9	10	Diabetes mellitus	86 154	1.6	10	Protein-energy malnutrition	171 433	1.4
11	Protein-energy malnutrition	93 556	1.4	11	Hypertensive heart disease	79 112	1.5	11	Suicide	63 544	1.4
12	Chronic obstructive disease	74 459	1.1	12	Protein-energy malnutrition	77 877	1.4	12	Diabetes mellitus	145 421	1.2
13	Fires	70 535	1.1	13	Septicaemia	55 808	1.0	13	Hypertensive heart disease	127 066	1.1
14	Septicaemia	59 439	0.9	14	Fires	868	1.0	14	Fires	123 400	1.0
15	Diabetes mellitus	59 267	0.9	15	Cervix ca	50 027	0.9	15	Septicaemia	115 247	1.0
16	Cirrhosis of liver	57 408	0.9	16	Neonatal infections	43 937	0.8	16	Chronic obstructive disease	113 499	0.9
17	Trachea/bronchi/lung ca	54 934	0.8	17	Asthma	43 037	0.8	17	Neonatal infections	96 819	0.8
18	Bacterial meningitis	54 876	0.8	18	Nephritis/nephrosis	43 025	0.8	18	Asthma	94 069	0.8
19	Neonatal infections	52 882	0.8	19	Suicide	39 721	0.7	19	Nephritis/nephrosis	93 973	0.8
20	Asthma	51 032	0.8	20	Chronic obstructive disease	39 041	0.7	20	Bacterial meningitis	90 964	0.8
<b>All causes</b>				<b>All causes</b>				<b>All causes</b>			
<b>6 529 811</b>				<b>5 438 011</b>				<b>11 967 822</b>			

## Disability adjusted life years (DALYs)

The estimated DALYs for the disease categories are shown in Figure 4.

Preliminary attempts to calculate YLDs from local data suggest that this approach underestimates the YLDs. While these estimates cannot be considered accurate for South Africa, they do highlight the fact that the mortality burden misrepresents the *total disease burden* in some cases. In particular, the impact of unintentional injuries, nervous system disorders, respiratory disease, disorders of the sense organs and mental disorders are significantly under-represented based on mortality alone. In terms of DALYs, HIV/AIDS is the major contributor, followed by other infectious and parasitic diseases, then unintentional and intentional injuries.

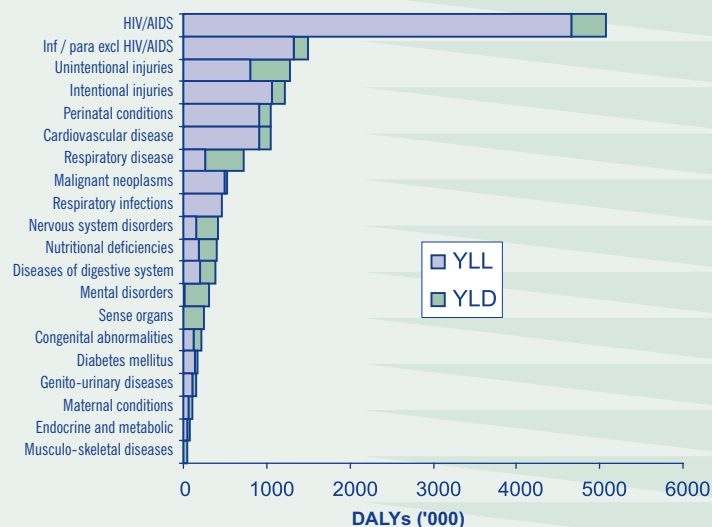


Figure 4: Estimated DALYs in 2000 for all disease categories.

If we had used the GBD category 'neuropsychiatric conditions' (which is 'mental disorders' and 'nervous system disorders' combined), it would be the second highest DALY ranking. Furthermore, the loss due to suicide (part of injuries) could be considered to arise from such conditions, making it a substantive category of health problem.

It is interesting to note that once non-fatal outcomes are taken into account, the ranking of unintentional injuries is higher than that of intentional injuries, opposite to the ranking based on mortality alone. There is a relatively high proportion of respiratory disease DALYs due to non-fatal outcomes.

## Projected impact of AIDS in 2010

Since it is unknown exactly how the disease pattern will be affected by HIV/AIDS, the estimates presented in Figure 5 are merely for illustrative purposes to get a sense of the future burden. Without interventions aimed at reducing HIV/AIDS mortality, HIV/AIDS will *more than double the burden of premature mortality* (YLLs) experienced in 2000. The impact will be greatest on females and by 2010 overall YLL rates will be comparable with levels in the Afro E region in 2000. By the year 2010 HIV/AIDS will account for 75% of premature mortality, compared to 39% in 2000. While the overall mortality burden (YLLs per 1000) was higher for males than females in 2000, the increase for females is greater and by 2010 the rates are similar. These results show that the disease burden from HIV/AIDS does not diminish the burden from other causes, but adds significantly to them.

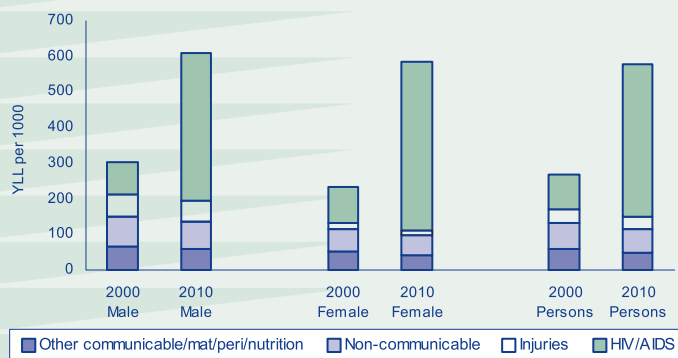


Figure 5: YLLs per 1000 (age standardised) by disease group for 2000 and 2010.

## Conclusions

This study succeeds in drawing together data from a range of sources to develop coherent estimates of underlying causes of death. As such, it has gone some way towards overcoming the shortcomings of the available data on mortality and morbidity, providing useful information for national health planning. Where it has been possible to compare alternative sources of data there has been a general level of consistency.

However, this study notes discrepancies in the statistics concerning road traffic accident deaths and homicides which needs further investigation.

Use of YLLs as a measure of premature mortality provides an important ranking that differs from that based on numbers (apart from for HIV/AIDS), because it takes age into account. This highlights potential areas for prevention of premature deaths. The YLLs show the quadruple BoD experienced in South Africa in 2000: a combination of the pre-transitional diseases and conditions related to poverty, the emerging chronic diseases, injuries and HIV/AIDS.

HIV/AIDS accounts for major early loss of life in both males and females, and is expected to continue to grow rapidly in the next few years. TB, diarrhoea, lower respiratory infections and conditions arising from low birthweight, part of the pre-transitional group, feature in the top causes of premature mortality. For the non-communicable diseases, stroke is highest for females and ischaemic heart disease is highest for males. Diabetes mellitus, other respiratory conditions and hypertensive heart disease feature in the top causes for females, and other respiratory conditions, chronic obstructive pulmonary disease, diabetes mellitus, cirrhosis of the liver and lung cancer feature in the top causes of death for males.

The already large burden due to HIV/AIDS is expected to grow rapidly in the next few years unless interventions that reduce HIV/AIDS mortality and morbidity become widely available. This affects both males and females, and will bring the levels of premature mortality experienced in SA to levels comparable to other sub-Saharan countries. The growing number of orphans will have a major social impact unless efforts are made to ensure that the basic needs of these children are met and psychosocial support is provided.<sup>10</sup>

The burden from injuries, both intentional and unintentional, is exceedingly high for males. Death rates for injuries rank amongst the highest in the world. Main causes are homicide, road traffic accidents and fires. Suicides contribute to a large loss for males. When premature mortality is considered, intentional injuries rank higher than unintentional. However, when non-fatal outcomes are taken into account, the ranking is reversed, making it important to target interventions for both intentional and unintentional injuries. This study highlights the need for a more detailed assessment of non-fatal outcomes from an improved base of information.

The *World Health Report* of 2002 presents findings from a global review of risk factors, and has identified 10 risk factors that account for more than a third of all deaths worldwide<sup>11</sup>: unsafe sex, alcohol consumption, tobacco

consumption, obesity, high blood pressure, under-nutrition, unsafe water, sanitation and hygiene, iron deficiency, indoor smoke from solid fuels and high cholesterol.

It is important to assess the burden resulting from selected risk factors, to identify the issues that need to be addressed to reduce BoD in South Africa. The next step in the BoD study will therefore be to quantify risk factors such as tobacco use, malnutrition, unsafe sex, alcohol consumption, poor water supply and sanitation, and hypertension. Cost-effectiveness of interventions also needs to be investigated.

## Policy recommendations

With the almost 40% of premature mortality due to HIV/AIDS in 2000 expected to increase to 75% by 2010, government needs to give this urgent attention. The National AIDS Plan<sup>10</sup> needs to be fully implemented and creative mechanisms need to be found to provide treatment for HIV-positive people who become AIDS sick.

Successful interventions such as the comprehensive health promotion approach used in the Australian State of Victoria and achievements in reducing the spread of HIV/AIDS in Uganda need to be examined and emulated.

The following strategies are likely to reduce the large BoD in SA:

- reducing the transmission of HIV through improving treatment of sexually transmitted infections, improving voluntary counselling and testing services, promoting safe sex and preventing mother to child transmission;
- delaying the onset of AIDS and mortality through the provision of anti-retrovirals to HIV positive patients who require it, improved nutrition and immune boosters;
- improving TB control;
- developing strategies to reduce violence and injuries;
- promote healthy lifestyles (including a prudent diet, physical activity, reduce smoking, alcohol, and substance abuse); and
- improving the integrated management of childhood diseases.

In addition to ensuring appropriate health care, the *World Health Report* of 2002 urges that governments and especially Health Ministers play a strong role in formulating risk-prevention policies, including more support for scientific research, improved surveillance systems and access to global information. However, we need to recognise that many health problems are socially and culturally rooted. Poverty, gender inequalities, crime and violence play a major role in exacerbating health problems. Efforts to improve health will have to extend to the very core of our society and cultures, with a refurbishment of our social fabric.

## References

1. Bradshaw D. Is the DALY measurable in South Africa? *SAMJ* 1996; **86**: 1483.
2. Botha JL, Bradshaw D. African vital statistics – a black hole? *SAMJ* 1985; **67**: 977-981.
3. Bradshaw D, Botha JL, Joubert G, Pretorius JPG, Van Wyk R, Yach D. *Review of South African Mortality (1984)* (MRC Technical Report No. 1). Cape Town: MRC, 1987. ISBN: 0-620-11036-8.
4. Bradshaw D, Sitas F, Dorrington R. The level of mortality in South Africa 1985 – what does it tell us about health? *SAMJ* 1992; **82**: 237-240.
5. Statistics South Africa. *Causes of death in South Africa 1997-2001*. Advanced release of recorded causes of death (P0309.2). Pretoria; Statistics South Africa. 2002.
6. Dorrington R, Bourne D, Bradshaw D, Laubscher R, Timæus IM. *The impact of HIV/AIDS on adult mortality* (MRC Technical Report). Cape Town: MRC, 2001. ISBN: 1-919809-14-7.
7. Bradshaw D, Schneider M, Dorrington R, Bourne D, Laubscher R. South African cause of death profile in transition – 1996 and future trends. *SAMJ* 2002; **92**: 618-623.
8. Murray CJ, Lopez AD. *The Global Burden of Disease: a comprehensive assessment of mortality and disability from diseases, injuries and risk factors in 1990 and projected to 2020* (Vol. 1, Global Burden of Disease and Injury Series). Boston: Harvard School of Public Health, 1996.
9. Murray CJ, Lopez AD. *Global Health Statistics* (Vol. 2, Global Burden of Disease and Injury Series). Boston: Harvard School of Public Health, 1996.
10. Johnson L, Dorrington RE. *The impact of AIDS on Orphanhood in South Africa: A Quantitative Analysis* (Monograph No. 4). Cape Town: Centre for Actuarial Research, University of Cape Town, 2001. <http://www.commerce.uct.ac.za/care/>
10. Department of Health. *A national AIDS plan for South Africa*. Pretoria: Department of Health, 2000.
11. World Health Organisation. *World health report 2002*. Geneva: World Health Organisation, 2002.