

Initial Burden of Disease Estimates for South Africa, 2000

March 2003



Burden of Disease Research Unit

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A copy of this report is available on the internet at: www.mrc.ac.za/bod/bod.htm

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Acronyms and Abbreviations

AIDS	Acquired Immune Deficiency Syndrome
ASSA2000	Actuarial Society of South Africa 2000, model
BOD	Burden of Disease
CMS	Cape Metropole Study
DALYs	Disability adjusted life years
DHS	Demographic and Health Survey
DISMOD	Disease model
FAS	Foetal alcohol syndrome
GBD List	Global Burden of Disease list
GBD	Global Burden of Disease
Group I	Communicable diseases, maternal causes, perinatal conditions and nutritional deficiencies, including HIV/AIDS unless otherwise specified
Group II	Non-communicable diseases
Group III	Injuries
HA	Department of Home Affairs
HIV	Human immuno-deficiency virus
ICD	International Classification of Disease
MRC	Medical Research Council
NTD	Neural tube defects
NIMSS	National Injury Mortality Surveillance Study
PTO	Person trade-off
RTAs	Road traffic accidents
SA BOD list	South African Burden of Disease list
SADHS	South African Demographic and Health Survey
SA NBD	South African National Burden of Disease Study
SABDSS	South African Births Defects Surveillance System
SIDS	Sudden Infant Death Syndrome
Stats SA	Statistics South Africa
UNISA	University of South Africa
WHO	World Health Organisation
YLDs	Years lived with disability
YLLs	Years of life lost due to premature mortality

Foreword

It gives me great pleasure to welcome readers to this landmark document. Country-specific estimates of the burden of disease are crucial for targeting health interventions that make a significant impact on the well-being of the population. In South Africa, an environment where the resource envelope is limited, the information in this report provides an excellent framework for the prioritisation of such health interventions. Concurrently, the report will, for the first time, present policymakers and health service providers with baseline data to evaluate the effectiveness of their responses to the major health challenges facing our country. Given the generally problematic quality of data available in many parts of South Africa, in particular, these estimates provide the most up-to-date picture of the extent to which HIV/AIDS has impacted on the South African burden of disease. The increasing burden caused by the epidemic, together with the considerable burden posed by intentional and unintentional injuries, point to two areas of intervention that will be of critical importance for the improvement in the health of South Africans in the future. It is disturbing to note that HIV/AIDS and injuries result in the premature mortality of a large proportion of young adults, whose contribution to the national economy as well as future leadership will be sorely missed.

The relatively low ranking of diarrhoeal diseases may reflect the benefits of the national endeavour to provide safe, potable water to large sections of our citizenry, who had erstwhile not had access to basic services, but certainly reflects the changing pattern of mortality in South Africa. All in all, the report confirms the health transition pattern reflecting a quadruple burden of disease, specifically poverty-related diseases, emerging chronic diseases, injuries and HIV/AIDS, borne by South Africans.

It is my sincere wish that this report will contribute significantly to our collective efforts to reduce the burden of disease in South Africa, thus making an indirect, but important, contribution to the development of our country.

My personal congratulations to all the researchers involved in this important work.

A handwritten signature in black ink, appearing to read 'William Pick', written in a cursive style.

William Pick
Acting President of the MRC South Africa
February, 2003

Executive Summary

Background

Comprehensive, timely and precise health information is essential for formulating health policy and for planning to meet the demand for appropriate health services and interventions. Information about the burden of disease in South Africa, in common with other developing countries, is incomplete and generally has not been systematically reviewed for coherence and consistency. In South Africa, the national mortality data, that should form the cornerstone of the burden of disease information, have been shown to be deficient with significant under-registration and misclassification. This is the first attempt to undertake a national burden of disease study for South Africa, in which estimates are derived for the levels and underlying causes of mortality and morbidity from different data sources. While the main focus of this study is the causes of premature mortality (years of life lost or YLLs) experienced in the year 2000, attempts are made to estimate the additional burden contributed by morbidity and injury, in order to estimate the disability adjusted life years (DALYs). An attempt is also made to estimate the impact of AIDS on premature mortality in the year 2010.

Methods

An adapted version of the 1990 Global Burden of Disease (GBD) list of causes of death (Murray and Lopez, 1996a) has been developed for this study. Overall mortality is divided into three broad groups of causes of death: Group I, the pre-transitional causes, include communicable diseases, maternal causes, perinatal conditions, and nutritional deficiencies; Group II, the non-communicable causes; and Group III, the injuries. HIV/AIDS is part of Group I but is kept separate in this analysis due to the size of the burden it contributes. In accordance with the GBD list, each group is divided into several major categories of causes of death such as the respiratory infections, cardiovascular diseases and intentional injuries. These categories are further disaggregated into more specific causes of death.

When the study was initiated, the latest cause of death data for South Africa was for the year 1996. Recognising that the cause of death profile was in transition and that burden in South Africa is undergoing a profound transition due to the rapid spread of the HIV/AIDS epidemic, a modelling approach, calibrated to empirical data, has been adopted. The number of deaths for the year 2000 is estimated using the ASSA2000 model of the Actuarial Society of South Africa. The overall level of mortality was calibrated to match estimates of child mortality and adult mortality from recent surveys, the census and vital statistics. The model was also calibrated to replicate the antenatal HIV seroprevalence survey data for pregnant women who attend the public sector clinics.

The non-AIDS cause of death profile is estimated from three sources. Firstly, the 1996 cause of death data from Statistics South Africa are used to provide information on the causes of death profile for Groups I and II, excluding AIDS. Ill-defined causes within a disease category have been reallocated proportionally by age and sex to the specified causes within that category. Experts were consulted in an attempt to refine this reallocation, particularly for cardiovascular diseases, perinatal conditions and congenital abnormalities. A multinomial model was used to reallocate the large ill-defined category into the broad Group I and II by age and sex, followed by a proportional allocation within the groups to specific causes. Secondly, the cause of death information processed by the Department of Home Affairs is used to estimate the overall proportion of deaths due to injuries by age and sex and, thirdly, the UNISA/MRC national injury mortality surveillance system, (NIMSS), is used to estimate the profile of causes of injury deaths.

Premature mortality has been 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 a maximum life expectancy) have been used. For illustrative purposes, the extent of burden from morbidity and non-fatal injury has been 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 South Africa is a part, for each of the disease categories. Future impact of HIV/AIDS has been 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.

Mortality profile

The key indicators of mortality in this study for the year 2000 are shown in Table 1.

Table 1: Mortality and population estimates for South Africa, 2000

Indicator	Male	Female	Persons
Infant mortality rate (per 1000 live births)	62	56	59
Under-5 mortality rate (per 1000 live births)	98	91	95
Total deaths	303 081	253 504	556 585
Adult mortality $_{45}q_{15}$ (%)	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

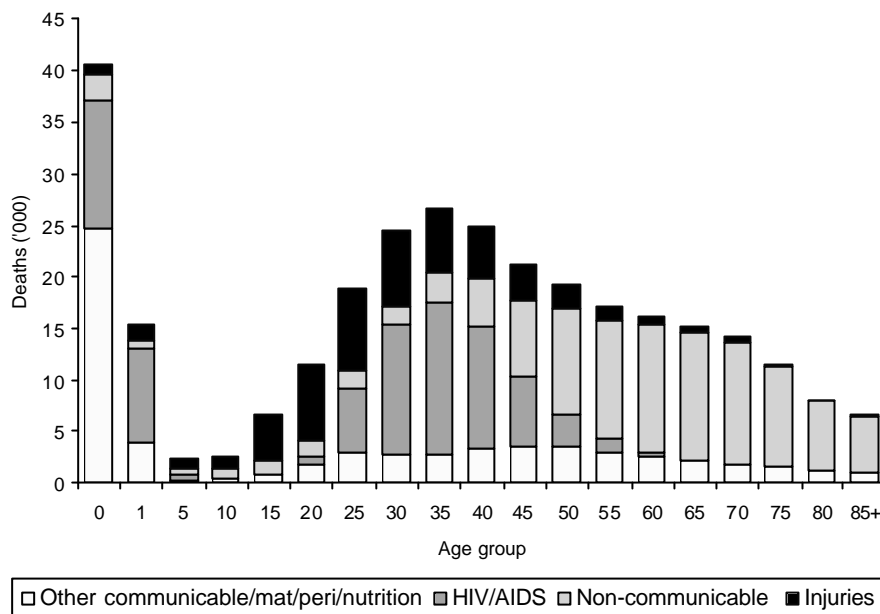
The cause of death profile by broad group is shown in Table 2. Non-communicable diseases account for 37% of the deaths, followed by HIV/AIDS which accounts for 30%. The patterns for males and

females differ. Females have a higher proportion of HIV/AIDS and non-communicable diseases and a lower proportion of injury deaths. The age distribution of the deaths is shown in Figure 1. It can be seen that the age distribution of the deaths is significantly influenced by HIV/AIDS which contributes to high infant deaths and high numbers of deaths in the young adult ages. Injury deaths further increase the number of deaths in the young adult ages, particularly for males.

Table 2: The 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 communicable, maternal, perinatal and nutritional (Group I)	21%	20%	21%
Non-communicable (Group II)	36%	40%	37%
Injuries (Group III)	17%	6%	12%

Male deaths by age, 2000
N=303081



Female deaths by age, 2000
N=253504

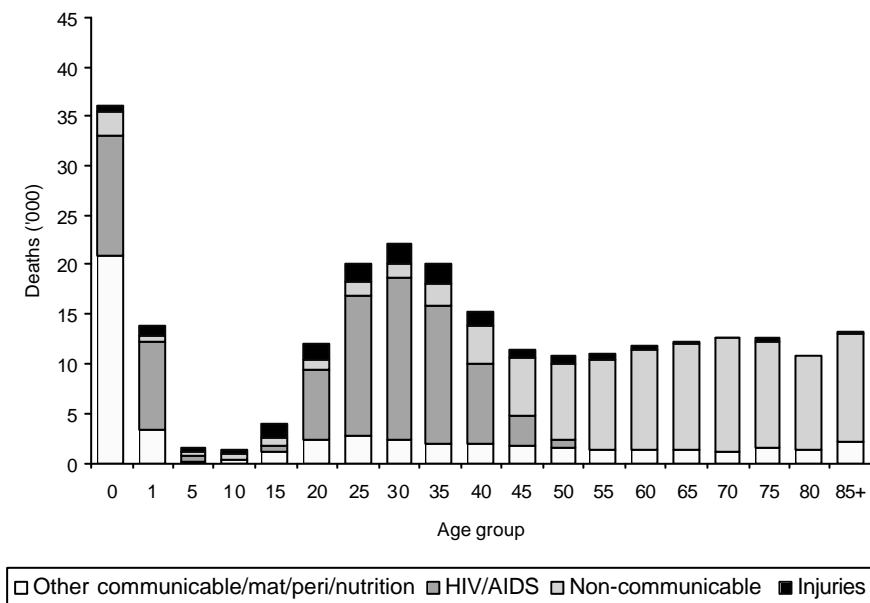


Figure 1: Age distribution of deaths by group and sex, 2000

The mortality profile reflected in Figure 2 shows the quadruple burden of disease experienced in South Africa. HIV/AIDS, chronic diseases, poverty-related conditions and injuries all contribute substantially to the number of deaths in 2000. After HIV/AIDS (29.8%), cardiovascular disease (16.6%), infectious and parasitic diseases (10.3%), malignant neoplasms (7.5%), intentional injuries (7.0%) and unintentional injuries (5.4%) are the leading cause of death categories for persons. Females have higher proportions of deaths due to HIV/AIDS and cardiovascular diseases than males. Males have a higher proportion of injury deaths.

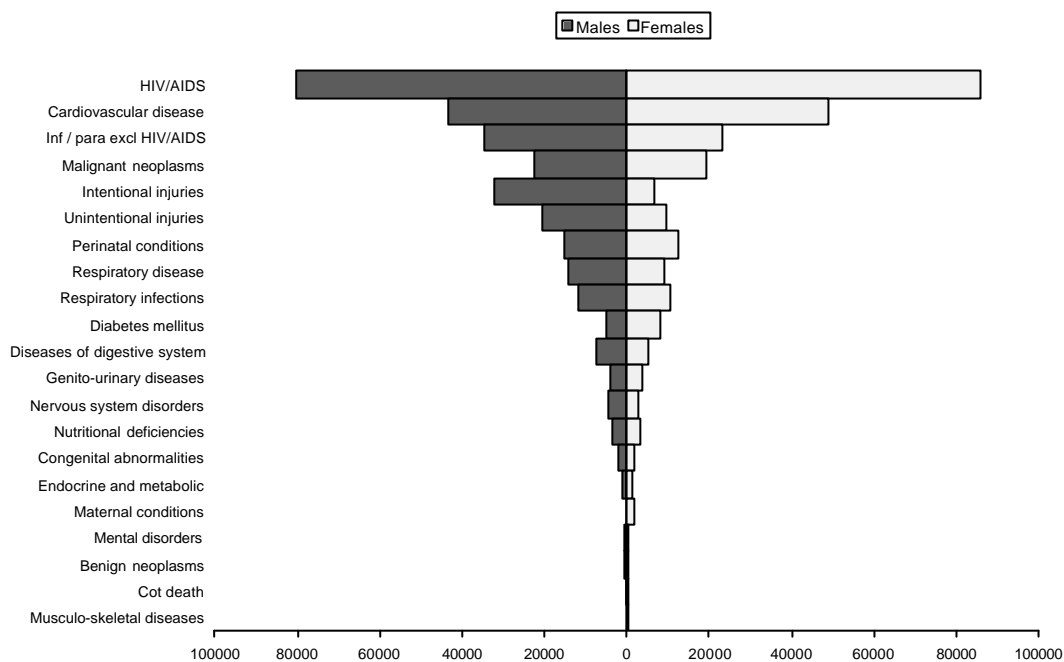


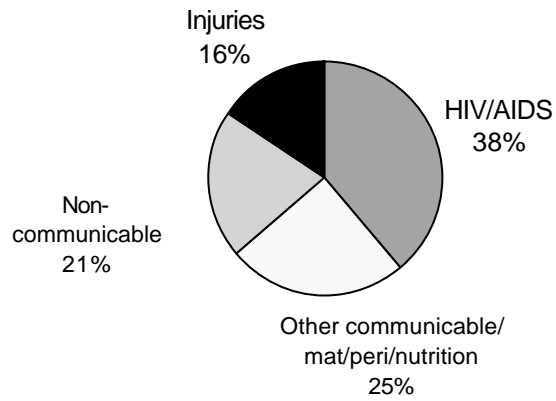
Figure 2: Cause of death by category, 2000

Premature mortality

The years of life lost (YLLs), calculated using the age weighting, discounting and the standard life expectancy used in the GBD study, are shown in Figure 3. 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 accounted for 21% of the years of life lost. Injuries accounted for 16% of the premature mortality; 8% for females and 22% for males. The top twenty causes of mortality burden are shown in Table 3, again reflecting the quadruple burden of disease and the different patterns for males and females.

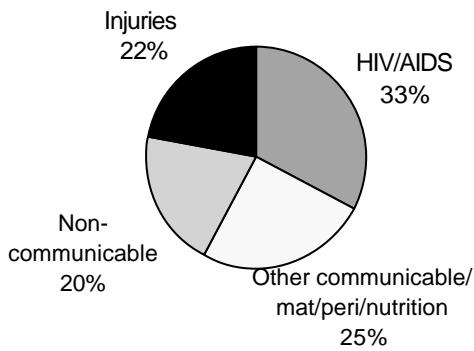
Years of life lost for persons, 2000

YLL=11967822



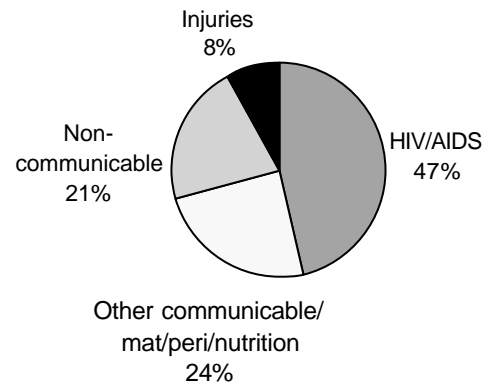
Years of life lost for males, 2000

YLL=6529811



Years of life lost for females, 2000

YLL=5438011



Mat=maternal, peri = perinatal conditions

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

Table 3: Top 20 specific causes of the 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 birth weight	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 birth weight	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	163 544	1.4
12	COPD	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	52 866	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	COPD	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	COPD	39 041	0.7	20	Bacterial meningitis	90 964	0.8
All causes		6 529 811		All causes		5 438 011		All causes		11 967 822	

Disability adjusted life years (DALYs)

The estimated DALYs for the disease categories are shown in Figure 4. The YLDs have been calculated using the YLD/YLL ratio estimated for the Afro E region by WHO. 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 serve to highlight the fact that the mortality burden misrepresents the total disease burden in some cases. In particular, the contribution of unintentional injuries, nervous system disorders, respiratory disease, sense organ and mental disorders are significantly under-represented based on mortality alone. In terms of DALYs, HIV/AIDS is the major contributor. This is followed by other infectious and parasitic diseases, then unintentional and intentional injuries.

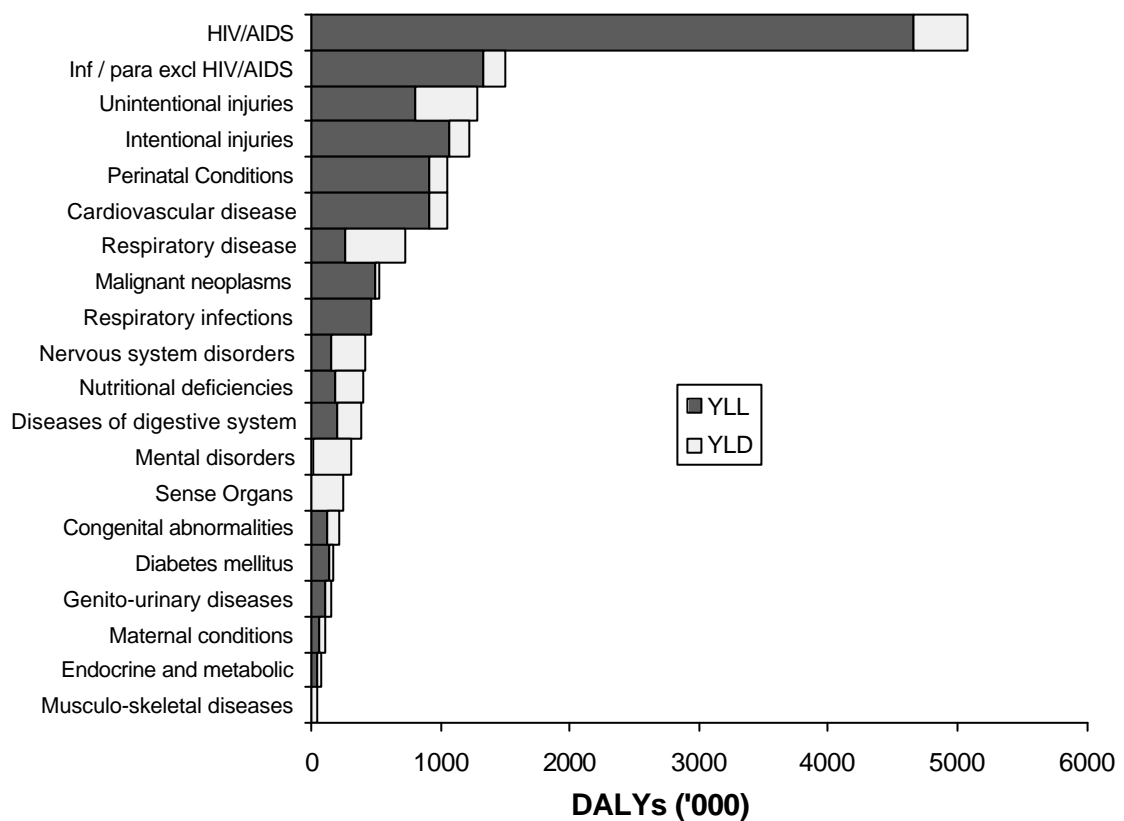


Figure 4: Estimated DALYs for persons in 2000 for all categories

Projected impact of AIDS in 2010

Without interventions, the impact of HIV/AIDS can be seen to more than double the burden of premature mortality by the year 2010, when comparing age-standardised rates (Figure 5). Since there are little data on how the epidemic affects other causes of death, a fairly simplistic YLL approach has been used, taking the demographic impact into account and assuming that the profile of other causes of death remains the same. 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, without behaviour change or treatment interventions, the rates reach similar levels. These results show that the disease burden from HIV/AIDS does not diminish the burden from other causes but adds significantly to them.

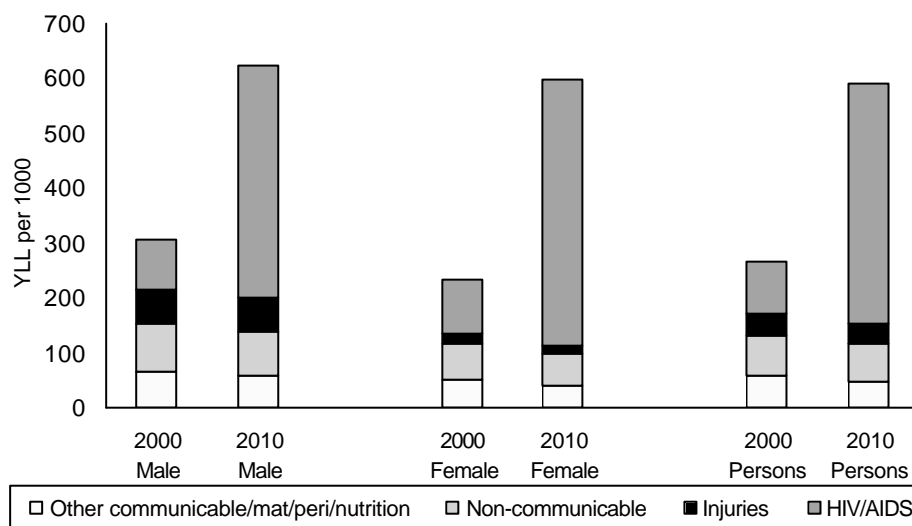


Figure 5: YLLs per 1 000 (age standardised) by disease group for 2000 and 2010

Conclusions and recommendations

This study has succeeded in drawing together data from a range of sources to develop coherent estimates of the underlying causes of death in South Africa. As such, it has gone a long way towards overcoming the shortcomings of the available data on mortality and morbidity, even the recently released sample of causes of death, and provides useful information that can be used for planning. Where it has been possible to compare alternative sources of data, even the recently released sample of causes of death, there has been a general level of consistency. The study does reveal sizable discrepancies in the number of road traffic accident deaths and homicides that need further investigation.

The use of YLLs as a measure of mortality provides a different ranking of causes from the ranking based on the number of deaths, apart from HIV/AIDS, as it takes age into account. YLLs are important, as premature mortality is emphasised. Specific diseases resulting in many early deaths and very premature deaths can be identified and targeted for prevention to reduce the burden. For example, cardiovascular diseases contribute relatively less, and homicide and violence relatively more to the YLL burden. The YLL is important for public health planning as it takes the age of the deceased into account.

The YLLs show the quadruple burden of disease experienced in South Africa in the year 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 a major loss of life for both males and females. TB, diarrhoea, lower respiratory infections and conditions arising from low birth weight contribute to the pre-transitional conditions. 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 for males. The burden from injuries, both intentional and unintentional, is extremely high for males, and interventions to reduce the burden need to be targeted urgently. The major causes of this burden are homicide, road traffic accidents and fires. Suicides also contribute a large loss for males.

The study highlights the need for a more detailed assessment of non-fatal outcomes. When premature mortality is considered, intentional injuries rank higher than unintentional. However, when non-fatal outcomes are taken into account, the ranking reverses, making it important to target both intentional and unintentional injuries. While these estimates of YLDs and DALYs for South Africa should not be considered definitive, they do illustrate the importance of including non-fatal outcomes when ranking diseases and conditions. It is clear that South Africa has enormous gaps in the database required to estimate DALYs nationally and for sub populations. This gap includes consensus values for health states as well as epidemiological data.

Despite the shortcomings of the study, it has identified the major causes of premature mortality and morbidity in South Africa. Further studies need to be conducted to assess the attributable burden resulting from selected risk factors and to assess the cost-effectiveness of interventions. Such information is necessary to identify the appropriate interventions to reduce the large burden of disease. It must be noted that more than half of the loss due to premature mortality resulted from only four conditions – HIV/AIDS, TB, homicide and road traffic accidents. Furthermore, the study highlights that the already large burden due to HIV/AIDS can be expected to grow rapidly in the next

few years unless interventions that reduce mortality and morbidity become widely available. This affects both males and females, and will bring the levels of premature mortality experienced in South Africa to levels comparable to other sub-Saharan countries. All role players, including government, pharmaceuticals, business, NGO's and the community need to give urgent attention to this.

1 Introduction

1.1 Background to the study

Burden of disease information is an important component of the health information needed for monitoring the health of the nation. The availability of comprehensive, timely and precise health information is the basis for formulating health policy and planning to meet the demand for appropriate health services and interventions. In the health sector, the scarcity of resources makes priority setting imperative so as to ensure the optimal use of available resources. Detailed burden of disease (BOD) information linked with cost-effectiveness analyses informs priority setting for health sector reform.

From 1993 to 1996 the Harvard School of Public Health, in collaboration with the World Bank and the WHO, carried out an initial global assessment of the burden of disease (Murray and Lopez, 1996a and 1996b). This global burden of disease (GBD) study made use of an innovative approach whereby a consistent and coherent set of estimates was derived from the available data. The GBD study produced estimates of disease and injury rates in 1990 by age and sex for eight geographical regions of the world. The magnitude of different health problems was measured using a common currency, the disability adjusted life year (DALY) that included both fatal and non-fatal health outcomes. The GBD study was important as it provided a unique assessment of the health of populations on a global scale. However, it must be borne in mind that the results of such an ambitious study are only approximate and that the process is, of necessity, an iterative one.

Many developed countries have compiled mortality and morbidity statistics for decades. In addition, the development of surveillance systems, disease registers and community-based epidemiological research have facilitated the availability of reliable health statistics at all levels of the health system. However, many developing countries do not have mortality statistics, let alone information on morbidity. South Africa has undergone a political transformation and has adopted new macro-economic policies that attempt to promote economic growth as well as redistribution of wealth. Part of this process includes the initiation of various programmes to improve health and demographic data. The 1996 census was the first comprehensive census to be undertaken and, in addition to providing basic demographic data, provided a sampling frame for numerous household surveys including the series of October Household Surveys and the Demographic and Health Survey (DHS) of 1998. Extensive efforts to improve vital registration have resulted in the coverage for adults improving from 50% in 1990 to over 90% in 2000. A sentinel HIV surveillance system, the national injury mortality surveillance system, the perinatal mortality surveillance, the confidential maternal mortality surveillance and the birth defects surveillance systems have been established to complement the routine disease notification system and the national cancer registry. These contribute detailed

information for specific conditions. The emerging demographic surveillance systems at Agincourt, Dikgale and Hlabisa provide data for rural settings.

It is important to consider the completeness and reliability of these data sets and carefully analyse and compare them, using the BOD approach to derive a well-considered estimate of the mortality and morbidity profile in the country. In addition to the comparison of alternative data sources, it may be necessary to seek expert opinion where no data exist or there are conflicting data. Furthermore, of particular relevance for South Africa and other developing countries is an understanding of the epidemiological transition. The epidemiological transition includes changes in the cause of death patterns and overall changes in health and disease that occur during socio-economic transformation. Interpretation of data in terms of these changes facilitates better estimation and projection of various epidemiological parameters (Mathers, *et al.*, 2001). Demographic modelling provides parameters, such as population numbers and age-specific rates. In addition, computer software is utilised to ensure the consistency of the values of certain parameters. It is envisaged that the top 20 diseases will be ranked. Those contributing the greatest burden will be prioritised for seeking cost-effective interventions, and cost-effectiveness analyses need to be undertaken depending on the current expenditure, evidence and policy debate.

About 35 countries worldwide have initiated or completed BOD studies. Designed to meet the needs of the specific country in which undertaken, these studies are not strictly comparable as there have been modifications due to data restraints and the basic premises of the country-specific studies.

Mexico was the first country to conduct a national assessment of burden of disease using DALYs, the new metric devised for the GBD study. The Mexican study highlighted regional variations and inequalities. The results of the study contributed significantly to the health policy debate in Mexico and formed part of the new national health plan at the time (Lozano, *et al.*, 1995).

The Mauritian national burden of disease study was completed in 1995 (Vos, *et al.*, 1995). As the initial study was based on the statistics of the island's small population, it was able to transform numerous data sets into a useful comprehensive profile. An update, published early in 1998, included the recalculation of the disability component of the BOD using the new version 5 disability weights from the 1996 GBD study (Vos, *et al.*, 1998).

A BOD study in the south and west regions of England, (Bowie, *et al.*, 1997), was a rapid effort based on mortality data. The study indicated the usefulness of such a study in an Established Market Economy region.

The Dutch national study, (Ruward and Kramers, 1998), was important as they used empirical data to develop their own weights for the disability or morbidity component of the study metric. These weights have subsequently been incorporated into other studies.

The Australian burden of disease study, (Mathers, *et al.*, 1999), drew on previous BOD studies. It highlighted the substantial contributions of mental health and drug abuse to the burden of disease in Australia and incorporated an estimate of the burden attributable to risk factors. The concurrent BOD study in the Australian state of Victoria focused on inequalities (Department of Human Services [DHS], 1999). The New Zealand study, (Ministry of Health, 2001), applied a rapid approach making use of much of the Australian estimates. It highlighted the added burden of disease experienced by the Maoris.

In Africa, where mortality and morbidity data are much more problematic, there is a growing movement to conduct BOD studies. Zimbabwe undertook a BOD study by processing mortality data for 1995 and combining it with hospital outpatient and admission data and various *ad hoc* studies. The results highlighted the extensive impact of AIDS, the large contribution of depression and anxiety disorders to the burden, and urban/rural differentials.

Uganda, as part of its planning, has undertaken a rapid assessment using a BOD approach and Tanzania and Mozambique are conducting studies that will form the foundation of BOD assessments.

1.2 The DALY

The disability adjusted life year (DALY) is a relatively new metric introduced by the global burden of disease study (Appendix A). It is a summary measure of population health, combining information on death and non-fatal health outcomes. Two complementary classes of summary measures of population health have been developed, namely, health expectancies and health gaps. The DALY is an example of the latter and measures the difference between the actual population health and some specified norm. It is a single indicator that uses time to equate death and disability. In its most commonly used form, it is an incidence-based rather than prevalence-based measure. It measures the future stream of healthy years of life lost due to each incident case of disease or injury. The DALY comprises Years of Life Lost, (YLLs), due to premature mortality and Years lived with disability, (YLDs), weighted according to the severity of the disability.

The computation of the DALY for any given condition i is simply the sum of YLLs and YLDs for that condition:

$$DALY_i = YLL_i + YLD_i$$

The aim of health interventions is to minimise the number of DALYs, that is to promote a longer and healthier life for people.

The DALY is based on the following principles:

- any health outcome that represents a loss of welfare should be included;
- age and sex are the only individual characteristics included in the set of variables used to calculate the DALY; and,
- like health outcomes are treated as like, irrespective of where or to whom they occur.

The DALY is considered the same in all settings. No preferences for individuals across age groups or socio-economic groups are incorporated into its calculation. This last criterion is an important one for the issue of equity in health and the use of the DALY as a measure of population health.

In contrast to previous composite health indicators, four key social preferences or values are incorporated in the DALY (Murray, 1994; Murray and Lopez, 1996a).

a. Life expectancy for calculating premature mortality

In order to ensure equity and comparability across countries the highest observed national life expectancy has been chosen as the standard for the GBD study. This can be represented by a model life table, Coale and Demeny West Level 26, with a life expectancy at birth of 82.5 years for females (Coale and Demeny, 1966). An arbitrary biological difference of life expectancy at birth of 2.5 years was chosen. Thus, the standard life expectancy at birth for males was 80 years, modelled on the West Level 25 life table for females.

b. The comparison of time lived with disability, with time lost to premature death

The disability component of the DALY is calculated on the basis of incidence and duration of conditions resulting in non-fatal outcomes that are weighted according to the severity or the sequelae of the disability. A set of weights for time spent in different health states is required. The person trade-off (PTO) method was used to define, measure and value disabilities for the estimates of the GBD. Thus, specific values are attached to time lived with disability to make it comparable to time lost to premature mortality. The PTO approach is a measurement protocol developed to investigate variation in health state preferences. It is based on a deliberative process, where individuals are faced with the policy consequences of their values choices (Murray and Lopez, 1996a). The so called

Dutch weights have been applied in the Australian study and WHO is promoting the collection of population based data on health state values to enhance the weights used in calculating DALYs.

c. Discounting

This value relates to time preference and involves the choice of a discount rate for future loss. The discounting of future health implies that individuals prefer time lived now rather than some time in the future. The GBD study selected a discount rate of three percent per year for years of life lost in future. For example, a year of healthy life gained in 10 years time is worth 24% less than one year gained now. For this study the 3 percent discount rate was chosen to allow international comparisons and because this rate is recommended by the International Panel on Cost Effectiveness in Health and Medicine (Gold, *et al.* 1996). A consequence of discounting life years is that prevention is devalued as costs are incurred now with benefits only years later. On the other hand, in terms of cost effectiveness analyses if health costs and benefits are not similarly discounted, it will always seem more cost effective to defer treatment.

d. Age weighting

The DALY formula (Appendix A) includes a continuous age-weighting function that assigns a greater value to a year of life lived in a young or middle-aged adult versus the very young or elderly. Age weighting does not imply preference for any age group, as it is assumed that an individual's life span encompasses all ages.

The focus of the criticisms of the DALY relates to these explicitly stated values. However, the very explicitness of the DALY values, enables one to choose which values to include in the measure. This means that age weighting and discount values can be altered and the life-expectancy can vary from study to study.

1.3 Aims

Due to limitations in the data, there have been no previous attempts to undertake a national BOD study in South Africa (Bradshaw, 1996). Analyses of the national mortality data have highlighted the deficiencies in the death statistics with under-registration and misclassification (Botha and Bradshaw, 1985; Bradshaw, *et al.*, 1987; Bradshaw, *et al.*, 1992). Analyses of the more recent data have highlighted the improvement in death registration and have described the transition from the triple burden to a quadruple burden arising from poverty-related conditions, emerging chronic diseases, injuries and AIDS (Dorrington, *et al.*, 2001; Bradshaw, *et al.*, 2002). However, in 1996, the latest year for which the full cause of death data are available, 14.8% of the deaths were ascribed to ill-defined natural causes, as the exact cause of death was unknown and 17.1% were due to undetermined

injuries, as the manner of injury was unknown. Such lack of detail is problematic when considering appropriate public health interventions.

This study is an initial attempt to derive coherent and consistent estimates of the burden of disease experienced in South Africa in the year 2000. It is informed largely by the available mortality data and the HIV antenatal seroprevalence data to estimate the premature loss of life. For illustrative purposes, attempts are made to estimate the additional burden contributed by the non-fatal components of morbidity and injury to estimate the DALY. In addition, the study attempts to assess the future impact of AIDS.

The public debates about the extent of AIDS have generated much interest in BOD in South Africa. Government has responded to the lack of timely cause of death statistics by processing the cause of death information from a 12% sample of the vital registration records for the years 1997 - 2001 (Stats SA, 2002). This is an extremely valuable initiative as the compilation of cause of death statistics will be fast-tracked and will remove the backlog in collection of such statistics. This recent cause of death data, based on a sample, will be assessed and used to update these initial BOD estimates in future.

2 Methods

2.1 Estimation process

Most BOD studies make use of vital registration data as a basis for the mortality estimates. The extent of under-registration is estimated using indirect demographic techniques so that adjustments can be made to compensate for the missing deaths. The cause of death information is analysed and the ill-defined causes of death are reallocated to specific causes. In the case where deaths are registered as due to ill-defined causes, these are reassigned to specific causes of death in order to obtain the best possible estimate of the magnitude of each cause of death category. Routinely collected morbidity and disability data as well as *ad hoc* studies are analysed and modelled to derive consistent estimates of the incidence, duration and severity of diseases and injuries so as to estimate the non-fatal component of the DALY. Expert opinion is sought at each step to inform the estimation and ensure coherence of the estimates.

The estimates from a BOD study usually refer to the burden experienced in some earlier period. In most instances, this approach is acceptable as demographic features and mortality profiles, are generally slow to alter. South Africa is, however, undergoing an extremely rapid transition as a result of the AIDS epidemic (Bradshaw, *et al.*, 2002), making the usual BOD approach inappropriate. Such an approach would generate estimates that would be so out of date as to misinform policy makers. In an attempt to avoid this situation, the estimation approach has been modified. Rather than being limited to using the latest vital registration data, currently 1996, a system has been developed to capture the basic details of registered deaths directly from the Department of Home Affairs. This has allowed us to monitor the trend in all cause mortality and obtain more up-to-date information on the changing age pattern of mortality (Dorrington, *et al.*, 2001). Use is made of this information together with a model of the AIDS epidemic so as to generate more up-to-date estimates of mortality. The model, bolstered by the data on total mortality, is used to obtain estimates of level of mortality for the year 2000. The cause of death profile is based on information from various data sources. In addition, the model is used to give a sense of how the mortality profile can be expected to change into the future.

A meeting was held with experts in 1996 to consider the initial work on mortality and the proposal for estimating DALYs. At this point it was recognised that the mortality data would provide an important foundation for the study, but that the rapidly changing mortality profile would require a model-based approach. In addition, technical assistance has been obtained from experts in demography, BOD, perinatal conditions and cardiovascular disease, at various points during the study. Meetings were

held with experts in the fields of injury and congenital abnormalities, in order to review available data and make decisions on how to improve the estimates.

2.2 Disease and injury categories

An adapted version of the 1990 Global Burden of Disease Study (Murray and Lopez, 1996a and 1996b) classification was used for the South African National Burden of Disease Study (SA NBD) (see Table B1 in Appendix B). The three-digit codes from the International Classification of Diseases (ICD-9) used to define each cause of death in the SA NBD classification system are included, for reference. Since the available data are coded using ICD-9, the SA NBD list refers to this version of the classification. The GBD study proposes a three-part tree structure of cause of death classification. Overall mortality is divided into three broad groups of causes of death:

Group I are the pre-transitional causes: communicable diseases, maternal causes, perinatal conditions, and nutritional deficiencies. HIV/AIDS is part of Group I but is kept separate in the SA NBD analysis due to the size of the burden that it contributes in South Africa.

Group II are the non-communicable causes.

Group III are the injuries.

Each group is divided into several major categories of causes of death, such as respiratory infections, diseases and injuries. The categories for the SA NBD study are identified by capital letters A–X shown in Table B1. These categories are further disaggregated into more specific causes of death (specific diseases or disease clusters). For the SA NBD study these specific causes are identified by the ZA codes 1 - 130 in Table B1. In some cases, where specific diseases may be of particular interest, such as the childhood cluster (ZA5), the disease codes are further disaggregated, in this case into pertussis, polio, diphtheria, measles, tetanus and rubella (ZA5a – ZA5f).

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 GBD study selected the specific diseases or disease clusters listed in the final level of disaggregation 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 SA NBD study.

For the South African Burden of (SA BOD) Disease List, modifications of the GBD list were required where local cause of death patterns differed from the GBD classification. For example, tropical-cluster diseases, with the exception of schistosomiasis, are not of much importance in South Africa, and were aggregated into one specific code, ZA9. In addition, some modifications, such as separating

the mental and nervous system disorder categories, were made in accordance with the Australian Burden of Disease Study cause of death classification (Mathers, *et al.*, 1999).

Foetal alcohol syndrome (FAS) and albinism, birth defects of particular importance in South Africa, were also included in the list. FAS (ZA27) has been assigned the ICD-9 code 760.7 and appears under perinatal conditions. Albinism (ZA56) has been listed under endocrine and metabolic disorders according to ICD-9 classifications (code 270.2). Other endocrine and metabolic disorders (ZA57) include other birth defects such as cystic fibrosis and haemophilia. Although these birth defects are included in the SA NBD list, the congenital abnormalities category (S) remains the classical congenital abnormalities as defined by the ICD-9 classification and does not encompass the abovementioned birth defects. Nor does it include congenital HIV, syphilis or rubella.

2.3 Projection model for overall mortality, AIDS mortality and population estimates

The Actuarial Society of South Africa has developed a suite of demographic projection models that take HIV/AIDS into account.¹ For the purposes of this study, we use the ‘lite’ version of the ASSA2000 model. It is a heterosexual behavioural demographic component projection model which we use to estimate and project overall mortality, the population size and the impact of AIDS mortality, as well as HIV incidence, for this study.

Briefly, the ‘lite’ version of the model treats the population of the country as one group and models the demographic impact of HIV/AIDS on the total population by assuming that the population (those aged 15 – 59 at the start of the epidemic and those turning 14 in each subsequent year) can be divided by risk into the following groups:

Age (young: under 15, adult: 15 – 59 and old: 60+ years)

‘behaviour’ comprising four risk groups:

- PRO – a small, high-risk group comprising sex workers and clients;
- STD – a much larger group, assumed to be at similar risk of transmitting/contracting the virus as people who regularly contract STDs;
- RSK – an even larger group who are at risk because of their sexual behaviour, but do not have an STD;
- NOT – a similarly sized group who are assumed never to be at risk.

¹ Actuarial Society of South Africa 2001. The ASSA2000 model can be downloaded from the web page of the AIDS sub-committee of the Actuarial Society of South Africa.

www.assa.org.za/information/AIDS/AIDSmodel/

In terms of HIV, it is assumed that the median term to death is 11 years for people infected when they are less than 25 years and 10 years when infected at an age older than 25 years. The model assumes that twenty five percent of babies born to HIV-positive mothers are infected at birth and that these children have a mortality rate of 30% per annum. Children who contract the virus three or more months after birth through breast milk have a median time to death of six years.

The basic mortality assumptions of the model are that for adults, the level of the non-HIV mortality has been set to the level estimated for 1985 by Dorrington, *et al.* (1999). These estimates are derived through the synthesis of the official life tables for whites, coloureds and Indians published by the national statistical office with the estimated life table for blacks. The detailed analysis of all the mortality data for the period 1985 onwards, based on vital registration, survey and census data, suggests that the level of adult mortality has been stable over the period until the late 1990s when it started to increase, in step with the HIV/AIDS epidemic (Timæus, *et al.*, 2000).

The level of childhood mortality has been estimated using the 1996 census and the 1998 Demographic and Health Survey (DHS), both of which give historical trend information. Both data sources confirm a reversal of the downward trend of childhood mortality indices although there are differences in the estimated levels (Nannan, *et al.*, 2000). Adjustments are made to both sets of estimates due to differences and inherent biases in the methodologies. An upward adjustment is made to the DHS data because child mortality rates were underestimated in three provinces (Western Cape, Free State and North West). This adjustment suggests that the national average should be increased by a factor of 6.1% (Department of Health, Medical Research Council, Macro International, 2002). The second adjustment refers to the census estimate of under-five mortality considered too high due to the inclusion of stillbirths incorrectly classified as live births who have died. An adjustment factor to reduce the level by 22% is used to correct for this (Moultrie and Timæus, 2002).

The population in ASSA2000 is projected from a base of 36 million in 1985, consistent with a projection from the 1970 census, considered to be one of the more reliable censuses taken in South Africa, albeit for segregated population groups. The population projection for 1996, is 41.5 million, larger than the Statistics South Africa figure of 40.4 million which is considered to have undercounted young children and working age men. The fertility has been assumed to follow the pattern observed in the DHS and to continue declining.

The ASSA2000 model has been calibrated to reproduce the antenatal clinic data since these are the most representative and reliable data available concerning the HIV/AIDS epidemic in South Africa. (An adjustment is made to the antenatal prevalence as it is assumed to be higher than the community prevalence as it is based on the women who have clearly had unprotected sex). The model has also

been calibrated against the most recent mortality estimates available namely the death data recorded by the Department of Home Affairs, after correcting for under-reporting and deaths without identify documents (Dorrington, *et al.*, 2001). The antenatal clinic survey data for the early years had to be adjusted downwards to match the later years of the antenatal survey and the mortality data. This was considered reasonable on the basis that the clinic selection had not been random in the early years of the survey.

For the year 2000 (July 2000 – June 2001), the ASSA model estimates a total population of 45 million, a total number of deaths due to all causes of 556 585 and a total number of AIDS deaths of 165 859. The estimates for key indicators of mortality are shown in Table 2.1 and the age-specific death rates are shown in Figure 2.1. The model is used to estimate the total number of deaths and the number due to AIDS for each age and sex group for this study. Mortality for males is heavier than for females, resulting in a shorter life expectancy.

Table 2.1: Mortality and population estimates for 2000 based on ASSA2000

Indicator	Male	Female	Persons
Infant mortality rate (per 1 000 live births)	62	56	59
Under-5 mortality rate (per 1 000 live births)	98	91	95
Total deaths	303 081	253 504	556 585
Adult mortality $_{45}q_{15}$	49.4	35.7	42.9
Life expectancy	52.4	58.5	55.2
Total population	22 067 941	23 013 069	45 081 010

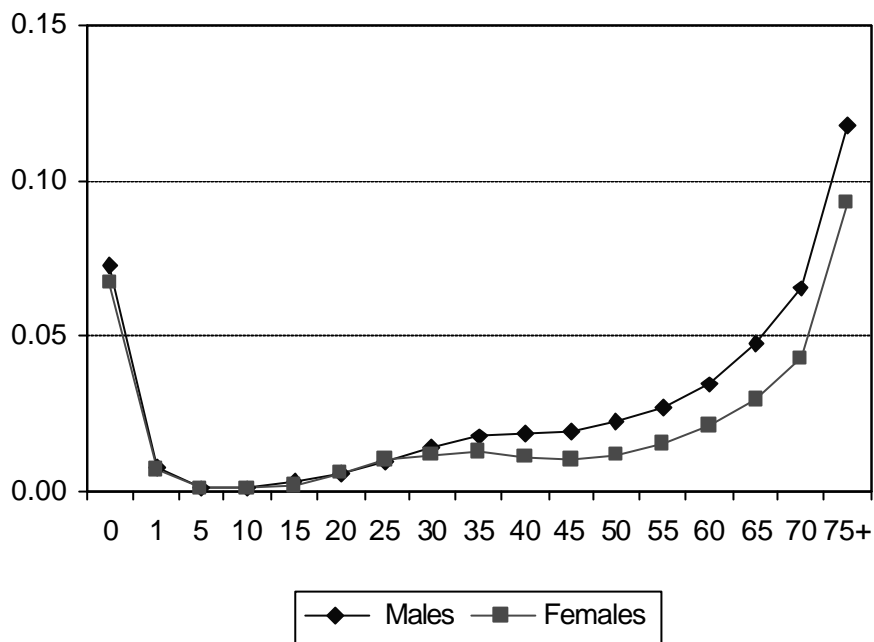


Figure 2.1: Estimates of age-specific death rates in 2000 using ASSA2000

2.4 Cause of death data

This study uses three reporting systems as the main sources of cause of death information. Firstly, the cause of death data compiled and reported by Statistics South Africa (Stats SA) for the year 1996 (Stats SA, 2000) are used to estimate the profile of natural causes of death that are not due to AIDS. This information is captured from the death notifications processed and archived by the Department of Home Affairs. The causes of death are coded according to the ICD-9 codes by Stats SA. The ICD is used to translate a disease or injury diagnosis into a code which facilitates management of the data. South Africa has adopted the format proposed by the WHO, whereby the patho-physiological sequence of diseases leading to death are reported on the death certificate. There are four parts to the ‘cause of death’ section on the death certificate. The underlying cause of death is the most important and must be specified as accurately as possible. This is the disease or injury that initiates the sequence leading ultimately to death – were it not for this particular cause, the patient would be alive. Although Stats SA has put out an advance release for 1997 – 2000 (Stats SA, 2001) which documents the changing age pattern of deaths and has recently completed processing a sample of the death notifications for the period 1997 – 2001 (Stats SA, 2002), 1996 is the most recent year for which the full cause of death details are available. Furthermore, 1996 was relatively early in the AIDS epidemic and largely reflects the non-AIDS cause of death profile.

There were 327 253 deaths reported in South Africa for 1996, comprising 186 538 male deaths, 140 530 female deaths and 185 deaths where sex was unknown. When compared to estimates based on the ASSA2000 model, it was found that 80% of all the deaths were registered. This is somewhat higher than the preliminary estimate of completeness by Stats SA that suggested that these data reflect 67% of all the deaths that occurred in that year (Stats SA, 2000), but is in keeping with the finding (Dorrington, *et al.* 2001), based on indirect demographic techniques, that 85% of adult deaths (15+) are registered.

The 1 376 deaths that had missing details about sex or age were excluded from the analysis. Over 96% of the recorded deaths were certified by a medical practitioner; a substantial increase from the 1995 figure of 80%. Deaths due to external causes (injuries), generally did not have the manner of death specified and are consequently classified as having an external cause with undetermined cause and undetermined intent (Bradshaw, *et al.*, 2002). It was therefore not possible to use this source of data for the causes of injury death.

Secondly, data from the Population Register compiled by Home Affairs are used to analyse external causes of death from 2000. A routine system has been established whereby the basic details of all the deaths that are registered are provided by the Department of Home Affairs on a monthly basis as part of a rapid surveillance system. One of the limitations of using this data set is that the register only includes the deaths of people with a South African identity document. Another problem is that children are often unregistered and causes of death as written on the death certificate are not necessarily the underlying cause, but one of several.

These data provide invaluable insight into the changing age pattern of death and have been used in estimating the levels of mortality, but the cause of death information is limited – often merely indicating whether the death was due to a natural or unnatural cause, or reflecting the immediate cause of death. A programme has been written to recognise a range of English and Afrikaans words that would indicate unnatural causes. This includes general words such as ‘unnatural’ and ‘onnatuurlik’ and specific manners of death such as ‘motor vehicle accident’ and ‘gunshot’. This was used to identify the deaths due to external causes. A comparison of this data for 1996 with the cause of death data from Stats SA for the same year, shows that the data from Home Affairs overestimates the external causes in children. Table 2.2 shows the proportions of deaths due to external causes based on the Home Affairs data compared with the full cause of death data for 1996. Due to the requirements of the Inquest Act, it is plausible that there is a bias towards better documentation of the external causes in the young ages, compared to natural causes in the same age group. The Act stipulates that any unnatural cause of death needs to be investigated.

Table 2.2: Proportion of deaths due to external causes based on Home Affairs (HA) data and Stats SA data for 1996, by age and sex

Age	Males		Females	
	HA %	Stats SA %	HA %	Stats SA %
0-4	23.6	9.1	18.6	8.0
5-14	64.1	57.1	52.3	46.8
15-24	76.9	77.0	33.1	32.1
25-34	56.4	58.1	22.1	24.0
35-44	35.7	36.9	17.8	19.2
45-54	18.6	20.0	10.3	11.0
55-64	8.6	9.4	5.1	5.5
65+	3.5	4.1	2.1	3.0

The third source of information is data from the National Injury Mortality Surveillance Study (NIMSS) for the years 1999 (Butchart, 2000) and 2000 (Burrows, *et al.*, 2001). This surveillance system captures fatal injuries or external causes of death in 16 sites around the country. Extensive details about the manner of death are included, based on the mortuary records including police records, autopsy records and the death notification. This data source is used to estimate the profile of the manner of death for the external causes. Due to the extensive urban bias in these data, the NIMSS injury profile was compared with those from the Hlabisa and Agincourt Demographic Surveillance Systems representative of rural areas of the country.

2.5 Estimation of deaths

2.5.1 Estimation of total external deaths (Group III)

The proportion of deaths due to external causes in the year 2000 calculated from the Home Affairs data has been multiplied by the total number of deaths estimated for the study using ASSA2000 to estimate the total number of deaths due to Group III causes. This is done in five-year age groups for males and females separately. To check the plausibility of this estimate, the age-specific injury deaths rates based on these estimates were compared with the rates observed in the Cape Metropolitan Study (CMS) of 1990, reanalysed by the MRC's Burden of Disease Research Unit (Norman, 2002), as well as the rates estimated for the sub-Saharan Africa region in the 1990 GBD study (Murray and Lopez, 1996b).

Figure 2.2 shows a marked difference in the estimated rates for the year 2000 in the young age group, but very similar trends in the ages 15 years plus. In the 0 – 4-year age group, the estimated death rate was the highest, with CMS the lowest and sub-Saharan Africa somewhere inbetween.

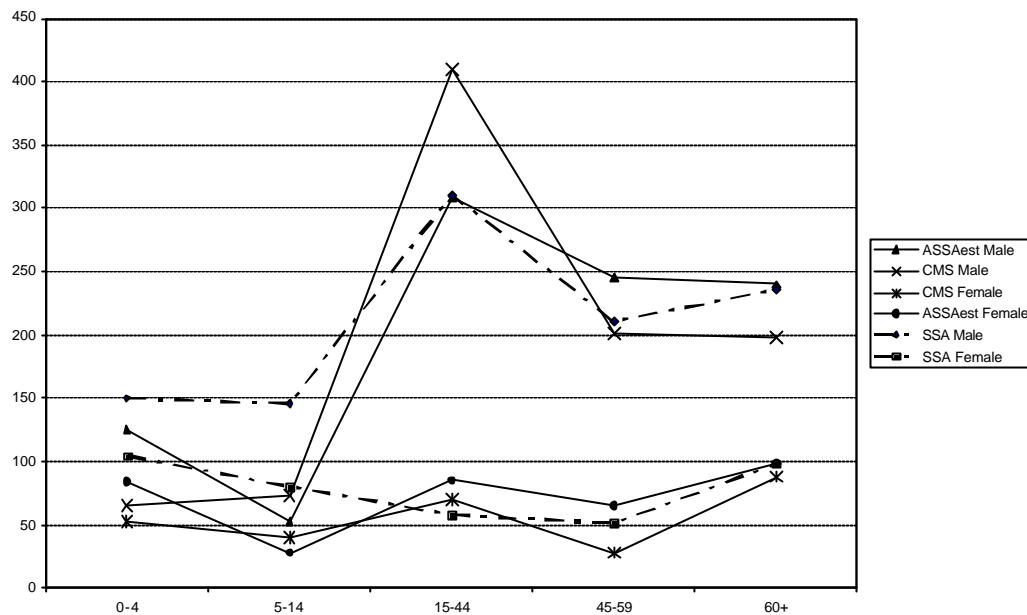


Figure 2.2: Comparison of estimated injury death rates SA (NBD) with Cape Town Metropolitan study (CMS) and sub-Saharan Africa estimate (SSA)

The assessment of the proportion of deaths due to external causes (Group III) based on the Home Affairs data with the Stats SA data for 1996 (Table 2.2) indicated that the Home Affairs proportion is generally similar to the Stats SA data but was about twice as high in the under-five year olds and slightly lower in the older age groups. This suggested that the under-registration of child deaths is disproportionate for natural causes. On the basis of both these assessments, it was decided to halve the estimated number of injury deaths in the under-five year old age group for the SA NBD. Since the number of deaths involved in the oldest age group is not high, it was decided not to adjust the estimate for those ages. The total number of injury deaths in 2000 was estimated to be 68 930, having subtracted 4 485 deaths (i.e. 50%) in children under-five years.

Alternative sources provided conflicting numbers of injury deaths. These included 80 000 injury deaths from the Forensic Audit (National Forensic Pathology Service Committee, personal communication) and just over 32 000 from the South African Police Service (SAPS): Crime Information Analysis Centre, (personal communication). However, on closer examination it was found that none were completely comparable as they were from different time periods and had different exclusion criteria. The alternative data sources are summarised in Table 2.3. This suggests that there has been a decline in the number of injury deaths over the period 1996 – 2000 and that there is coherence between the Stats SA number for 1996, as adjusted in this study, the Forensic audit for 1997 and the series based on a crude adjustment of the Home Affairs (HA) data and the final South African NBD estimate for 2000.

Table 2.3: Estimates of the number of injury deaths from alternative data sources, 1996 – 2000

Year	Stats SA		Forensic audit	HA		SAPS+	SA NBD
	Reported	Adjusted*		Reported	Adjusted#		
1996	61 303	91 634 (Stats SA) 81 737 (MRC)				39 725	
1997			+/- 80 000	47 077	72 354	38 090	
1998				47 904	73 626	38 015	
1999				44 748	68 775	35 989	
2000				41 537	63 839	32 409	68 930

* adjusted for estimates of completeness (Stats SA - 66.9% complete; MRC - 75% complete).

adjusted for proportion without ID or under 15 years of age and completeness of registration (Dorrington, *et al.*, 2001).

+ includes homicide and culpable homicide.

2.5.2 Estimation of natural deaths (Group I and II deaths)

The ASSA2000 model is used to estimate the number of AIDS deaths and the 1996 cause of death data are used to estimate the cause of death profile for Groups I (excluding HIV/AIDS) and II. However, a substantial number of deaths are categorised as ‘Ill-defined’ (ICD-9: 780-797, 799). Deaths due to ‘Ill-defined’ causes are reassigned to specific causes of death in order to obtain the best possible estimate of the magnitude of each cause of death category. In the first step, a multinomial model is used to redistribute the ill-defined category to Group I and Group II and thereby estimate proportions in each age sex group that are due to Group I and Group II causes. It should be noted that although the proportion of deaths categorised as ‘ill-defined’, has declined since 1990, there is still a sizable proportion (14.8%), in 1996 (Table 2.4).

Table 2.4: The proportion of ‘Ill-defined’ registered deaths in 1990 – 1996.

Year of registration	Number of deaths	% Ill-defined
1990	148 658	21.8
1992	177 841	23.0
1994	213 279	16.6
1996	325 877	14.8

The multinomial model was fitted to the 1996 cause of death data by assuming that the true proportions of deaths in Group I, Group II and Group III are θ_1 , θ_2 and θ_3 respectively, where

$\Sigma\theta_i = 1$. If the observed proportions of deaths in these groups are π_1, π_2 , and π_3 and the proportion of ill-defined deaths is π_4 then $\Sigma\pi_i = 1$, for each of the covariates: age group, sex, metropolitan/non-metropolitan region.

Let p be the probability of a Group I or Group II death being misclassified as ill-defined, and reparamaterise the working probabilities:

$$p_1 = pq_1 \quad p_2 = pq_2 \quad p_3 = 1 - q_1 - q_2 \quad p_4 = (1 - p)(q_1 + q_2)$$

The response functions to be modelled are then:

$$\log \left(\frac{p_1}{p_2} \right) = \log \left(\frac{q_1}{q_2} \right)$$

$$\log \left(\frac{p_1}{p_2} \times \frac{p_1 + p_2 + p_4}{p_1 + p_2} \right) = \log \left(\frac{q_1}{q_3} \right)$$

which gives \hat{q}_i where $i = 1, 2, 3$.

The modelling was done using Proc Catmod in SAS (SAS Institute Inc., 1999) and specifying the two response function in the RESPONSE statement. These functions are generalised logits. They enable the inclusion of the covariates with the following log-linear model:

$$\mathbf{q} = \exp(\mathbf{Xb})$$

The covariates considered in the model included SEX (male/female), AGE GP (0, 1-4, 5-9, ..., 95+) and AREA (metro, non-metro). The most parsimonious fit was a model with the abovementioned covariates all significant ($P < 0.0001$) and also two interaction terms AGE GP with SEX ($P < 0.0001$) and AGE GP with AREA ($P < 0.0001$), where $P = 0.0510$ of the residual indicates that the model fits. The analysis of variance for the selected model is shown in Table 2.5.

Table 2.5: The analysis of variance for the multinomial model

Analysis of variance			
Source	DF	Chi-Square	Pr > ChiSq
Intercept	2	14 719.3	<.0001
AGEGP	40	81 108.8	<.0001
SEX	2	781.6	<.0001
AREA	2	237.2	<.0001
AGEGP*SEX	40	3 442.5	<.0001
AGEGP*AREA	40	318.5	<.0001
Residual	42	58.01	0.051

Applying the model estimates, a set of probabilities for Group I, Group II and Group III in 1996 can be calculated for each combination of the three covariates, taking the best fit into account. For each age and sex group, the relative proportions of Group I and Group II causes are calculated (i.e. ignoring the Group III proportion in the 1996 data) and applied to the remaining total from the ASSA2000 estimate having subtracted the number of external deaths and the AIDS deaths. The estimation process is shown in Figure 2.3 and the overall proportions are shown in Table 2.6.

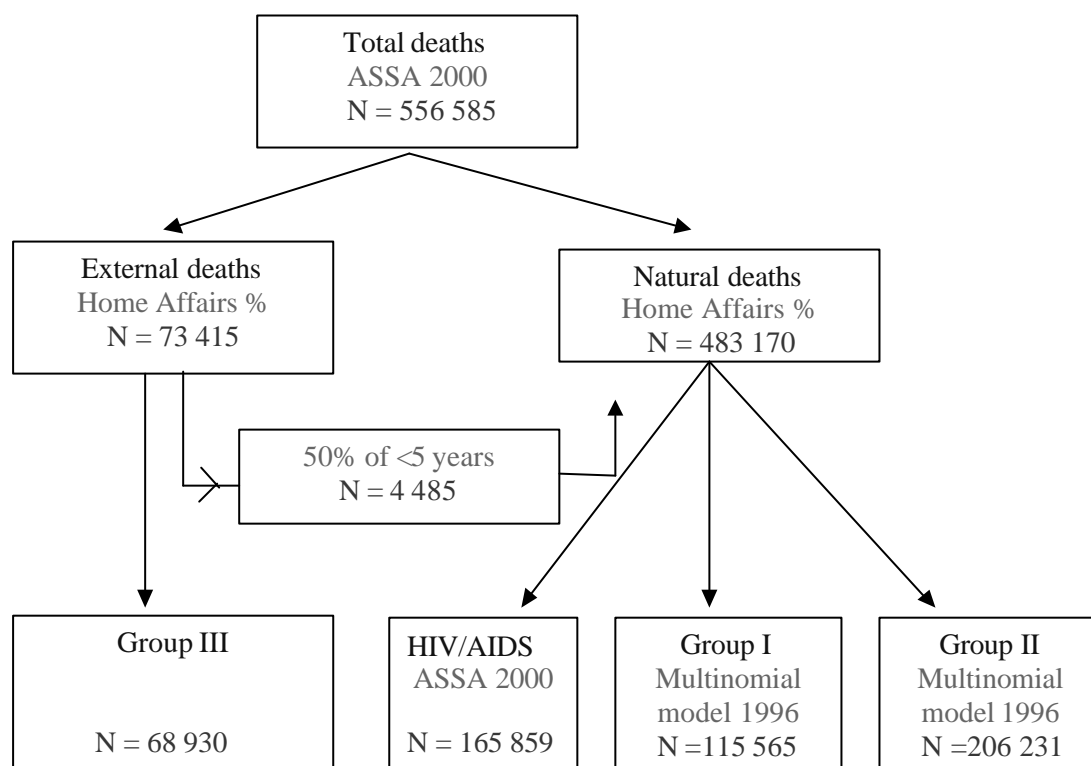


Figure 2.3 Schematic diagram of the estimation of total deaths in South Africa, 2000

Table 2.6: The estimated number of deaths in each group and HIV/AIDS

Group	Estimated deaths	Percentage
HIV/AIDS	165 859	29.8
Other Group I	115 565	20.8
Group II	206 231	37.1
Group III	68 930	12.4
Total	556 585	100

2.5.3 Estimation of causes of death in Groups I and II

Vital registration is known to under-represent maternal deaths (Graham, *et al.*, 1989). The number of maternal deaths, estimated from the proportion reported in 1996, was therefore increased by an arbitrary factor of 2, yielding a maternal mortality ratio of 144 per 100 000 live births when compared with the estimated births using the ASSA2000 model. This is in keeping with the estimate of 150 obtained from the South African Demographic and Health Survey (Department of Health, MRC, Macro Int, 2002), for the previous 10 years using the sisterhood method.

Deaths due to ill-defined causes are reassigned to specific causes of death in order to obtain the best possible estimate of the magnitude of each cause of death category. The ICD-9 Chapter XVI 'Symptoms, signs and ill-defined conditions' (ICD-9: 780-797, 799), are the most important and have been reallocated to Group I and Group II using the multinomial model described above.

The small ill-defined categories included in some ICD-9 Chapters such as the ill-defined perinatal conditions (ICD-9: 779), ill-defined cancers (ICD-9: 195-199) and ill-defined congenital abnormalities (ICD-9: 759) were redistributed proportionally by age and sex across the specific diseases within the appropriate SA NBD categories. Thus, ill-defined perinatal conditions were redistributed proportionally by age and sex across all the conditions listed under the category perinatal conditions (D) covering codes ZA23-28, ill-defined cancers across all the malignant neoplasms (F) covering codes ZA32-53 and the ill-defined congenital abnormalities across all congenital abnormalities (S) covering codes ZA107-112.

Certain cardiovascular codes have been termed 'garbage codes' by the GBD and need to be redistributed to actual underlying causes. The cardiovascular garbage codes are: heart failure (ICD-9: 428), cardiac dysrhythmia (ICD-9: 427), pulmonary oedema (ICD-9: 514) and atherosclerosis (ICD-9: 440). These are complications of cardiac disease and do not reflect the actual underlying cause of death. A few experts in cardiology were consulted to assist with the redistribution of these 'garbage codes'. These codes accounted for a high proportion (35%) of the 64 945 deaths due to cardiovascular causes, including stroke. The experts recommended that cardiac dysrhythmias, heart failure, pulmonary oedema and ill-defined cardiovascular conditions be redistributed proportionally, by age and sex, across all cardiovascular causes of death, namely rheumatic heart disease (ZA78), ischaemic heart disease (ZA79), inflammatory heart disease (ZA81), hypertensive heart disease (ZA82) and non-rheumatic vascular heart disease (ZA83) but not stroke (ZA80). The following algorithm was recommended for redistributing the deaths due to atherosclerosis: 60% to ischaemic heart disease (ZA79), 20% to stroke (ZA80), 15% to aortic aneurism (ZA85) and 5% to peripheral vascular disease (ZA86).

In addition other codes are reassigned to more specific cause of death categories or disease clusters. Using expert medical opinion, the following codes were reallocated: pleural effusions (ICD-9: 511) to tuberculosis (ZA1); pulmonary oedema (ICD-9: 514) to heart failure (which in turn was redistributed); gastric haemorrhage (ICD-9: 578) 50% to peptic ulcer (ZA92) and 50% to liver cirrhosis (ZA93); and liver diseases and sequelae of chronic liver disease (ICD-9: 572) to liver cirrhosis (ZA93).

2.5.4 Estimation of causes of deaths in Group III (injuries)

Unfortunately, since 1991, information on the cause of death due to injuries has been missing from the routine national vital statistics compiled by Stats SA. The cause of death distribution for injuries for the years 1988/89, a period prior to the lowest levels of completeness, is available but considered to be too outdated for this study. The data sets for 1999 and 2000 from the National Injury Mortality Surveillance System (NIMSS), which was established to provide national information about the cause of death due to injuries in 1999 (Butchart, *et al.*, 2000), were made available for this study and will be described in more detail below.

NIMSS is a mortuary-based system capturing information on the cause of fatal injuries from sentinel sites. During 1999, 14 829 fatal injuries were recorded at 10 mortuaries in five provinces, accounting for approximately 25% of the estimated 60 000 fatal injuries occurring annually in South Africa. During 2000, 18 876 fatal injuries were recorded at 15 mortuaries in five provinces, accounting for 24 – 29% of all non-natural mortality (Burrows, *et al.*, 2001). This source of data is the only recent source available for estimating the cause of death distribution for injuries on a national level.

There were 33 630 unnatural fatal injuries in the combined 1999 and 2000 NIMSS data set. Information on age, sex, manner of death, cause of injury and scene of injury was available. Cases where sex or cause of injury were unknown were excluded from further analysis (298). All the cases where the manner of death was undetermined were excluded (3 876), with the exception of deaths due to poisonings (145), burns (406) and medical procedures (360). These were included under accidental deaths, as a comparison of the cause of death distribution between the homicide, suicide and accidental deaths, and the undetermined manner of death category revealed that these were disproportionately high in the undetermined group.

Further abnormalities in the data were noted: Sudden infant death syndrome (SIDS) and stillbirths (10) were included in both intentional and unintentional injury deaths and were excluded from further analysis. Suicides (four) in children under five years of age were also excluded. The cause of death

was coded as natural in a number of cases where the manner of death was coded as homicide, suicide or accidental. The exact cause was considered undetermined in these cases.

There were a large number (4 497) of cases where the age was unknown. These were redistributed proportionally by age and sex within homicide, suicide and each of the unintentional causes. The NIMSS cause of death codes were recoded to the SA NBD List of injury codes.

This cause of death distribution was then applied to the age- and sex-specific SA NBD estimates of injury deaths for 2000 to get the first injury cause of death distribution estimate for the SA NBD.

Additional sources of data were used to assess the coherence of these estimates, including:

The SAPS Crime Information Analysis Centre which compiles data on homicide and culpable homicide.

The Department of Transport which collects information on road traffic accidents.

The Department of Minerals and Energy, which collects statistics on mining accidents.

The forensic audit conducted through the Department of Health in 1998.

Since the mining deaths were far less than those reported by the Department of Mineral and Energy, these were increased from 28 to 122 in the NIMSS recoded data to reach a total of 300 in the final injury estimates. These 122 deaths were deducted from the other unintentional deaths category in the NIMSS recoded data.

The SA NBD injury cause of death distribution was then compared with the injury cause of death distributions from the 1988/89 Stats SA death data, 1994 Cape Metropole Mortality Study (Lerer, *et al.*,1997), the 1990 Cape Metropole Study (Norman, 2002) and the Agincourt and Hlabisa surveillance systems. In all these studies, homicide and road traffic accidents accounted for the majority of deaths with a large predominance of males over females. In addition, the SA NBD age and sex distribution for the major causes of injury deaths (homicide, RTAs, suicide, fires, and drowning) were compared with the alternative sources mentioned above. These distributions were, without exception, all very similar.

A comparison of the estimates of total deaths for homicides show that the SA NBD study estimate is reasonable in comparison with the Department of Home Affairs (HA) and higher than the SAPS data, see Table 2.7. However, a comparison of the estimates of deaths for road traffic accidents suggests that the NBD study estimate is about double the number of deaths reported through the Department of Transport. This is a substantial difference. One possible reason could be that the accident reports on which Department of Transport statistics are based, include only deaths at the scene of the accident and exclude deaths that occur on the way to hospital or at some later point. The discrepancies in

homicide statistics and transport statistics require further investigation. However, given the agreement noted for the total number of injury deaths, particularly with the forensic audit, it is inevitable that our estimates for specific causes have to be higher than the reported numbers from these other sources.

Table 2.7: The number of homicides reported and estimated from various sources

Year	SAPS +	HA #	SA NBD
1996	25 782		
1997	24 588	34 079	
1998	24 875	34 678	
1999	23 823	32 393	
2000	21 683	30 068	32 482

+ Homicide only

Estimated by applying the proportion of injury deaths (47.1%) due to homicide observed in NIMSS to the adjusted number of injury deaths taking into account those without IDs and completeness of registration (Dorrington, *et al.*, 2001).

Table 2.8: The number of road traffic accidents reported and estimated from various sources

Year	Dept Trans	HA #	SA NBD
1990	11 464		
1991	11 385		
1992	10 380		
1993	9 762		
1994	10 285		
1995	10 533		
1996	10 084		
1997	9 935	19 319	
1998	9 288	19 658	
1999		18 363	
2000		17 045	18 443

Estimated by applying the proportion of injury deaths (26.7%) due to RTAs observed in NIMSS, to the adjusted number of injury deaths (DOHA) taking into account those with and without ID documents, and completeness of registration (Dorrington, *et al.*, 2001).

2.6 Years of life lost (YLLs)

The GBD approach for measuring the disease burden due to premature mortality has been adopted from the Standard Expected Years of Life Lost method. The expectation of life at a given age is used as an optimal value from which to calculate the loss of life associated with the specific death at a particular age. The standard used was the highest observed in any population by 1990, that of Japanese women (82.5 years life expectancy at birth). The equivalent age-specific expectations of life for females are taken from the Coale and Demeny West Level 26 model life tables (Coale and

Demery, 1966). The age-specific expectations of life for males with a life expectancy at birth of 80 years is taken from West Level 25.

The number of years of life lost (YLLs) due to premature mortality are then calculated as the difference between a selected life expectancy and age at death. This National Burden of Disease Study estimates YLLs using the life expectancies that the GBD used for purposes of comparison and as a means of gauging the extent of the 'gap' between the existing health status and that which is achievable.

In addition, the age-weighting parameter used in the GBD study and discounting of 3% have been used for the calculation of YLLs (Appendix A).

2.7 Years lived with disability (YLDs)

The YLD is the disability component of the DALY based on non-fatal health outcomes. Disability has many dimensions including pain, discomfort, physical dysfunction, emotional distress, inability to carry out usual activities and loss of dignity, among others. The YLD takes the severity and duration of the disability into account using the basic formula (Mathers, *et al.*, 2001):

$$YLD = I \times DW \times L$$

I is the number of incident cases for the reference period

DW is the disability weight in the range 0 – 1

L is the average duration of disability (measured in years)

The duration can be modulated to incorporate discounting and age weighting in the same fashion as for YLLs. The data requirements for the computation of YLDs are (disaggregated by age and sex):

Incidence of disability

Duration of disability

Age of onset

Distribution by severity class

Estimation of YLDs is the most difficult component of a national BOD study. For most diseases information on incidence and duration is generally not available. Rather the prevalence of a disease or the disabling sequelae are more likely to be known. Estimation of incidence and average duration from prevalence requires additional information on remission and relative risk or case fatality rates. As little is known of these parameters, there is a tendency to rely on the few studies carried out around the world to provide the estimates (Harvard Burden of Disease Unit and WHO, 2001). The

computation is further complicated as there are a number of diseases that have a large disability component, and, in addition, may have various levels of severity of symptoms or the disability may have various stages. Examples of the former include certain psychological conditions, such as depression or anxiety disorders and examples of the latter include some cancers. Injuries may have multiple disabling effects or sequelae, also at different levels of severity (Harvard Burden of Disease Unit and WHO, 2001).

Disability is coded according to the nature of the disability whether it is short-term or life-long. In addition, there are severity weights for disability that depend on treatment status, i.e. treated or untreated.

It is also necessary to consider co-morbidity, which concerns the quantification of the effect of more than one disease affecting the same individual. The GBD 1990 used an additive model, in which, for the same individual, the average time spent in two different health states are combined. Adjustments have not been made for co-disability, except for some important examples of dependent co-disability (Murray and Lopez, 1996a). The current GBD 2000 work being undertaken by the WHO is examining co-morbidity in more detail.

2.8 Estimation of YLDs

The main problem with attempting an NBD study in middle- or low-income countries, is the weak information base for disability for most diseases. (Bobadilla, 1996). Although the South African epidemiological database has improved, there remains a paucity of reliable morbidity information. The notification data for tuberculosis, malaria and sexually transmitted diseases are incomplete. The National Cancer Registry provides incidence data on a number of cancers but the limitation here is that submissions are based on the histologically confirmed cases and therefore rates must be interpreted cautiously. Some morbidity data have been collected in surveys such as the 1998 DHS. These include respiratory diseases, self-reported work-related illness and injury. These fragmented data do not provide the detail required to accurately estimate the YLDs. However, non-fatal health conditions need to be included to ensure that they receive adequate policy attention, as they contribute substantially to BOD measures. The Mexican NBD study demonstrated the large increase in disease burden (42%) when disability is included with mortality (Lozano, *et al.*, 1995). The English BOD study also showed that disability accounts for 48% of the burden of disease and changes the ranking of diseases based on mortality alone (Bowie, *et al.*, 1997). The Zimbabwe study reported that 24% of the burden of disease was due to YLDs (Zimbabwe Burden of Disease Committee). For the initial SA NBD study, local YLDs will not be calculated from morbidity data. Instead YLDs will be estimated making use of ratios based on the GBD 2000. This is done for illustrative purposes and to have some

preliminary figures for DALYs in South Africa. Following the example of the first GBD study, the initial South African study will estimate for the disease categories only and not for single diseases and conditions.

Some medical classifications have only a mortality component, for example suicide, whereas others have negligible excess mortality and a large non-fatal component such as some psychological disorders. Between these two extremes, lies a whole spectrum of differing morbidity/mortality ratios for different diseases and injuries. The YLD component of the DALY was estimated by using the YLD/YLL ratios from the GBD 2000 estimates representative of the Afro E region (WHO, 2001) illustrated by the following relationship:

$$YLD_{SA} = YLL_{SA} \times YLD_{GBD}/YLL_{GBD}$$

The YLD/YLL ratios from the Afro E region are shown in Appendix C. There are two mortality strata for Africa in the GBD 2000 namely Afro E and Afro D. Afro D has high child and high adult mortality and Afro E has high child and very high adult mortality. South Africa falls into the Afro E region and hence these estimates were considered to be the most appropriate for South Africa. As the South African BOD list does not correspond exactly with the GBD 2000 cause list, where necessary, ratios for causes that appeared on the lists of other comparable GBD studies, namely, Zimbabwe, Mauritius and Australia were used.

Some conditions result in morbidity but not mortality such as the sense organ category (L), skin diseases (Q) and oral conditions (T). In these cases it is not possible to use the YLD/YLL ratio approach. Instead, the proportion of the total YLDs that was observed in the Afro E region for each of the abovementioned categories was applied to the South African YLDs, once all the others had been estimated. South Africa does have epidemiological data for congenital abnormalities and estimates for HIV/AIDS generated from demographic models, enabling estimates of disability for these two conditions. In addition, an alternative approach using the Cape Town Metropolitan study (Norman, 2002) could be used to estimate local YLDs for injuries.

Congenital abnormalities

The South African Birth Defects Surveillance System (SABDSS) has data representative of the period 1995 – 2000 (SABDSS, 2001). The overall congenital abnormalities incidence rate was taken as 20.0 per 1 000 live births (excluding stillbirths). Our interpretation of birth defects has been a narrow one, only considering those conditions falling within the chapter ‘Congenital Abnormalities’ in ICD-9 (rubrics 740 to 759). It thus excludes, for example, albinism and certain inborn errors of metabolism such as cystic fibrosis, as well as foetal alcohol syndrome.

The SABDSS, which monitors defects only during the immediate postnatal period, while the child is at the birth institution, is known to substantially underreport congenital heart disease. It was noted that, in terms of the empirical South African mortality data for infants under one year old, deaths due to congenital heart disease consistently exceed deaths due to neural tube defects (NTDs). The estimate for the NTD baseline incidence rate was then adjusted by the ratio of the congenital heart disease to NTD for deaths of infants under one year old. The resulting figure was checked against incidence rates from surveillance systems reported to the International Clearinghouse for Birth Defects Monitoring Systems (International Clearinghouse for Birth Defects Monitoring Systems, 1996), which had programmes capable of ascertaining congenital heart defects accurately. The resulting figures shown in Table 2.9 are consistent with these reported rates and are used in this study.

Table 2.9: Incidence of congenital abnormalities per 1 000 live births for South Africa, (1995 – 2000)

SA NBD Code	Condition	Incidence (per 1 000 live births)
ZA 107	Neural Tube Defects	3.5
ZA 108	Cleft lip/palate	0.3
ZA 109	Congenital heart disease	5.0
ZA 110	Congenital disorders of the GIT	0.8
ZA 111	Down's syndrome & other chromosomal abnormalities	2.0
ZA 112	Other congenital abnormalities & ill-defined	8.4
Total		20.0

Most of the disability weights and duration assumptions for the calculation of YLDs for congenital abnormalities are taken from the 1990 GBD study and applied to the South African data. However, in all cases, South African incidence rates and life expectancy are used. In other cases, the assumptions are a combination of those taken from the Zimbabwe study and our own.

These are in the cases of:

- (a) congenital heart disease where 50% of incident cases die before reaching their first birthdays and the remainder live on average for another 20 years;
- (b) neural tube defects where 50% of incident cases die before reaching their first birthdays and the remainder on average would not live beyond 30 years;
- (c) people affected by Down's Syndrome who, on average, would not live beyond 40 years;
- (d) Working out the disability weight for the 'other congenital and ill-defined' category was largely done by averaging the Australian weights for each condition included in this category. These are renal agenesis for males of 0.498 and females of 0.512; end-stage renal failure for all ages 0.3; disability weights for this category of 0.44. In order to build in the minor defects, we decided on a disability weight of 0.25. These people would live 80% of the life expectancy, e.g. 48.5 for men and 54.2 for women.

HIV/AIDS

The case sequelae and disability weights have been adapted from those used in the Australian NBD study and are shown in Table 2.10. However, the incidence and duration of the disease at each stage for different age groups have been derived from a staging model adapted from ASSA2000 which classifies individuals according to the WHO clinical staging system (personal communication – Leigh Johnson). Although the model does not explicitly model diagnoses it is possible to match the stages. The second stage has been designated a duration of 0 because in South Africa, (at least at the moment), the majority of people only discover their HIV status after becoming symptomatic. The 0 – 4 age interval comprises two groups with different duration assumptions for: (i) those born HIV-positive, and (ii) those infected through breast milk.

Table 2.10: Stages, disability weights and duration of HIV/AIDS for different age groups

	Stage	HIV+ no symptoms, no diagnosis	Diagnosed HIV+, no symptoms	Late HIV with symptoms	AIDS serious illness	AIDS terminal	Mean period to death (yrs)	
Age	Disability weight	0	0.2	0.31	0.5	0.95	M	F
0-4	HIV+ at birth	0.90	0.00	0.90	0.92	0.17	2	2
0-4	HIV+ via breast milk	2.46	0.00	2.46	0.92	0.17	6	6
5-24		5.85	0.00	4.48	1.97	0.21	11	11
25-54		4.68	0.00	3.58	1.57	0.17	10	10
55-64		2.85	0.00	2.18	0.96	0.10	9.25	10
65-74		1.87	0.00	1.43	0.63	0.07	4.69	7.82
75+		1.87	0.00	1.43	0.63	0.07	1.65	3.28

Injuries

In the case of injuries, YLDs were also estimated using the mortality and morbidity estimates based on the Cape Metropole Injury study. The Cape Metropole study (CMS) was undertaken in 1990 and constituted the first complete cross-sectional metropolitan trauma study in Africa. It was designed to obtain a representative sample of the fatal and non-fatal injury cases that occurred in both the public and private sectors. In an attempt to quantify the BOD due to injuries, YLLs and YLDs were calculated using the 1990 CMS data (Norman, 2002) and the CMS YLD/YLL ratio for each cause of injury was applied to YLLs obtained in this study for each sex and age category in order to estimate YLDs and subsequently DALYs. Estimates of YLDs for intentional and unintentional injuries based on the CMS ratio of YLD/YLL were compared with estimates in this study obtained by applying the Afro E ratios shown in Appendix C. Due to the small number of cases in certain age groups, it was only possible to calculate age standardised DALYs/1 000 for the five most common cause of injury categories.

2.9 2010 projection

The ASSA2000 model is used to project the total number of deaths, the number of AIDS deaths and the population for the year 2010. It is estimated that the total number of deaths will be 1 212 400 and the AIDS deaths will be 797 330. The estimated age-specific death rates for 2010 are shown in Figure 2.4 for males and females. This is done with a scenario of no intervention or no behaviour change. Since the number of AIDS deaths in the year 2010 depends largely on the number of people already infected, alternative scenario's on behaviour change will not affect the mortality estimates. However, a national programme to make antiretrovirals accessible would produce very different estimates for 2010.

Table 2.11: Mortality and population estimates for 2010 based on ASSA2000

(no-change scenario)

Indicator	Male	Female	Persons
Infant mortality rate (per 1 000 live births)	58	54	56
Under five mortality rate (per 1 000 live births)	111	105	108
Total deaths	611 969	600 431	1 212 400
Adult mortality $_{45}q_{15}$	82.6	77.0	79.9
Life expectancy	39.6	40.2	39.7
Total population	22 948 702	24 143 686	47 092 389

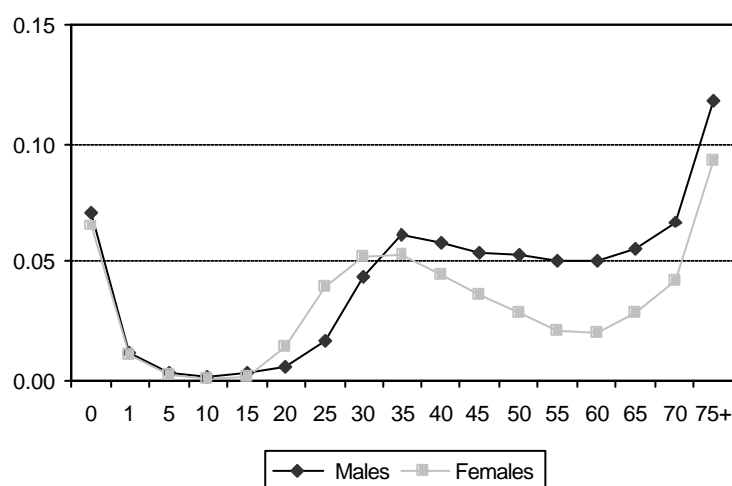


Figure 2.4: Estimates of age-specific death rates in 2010, using ASSA2000

3 Results

3.1 Mortality profile

The mortality profiles are based on 303 081 (54.5%) male and 253 504 (45.5%) female deaths estimated for the year 2000. The causes of death are shown for the broad Groups I, II, III and AIDS in Figure 3.1. The proportions of other infectious, maternal, perinatal and nutritional deficiencies comprising Group I and the non-communicable diseases are very similar for men and women while the proportions of deaths due to HIV/AIDS account for 34% of female deaths and 26% of male deaths. The greatest differences are seen in the proportions of deaths due to injuries of 17% for men and 6% for women.

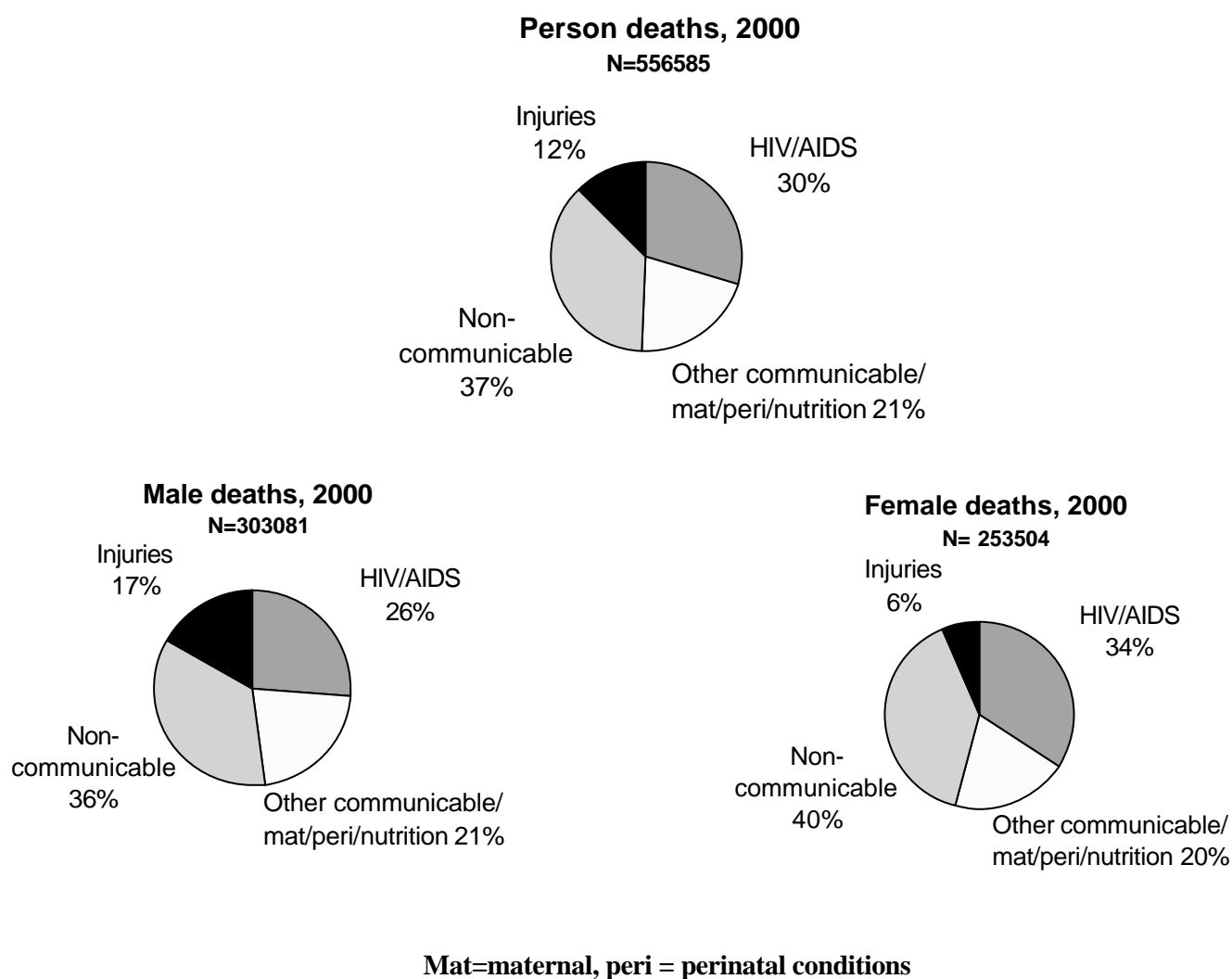


Figure 3.1: Estimated deaths by group, South Africa 2000

The age-specific cause of death profiles are shown in Figure 3.2. The number of deaths are presented by five-year age intervals for the three broad groups of causes and HIV/AIDS. The under-five-year age group is divided into infants less than one year of age and 1 - 4 year olds. HIV/AIDS deaths are exceptionally high for young adult men and women. Deaths due to injuries are very high in young, adult men. In addition, deaths due to other infectious diseases and HIV/AIDS are extremely high for boys and girls in the perinatal period.

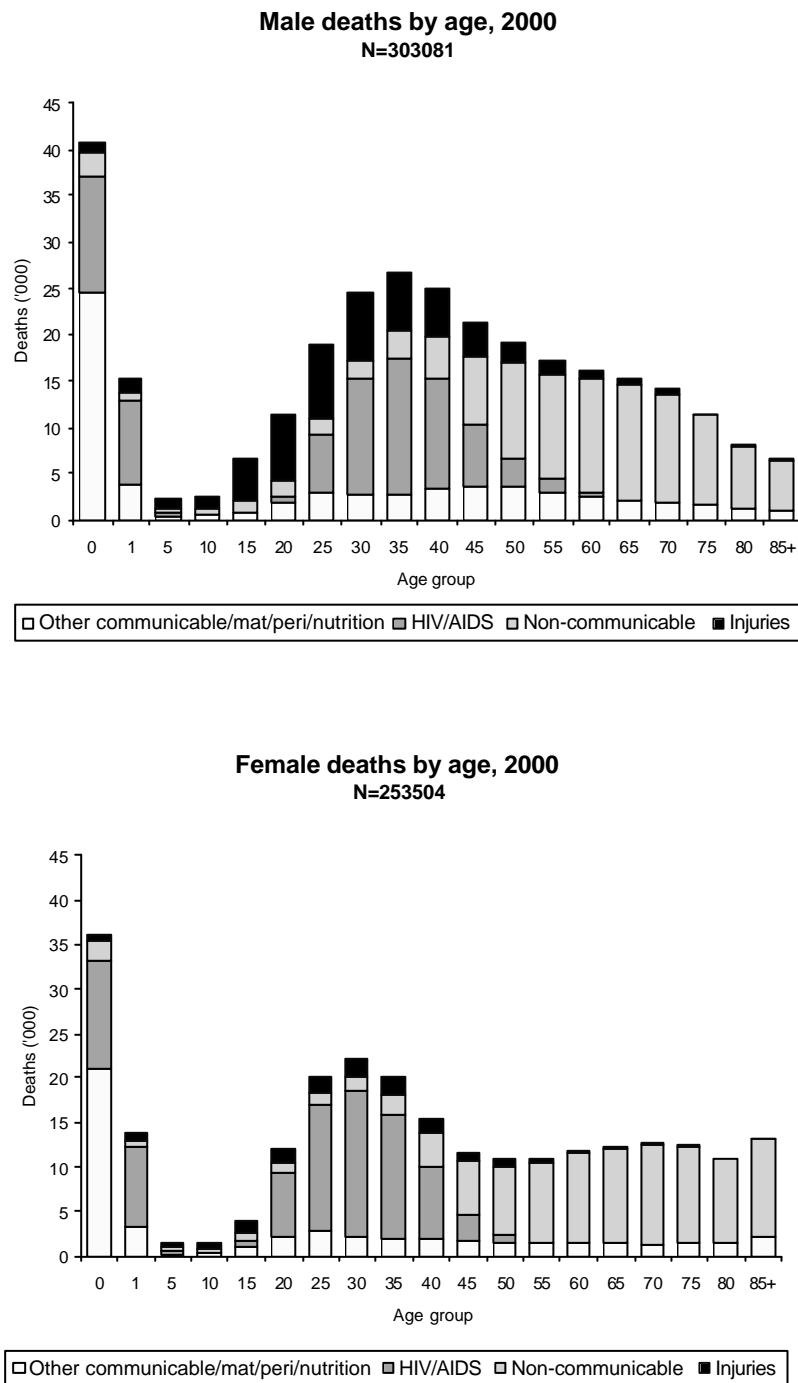


Figure 3.2: Age distribution of deaths by groups, South Africa 2000

The cause of death profile for the major categories (A-X) are shown in Figure 3.3. These are ranked in descending order by the persons total. This clearly shows the quadruple burden with HIV/AIDS, chronic diseases, poverty-related conditions and injuries all appearing among the top ten sub-categories of causes of death. HIV/AIDS is the leading cause of death accounting for 30% of all deaths. This is followed by cardiovascular disease (17%), infectious and parasitic excluding HIV (10%), malignant neoplasms (7%), intentional injuries (7%) and unintentional injuries (5%). Perinatal conditions, respiratory disease (chronic), respiratory infections and diabetes make up the balance of the ten leading sub-categories. There are some noticeable differences between males and females, with HIV/AIDS and cardiovascular disease accounting for a higher proportion of female deaths compared with males (34% vs. 26%; 19% vs. 14%, respectively). Injuries, both intentional and non-intentional, however, account for a much higher proportion of male deaths (11% vs. 3%).

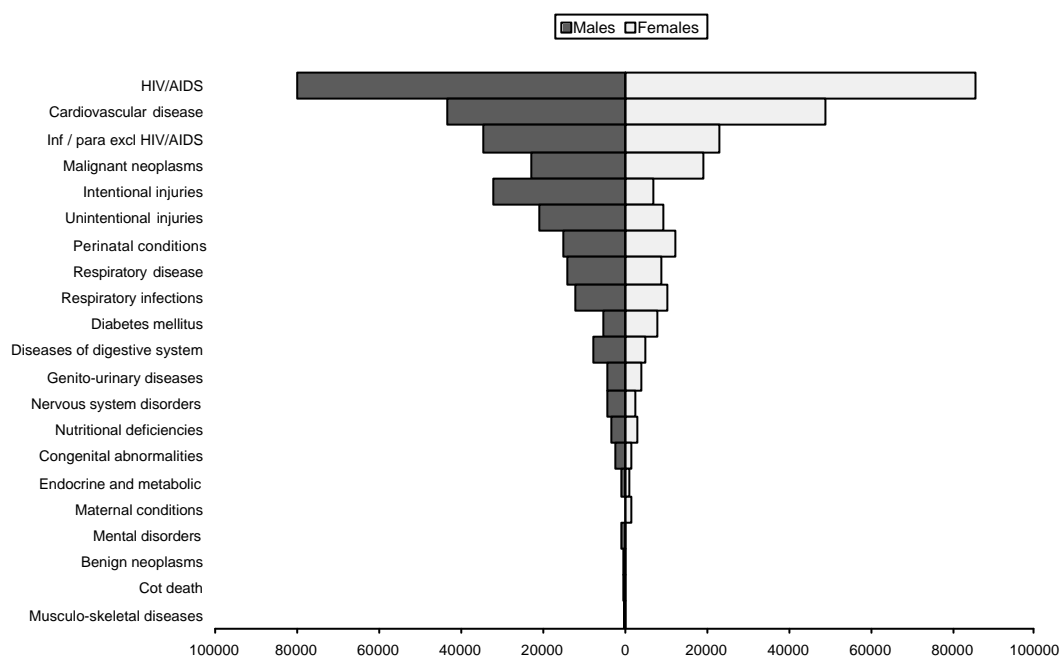


Figure 3.3: Cause of death according to categories, South Africa 2000

The twenty leading single causes of death are shown in Figure 3.4. These are ranked by the person's total. The largest single cause of death is HIV/AIDS accounting for 30% of all deaths. This is at least five times greater than the next largest single cause of death. Ischaemic heart disease, homicide/violence, and stroke are next in the ranking, each accounting for almost 6% of deaths. Males have higher proportions of deaths due to homicide/violence, tuberculosis and road traffic accidents than females. Females have higher proportions of deaths due to HIV/AIDS, stroke, hypertensive heart disease and diabetes mellitus.

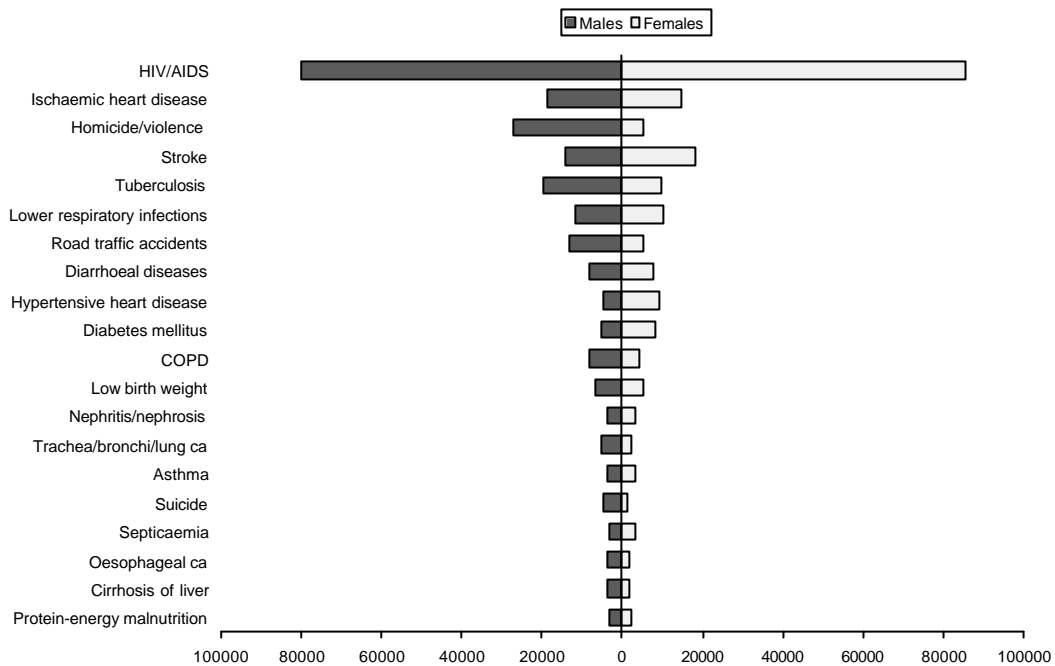


Figure 3.4: Leading specific causes of death, South Africa 2000

3.2 Years of life lost

The years of life lost measure does not merely consider the number of deaths but takes into account the age at which the death occurred. From Figure 3.5, it can be seen that there was a striking loss of life due to HIV/AIDS which accounts for the largest proportions of male (33%) and female (47%) years of life lost. The proportions attributable to the remainder of Group I and Group II are very similar for men and women, however, males experience a far greater loss of premature life due to injuries, 22%, compared with 8% for females.

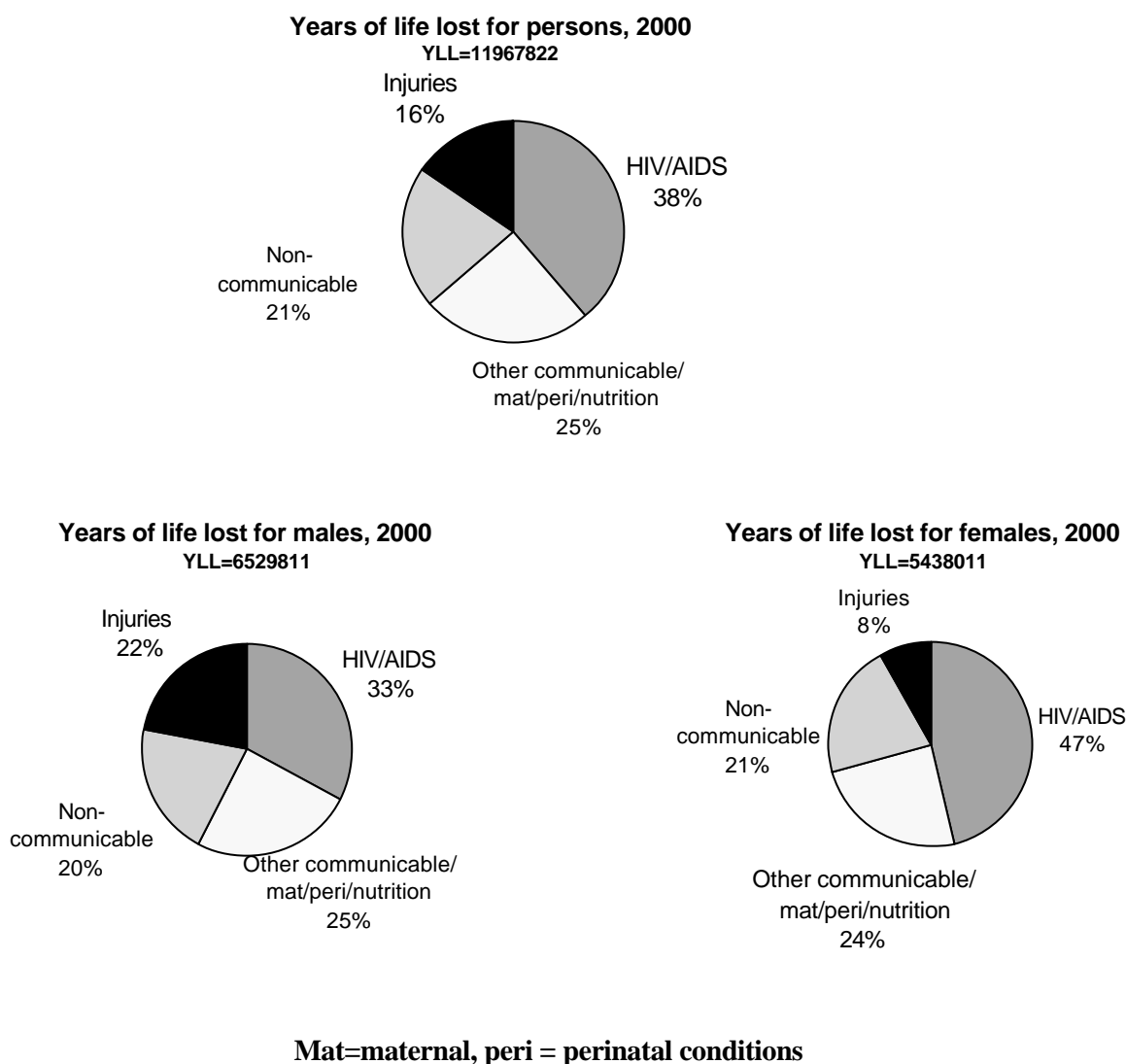


Figure 3.5: Estimated years of life lost (YLLs), South Africa 2000

The disease categories (A-X) are ranked by premature mortality burden (YLLs) in Table 3.1. HIV/AIDS is the disease category accounting for the largest mortality burden in both males and females. This is followed by the following disease categories: intentional injuries, infectious and parasitic excluding AIDS and unintentional injuries in males, and infectious and parasitic, cardiovascular disease and perinatal conditions in females.

HIV/AIDS is by far the largest single cause of years of life lost in both males and females (Table 3.2) Homicide/violence is the second largest cause of YLLs in males followed by tuberculosis and road traffic accidents. Homicide and violence accounts for almost double the YLLs due to tuberculosis in males. HIV/AIDS is followed by diarrhoeal diseases, tuberculosis and lower respiratory infections in females.

Table 3.1: Disease categories ranked by premature mortality burden (YLLs), by sex, South Africa 2000

Males				Females				Persons			
Rank	Disease category	YLL	%	Rank	Disease category	YLL	%	Rank	Disease category	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	Intentional injuries	880 305	13.5	2	Inf / para excl HIV/AIDS	556 515	10.2	2	Inf / para excl HIV/AIDS	1 331 432	11.1
3	Inf / para excl HIV/AIDS	774 917	11.9	3	Cardiovascular disease	452 672	8.3	3	Intentional injuries	1 066 136	8.9
4	Unintentional injuries	547 022	8.4	4	Perinatal conditions	408 635	7.5	4	Cardiovascular disease	917 203	7.7
5	Perinatal conditions	498 565	7.6	5	Unintentional injuries	255 113	4.7	5	Perinatal conditions	907 199	7.6
6	Cardiovascular disease	464 531	7.1	6	Malignant neoplasms	238 335	4.4	6	Unintentional injuries	802 135	6.7
7	Malignant neoplasms	260 923	4.0	7	Respiratory infections	212 280	3.9	7	Malignant neoplasms	499 257	4.2
8	Respiratory infections	243 813	3.7	8	Intentional injuries	185 831	3.4	8	Respiratory infections	456 093	3.8
9	Respiratory disease	161 928	2.5	9	Respiratory disease	103 401	1.9	9	Respiratory disease	265 329	2.2
10	Diseases of digestive system	122 829	1.9	10	Nutritional deficiencies	90 354	1.7	10	Diseases of digestive system	197 322	1.6
11	Nutritional deficiencies	100 616	1.5	11	Diabetes mellitus	86 154	1.6	11	Nutritional deficiencies	190 970	1.6
12	Nervous system disorders	93 169	1.4	12	Diseases of digestive system	74 494	1.4	12	Nervous system disorders	146 742	1.2
13	Congenital abnormalities	70 419	1.1	13	Congenital abnormalities	58 257	1.1	13	Diabetes mellitus	145 421	1.2
14	Diabetes mellitus	59 267	0.9	14	Maternal conditions	56 806	1.0	14	Congenital abnormalities	128 676	1.1
15	Genito-urinary diseases	55 317	0.8	15	Nervous system disorders	53 573	1.0	15	Genito-urinary diseases	101 980	0.9
16	Endocrine and metabolic	19 308	0.3	16	Genito-urinary diseases	46 664	0.9	16	Maternal conditions	56 806	0.5
17	Mental disorders	10 638	0.2	17	Endocrine and metabolic	20 519	0.4	17	Endocrine and metabolic	39 828	0.3
18	Cot death	8 303	0.1	18	Cot death	7 992	0.1	18	Cot death	16 294	0.1
19	Benign neoplasms	8 171	0.1	19	Benign neoplasms	5 591	0.1	19	Mental disorders	14 379	0.1
20	Musculo-skeletal diseases	1 353	0.0	20	Mental disorders	3 741	0.1	20	Benign neoplasms	13 763	0.1
21	Skin diseases	336	0.0	21	Musculo-skeletal diseases	3 302	0.1	21	Musculo-skeletal diseases	4 655	0.0
22	Maternal conditions		0.0	22	Skin diseases	454	0.0	22	Skin diseases	790	0.0
23	Sense organs		0.0	23	Sense organs		0.0	23	Sense organs		0.0
24	Oral conditions		0.0	24	Oral conditions		0.0	24	Oral conditions		0.0
	All causes	6 529 811	100.0		All causes	5 438 011	100.0		All causes	11 967 822	100.0

Table 3.2: Top twenty specific causes of the 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 birth weight	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 birth weight	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	163 544	1.4
12	COPD	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	52 866	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	COPD	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	COPD	39 041	0.7	20	Bacterial meningitis	90 964	0.8
All causes		6 529 811		All causes		5 438 011		All causes		11 967 822	

It is interesting to contrast the size of the burden as measured by the number of deaths with the size of the burden measured by the number of YLLs. Table 3.3 contrasts these proportions for the two main causes, i.e. HIV/AIDS and non-communicable causes (Group II). It can be seen from Table 3.3 that in terms of deaths, the non-communicable group is larger than the HIV/AIDS group but that in terms of YLLs, HIV/AIDS, in effect, part of Group I, is double that of the non-communicable group. This dramatic reversal can be explained by an examination of the age distribution in Figure 3.2 that shows a large proportion of the deaths due to HIV/AIDS occur in young adults and children under the age of five. Conversely, the decrease in the YLLs from non-communicable diseases indicates that these diseases occur in older age groups, where life expectancy is diminishing. The picture is even more striking when comparing the number of deaths and YLLs for males and females separately.

Table 3.3: Comparison of the proportions of deaths and YLLs due to non-communicable diseases and HIV/AIDS, South Africa 2000

Group	Deaths	%	YLLs	%
Persons	Non-communicable	37	Non-communicable	21
	HIV/AIDS	30	HIV/AIDS	38
Male	Non-communicable	36	Non-communicable	20
	HIV/AIDS	26	HIV/AIDS	33
Female	Non-communicable	40	Non-communicable	21
	HIV/AIDS	34	HIV/AIDS	47

Just under half of all YLLs for females are attributed to HIV/AIDS, compared with about one third of all male YLLs. An examination of the age distribution, Figure 3.2, reveals that not only are more females dying of HIV/AIDS but that more young, female adults are dying. For males, injuries account for a large proportion of both the number of deaths (17%) and the YLLs (22%). (The corresponding figures for females are 6% and 8% respectively.) It is particularly the young, adult male deaths that add to the proportion of the YLLs for injuries for males.

A comparison of the top 20 single causes of death for persons, ranked by the number of deaths and the YLLs, reveals that there is a general upward shift for YLLs relative to the number of deaths for infectious and perinatal conditions, as well as for homicide and violence, suicide and road traffic accidents. The use of YLLs, a measure of premature mortality, emphasises these conditions, which tend to take young lives. Conversely, there is a downward shift in the relative ranking of YLLs versus the number of deaths for degenerative conditions related to ageing.

Table 3.4: Top 20 single causes of death ranked in descending order by number of deaths and YLLs for persons, South Africa 2000

Single causes	Number of deaths	Rank	Rank	Single causes	YLLs
HIV/AIDS	165 859	1	1	HIV/AIDS	4 665 410
Ischaemic heart disease	32 919	2	2	Homicide/violence	902 592
Homicide/violence	32 485	3	3	Tuberculosis	595 277
Stroke	32 114	4	4	Road traffic accidents	489 979
Tuberculosis	29 553	5	5	Diarrhoeal diseases	452 827
Lower respiratory infections	22 097	6	6	Lower respiratory infections	449 010
Road traffic accidents	18 446	7	7	Low birth weight	393 763
Diarrhoeal diseases	15 910	8	8	Stroke	318 083
Hypertensive heart disease	14 233	9	9	Ischaemic heart disease	284 438
Diabetes mellitus	13 157	10	10	Protein-energy malnutrition	171 433
COPD	12 473	11	11	Suicide	163 544
Low birth weight	11 876	12	12	Diabetes mellitus	145 421
Nephritis/nephrosis	7 225	13	13	Hypertensive heart disease	127 066
Trachea/bronchi/lung ca	7 173	14	14	Fires	123 400
Asthma	6 987	15	15	Septicaemia	115 247
Suicide	6 370	16	16	COPD	113 499
Septicaemia	6 047	17	17	Neonatal infections	96 819
Oesophageal ca	5 803	18	18	Asthma	94 069
Cirrhosis of liver	5 672	19	19	Nephritis/nephrosis	93 973
Protein-energy malnutrition	5 511	20	20	Bacterial meningitis	90 964

- - - -> *downward shifts in the above ranking*
 ———> *upward shifts in the above ranking*

Table 3.5: Comparison of the estimates of deaths, YLLs and DALYs for all persons in South Africa, 2000

Deaths				YLLs				DALYs			
Rank	Disease category	Total	%	Rank	Disease category	Total	%	Rank	Disease category	Total	%
1	HIV/AIDS	165 859	29.8	1	HIV/AIDS	4 665 410	39.0	1	HIV/AIDS	5 067 490	32.8
2	Cardiovascular disease	92 201	16.6	2	Inf / para excl HIV/AIDS	1 331 432	11.1	2	Inf / para excl HIV/AIDS	1 490 399	9.6
3	Inf / para excl HIV/AIDS	57 502	10.3	3	Intentional injuries	1 066 136	8.9	3	Unintentional injuries	1 279 304	8.3
4	Malignant neoplasms	41 691	7.5	4	Cardiovascular disease	917 203	7.7	4	Intentional injuries	1 210 880	7.8
5	Intentional injuries	38 854	7.0	5	Perinatal conditions	907 199	7.6	5	Perinatal conditions	1 055 302	6.8
6	Unintentional injuries	30 076	5.4	6	Unintentional injuries	802 135	6.7	6	Cardiovascular disease	1 049 599	6.8
7	Perinatal conditions	27 361	4.9	7	Malignant neoplasms	499 257	4.2	7	Respiratory disease	729 442	4.7
8	Respiratory disease	23 009	4.1	8	Respiratory infections	456 093	3.8	8	Malignant neoplasms	520 883	3.4
9	Respiratory infections	22 340	4.0	9	Respiratory disease	265 329	2.2	9	Respiratory infections	467 062	3.0
10	Diabetes mellitus	13 157	2.4	10	Diseases of digestive system	197 322	1.6	10	Nervous system disorders	421 915	2.7
11	Diseases of digestive system	12 617	2.3	11	Nutritional deficiencies	190 970	1.6	11	Nutritional deficiencies	403 374	2.6
12	Genito-urinary diseases	8 049	1.4	12	Nervous system disorders	146 742	1.2	12	Diseases of digestive system	381 426	2.5
13	Nervous system disorders	7 160	1.3	13	Diabetes mellitus	145 421	1.2	13	Mental disorders	304 310	2.0
14	Nutritional deficiencies	6 488	1.2	14	Congenital abnormalities	128 676	1.1	14	Sense organs	249 936	1.6
15	Congenital abnormalities	3 859	0.7	15	Genito-urinary diseases	101 980	0.9	15	Congenital abnormalities	222 283	1.4
16	Endocrine and metabolic	2 109	0.4	16	Maternal conditions	56 806	0.5	16	Diabetes mellitus	175 849	1.1
17	Maternal conditions	1 875	0.3	17	Endocrine and metabolic	39 828	0.3	17	Genito-urinary diseases	149 718	1.0
18	Mental disorders	838	0.2	18	Cot death	16 294	0.1	18	Maternal conditions	101 300	0.7
19	Benign neoplasms	744	0.1	19	Mental disorders	14 379	0.1	19	Endocrine and metabolic	75 011	0.5
20	Cot death	491	0.1	20	Benign neoplasms	13 763	0.1	20	Musculo-skeletal diseases	45 681	0.3
21	Musculo-skeletal diseases	259	0.0	21	Musculo-skeletal diseases	4 655	0.0	21	Oral conditions	21 076	0.1
22	Skin diseases	48	0.0	22	Skin diseases	790	0.0	22	Cot death	16 294	0.1
23	Sense organs		0.0	23	Sense organs		0.0	23	Skin diseases	14 529	0.1
24	Oral conditions		0.0	24	Oral conditions		0.0	24	Benign neoplasms	13 763	0.1
All causes		556 585		All causes		11 967 822		All causes		15 466 828	

3.3 Disability adjusted life years (DALYs)

The total DALYs for each group are shown in Table 3.6 as well as the age-standardised rates (DALY/1 000 population) using the WHO world standard (downloaded from the WHO Internet site). Based on DALYs, Group II accounts for the largest burden, followed by HIV/AIDS, Group I and then Group III.

Table 3.6: DALY estimates and age-standardised DALY/1 000 population rates, South Africa 2000

	DALYs ('000)			Age-standardised* DALY per 1 000 population		
	Male	Female	Persons	Male	Female	Persons
HIV/AIDS	2 330	2 738	5 067	97.1	107.5	102.1
Other infectious, maternal, perinatal and nutritional (Group I)	1 912	1 606	3 517	78.7	62.9	70.5
Non-communicable diseases (Group II)	2 331	2 060	4 392	153.3	121.4	136.0
Injuries (Group III)	1 838	652	2 490	79.4	26.5	52.3
Total	8 411	7 056	15 467	408.5	318.3	361.0

*WHO world standard population

Figure 3.6 depicts estimated DALYs, in descending order, for all disease categories for persons. The DALYs have been calculated for the disease categories on the basis of the YLD/YLL ratio for the Afro E region for illustrative purposes. These show that some disease categories are severely underestimated using the YLLs alone, ignoring non-fatal outcomes. In particular, the nervous system, sense organs, respiratory infections and mental disorders are completely misrepresented by mortality as the major part of the burden is from disability.

For the nervous system disorders, the bulk of the YLLs are for epilepsy, followed by other nervous system disorders, encephalitis and brain abscess. Other nervous system disorders include cerebral palsy, paralytic syndromes and other conditions of the brain. Most of the YLLs and YLDs in the mental disorder category accrue for the specific causes, namely, alcohol dependence and drug abuse. Nervous system disorders are ranked tenth and mental disorders are thirteenth. Noteworthy, is that should one use the GBD category, neuropsychiatric conditions, (which is the mental and nervous system disorders combined), it would be the second highest DALY ranking. In the Zimbabwean Burden of Disease study (1995), for both sexes combined, depression and anxiety disorders as an underlying cause was the most common reason for YLDs, responsible for 23.0 % of the total (Zimbabwe Burden of Disease Committee, 2001).

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

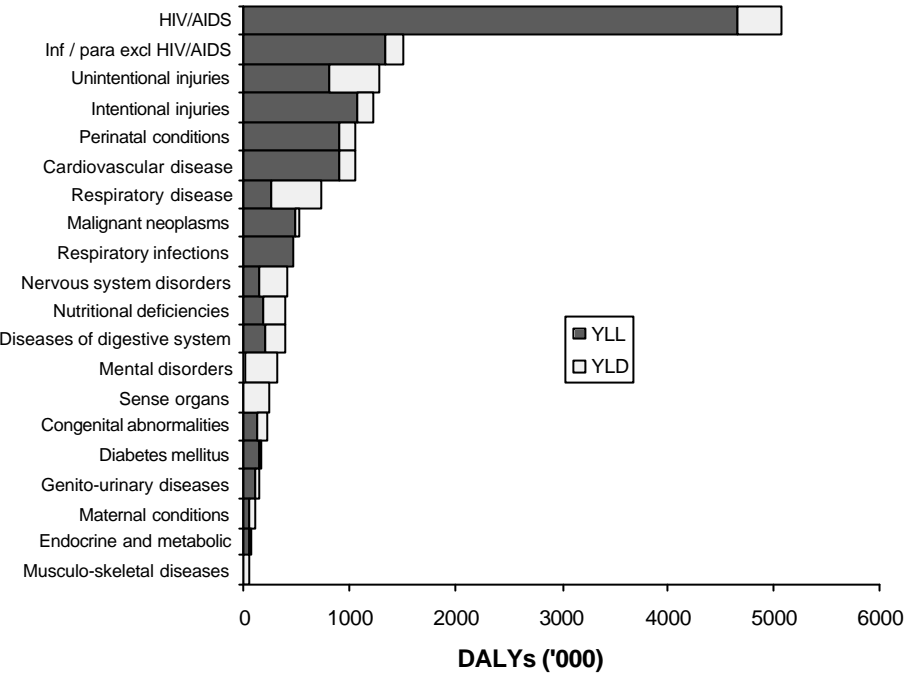


Figure 3.6: Estimated DALYs for persons for all categories, South Africa 2000

Congenital abnormalities

Applying the birth defect incidence rate to the number of live births in 2000, an overall age-specific incidence rate for the 0 - 4 year age group is 474 per 100 000 for males and 470 per 100 000 for females. The incidence estimates used in the calculation of YLDs for selected congenital abnormalities are compared with the GBD estimates for sub-Saharan Africa in Table 3.7. The category ‘other congenital and ill-defined’ has the highest incidence rates because most of the residual conditions have been grouped here. The comparison with the 1990 GBD estimates are quite varied. The estimates for Down’s Syndrome, for example, are very similar, whereas cleft/lip palate is lower for South Africa and neural tube defects are higher.

Table 3.7: Estimated incidence (per 100 000 births) of congenital abnormalities in South Africa compared with sub-Saharan Africa

Congenital abnormalities	South Africa		sub-Saharan Africa	
	Males	Females	Males	Females
Cleft lip/palate	6.6	6.5	35.8	31.9
Congenital GIT	17.5	17.4	-	-
Down's syndrome	43.8	43.5	40.2	33.2
Congenital heart	109.0	109.0	131.0	130.0
Neural tube defects	76.6	76.1	20.9	34.4
Other congenital and ill-defined	183.8	182.6	-	-
Total	437.7	434.6		

The estimates of the YLD rates for congenital abnormalities based on the incidence estimates for South African are compared with the South Africa estimates based on the Afro E region YLD/YLL ratio (Table 3.8) and estimates for other countries or regions. South Africa and Zimbabwe are very similar. The Afro E region is lower and the earlier estimate from the GBD for sub-Saharan Africa is somewhat higher. The Afro E ratios have a low estimate of YLD, but Australia has the lowest. The comparison with DALY estimates is shown in Table 3.9. South Africa, Zimbabwe and the Afro E region are very similar while the sub-Saharan Africa estimate is quite a bit higher than the others and Australia's estimates are considerably lower.

Table 3.8: Estimated YLD rates (per 100 000) for congenital abnormalities for South Africa 2000

	YLD/100 000		
	Males	Females	Persons
South Africa (local estimates)	358	340	349
South Africa (Afro E estimates)	238	179	208
Australia 1996	83	66	74
SSA (GBD 1990)	413	424	419
Afro E (GBD 2000)	253	244	248
Zimbabwe 1997	301	268	316

Table 3.9: Estimated DALY rates (per 100 000) for congenital abnormalities for South Africa and selected countries and regions

	DALY/100 000		
	Males	Females	Persons
South Africa (local estimates)	677	593	634
South Africa (Afro E estimates)	557	432	493
Australia 1996	193	160	177
SSA (GBD 1990)	756	787	771
Afro E (GBD 2000)	593	589	591
Zimbabwe 1997	581	596	589

The BOD methodology attaches no significance to any prenatal disability in the foetus nor measures the effects of stillbirths. In this study the only effects measured are those occurring after a live birth. With neural tube defects, for example, the majority of cases arising in the foetus will result in stillbirths, so the methodology underestimates the effect of the condition, and would also not reflect interventions such as the periconceptual administration of folic acid.

HIV/AIDS

South African estimates of incidence and average duration of HIV/AIDS are compared with sub-Saharan Africa estimates from the GBD 1990 and Australian 1996 studies in Table 3.10. South Africa's very much higher rates at all ages are striking.

Table 3.10: Comparison of HIV/AIDS incidence rates and average duration for sub-Saharan Africa, South Africa and Australia

	Incidence/100 000			Average duration		
	SSA 1990	South Africa	Australia 1996	SSA	South Africa	Australia
Males						
0-4	4.6	1 343.6	0.45	6.0	8.9	19.5
5-14	0.2	0.0	0.19	12.0	12.51	18.4
15-44	55.7	3 189.4	12.44	12.0	10.84	15.7
45-59	13.6	1 799.3	6.49	12.0	8.7	9.7
60+	1.3	271.3	2.56	12.0	8.0	7.5
All ages	29.1	1 951.6	7.19	11.9	10.13	14.3
Females						
0-4	4.8	1 334.2	0.19	6.0	8.9	19.6
5-14	0.2	0.0	0.16	12.0	12.51	18.5
15-44	12.5	3 518.6	1.06	12.0	10.84	15.8
45-59	1.7	476.8	0.29	12.0	8.7	10
60+	0.1	0.0	0.14	12.0	8.0	7.9
All ages	6.1	1 930.5	0.58	11.7	10.69	15.4

A comparison of South African YLD estimates with other countries and regions show huge variation. South Africa's local estimates of total YLDs show the greatest morbidity burden. When the local estimate is compared with the estimate calculated by applying the disability component from the GBD 2000 for the Afro E region (the ratio method) shown in Table 3.11, it demonstrates a large under-estimation of YLDs.

Table 3.11: Comparison of YLD rates for HIV/AIDS (per 100 000) for males and females, South Africa with other NBD estimates

	Males	Females	Persons
South Africa (local estimate)	3 987	4 348	4 171
Australia 1996	27	3	14
Mauritius 1993	16	4	10
EME (GBD1990)	68	13	40
SSA (GBD 1990)	267	262	265
AFRO E (GBD 2000)	1 179	957	1 310
South Africa (AFRO E estimate)	824	957	892
Zimbabwe 1997	2 358	2 043	2 194

A similar comparison of the proportions of YLD:DALY and the population estimates of DALYs show huge differences in the total number of DALYs and in the composition of the ratios (Table 3.12). Again the under-estimation of morbidity using the ratio method and applying the Afro E estimates is apparent. Interesting is the comparison of DALY rates for sub-Saharan Africa in 1990 with estimates from the GBD 2000 and the South Africa local estimate a decade later which illustrate the aggressive spread of the epidemic in this region. It is also noteworthy that the differences in DALYs for Zimbabwe in 1997 and the other regional estimates may well be reflecting different stages of the HIV/AIDS epidemic.

Table 3.12 Comparison of the YLD/DALY ratio and DALYs (per 100 000) for persons

Persons	YLD/DALY	DALY/
	%	100 000
South Africa (local estimate)	25	13 545
Australia 1996	17	79
Mauritius 1993	58	18
EME (GBD 1990)	25	159
SSA (GBD 1990)	16	1640
Afro E (GBD 2000)	8	16 510
South Africa (Afro E estimate)	8	11 241
Zimbabwe 1997	11	19 441

Injuries

Differences in the estimates of injury YLDs using the Afro E ratio and the CMS ratio for males and females are shown in Table 3.13. Estimates of YLDs and DALYs for unintentional injuries using the Afro E ratio were very similar to estimates obtained using the CMS ratio (Figure 3.7). The ratio of YLD/YLL for unintentional injuries was very similar in males: 0.56 and 0.53 and in females: 0.68 and 0.54 for the Afro E region and CMS, respectively (data not presented). For intentional injuries, however, YLD and DALY estimates based on the CMS study were greater than the estimates based on the Afro E region of the GBD 2000 (Figure 3.7). The ratio of YLD/YLL for intentional injuries was almost 2-fold greater and the female YLD/YLL ratio was almost 3-fold greater in the CMS study compared with the Afro E region. Another important difference was that DALYs from unintentional injuries were greater than DALYs from intentional injuries when applying the Afro E ratio to YLLs. With the alternative estimates based on the CMS ratio, however, the reverse was true (Figure 3.7). Using the Afro E ratio halves the non-fatal component of intentional injuries when compared with CMS estimates (Table 3.13).

Table 3.13: YLD and DALY estimates based on YLD/YLL ratios from CMS and Afro E, South Africa 2000

	CMS estimates			Afro E estimates		
	YLD	DALY	YLD/ DALY %	YLD	DALY	YLD/ DALY %
Males						
Total injuries	481 814	1 909 141	25	410 890	1 838 217	22
Unintentional	291 278	838 301	35	304 320	851 342	36
Intentional	190 536	1 070 841	18	106 570	986 875	11
Females						
Total injuries	238 844	679 787	35	211 023	651 967	32
Unintentional	138 733	393 845	35	172 849	427 962	40
Intentional	100 111	285 942	35	38 175	224 005	17
Persons						
Total injuries	720 658	2 588 929	28	621 913	2 490 184	25
Unintentional	430 011	1 232 146	35	477 168	1 279 304	37
Intentional	290 647	1 356 783	21	144 745	1 210 880	12

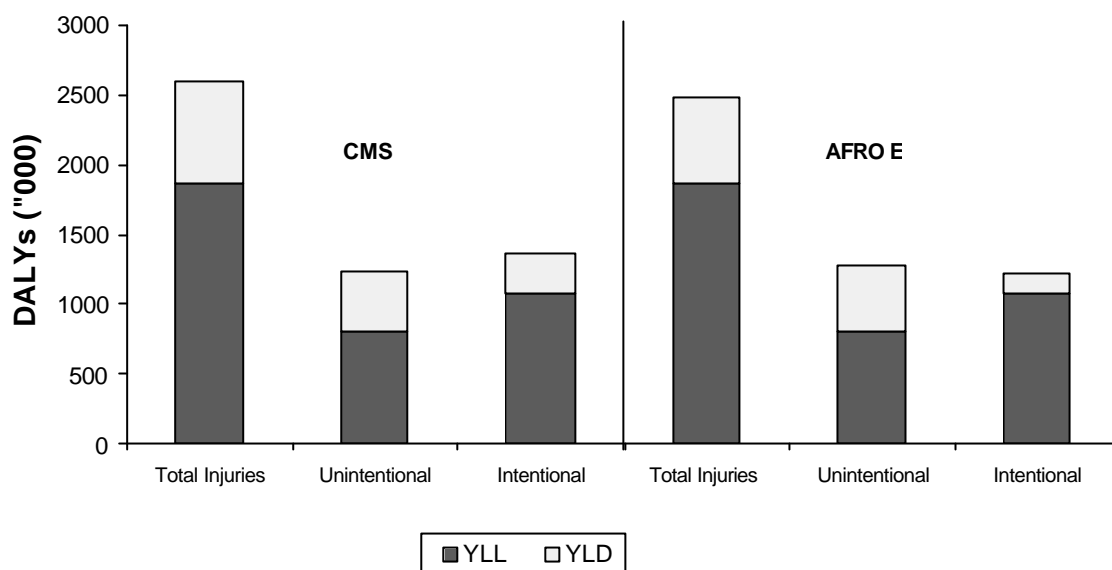


Figure 3.7: Comparison of DALY estimates for injuries based on CMS and Afro E ratios of YLD/YLL for persons, South Africa 2000

Estimates of the DALYs due to specific injuries were calculated using CMS ratios and are shown in Figure 3.8 for males and females separately. For both males and females, injuries caused by homicide and violence contribute the most DALYs, followed by injuries from road traffic accidents. Both YLLs and YLDs for these causes are greater in males than females. For road traffic and other transport accidents and self-inflicted injuries, most of the burden is from premature mortality while in the case of falls and other unintentional injuries the majority of the burden is from disability caused by non-fatal outcomes. The crude YLD and DALY rates for South Africa and ratio of YLD/DALY were compared with estimates from other studies (Table 3.14). The alternative YLD estimates for South Africa using the CMS ratio of YLD/YLL are comparable to studies from other countries with regard to unintentional injuries. For intentional injuries, however, DALYs per 100 000 for homicide and violence-related injuries are very high compared with rates reported for other regions. Age-standardised DALYs per 1 000 are presented in Table 3.15.

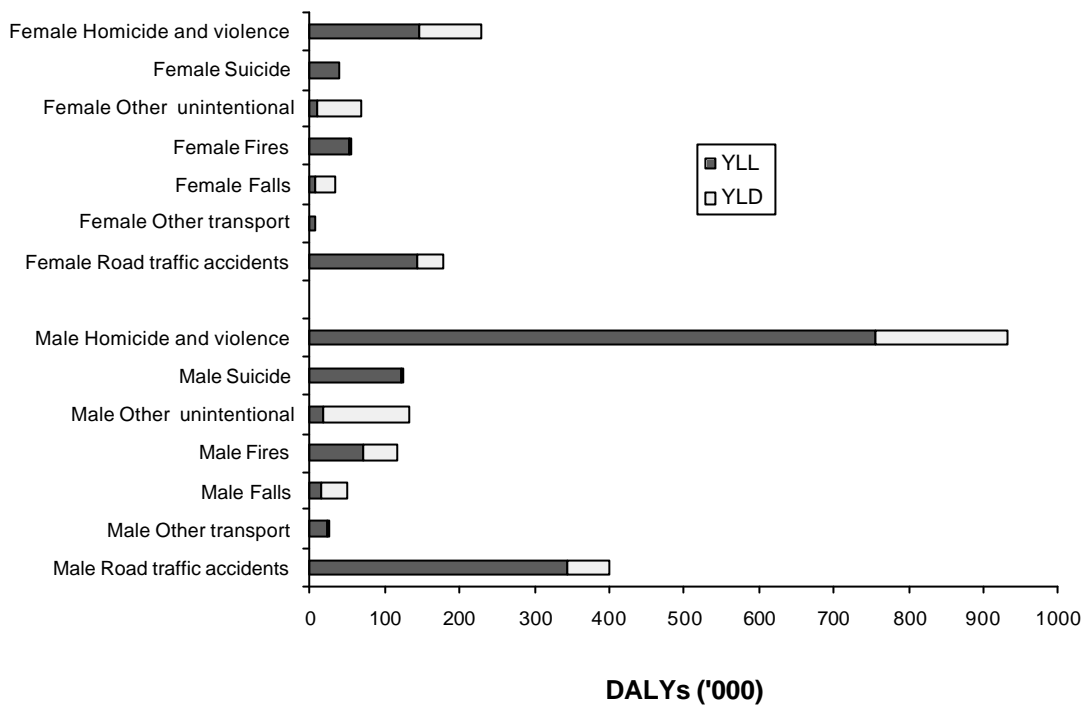


Figure 3.8: DALY estimates by cause of injury and sex, South Africa 2000

Table 3.14: Comparison of injury YLD and DALY rates for South Africa with estimates from Australian 1996, Mauritian 1993 and GBD 1990 and 2000 studies

	YLD/ 100 000		YLD/ DALY %	DALY/ 100 000
	Males	Females	Persons	Persons
<i>Road traffic accidents</i>				
Mauritius	82.9	35.1	15	396.6
Australia	85.0	34.6	18	304.2
South Africa (CMS estimates)	245.2	143.9	15	1 280.4
Afro E (GBD 2000)	302.4	170.2	23	1 005.1
*SSA (GBD 1990)	298.0	119.8	19	1 122.7
<i>Falls</i>				
Mauritius	176.7	106.2	83	170.4
Australia (exc sports related)	60.0	43.2	57	128.9
South Africa (CMS estimates)	161.5	124.2	75	190.3
Afro E (GBD 2000)	250.6	217.9	82	286.5
*SSA (GBD 1990)	378.5	292.7	80	416.6
<i>Fires</i>				
Mauritius	38.2	36.2	22	170.2
Australia (includes scalds)	312.5	148.6	40	25.7
South Africa (CMS estimates)	211.1	8.6	28	381.5
Afro E (GBD 2000)	99.1	98.3	41	242.8
*SSA (GBD 1990)	270.3	316.0	42	697.1
<i>Other unintentional</i>				
Australia	313.3	227.9	84	125.4
South Africa (CMS estimates)	516.6	263.1	87	446.1
Afro E (GBD 2000)	710.9	532.4	56	1 115.4
*SSA (GBD 1990)	2 003.8	690.8	58	2 317.0
<i>Suicide and self inflicted</i>				
Mauritius	1.1	0.2	0	333.0
Australia	24.9	22.8	1	305.4
South Africa (CMS estimates)	0.6	2.0	0	364.0
Afro E (GBD 2000)	8.7	9.8	7	125.0
*SSA (GBD 1990)	7.1	5.8	7	92.5
<i>Homicide and violence</i>				
Mauritius	29.8	10.8	25	81.1
Australia	41.3	12.7	29	59.3
South Africa (CMS estimates)	798.2	354.6	22	2 573.9
Afro E (GBD 2000)	127.6	57.5	13	700.4
*SSA (GBD 1990)	191.4	33.0	9	1 288.7
<i>Total unintentional</i>				
South Africa (CMS estimates)	1 319.9	602.8	35	2 733.2
South Africa (Afro E estimates)	1 379.0	751.1	37	2 837.8
Afro E (GBD 2000)	1 383.4	1040.7	38	3 218.8
<i>Total intentional</i>				
South Africa (CMS estimates)	863.4	435.0	21	3 009.7
South Africa (Afro E estimates)	482.9	165.9	12	2 686.0
Afro E (GBD 2000)	280.3	176.5	13	1 811.7

*SSA=Sub-Saharan Africa

Table 3.15 Age-standardised DALY rates (per 1 000), South Africa 2000

	Males	Females	Persons
Total injuries	89.7	29.8	59.0
Total unintentional	39.5	16.3	27.7
Road traffic accidents	17.8	7.2	12.4
Total intentional	48.5	14.2	30.9
Homicide and violence	41.8	11.0	26.0

Overall, applying the Afro E ratio of YLD/YLL to calculate YLDs for injuries for South Africa in this study results in an underestimation of the disability burden due to intentional injuries and therefore the total burden for injuries when compared to estimates based on local data.

One of the limitations of the CMS study was that the different groupings in the CMS questionnaire were used to code external cause of injury (Norman, 2002) and not the ICD-9 as in most other BOD studies. Rape and assault were combined to indicate violence and data were only available for the categories illustrated in Figure 3.8. The homicide and violence profile may have changed since 1990 with more injuries from homicide and violence with firearms than without firearms. If the profile has indeed changed, we would expect the ratio of morbidity to mortality for homicide and violence total to have decreased considerably but data in this regard are scanty.

3.4 Projected impact of AIDS for 2010

Since it is unknown exactly how the disease pattern will be affected by HIV/AIDS, the estimates presented in Figure 3.9 are merely for illustrative purposes to get a sense of the future burden. By 2010, HIV/AIDS will double the amount of YLLs experienced in 2000. The impact will be greatest on females and, by 2010, the overall YLL rates will be comparable with the levels in the Afro E region in 2000. By the year 2010, HIV/AIDS will account for 75% of the premature loss due to mortality, compared to 39% in 2000.

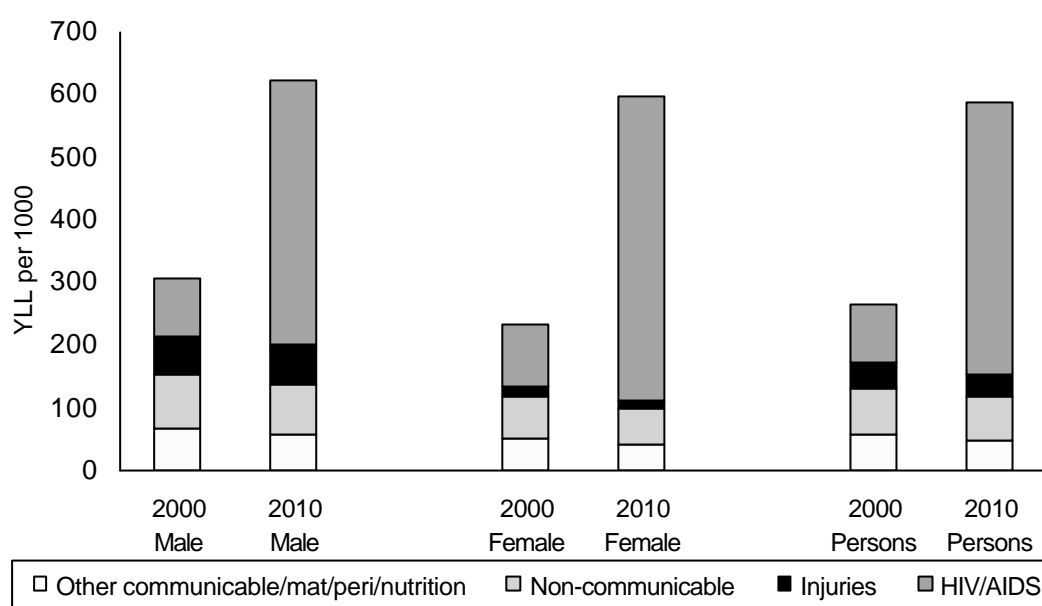


Figure 3.9: YLLs per 1 000 (age-standardised) by disease group for 2000 and 2010, South Africa

3.5 Sensitivity analyses

The GBD study draws a clear distinction between uncertainty analysis and sensitivity analysis. Uncertainty analysis refers to the effect of varying the epidemiological parameters such as incidence, prevalence and duration of disease and mortality (Murray and Lopez, 1996a). It is obvious that the results would be affected by changing any of these estimates, and uncertainty can be reduced through further measurement of these parameters. Sensitivity analysis refers to the effect of changes in the preferences that have been incorporated into the study, for example, discount rates, age-weights and disability weights (health-state preferences). Changes in these preferences are likely to have less effect on the results than the epidemiological parameters. The GBD study included an analysis of the sensitivity of the DALY to various combinations of age weighting and discounting.

As the main focus of this study is the burden due to premature mortality, the sensitivity of the YLLs to various combinations of age weighting and discounting is explored. For this study, the YLL estimates are considered more robust than the DALY estimates. The effects of changing the discount rate (r), age-weighting modulation factor (K), and life expectancy (LE) on the overall pattern of YLLs are summarised in Table 3.16. The standard notation $DALY[r; K]$ denoting the combinations of discount rate and age-weighting modulation factor used by Murray and Lopez, has been adapted to $YLL[r; K]$ (Murray and Lopez, 1996a). This study uses $YLL [0.03; 1]$ which means that the discount rate is 3% and $K=1$ denotes that age weighting is applied. In addition, YLLs are calculated with a zero discount

rate ($r = 0$) and uniform age weighting ($K = 0$) and various combinations of age weighting and discounting. In addition, the effect of changing the GBD life expectancy from 80 years for males and 82.5 years for females to the South African 1990 (pre-AIDS) life expectancy of 57.7 years for males and 65.7 years for females is analysed.

Table 3.16: Comparison of the effects of changing the discount rate (r), age-weighting modulation factor (K) and life expectancy (LE) on the composition of total YLLs [r;k], South Africa 2000

	YLL [0.03; 1], GBD LE		YLL [0.03; 0], GBD LE		Sensitivity analysis YLL [0; 1], GBD LE		YLL [0; 0], GBD LE		YLL [0.03; 1], SA (1990) LE	
	YLL	%	YLL	%	YLL	%	YLL	%	YLL	%
<i>By cause</i>										
HIV/AIDS	4 665 410	39.0	4 341 719	36.2	9 120 775	39.8	9 132 910	38.3	4 317 352	39.6
Group I	2 942 500	24.6	2 826 475	23.6	6 504 936	28.4	6 405 804	26.9	2 736 417	25.1
Group II	2 491 641	20.8	3 120 254	26.0	3 906 566	17.0	4 897 781	20.6	2 135 303	19.6
Injuries	1 868 271	15.6	1 706 554	14.2	3 389 170	14.8	3 382 645	14.2	1 704 354	15.6
Total	11 967 822	100.0	11 995 002	100.0	22 921 448	100.0	23 819 140	100.0	10 893 426	100.0
<i>By age</i>										
0-4	3 577 375	29.9	3 219 525	26.8	9 165 961	40.0	8 540 858	35.9	3 407 425	31.3
5-14	289 903	2.4	228 454	1.9	621 769	2.7	554 603	2.3	277 210	2.5
15-29	2 398 916	20.0	1 997 188	16.7	4 404 037	19.2	4 191 656	17.6	2 250 256	20.7
30-44	3 370 243	28.2	3 274 355	27.3	5 544 575	24.2	5 955 548	25.0	3 047 143	28.0
45-59	1 461 700	12.2	1 791 454	14.9	2 113 264	9.2	2 731 999	11.5	1 229 817	11.3
60+	869 685	7.3	1 484 025	12.4	1 071 841	4.7	1 844 477	7.7	681 575	6.3
Total	11 967 822	100	11 995 002	100.0	22 921 448	100.0	23 819 140	100.0	10 893 426	100.0
<i>By sex</i>										
Male	6 529 811	54.6	6 511 910	54.3	12 339 183	53.8	12 711 655	53.4	5 836 041	53.6
Female	5 438 011	45.4	5 483 092	45.7	10 582 265	46.2	11 107 485	46.6	5 057 385	46.4
Total	11 967 822	100.0	11 995 002	100.0	22 921 448	100.0	23 819 140	100.0	10 893 426	100.0

The effects of changing the discount rate, age weighting and life expectancy on the composition of total YLLs by cause, age and sex, are illustrated in Table 3.16. Changes in these parameters have little effect on the gender distribution of total YLLs. Changes in discounting, age weighting and life expectancy do, however, affect the age distribution of YLLs and the distribution of cause of death. The effect on the distribution by cause is largely influenced by the epidemiological age pattern of the cause. Injuries and HIV/AIDS are relatively unaffected by discounting, age weighting and changes in life expectancy, since these occur mainly in the young, adult age groups. Group II is particularly sensitive to changes in both age weighting and discounting because of the older age structure of this group. It is noted that overall the effect of discounting is greater than that of age weighting.

Discounting increases the importance of the YLL burden in older age groups and thus increases the burden due to Group II. Age weighting increases the importance of the burden in ages 0 - 44 years thus enhancing the burden of HIV and Group I and decreasing the burden due to Group II. The effects of age weighting and discounting on Group II tend to balance each other out. Changing to the South African 1990 life expectancy (with age weighting and discounting) increases the burden in younger age groups slightly and thus in Group I and HIV, in comparison with using the GBD 1990 life expectancy. However, once discounting and age weighting are applied, there is a surprising small reduction in the total YLLs or the distribution by age and broad cause group.

It must be pointed out that the values chosen for discounting and age weighting are those used by the GBD 1990 study. The preferences of the South African population in this regard remain to be tested.

4 Discussion

4.1 Data limitations

The major limitation of this study is the lack of recent, complete and reliable mortality data. The most recent vital registration data refers to 1996, which is too out of date to be of any use to policy makers. In 1996 only 2% of registered deaths had AIDS identified as the underlying cause of death. When compared to the ASSA2000 estimate of over 7% there is indication of under-reporting of deaths which have HIV or AIDS recorded as the underlying cause. This is likely to be due to the fact that indicator conditions or co-morbidity are specified on the death certificate rather than the actual underlying cause. The HIV status is sometimes unknown or unverified and there also appears to be a tendency to avoid recording HIV as the underlying cause of death due to the associated stigma and possible legal implications. For this reason a model was used to obtain total mortality estimates and estimates of the mortality due to AIDS.

Based on the ASSA2000 model, we estimate that in 2000 30% of the deaths are due to AIDS. All the deaths due to HIV/AIDS are included in these estimates, whereas in reality one would expect the reported deaths to show increases due to certain sentinel diseases related to HIV/AIDS, such as TB, pneumonia, meningitis, Kaposi sarcoma, etc. This is reflected in the recent report on the sample of deaths (Stats SA, 2002) which reported just over 9% of deaths due to HIV/AIDS but also reported concurrent increases in the proportions of deaths due to TB and pneumonia in the period 1997 - 2001.

Another important limitation in this study is the cause of death distribution for non-AIDS mortality, arising from the high proportion of ill-defined causes (15%) in 1996. The cause of injury estimates are also problematic being extrapolated from a surveillance system with an urban bias. This pertains particularly to road traffic accidents where there were large discrepancies between the various data sources.

There are certain to be marked differences in mortality between the various population groups in South Africa. However, since the vital statistics in 1996 did not collect data on population group or other socio-economic variables, this study, of necessity, ignores variations in mortality between subpopulations. It has also not been possible to estimate the variations between provinces due to the difficulties in estimating provincial levels of adult mortality as a result of the mobility of people between provinces and the lack of certainty about provincial levels of completeness of death reporting.

The age weighting and discounting values used in the GBD 2000 were applied in this study. These may not, however, reflect the values that would be selected by the South African population. Without population-based data on health state preferences, age weighting or discounting, it is not possible to adjust for this. It is recognised that a difficult step in estimating YLD for most diseases is matching existing population data to severity categories that have specific weights assigned to them. The weights can be derived from experts but preferably from population health state preference surveys.

It is important to note that ranking causes of death will be influenced by the specific aggregation and level of aggregation used. For this reason, the GBD list has been used as far as possible.

Another obvious limitation of this study is the estimation of YLDs using the Afro E region (GBD 2000) YLD/YLL ratios rather than calculating the YLDs from local epidemiological data. However, given the paucity of morbidity data in South Africa, this initial study has focused on estimating the mortality burden. It is envisaged that the disability burden will be estimated more systematically in a future BOD study.

An in-depth epidemiological understanding is needed to judge what is the most plausible source of information for the disease in question and which parameters best describe the disability caused by the specific disease. Various methods have been developed to reconcile the fragmented and partial estimates derived from different studies. The Disease Model (DISMOD) was developed for the GBD by Harvard University (<http://www.hsph.harvard.edu/Organisations/bdu/dismod/index.html>). It is a computer program that can be used to assess the consistency of epidemiological data gleaned from various sources and has been enhanced by WHO.

<http://www3.who.int/whosis/menu.cfm?path=evidence,burden,burden.dismod&language=english>

If a particular condition is expected to contribute significantly to the disability component of the BOD in a country then it is advisable to use epidemiological modelling drawing on available data sources, research findings and expert opinion (Harvard Burden of Disease Unit, World Health Organisation, 2001).

4.2 Contribution of risk factors

The next step in the BOD study will be to quantify risk factors, such as tobacco use, malnutrition, unsafe sex, alcohol consumption, poor water supply and sanitation, and hypertension. There are two main traditions in general use for causal attribution in health, categorical and counterfactual analysis. In categorical attribution, an event such as death is attributed to a single cause according to specific rules. In counterfactual analysis, the contribution of a disease, injury or risk factor is estimated by

comparing current and future levels of a summary measure with the levels that would be expected under an alternative hypothesis. Such an approach is preferable. However, the paucity of estimates of risk ratios and prevalences in the South African setting will be challenging in estimating the contribution of risk factors.

5 Conclusions and recommendations

This study has succeeded in drawing together data from a range of sources to develop coherent estimates of the underlying causes of death. As such, it has gone some way towards overcoming the shortcomings of the available data on mortality and morbidity, and provides useful information that can be used for national health planning. While the new Stats SA data based on a sample of deaths for 1997 - 2001 need to be analysed in more detail, we consider that these initial NBD estimates are not inconsistent with the sample results.

The alternative sources of data on injury-related deaths do suggest a downward trend during the late 1990s but reveal discrepancies; our study estimates that the number of road traffic deaths are about twice as high as the numbers reported by the Department of Transport and our study estimates of homicides are 50% higher than the number reported by the South African Police Service. It is important to investigate these discrepancies.

The use of YLLs as a measure of premature mortality provides an important ranking of causes of mortality that differs from the ranking based on numbers as it takes age into account and highlights the potential areas for prevention. The YLLs shows the quadruple burden of disease experienced in South Africa in the year 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 a considerable amount of the early loss of life for both males and females. TB, diarrhoea, lower respiratory infections and conditions arising from low birth weight are part of the pre-transitional group. 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 of death 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 burden from injuries, both intentional and unintentional, is exceedingly high for males. The 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. It is interesting to note that the ranking is not reversed if local YLD estimates are used.

The study highlights that the already large burden due to HIV/AIDS can be expected to grow rapidly in the next few years unless interventions that reduce mortality become widely available. This affects both males and females and will bring the levels of premature mortality experienced in South Africa to levels comparable with 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 psycho-social support is provided (Johnson and Dorrington, 2001).

It is difficult to know the exact amount spent on HIV/AIDS as much of the health budget is undifferentiated according to disease category, and the likely low levels of lack of knowledge of HIV status amongst patients treated by the health services. Specific expenditure by national government on HIV/AIDS for 2001/02 was estimated at R236 million, accounting for 3.5% of the total national health budget (Streak, 2002). A more inclusive estimate would be 4.46% of the national health budget (*ibid*). Government has stepped up the specific allocation for HIV/AIDS in the 2002/03 budget to just over R1 billion and will almost double this amount for the year 2003/04 (personal communication – Dr Mark Bletcher, National Treasury). Compared to the almost 40% of premature mortality due to HIV/AIDS which can be expected to increase to 75% by 2010, this needs further attention so that the National AIDS Plan (Department of Health, 2000) can be fully implemented. In addition, creative mechanisms need to be found to provide treatment for HIV-positive people who become AIDS sick.

While these estimates of YLDs and DALYs for South Africa should not be considered definitive, they do illustrate the importance of including non-fatal outcomes when ranking diseases and conditions. Mortality alone clearly underestimates the burden of mental ill health. The study highlights the need for a more detailed assessment of non-fatal outcomes from an improved base of information. South Africa has enormous gaps in the database needed to estimate DALYs nationally and for sub-populations. This includes values for health states, (disability weights), as well as epidemiological data. In addition, as more up-to-date mortality data become available, it will be possible to refine these estimates. Given limited resources, careful attention needs to be given to the specific efforts for subsequent work in the BOD assessment.

The World Health Report of 2002 presents the findings from a global review of risk factors and has identified 10 risk factors that account for more than a third of all the deaths worldwide (WHO, 2002). These are 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. Given the quadruple burden experienced in South Africa, these risk factors are clearly all contributing to ill health and need to be reduced in order to improve health. However, it is important to assess the attributable burden resulting from selected risk factors so as to identify the issues that need to be addressed to reduce the burden of disease in South Africa. In addition, the cost-effectiveness of interventions needs to be investigated. The World Health Report (WHO, 2002) illustrates how such analysis can be used to inform the policy debate.

While it is clear that further research is required to improve the BOD estimates and evidence of cost-effectiveness needs to be examined, the following strategies are likely to reduce the large burden of disease in South Africa:

- reducing the transmission of HIV and delay mortality from AIDS, through improving treatment of sexually transmitted infections, improving the voluntary counselling and testing services, provision of antiretroviral treatment to pregnant HIV-positive and HIV-positive patients and promoting safe sex;
- improving TB control;
- developing strategies to reduce violence and injuries;
- promote healthy lifestyles (including diet, physical activity, reduce smoking, alcohol, and substance abuse); and
- improving the integrated management of childhood diseases.

Strengthening health promotion efforts aimed at youth (including safer sex, gender violence, general violence, smoking and alcohol abuse) and promoting healthy lifestyles at all ages (including diet and physical activity) are clearly important in South Africa. Examples such as the comprehensive health promotion approach used in the Australian State of Victoria and the achievements in reducing the spread of HIV/AIDS in Uganda need to be examined and emulated. The World Health Report (WHO, 2002) urges that governments, 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 the 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.

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Appendix A: Formulae for years of life lost (YLLs), years of life with disability (YLDs) and DALYs

Years of Life Lost (YLLs) are calculated using standard expected years of life lost, and an exponential function of the form Cxe^{-bx} , to value time lived at different ages. A continuous discounting function of the form e^{-rt} has been used where r is the discount rate and t is time. A parameter K has been included which can be used in sensitivity analysis to remove non-uniform age weights. The general formula for calculating YLLs is:

$$YLLs = \frac{KCe^{ra}}{(r+b)^2} [e^{-(r+b)(L+a)} [-(r+b)(L+a) - 1] - e^{-(r+b)a} [-(r+b)a - 1]] + \frac{1-K}{r} (1 - e^{-rL})$$

where r is the discount rate, b is the parameter from the age-weighting function, K is the age-weighting modulating factor, C is a constant, a is the age at death and L is the standard expectation of life at age a . For this study, the GBD values are used: r is 0.03, b is 0.04, K is 1, and C is 0.1658. For calculating YLLs with uniform age weighting K is set to 0. To calculate the number of YLLs lost to a specific condition, the number of YLLs lost per death at each age must be multiplied by the number of deaths due to that condition at each age, and then summed across all ages.

In the formula for Years Lived with Disability (YLDs), a disability weight for each condition is added and a and L take on different meanings. The formula for YLDs from a single disabling event is:

$$YLDs = D \left\{ \frac{KCe^{ra}}{(r+b)^2} [e^{-(r+b)(L+a)} [-(r+b)(L+a) - 1] - e^{-(r+b)a} [-(r+b)a - 1]] + \frac{1-K}{r} (1 - e^{-rL}) \right\}$$

where D is the disability weight for a particular condition, a is the age of onset of disability, L is the duration of disability, and the other the parameters are exactly the same as for YLLs. The number of YLDs lost per incident case must be multiplied by the number of incident cases, in order to calculate the number of YLDs lost to a condition.

Appendix B: South Africa Burden of Disease List

SA NBD code	Title of SA NBD cause	ICD-9 Code
I	Communicable, maternal, perinatal and nutritional diseases	001-139,209, 243, 260-269, 279, 280-281, 285, 209, 279, 320-322, 381-383, 460-466,480-487, 614-616, 630-676,760-779, 511
I A	Infectious and parasitic	001-139, 209, 279, 320-322, 614-616, 511
I A ZA1	Tuberculosis	010-018,137, 511
I A ZA2	STDs excluding HIV	090-099, 614-616
I A ZA2a	Syphilis	090-097
I A ZA2b	Other STDs	098,099, 614-616
I A ZA4	Diarrhoeal diseases	001, 002, 004, 006-009
I A ZA5	Childhood (Vaccine preventable) cluster	032, 033, 037, 045, 050, 055, 056, 138
I A ZA5a	Pertussis	033
I A ZA5b	Polio	045, 138
I A ZA5c	Diphtheria	032
I A ZA5d	Measles	055
I A ZA5e	Tetanus	037
I A ZA5f	Rubella	056
I A ZA6	Bacterial meningitis	036, 320-322
I A ZA7	Hepatitis	070
I A ZA8	Malaria	084
I A ZA9	Schistosomiasis and other tropical diseases	085, 086, 120, 125
I A ZA10	Leprosy	030
I A ZA11	Intestinal parasites	126-129
I A ZA12	Septicaemia	038
I A ZA13	Other infectious and parasitic	003, 005, 020-027, 031, 034, 035, 039-041, 046-049, 051-054, 057, 060-066, 071-079, 080-083, 087-088, 100-104, 110-118, 121-124, 130-136, 139
I B	Respiratory infections	460-466, 480-487, 381-383
I B ZA14	Lower respiratory infections	466, 480-487
I B ZA15	Upper respiratory infections	460-465
I B ZA16	Otitis media	381-383
I C	Maternal conditions	630-676
I C ZA17	Maternal haemorrhage	640, 641, 666
I C ZA18	Maternal sepsis	670
I C ZA19	Hypertension in pregnancy	642
I C ZA20	Obstructed labour	660
I C ZA21	Abortion	630-639
I C ZA22	Other maternal	643-648, 650-659, 661-665, 667-669, 671-676
I D	Perinatal conditions	760-779
I D ZA23	Low birth weight	764-765, 769
I D ZA24	Birth asphyxia and trauma	767-768
I D ZA25	Other respiratory conditions	770
I D ZA26	Neonatal infections	771
I D ZA27	Foetal alcohol syndrome	760.7
I D ZA28	Other perinatal	761-763, 766, 772-778, 760.0 - 760.6, 760.8-760.9
I E	Nutritional deficiencies	243, 260-269, 280-281, 285
I E ZA29	Protein-energy malnutrition	260-263
I E ZA30	Deficiency anaemias	280-281, 285
I E ZA31	Other nutritional deficiencies including pellagra and vitamin A deficiency	243, 264-269
I X	HIV/AIDS	209, 279
I X ZA3	Acquired immunity deficiency syndrome	209, 279

SA NBD code	Title of SA NBD cause	ICD-9 Code
II	Non-communicable diseases	140-208, 210-242, 244-259, 270-278, 282-284, 286-319, 323-380, 384-459, 470-478, 490-510, 512-611, 617-629, 680-759
II F	Malignant neoplasms	140-208
II F ZA32	Mouth and oropharynx	140-149
II F ZA33	Oesophagus	150
II F ZA34	Stomach	151
II F ZA35	Colo-rectal	153, 154
II F ZA36	Liver	155
II F ZA37	Pancreas	157
II F ZA38	Larynx	161
II F ZA39	Trachea/bronchi/lung	162, 166
II F ZA40	Bone and connective tissue	170-171
II F ZA41	Melanoma	172
II F ZA42	Other skin cancer	173
II F ZA43	Breast	174, 175
II F ZA44	Cervix	180
II F ZA45	Corpus uteri	179,181-182
II F ZA46	Ovary	183
II F ZA47	Prostate	185
II F ZA48	Bladder	188
II F ZA49	Kidney	189
II F ZA50	Brain	191
II F ZA51	Lymphoma	200 -202
II F ZA52	Leukaemia	204 - 208
II F ZA53	Other malignant neoplasms	152, 156, 158-160, 163-165, 184, 186-187, 190, 192-194, 203
II G ZA54	Benign neoplasms	210-229, 230-234, 235-239
II H ZA55	Diabetes mellitus	250
II I	Endocrine and metabolic disorders	240-242, 244-246, 251-259, 270-278, 282-284, 286-289
II I ZA56	Albinism	270.2
II I ZA57	Other endocrine and metabolic	240-242, 244-246, 251-259, 271-278, 282-284, 286-289, 270.0 - 270.1, 270.3 - 270.9
II J	Mental disorders	291-319, 327
II J ZA58	Alcohol dependence	291, 303
II J ZA59	Drug use	304, 305
II J ZA60	Schizophrenia	295
II J ZA61	Affective disorders (depression, bipolar)	296
II J ZA62	Anorexia nervosa	327
II J ZA63	Anxiety disorders (Obsessive compulsive/ panic disorders)	300
II J ZA64	Hyperkinetic Syndrome of childhood	314
II J ZA65	Adjustment reaction (PTSS)	309
II J ZA66	Mental disability	317-319
II J ZA67	Other mental disorders	292-294, 297-299, 301-302, 306-308, 310, 313, 315-316
	Nervous system disorders	290, 323-326, 330-337, 340-345, 346-359
II K ZA68	Alzheimer and other dementias	290, 330-331
II K ZA69	Parkinsons disease	332
II K ZA70	Multiple sclerosis	340
II K ZA71	Epilepsy	345
II K ZA72	Encephalitis and brain abscess	323-324
II K ZA73	Other nervous system disorders	325-326, 333-337, 341-344, 346-349, 350-359
II L	Sense organs	360-380, 384-389
II L ZA74	Glaucoma	365
II L ZA75	Cataracts	366
II L ZA76	Other visual disorders	360-364, 367-379
II L ZA77	Hearing loss and other ear disorders	380, 384-389
II M	Cardiovascular	390-402, 404-415, 417-455, 457-459, 514
II M ZA78	Rheumatic heart disease	390-398
II M ZA79	Ischaemic heart disease	410-414
II M ZA80	Stroke	430-438
II M ZA81	Inflammatory heart disease	420-422, 425
II M ZA81a	Peri-, endo, myocardit is	420-422
II M ZA81b	Cardiomyopathy	425
II M ZA82	Hypertensive heart disease	401-402, 404, 405
II M ZA83	Non-rheumatic valvular disease	424
II M ZA84	Pulmonary embolism	415
II M ZA85	Aortic aneurism	441
II M ZA86	Peripheral vascular disorders	442- 448, 4510455
II M ZA87	Other cardiovascular	417,423, 426, 457, 458, 459

SA NBD code	Title of SA NBD cause	ICD-9 Code
II N	Respiratory	470-478, 490-496, 500-509, 510-513, 515-519, 416
II N	ZA88 COPD	490-492, 495-496, 416
II N	ZA89 Asthma	493
II N	ZA90 Aspiration pneumonia/ lung abscess	507, 513
II N	ZA91 Other respiratory	470-478, 494, 500-506, 508, 509, 510, 512, 515-519
II O	Digestive	456, 530-579, 609
II O	ZA92 Peptic ulcer	531-533
II O	ZA93 Cirrhosis of liver	571, 609, 456, 572
II O	ZA94 Appendicitis	540-543
II O	ZA95 Intestinal obstruction, non-infective gastroenteritis and colitis, peritonitis	551,552,560, 558, 567
II O	ZA96 Gall bladder disease	574-576
II O	ZA97 Pancreatitis	577
II O	ZA98 Other digestive	530, 534-537, 550, 553, 555-557, 562-566, 568-570, 573, 579
II P	Genito-urinary	403, 580-608, 610-611, 617-629
II P	ZA99 Nephritis/nephrosis	580-589, 403
II P	ZA100 Benign prostatic hypertrophy	600
II P	ZA101 Stress incontinence	625.6
II P	ZA102 Other genito-urinary	590-599,601-608,610-611, 617-629
II Q	ZA103 Skin disease	680-698, 700-709
II R	Musculo-skeletal	710-739
II R	ZA104 Rheumatoid arthritis	714
II R	ZA105 Osteoarthritis	715
II R	ZA106 Other musculo-skeletal	710-713, 716-739
II S	Congenital abnormalities	740-759
II S	ZA107 Neural tube defects	740-742
II S	ZA108 Cleft lip/palate	749
II S	ZA109 Congenital heart disease	745-747
II S	ZA110 Congenital disorders of GIT	750-751
II S	ZA111 Down's syndrome and other chromosomal anomalies	758
II S	ZA112 Other congenital abnormalities	743-744, 748, 752-757
II T	Oral conditions	520-529
II T	ZA113 Dental caries	521
II T	ZA114 Periodontal disease	523
II T	ZA115 Other oral health	520, 522, 524-529
II U	Cot death	699, 798 <12 months
II U	ZA116 Cot death	699, 798 < 12 months
III	Injuries	E800-807, E810-838, E840-858, E860-888, E980-999
III V	Unintentional	E800-807, E810-838, E840-858, E860-888, E890-949
III V	ZA117 Road traffic accidents	E810-819, 826-829
III V	ZA118 Other transport accidents	E800-807, 820-825, 830-838, 840-848
III V	ZA119 Mining accidents	E849
III V	ZA120 Poisoning	E850-858, E860-869
III V	ZA121 Surgical / medical misadventure	E870-879
III V	ZA122 Falls	E880-888
III V	ZA123 Fires	E890-899
III V	ZA124 Natural and environmental factors	E900-909
III V	ZA125 Drowning	E910
III V	ZA126 Suffocation and foreign bodies	E911-915
III V	ZA127 Other unintentional injuries specified	E839, E916-927, E930-949
III W	Intentional injuries	E950-979, E990-999
III W	ZA128 Suicide and self-inflicted	E950-959; E979
III W	ZA129 Homicide and violence	E960-969
III W	ZA129a with firearm	E965
III W	ZA129b without firearm	E960-964, E966-967
III W	ZA130 Legal intervention and war	E889, E970-978, E990-999

Appendix C: Afro E ratios to estimate YLDs from YLLs

Table C1 : Afro E ratios of YLD to YLL by group, disease category and sex

	Male	Female	Persons
Group			
HIV/AIDS	0.0846	0.0875	0.0862
I Other communicable, maternal, perinatal and nutritional diseases	0.1275	0.1704	0.1496
II Non-communicable diseases	1.0856	1.1794	1.1301
III Injuries	0.3464	0.5081	0.4007
Disease category			
A. Infectious and parasitic excl HIV	0.1190	0.1200	0.1195
B. Respiratory infections	0.0293	0.0181	0.0242
C. Maternal conditions		0.7833	0.7833
D. Perinatal conditions	0.1653	0.1607	0.1633
E. Nutritional deficiencies	1.1124	1.1120	1.1122
F. Malignant neoplasms	0.0261	0.0622	0.0431
G. Benign neoplasms	0.0000	0.0000	0.0000
H. Diabetes mellitus	0.3099	0.1400	0.2023
I. Endocrine and metabolic	0.7722	1.0767	0.8765
J. Mental disorders	15.2475	34.1398	20.7880
K. Nervous system disorders	1.3068	2.8638	1.8715
L. Sense organs	-	-	-
M. Cardiovascular disease	0.1431	0.1456	0.1444
N. Respiratory disease	1.6499	1.9047	1.7542
O. Diseases of the digestive system	0.7267	1.2731	0.9154
P. Genito-urinary diseases	0.4602	0.4774	0.4671
Q. Skin diseases	-	-	-
R. Musculo-skeletal diseases	9.0305	8.7228	8.8522
S. Congenital abnormalities	0.7453	0.7059	0.7253
T. Oral conditions	-	-	-
U. Cot death	-	-	-
V. Unintentional injuries	0.5563	0.6775	0.6030
W. Intentional injuries	0.1211	0.2054	0.1441
X. HIV/AIDS	0.0846	0.0875	0.0862

For the nervous system disorders, the sum of the YLDS for Alzheimer and other dementias, Parkinson's disease, multiple sclerosis, epilepsy, encephalitis and brain abscess and half of the other nervous system disorders was divided by the summation of the respective YLLs. This was done for all the age and sex groups.

Similarly, the YLD/YLL ratios for the remaining specific causes for the mental disorder categories were calculated.

Table C2 : Afro E proportion of total YLDs due to sense organs, skin disease and oral conditions

		Male	Female	Total
	Disease Category	% total YLDs	% total YLDs	% total YLDs
L	Sense organs	7.26	7.01	7.13
Q	Skin diseases	0.51	0.25	0.38
T	Oral conditions	0.62	0.58	0.60

Appendix D continue/... Disease	Male	Male	Male	Male	Male	Male	Male	Male	Male	Male	Female	Female	Female	Female	Female	Female	Female	Female	Female	Female	Persons	Persons	Persons	Persons	Persons	Persons	Persons	Persons	Persons	Persons	
	0-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75+	Total	0-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75+	Total	0-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75+	Total	
44 Cervix cancer	0	0	0	0	0	0	0	0	0	0	0	0	16	131	541	928	871	596	341	3424	0	0	16	131	541	928	871	596	341	3424	
45 Uterus cancer	0	0	0	0	0	0	0	0	0	0	0	0	4	14	30	104	135	164	141	593	0	0	4	14	30	104	135	164	141	593	
46 Ovary cancer	0	0	0	0	0	0	0	0	0	0	0	3	6	15	64	155	161	165	106	675	0	3	6	15	64	155	161	165	106	675	
47 Prostate cancer	0	0	0	4	7	77	357	813	1153	2411	0	0	0	0	0	0	0	0	0	0	0	0	0	4	7	77	357	813	1153	2411	
48 Bladder cancer	0	0	0	7	16	39	86	150	168	466	0	0	0	8	12	19	53	29	63	185	0	0	0	15	27	59	140	179	231	650	
49 Kidney cancer	25	8	5	4	11	35	91	50	40	269	29	6	0	4	14	21	33	15	41	163	54	14	5	8	25	56	124	66	81	433	
50 Brain cancer	7	29	16	15	17	43	96	59	13	295	8	9	13	8	18	56	46	54	28	240	15	38	29	23	35	99	142	113	41	535	
51 Lymphoma	19	28	69	67	67	93	112	91	77	623	14	11	24	19	34	46	69	89	89	395	33	39	93	86	102	139	181	180	166	1018	
52 Leukemia	45	87	149	57	50	76	120	142	103	829	41	43	61	27	45	61	83	103	125	589	86	130	210	85	95	137	203	245	228	1418	
53 Other malignant neoplasms	32	4	22	19	64	137	205	199	135	815	16	9	15	21	60	171	214	257	243	1006	48	13	37	40	124	308	419	456	377	1822	
54 Benign neoplasms	13	37	72	19	36	67	67	49	38	400	13	19	12	15	37	70	68	62	47	344	26	57	84	34	74	138	135	111	85	744	
55 Diabetes mellitus	9	16	99	133	361	971	1325	1236	926	5076	8	17	92	143	356	1155	2160	2220	1931	8081	16	33	191	276	717	2126	3485	3456	2857	13157	
56 Albinism	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57 Other endocrine and metabolic disorders	124	52	83	79	111	155	153	104	98	959	151	35	70	63	108	170	193	178	181	1150	276	88	153	142	219	325	346	282	279	2109	
58 Alcohol dependence	0	3	17	50	137	173	130	71	23	604	0	0	4	15	47	69	38	28	8	210	0	3	20	65	184	242	168	100	31	813	
59 Drug abuse	0	0	0	2	2	5	1	1	0	12	0	0	0	0	0	0	2	0	0	2	0	0	0	2	2	5	3	1	0	14	
60 Schizophrenia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61 Affective disorders	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62 Anorexia nervosa	0	0	0	0	0	2	0	1	0	3	0	0	1	1	2	0	0	0	1	5	0	0	1	1	2	2	0	1	1	9	
63 Anxiety disorders	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64 Hyperkinetic syndrome of childhood	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65 Adjustment reaction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66 Mental disability (no defined aetiology)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67 Other mental disorders	0	0	0	1	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	2	
68 Alzheimer and other dementias	7	4	10	9	21	14	47	104	166	381	8	3	7	9	15	9	30	96	242	419	15	7	17	17	36	22	77	201	407	800	
69 Parkinsons's disease	0	0	0	0	2	3	27	97	170	300	0	0	0	1	0	2	17	57	161	237	0	0	0	1	2	5	44	154	330	537	
70 Multiple sclerosis	0	1	0	1	1	0	4	0	2	11	0	0	0	1	8	18	12	1	1	41	0	1	0	2	9	18	17	1	4	52	
71 Epilepsy	61	119	396	323	341	392	242	157	86	2117	59	69	186	147	136	176	138	90	81	1082	120	187	581	470	477	568	380	247	167	3200	
72 Encephalitis and brain abscess	43	37	77	40	34	42	21	3	8	304	16	29	49	25	14	18	11	3	4	169	59	66	125	65	48	61	32	5	12	473	
73 Other nervous system disorders	228	144	198	105	105	150	151	103	68	1252	187	68	81	49	69	101	92	102	96	846	415	213	278	154	174	252	243	205	164	2098	
74 Glaucoma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
75 Cataracts	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76 Vision disorders	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
77 Hearing loss	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78 Rheumatic heart disease	8	71	163	91	51	73	48	46	37	589	8	59	206	165	134	135	158	98	90	1053	16	130	369	256	185	208	206	144	127	1642	
79 Ischaemic heart disease	0	0	70	234	931	2866	4438	4911	4929	18380	0	6	25	91	398	1270	2315	3448	6986	14539	0	6	95	325	1329	4136	6753	8359	11915	32919	
80 Stroke	2	40	246	337	904	2210	3076	3640	3474	13930	0	28	144	266	865	2275	3531	4414	6659	18184	2	69	390	604	1769	4485	6608	8054	10133	32114	
81 Inflammatory heart disease	89	33	116	214	263	444	558	475	542	2735	64	32	93	174	202	342	438	438	775	2559	153	65	209	388	466	787	995	914	1317	5294	
82 Hypertensive heart disease	0	0	30	83	291	827	1087	1137	1320	4774	0	0	33	102	416	955	1687	2127	4139	9458	0	0	63	185	707	1782	2774	3264	5458	14233	
83 Non-rheumatic valvular disease	6	42	107	77	86	80	91	93	142	723	3	30	74	88	84	98	121	122	253	873	8	72	182	165	171	177	212	214	394	1596	
84 Pulmonary embolism	0	3	15	43	89	191	237	192	173	942	0	2	36	70	133	212	176	238	261	1127	0	4	52	114	221	402	413	429	434	2069	
85 Aortic aneurism	0	0	2	4	17	41	108	172	208	553	0	0	1	3	7	30	50	78	166	336	0	0	4	7	24	71	158	251	375	888	
86 Peripheral vascular disease	0	0	9	13	36	75	107	112	140	492	0	0	7	18	31	54	67	75	189	441	0	0	16	31	68	129	174	187	329	933	
87 Other cardiovascular disease	2	3	24	25	27	39	44	46	55	265	0	2	8	21	15	26	46	47	83	248	2	4	32	46	43	66	89	93	138	513	

Appendix D continue/... Disease	Male	Male	Male	Male	Male	Male	Male	Male	Male	Male	Female	Female	Female	Female	Female	Female	Female	Female	Female	Female	Persons	Persons	Persons	Persons	Persons	Persons	Persons	Persons	Persons	Persons	
	0-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75+	Total	0-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75+	Total	0-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75+	Total	
88 Chronic obstructive pulmonary disease	33	10	27	78	293	1056	1960	2480	2164	8102	18	3	30	46	129	488	864	1197	1596	4372	51	13	56	124	423	1544	2824	3677	3761	12473	
89 Asthma	73	45	129	151	322	718	978	765	579	3760	44	30	100	163	295	550	667	685	693	3227	116	76	229	314	617	1268	1645	1450	1272	6987	
90 Aspiration pneumonia/ lung abscess	64	10	16	39	61	109	80	57	43	479	57	9	22	13	20	32	18	23	30	224	120	19	38	52	81	141	99	80	73	703	
91 Other respiratory diseases	173	18	67	103	159	305	358	280	285	1748	106	9	26	61	111	166	160	197	262	1098	279	27	94	164	270	470	518	477	547	2845	
92 Peptic ulcer disease	0	0	37	81	128	210	195	161	118	930	0	3	17	41	70	86	161	129	228	735	0	3	54	122	198	295	356	290	346	1665	
93 Cirrhosis of the liver	14	37	103	217	545	1047	893	594	254	3704	9	27	84	115	285	445	423	364	216	1968	23	63	187	331	831	1492	1316	958	471	5672	
94 Appendicitis	0	16	2	7	6	9	9	7	7	61	0	5	11	6	0	7	3	2	4	38	0	21	13	13	6	16	12	9	11	100	
95 Intestinal obstruction	54	22	94	123	145	183	132	125	132	1010	20	6	62	118	127	119	110	149	290	1003	74	28	156	241	272	302	242	274	422	2013	
96 Gall bladder and bile duct disease	0	1	0	2	10	16	17	28	37	111	0	0	2	1	11	11	35	42	36	139	0	1	2	3	21	27	52	70	73	250	
97 Pancreatitis	0	1	17	94	162	136	68	28	11	518	0	2	4	9	20	38	26	28	23	149	0	3	21	103	182	174	94	56	34	666	
98 Other digestive system diseases	21	31	63	116	145	266	247	176	132	1196	9	20	83	63	97	160	170	180	273	1055	30	51	146	179	242	425	417	356	405	2251	
99 Nephritis and nephrosis	78	59	191	206	385	580	670	690	861	3720	54	47	112	146	347	489	527	592	1191	3505	131	106	303	352	732	1070	1197	1282	2053	7225	
100 Benign prostatic hypertrophy	0	0	0	0	0	2	17	42	77	137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	17	42	77	137	
101 Stress incontinence	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
102 Other genitourinary diseases	11	0	5	15	29	43	47	71	89	311	6	3	17	11	18	31	44	57	189	376	17	3	22	27	47	74	90	128	278	687	
103 Skin diseases	2	0	0	3	1	4	4	1	1	18	0	0	1	4	5	2	8	6	4	30	2	0	1	7	6	6	12	7	6	48	
104 Rheumatoid arthritis	0	0	0	1	1	0	1	1	0	5	0	0	0	0	1	7	5	6	3	22	0	0	0	1	3	7	6	7	3	27	
105 Osteoarthritis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	1	
106 Other musculo-skeletal disorders	0	4	8	5	8	15	10	14	9	74	0	2	18	20	32	33	20	10	23	158	0	6	26	25	40	48	30	24	32	231	
107 Neural Tube Defects	558	51	21	6	0	0	0	0	0	636	461	17	14	3	1	0	0	0	0	496	1019	69	35	9	1	0	0	0	0	1132	
108 Cleft lip and/or palate	9	0	0	0	0	0	0	0	0	9	14	0	0	0	0	0	0	0	0	14	23	0	0	0	0	0	0	0	0	23	
109 Congenital heart disease	656	29	33	9	9	1	2	0	0	739	581	28	14	5	10	5	3	2	0	649	1238	57	47	14	20	7	5	2	0	1388	
110 Congenital disorders of GIT	213	8	3	0	0	0	0	0	0	224	166	3	0	0	0	2	0	0	0	170	379	10	3	0	0	2	0	0	0	394	
111 Down syndrome and other chromosomal	217	1	5	5	0	2	0	0	0	229	229	3	6	1	0	2	0	0	0	241	445	4	12	6	0	3	0	0	0	470	
112 Other congenital anomalies	242	6	13	0	1	4	4	0	0	271	166	2	4	0	1	2	1	2	3	181	408	8	17	0	3	6	6	2	3	452	
113 Dental caries	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
114 Periodontal disease	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
115 Other oral health problems	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
116 Cot death	251	0	0	0	0	0	0	0	0	251	241	0	0	0	0	0	0	0	0	241	491	0	0	0	0	0	0	0	0	0	491
117 Road traffic accidents	675	1148	2078	3232	2978	1675	815	325	150	13076	544	534	970	1056	999	606	330	226	107	5370	1219	1682	3047	4288	3977	2280	1145	552	256	18446	
118 Other transport accidents	0	39	194	240	262	143	57	8	0	942	28	21	28	60	70	13	17	9	6	253	28	60	222	300	332	156	74	18	6	1195	
119 Mining accidents	0	0	25	54	167	70	0	0	0	316	0	0	0	0	0	0	0	0	0	0	0	0	25	54	167	70	0	0	0	316	
120 Poisoning	141	18	59	78	72	35	24	0	0	426	67	11	30	85	42	27	17	5	3	287	208	29	89	163	114	61	42	5	3	714	
121 Surgical / medical misadventure	61	31	11	25	39	60	110	119	64	520	94	19	29	62	25	67	64	72	71	503	155	50	40	87	63	127	173	191	135	1022	
122 Falls	47	58	69	109	116	127	72	57	44	698	73	20	15	15	25	15	48	29	46	285	120	78	84	124	141	141	120	85	90	983	
123 Fires	635	174	275	501	482	285	107	58	34	2551	467	78	272	398	339	148	88	66	68	1925	1102	252	547	899	821	434	194	125	103	4476	
124 Natural and environmental factors	26	8	19	16	27	23	9	5	0	132	26	3	14	3	12	3	5	6	0	70	52	10	33	19	39	26	14	11	0	203	
125 Drowning	350	317	119	123	145	74	41	3	1	1172	182	69	41	21	19	18	5	3	0	357	532	386	160	144	164	91	46	6	1	1529	
126 Suffocation and foreign bodies	85	4	6	13	16	13	0	0	0	136	83	7	13	4	7	12	9	3	0	139	168	11	19	17	23	25	9	3	0	275	
127 Other unintentional injuries	124	90	115	121	61	66	36	25	3	642	120	29	30	25	29	23	7	11	0	275	244	119	146	147	91	89	44	35	3	917	
128 Homicide and violence	357	295	7676	9148	5950	2351	923	269	165	27134	297	151	1118	1631	1237	489	198	127	102	5351	654	446	8795	10779	7187	2839	1121	396	268	32485	
129 Suicide and self-inflicted injuries	0	107	1091	1388	981	726	317	181	76	4866	0	49	379	376	366	155	111	41	28	1504	0	156	1469	1764	1347	880	428	222	104	6370	
130 Legal intervention and war	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix E: Estimated death rates (per 100 000) by age group and sex, 2000

Disease	Male	Male	Male	Male	Male	Male	Male	Male	Male	Male	Female	Female	Female	Female	Female	Female	Female	Female	Female	Female	Age-standardised rates		
	0-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75+	Total	0-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75+	Total	Male	Female	Persons
1 Tuberculosis	15.3	2.4	28.2	89.6	137.2	227.4	300.5	361.2	519.1	89.7	13.2	2.0	30.2	50.7	60.2	77.3	86.5	110.4	172.4	42.4	124.5	49.6	83.5
2 Sexually transmitted diseases (not HIV/AIDS)	4.5	0.0	0.1	0.4	0.4	1.1	0.4	0.0	1.2	0.8	5.4	0.0	0.6	1.0	1.5	1.1	0.7	0.9	1.7	1.3	0.7	1.2	1.0
3 HIV/AIDS	820.5	10.9	15.5	510.3	918.3	521.7	160.3	12.1	0.0	362.9	820.2	10.9	176.1	788.9	720.0	178.2	6.7	0.0	0.0	372.7	355.9	346.0	349.9
4 Diarrhoeal diseases	214.0	4.3	6.9	8.3	10.6	18.3	28.5	59.4	185.8	36.9	199.8	2.5	6.0	8.5	8.1	14.2	25.0	47.2	179.5	33.7	36.6	33.0	34.7
5 Childhood immunisable diseases	4.6	0.5	0.0	0.1	0.2	0.2	0.3	0.5	0.6	0.8	4.2	0.1	0.1	0.1	0.0	0.4	0.7	0.7	0.0	0.6	0.6	0.6	0.6
6 Meningitis	24.9	3.5	6.3	8.0	6.7	7.9	4.9	9.4	14.5	8.5	18.8	2.1	4.0	4.3	3.6	4.1	3.2	6.3	5.4	5.3	8.3	5.1	6.6
7 Hepatitis	1.0	0.5	0.7	1.2	1.8	2.0	1.9	1.2	3.3	1.1	1.1	0.1	0.7	0.7	0.8	1.1	1.3	1.4	2.0	0.7	1.3	0.8	1.0
8 Malaria	1.0	0.8	2.9	3.3	3.0	5.0	4.7	5.1	9.8	2.7	0.4	0.5	1.0	1.4	1.1	1.4	2.9	3.6	2.0	1.1	3.2	1.3	2.2
9 Schistosomiasis and other tropical diseases	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.7	0.5	0.1	0.0	0.0	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.1
10 Leprosy	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	1.0	0.0	0.1	0.1	0.1
11 Intestinal parasites	0.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1
12 Septicaemia	19.5	1.8	4.4	8.9	10.9	21.9	34.3	67.1	176.5	13.5	18.1	1.3	4.5	8.5	9.4	15.6	25.6	51.5	177.7	13.3	19.8	17.1	18.3
13 Other infectious and parasitic diseases	2.1	0.4	1.0	2.7	3.0	3.2	2.4	2.7	2.3	1.9	1.8	0.4	1.3	2.1	2.1	1.6	0.9	1.4	1.0	1.4	2.0	1.4	1.7
14 Lower respiratory tract infections	120.1	4.0	11.8	28.7	41.3	66.8	112.7	223.2	821.8	52.9	114.4	3.1	14.1	24.7	26.1	36.6	53.2	122.6	674.8	45.3	76.6	55.6	64.8
15 Upper respiratory tract infections	2.8	0.3	0.1	0.1	0.3	0.2	0.5	1.0	1.6	0.5	2.2	0.2	0.1	0.1	0.1	0.0	0.3	0.7	2.3	0.4	0.5	0.4	0.5
16 Otitis media	0.3	0.0	0.0	0.1	0.1	0.0	0.0	0.2	0.0	0.1	0.2	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1
17 Maternal haemorrhage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	3.9	3.0	0.2	0.0	0.0	0.0	1.6	0.0	1.5	0.8
18 Maternal sepsis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	1.5	0.7	0.2	0.0	0.0	0.0	0.7	0.0	0.6	0.3
19 Hypertension in pregnancy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	4.6	5.0	3.1	0.2	0.0	0.0	0.0	0.0	2.2	0.0	2.0	1.0
20 Obstructed labour	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21 Abortion	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	4.2	2.6	0.7	0.0	0.0	0.0	1.7	0.0	1.6	0.8
22 Other maternal conditions	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	5.6	3.4	0.2	0.0	0.0	0.0	2.0	0.0	1.9	1.0
23 Low birth weight	244.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	29.2	210.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	23.6	21.5	18.5	20.1	
24 Birth asphyxia and trauma	55.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7	43.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	4.9	3.8	4.4	
25 Other respiratory conditions	113.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.5	99.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.1	10.0	8.7	9.4	
26 Neonatal infections	60.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.2	51.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.7	5.3	4.5	4.9	
27 Foetal alcohol syndrome	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28 Other perinatal causes	97.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.6	72.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.2	8.5	6.4	7.5	
29 Protein-energy malnutrition	93.8	1.2	0.5	1.6	2.0	5.4	7.4	19.9	37.6	13.8	81.2	0.6	0.5	1.1	1.8	2.5	3.1	6.1	24.3	10.7	12.4	9.3	10.8
30 Deficiency anaemias	1.4	0.3	0.6	0.9	0.9	2.0	2.8	5.8	17.2	1.2	1.6	0.3	1.6	2.4	2.3	3.2	4.2	6.7	15.6	2.3	1.8	2.7	2.3
31 Other nutritional deficiencies including pellagra	0.1	0.0	0.1	0.1	0.4	1.0	2.9	2.9	6.7	0.5	0.1	0.0	0.1	0.2	0.6	0.4	1.1	1.8	4.1	0.3	0.8	0.5	0.6
32 Mouth and oropharynx cancers	0.0	0.0	0.3	0.5	2.2	14.3	30.1	49.7	50.1	4.9	0.0	0.0	0.1	0.2	0.7	4.3	8.7	9.9	19.1	1.7	8.7	2.4	5.2
33 Oesophagus cancer	0.0	0.0	0.2	0.8	9.0	50.0	103.1	176.9	242.3	17.6	0.0	0.0	0.1	0.5	4.5	19.4	44.2	64.1	82.1	8.3	32.1	12.4	20.9
34 Stomach cancer	0.0	0.0	0.2	0.8	3.4	14.7	38.6	72.1	114.2	6.7	0.0	0.0	0.1	0.6	1.6	7.8	14.3	29.0	64.9	3.8	12.7	5.9	8.8
35 Colorectal cancer	0.0	0.0	0.5	0.8	2.0	9.0	22.9	67.3	132.8	5.4	0.0	0.0	0.2	0.7	1.7	6.3	19.2	45.7	117.7	5.4	10.9	8.6	9.6
36 Liver cancer	0.2	0.1	1.2	2.4	6.1	19.0	37.4	75.7	116.3	8.0	0.2	0.1	0.4	0.6	1.9	7.0	17.8	33.6	49.5	4.0	14.2	6.0	9.5
37 Pancreas cancer	0.0	0.0	0.0	0.1	1.7	9.3	23.4	41.2	61.4	3.8	0.0	0.0	0.0	0.1	1.0	4.5	13.0	25.7	51.7	3.0	7.2	4.6	5.8
38 Larynx	0.0	0.0	0.1	0.1	1.0	7.7	21.4	33.1	41.8	3.1	0.0	0.0	0.0	0.0	0.1	1.6	2.7	4.3	2.5	0.5	5.8	0.7	2.9
39 Lung cancer	0.0	0.0	0.1	1.0	8.2	55.4	143.3	268.8	322.2	23.0	0.0	0.0	0.1	0.4	3.6	18.9	45.3	84.7	96.1	9.1	43.2	13.8	26.4
40 Bone and connective tissue cancers	0.3	0.4	2.1	0.8	1.0	2.9	6.2	6.5	17.7	1.7	0.2	0.7	0.9	0.4	0.8	2.0	3.5	9.2	9.9	1.3	2.4	1.7	2.0
41 Melanoma	0.0	0.1	0.1	0.3	0.6	2.7	5.9	10.5	17.5	1.1	0.0	0.0	0.0	0.0	0.5	1.7	2.7	6.4	13.1	0.8	2.0	1.2	1.6
42 Other skin cancers	0.0	0.0	0.1	0.9	0.9	1.1	2.7	3.7	11.5	0.7	0.0	0.0	0.1	0.4	0.3	0.7	0.9	2.5	6.1	0.4	1.2	0.6	0.8
43 Breast cancer	0.0	0.0	0.0	0.0	0.0	0.5	1.8	2.6	3.5	0.2	0.0	0.0	0.2	1.6	11.6	36.3	56.2	77.0	141.8	13.1	0.5	18.9	10.8
44 Cervix cancer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	3.3	17.8	44.5	67.5	83.5	86.9	14.9	0.0	20.7	11.4
45 Uterus cancer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	1.0	5.0	10.5	23.0	35.9	2.6	0.0	3.9	2.2
46 Ovary cancer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.4	2.1	7.4	12.5	23.2	27.0	2.9	0.0	4.3	2.4
47 Prostate cancer	0.0	0.0	0.0	0.1	0.2	4.0	32.4	151.7	521.8	10.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.7	0.0	0.0	10.5
48 Bladder cancer	0.0	0.0	0.0	0.2	0.5	2.0	7.8	27.9	75.9	2.1	0.0	0.0	0.0	0.2	0.4	0.9	4.1	4.0	16.1	0.8	4.7	1.2	2.6
49 Kidney cancer	1.0	0.2	0.1	0.1	0.4	1.8	8.2	9.4	18.1	1.2	1.1	0.1	0.0	0.1	0.5	1.0	2.5	2.2	10.5	0.7	2.1	1.0	1.5
50 Brain cancer	0.3	0.6	0.4	0.4	0.6	2.2	8.7	11.0	6.0	1.3	0.3	0.2	0.3	0.2	0.6	2.7	3.6	7.6	7.1	1.0	2.1	1.4	1.7

Appendix E continue/... Disease	Male	Male	Male	Male	Male	Male	Male	Male	Male	Male	Female	Female	Female	Female	Female	Female	Female	Female	Female	Female	Age-standardised rates		
	0-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75+	Total	0-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75+	Total	Male	Female	Persons
51 Lymphoma	0.7	0.6	1.6	1.8	2.3	4.8	10.1	17.1	34.8	2.8	0.5	0.2	0.5	0.5	1.1	2.2	5.4	12.5	22.6	1.7	4.4	2.4	3.3
52 Leukemia	1.7	1.8	3.5	1.5	1.7	3.9	10.9	26.4	46.7	3.8	1.6	0.9	1.4	0.7	1.5	2.9	6.4	14.4	31.8	2.6	5.7	3.4	4.4
53 Other malignant neoplasms	1.2	0.1	0.5	0.5	2.2	7.1	18.5	37.2	60.9	3.7	0.6	0.2	0.3	0.5	2.0	8.2	16.6	36.1	61.8	4.4	6.7	6.5	6.6
54 Benign neoplasms	0.5	0.8	1.7	0.5	1.3	3.5	6.1	9.1	17.2	1.8	0.5	0.4	0.3	0.4	1.2	3.4	5.3	8.8	11.9	1.5	2.6	2.0	2.3
55 Diabetes mellitus	0.3	0.3	2.3	3.6	12.6	50.1	120.0	230.6	419.0	23.0	0.3	0.4	2.1	3.7	11.7	55.4	167.3	311.1	492.1	35.1	43.0	53.8	49.2
56 Albinism	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
57 Other endocrine and metabolic disorders	4.7	1.1	1.9	2.1	3.9	8.0	13.9	19.3	44.2	4.3	5.9	0.8	1.6	3.5	8.2	15.0	25.0	46.2	5.0	6.2	6.5	6.4	
58 Alcohol dependence	0.0	0.1	0.4	1.4	4.8	8.9	11.7	13.3	10.5	2.7	0.0	0.0	0.1	0.4	1.5	3.3	3.0	4.0	2.0	0.9	3.9	1.2	2.4
59 Drug abuse	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0
60 Schizophrenia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
61 Affective disorders	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
62 Anorexia nervosa	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
63 Anxiety disorders	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
64 Hyperkinetic syndrome of childhood	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
65 Adjustment reaction	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
66 Mental disability (no defined aetiology)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
67 Other mental disorders	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
68 Alzheimer and other dementias	0.3	0.1	0.2	0.2	0.7	0.7	4.3	19.4	75.0	1.7	0.3	0.1	0.2	0.2	0.5	0.4	2.3	13.5	61.5	1.8	3.9	3.0	3.3
69 Parkinson's disease	0.0	0.0	0.0	0.0	0.1	0.2	2.5	18.1	76.8	1.4	0.0	0.0	0.0	0.0	0.0	0.1	1.3	8.0	41.0	1.0	3.5	1.8	2.4
70 Multiple sclerosis	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.3	0.9	0.9	0.2	0.3	0.2	0.1	0.2	0.2
71 Epilepsy	2.3	2.5	9.2	8.7	11.9	20.2	21.9	29.3	38.9	9.6	2.3	1.5	4.3	3.8	4.5	8.5	10.7	12.7	20.7	4.7	12.0	5.5	8.5
72 Encephalitis and brain abscess	1.6	0.8	1.8	1.1	1.2	2.2	1.9	0.5	3.6	1.4	0.6	0.6	1.1	0.6	0.5	0.9	0.8	0.4	1.0	0.7	1.4	0.7	1.1
73 Other nervous system disorders	8.7	3.0	4.6	2.8	3.7	7.8	13.6	19.2	30.9	5.7	7.3	1.5	1.9	1.3	2.3	4.9	7.2	14.3	24.5	3.7	6.9	4.3	5.6
74 Glaucoma	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75 Cataracts	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
76 Vision disorders	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
77 Hearing loss	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
78 Rheumatic heart disease	0.3	1.5	3.8	2.5	1.8	3.8	4.3	8.6	16.6	2.7	0.3	1.3	4.7	4.2	4.4	6.5	12.2	13.7	23.0	4.6	3.3	5.5	4.5
79 Ischaemic heart disease	0.0	0.0	1.6	6.3	32.4	148.0	402.0	916.2	2230.2	83.3	0.0	0.1	0.6	2.3	13.1	61.0	179.3	483.3	1779.9	63.2	170.5	102.6	132.1
80 Stroke	0.1	0.8	5.7	9.1	31.4	114.1	278.6	679.0	1571.9	63.1	0.0	0.6	3.3	6.8	28.4	109.2	273.6	618.8	1696.6	79.0	125.5	123.9	124.9
81 Inflammatory heart disease	3.4	0.7	2.7	5.8	9.2	22.9	50.5	88.7	245.1	12.4	2.5	0.7	2.2	4.5	6.6	16.4	33.9	61.4	197.4	11.1	21.8	16.1	18.6
82 Hypertensive heart disease	0.0	0.0	0.7	2.2	10.1	42.7	98.4	212.1	597.2	21.6	0.0	0.0	0.8	2.6	13.7	45.8	130.7	298.1	1054.5	41.1	43.8	65.6	57.1
83 Non-rheumatic valvular disease	0.2	0.9	2.5	2.1	3.0	4.1	8.2	17.3	64.1	3.3	0.1	0.6	1.7	2.3	2.8	4.7	9.4	17.1	64.4	3.8	5.3	5.3	5.3
84 Pulmonary embolism	0.0	0.1	0.4	1.2	3.1	9.8	21.4	35.8	78.3	4.3	0.0	0.0	0.8	1.8	4.3	10.2	13.6	33.3	66.4	4.9	7.8	7.0	7.3
85 Aortic aneurism	0.0	0.0	0.1	0.1	0.6	2.1	9.7	32.1	94.2	2.5	0.0	0.0	0.0	0.1	0.2	1.4	3.9	11.0	42.4	1.5	5.7	2.4	3.7
86 Peripheral vascular disease	0.0	0.0	0.2	0.4	1.3	3.9	9.7	20.9	63.3	2.2	0.0	0.0	0.2	0.5	1.0	2.6	5.2	10.5	48.0	1.9	4.5	3.0	3.6
87 Other cardiovascular disease	0.1	0.1	0.6	0.7	0.9	2.0	4.0	8.7	24.7	1.2	0.0	0.0	0.2	0.5	0.5	1.3	3.5	6.6	21.2	1.1	2.1	1.6	1.8
88 Chronic obstructive pulmonary disease	1.3	0.2	0.6	2.1	10.2	54.5	177.6	462.6	979.3	36.7	0.7	0.1	0.7	1.2	4.2	23.4	66.9	167.8	406.8	19.0	76.4	30.1	49.3
89 Asthma	2.8	1.0	3.0	4.1	11.2	37.0	88.6	142.8	262.1	17.0	1.7	0.6	2.3	4.2	9.7	26.4	51.7	96.0	176.5	14.0	29.9	20.2	24.4
90 Aspiration pneumonia/ lung abscess	2.4	0.2	0.4	1.0	2.1	5.6	7.3	10.7	19.4	2.2	2.2	0.2	0.5	0.3	0.7	1.6	1.4	3.2	7.6	1.0	3.1	1.1	2.0
91 Other respiratory diseases	6.6	0.4	1.6	2.8	5.5	15.7	32.4	52.2	129.2	7.9	4.1	0.2	0.6	1.6	3.6	8.0	12.4	27.6	66.7	4.8	13.2	6.6	9.5
92 Peptic ulcer disease	0.0	0.0	0.9	2.2	4.5	10.8	17.7	30.0	53.3	4.2	0.0	0.1	0.4	1.0	2.3	4.1	12.5	18.1	58.2	3.2	7.0	4.7	5.8
93 Cirrhosis of the liver	0.5	0.8	2.4	5.8	18.9	54.0	80.8	110.9	115.1	16.8	0.3	0.6	1.9	2.9	9.4	21.4	32.8	51.0	55.1	8.6	26.2	11.7	18.2
94 Appendicitis	0.0	0.3	0.0	0.2	0.2	0.4	0.8	1.3	3.0	0.3	0.0	0.1	0.3	0.2	0.0	0.3	0.2	0.2	1.0	0.2	0.4	0.2	0.3
95 Intestinal obstruction	2.0	0.5	2.2	3.3	5.0	9.5	12.0	23.3	59.9	4.6	0.8	0.1	1.4	3.0	4.2	5.7	8.5	20.9	73.9	4.4	6.9	6.0	6.5
96 Gall bladder and bile duct disease	0.0	0.0	0.0	0.1	0.4	0.8	1.5	5.2	16.6	0.5	0.0	0.0	0.1	0.0	0.3	0.5	2.7	5.9	9.2	0.6	1.1	0.9	1.0
97 Pancreatitis	0.0	0.0	0.4	2.5	5.6	7.0	6.2	5.2	4.8	2.3	0.0	0.0	0.1	0.2	0.7	1.8	2.0	3.9	5.9	0.6	3.0	0.9	1.9
98 Other digestive system diseases	0.8	0.7	1.5	3.1	5.0	13.7	22.4	32.8	59.7	5.4	0.4	0.4	1.9	1.6	3.2	7.7	13.2	25.2	69.5	4.6	8.5	6.5	7.5
99 Nephritis and nephrosis	2.9	1.2	4.5	5.6	13.4	30.0	60.7	128.7	389.7	16.9	2.1	1.0	2.6	3.7	11.4	23.5	40.8	83.0	303.6	15.2	30.8	22.4	26.0
100 Benign prostatic hypertrophy	0.0	0.0	0.0	0.0	0.0	0.1	1.5	7.9	34.8	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.6
101 Stress incontinence	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
102 Other genitourinary diseases	0.4	0.0	0.1	0.4	1.0	2.2	4.2	13.3	40.2	1.4	0.2	0.1	0.4	0.3	0.6	1.5	3.4	8.0	48.2	1.6	2.8	2.5	2.7

Appendix E continue/... Disease	Male	Male	Male	Male	Male	Male	Male	Male	Male	Male	Female	Female	Female	Female	Female	Female	Female	Female	Female	Female	Age-standardised rates		
	0-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75+	Total	0-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75+	Total	Male	Female	Persons
103 Skin diseases	0.1	0.0	0.0	0.1	0.0	0.2	0.4	0.3	0.6	0.1	0.0	0.0	0.0	0.1	0.2	0.1	0.6	0.8	1.1	0.1	0.1	0.2	0.2
104 Rheumatoid arthritis	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.4	0.8	0.7	0.1	0.0	0.1	0.1	0.1
105 Osteoarthritis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0
106 Other musculo-skeletal disorders	0.0	0.1	0.2	0.1	0.3	0.8	0.9	2.6	4.2	0.3	0.0	0.0	0.4	0.5	1.0	1.6	1.6	1.4	5.9	0.7	0.5	0.9	0.7
107 Neural tube defects	21.2	1.1	0.5	0.2	0.0	0.0	0.0	0.0	0.0	2.9	17.9	0.4	0.3	0.1	0.0	0.0	0.0	0.0	0.0	2.2	2.2	1.7	1.9
108 Cleft lip and/or palate	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
109 Congenital heart disease	24.9	0.6	0.8	0.2	0.3	0.1	0.1	0.0	0.0	3.4	22.6	0.6	0.3	0.1	0.3	0.3	0.2	0.2	0.0	2.8	2.5	2.3	2.4
110 Congenital disorders of GIT	8.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	1.0	6.4	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.7	0.8	0.6	0.7
111 Down 's syndrome and other chromosomal	8.2	0.0	0.1	0.1	0.0	0.1	0.0	0.0	0.0	1.0	8.9	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0	1.0	0.8	0.8	0.8
112 Other congenital anomalies	9.2	0.1	0.3	0.0	0.0	0.2	0.4	0.0	0.0	1.2	6.4	0.0	0.1	0.0	0.0	0.1	0.1	0.2	0.7	0.8	0.9	0.6	0.8
113 Dental caries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
114 Periodontal disease	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
115 Other oral health problems	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
116 Cot death	9.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	9.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.8	0.8	0.8
117 Road traffic accidents	25.6	24.1	48.4	87.2	103.5	86.5	73.8	60.7	67.7	59.3	21.1	11.4	22.4	27.1	32.8	29.1	25.5	31.7	27.2	23.3	63.5	24.2	43.0
118 Other transport accidents	0.0	0.8	4.5	6.5	9.1	7.4	5.1	1.5	0.0	4.3	1.1	0.4	0.7	1.5	2.3	0.6	1.3	1.3	1.5	1.1	4.5	1.1	2.8
119 Mining accidents	0.0	0.0	0.6	1.4	5.8	3.6	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.7
120 Poisoning	5.4	0.4	1.4	2.1	2.5	1.8	2.2	0.0	0.0	1.9	2.6	0.2	0.7	2.2	1.4	1.3	1.4	0.7	0.7	1.2	1.8	1.2	1.5
121 Surgical / medical misadventure	2.3	0.7	0.3	0.7	1.3	3.1	9.9	22.2	28.9	2.4	3.6	0.4	0.7	1.6	0.8	3.2	4.9	10.1	18.2	2.2	3.8	2.7	3.2
122 Falls	1.8	1.2	1.6	2.9	4.0	6.5	6.5	10.6	20.1	3.2	2.8	0.4	0.4	0.8	0.7	3.7	4.0	11.7	1.2	4.1	1.5	2.7	
123 Fires	24.1	3.7	6.4	13.5	16.7	14.7	9.7	10.9	15.5	11.6	18.1	1.7	6.3	10.2	11.1	7.1	6.8	9.3	17.4	8.4	11.7	8.4	10.0
124 Natural and environmental factors	1.0	0.2	0.4	0.4	0.9	1.2	0.8	1.0	0.0	0.6	1.0	0.1	0.3	0.1	0.4	0.1	0.4	0.8	0.0	0.3	0.6	0.3	0.5
125 Drowning	13.3	6.7	2.8	3.3	5.0	3.8	3.7	0.5	0.4	5.3	7.0	1.5	0.9	0.5	0.6	0.9	0.4	0.4	0.0	1.6	4.8	1.4	3.0
126 Suffocation and foreign bodies	3.2	0.1	0.1	0.4	0.5	0.7	0.0	0.0	0.0	0.6	3.2	0.1	0.3	0.1	0.2	0.6	0.7	0.5	0.0	0.6	0.5	0.6	0.5
127 Other unintentional injuries	4.7	1.9	2.7	3.3	2.1	3.4	3.3	4.6	1.4	2.9	4.6	0.6	0.7	0.7	1.0	1.1	0.6	1.5	0.0	1.2	2.9	1.1	2.0
128 Homicide and violence	13.5	6.2	178.8	246.8	206.7	121.4	83.6	50.2	74.9	123.0	11.5	3.2	25.8	41.8	40.6	23.5	15.3	17.8	26.1	23.3	124.5	23.6	72.5
129 Suicide and self-inflicted injuries	0.0	2.2	25.4	37.4	34.1	37.5	28.7	33.8	34.2	22.0	0.0	1.1	8.7	9.6	12.0	7.4	8.6	5.7	7.2	6.5	24.6	6.9	15.3
130 Legal intervention and war	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Appendix F: Estimated YLLs by age group and sex, 2000 (male and female)

Disease	Male 0-4	Male 5 - 14	Male 15 - 24	Male 25 - 34	Male 35 - 44	Male 45 - 54	Male 55 - 64	Male 65 -74	Male 75+	Male Total	Female 0-4	Female 5 - 14	Female 15 - 24	Female 25 - 34	Female 35 - 44	Female 45 - 54	Female 55 - 64	Female 65 - 74	Female 75+	Female Total
1 Tuberculosis	13838	4267	41543	98366	91578	75550	38666	13365	3618	380789	11694	3544	45427	59423	43538	28718	13785	6045	2313	214488
2 Sexually transmitted diseases excl HIV/AIDS	3961	0	187	422	247	347	52	0	4	5219	4596	0	910	1173	1075	441	104	46	19	8365
3 HIV/AIDS	734444	19236	22476	550150	621236	178506	21526	505	0	2148080	720314	19012	261420	916091	530363	68958	1172	0	0	2517330
4 Diarrhoeal diseases	189245	7563	10273	9211	7106	5997	3651	2167	1125	236339	173463	4338	8990	9949	5833	5289	3944	2501	2181	216488
5 Childhood immunisable diseases	4142	885	0	120	155	80	34	20	4	5439	3629	196	176	116	32	170	121	39	0	4478
6 Meningitis	22135	6261	9428	8830	4473	2668	633	343	105	54876	16294	3605	6134	5029	2577	1530	511	342	67	36088
7 Hepatitis	884	967	992	1323	1198	694	232	42	25	6356	962	196	1002	807	603	400	204	79	26	4278
8 Malaria	899	1490	4274	3600	2021	1653	626	181	60	14805	354	855	1500	1667	747	522	465	195	27	6333
9 Schistosomiasis and other tropical diseases	0	0	0	67	31	53	0	27	5	184	0	0	113	93	0	35	0	0	0	241
10 Leprosy	0	0	0	0	31	80	34	0	5	149	0	0	0	0	0	0	36	10	13	60
11 Intestinal parasites	789	95	0	0	0	0	0	0	0	884	549	134	0	0	0	0	0	0	0	683
12 Septicaemia	17298	3272	6530	9866	7318	7252	4380	2431	1092	59439	15641	2261	6716	9904	6797	5709	4056	2697	2027	55808
13 Other infectious and parasitic diseases	1838	735	1453	2937	1991	1067	307	94	13	10437	1578	770	1999	2454	1566	598	152	79	10	9206
14 Lower respiratory tract infections	106389	7099	17572	31660	27570	22132	14356	8104	4888	239770	99223	5402	21219	29014	18927	13445	8311	6598	7101	209240
15 Upper respiratory tract infections	2459	490	101	153	185	53	64	30	14	3550	1884	367	176	73	103	0	46	39	29	2716
16 Otitis media	224	48	0	153	61	0	0	7	0	493	136	0	126	62	0	0	0	0	0	324
17 Maternal haemorrhage	0	0	0	0	0	0	0	0	0	0	0	0	4659	4474	2183	69	0	0	0	11386
18 Maternal sepsis	0	0	0	0	0	0	0	0	0	0	0	0	2356	1743	527	63	0	0	0	4688
19 Hypertension in pregnancy	0	0	0	0	0	0	0	0	0	0	0	122	6978	5934	2266	69	0	0	0	15370
20 Obstructed labour	0	0	0	0	0	0	0	0	0	0	0	0	231	0	0	0	0	0	0	231
21 Abortion	0	0	0	0	0	0	0	0	0	0	0	0	4302	4880	1874	264	0	0	0	11320
22 Other maternal conditions	0	0	0	0	0	0	0	0	0	0	0	0	4806	6483	2459	63	0	0	0	13811
23 Low birth weight	213489	0	0	0	0	0	0	0	0	213489	180274	0	0	0	0	0	0	0	0	180274
24 Birth asphyxia and trauma	48629	0	0	0	0	0	0	0	0	48629	37054	0	0	0	0	0	0	0	0	37054
25 Other respiratory conditions	98896	0	0	0	0	0	0	0	0	98896	84951	0	0	0	0	0	0	0	0	84951
26 Neonatal infections	52882	0	0	0	0	0	0	0	0	52882	43937	0	0	0	0	0	0	0	0	43937
27 Foetal alcohol syndrome	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28 Other perinatal causes	84669	0	0	0	0	0	0	0	0	84669	62417	0	0	0	0	0	0	0	0	62417
29 Protein-energy malnutrition	84014	2057	734	1783	1290	1759	938	737	243	93556	71457	1136	687	1300	1277	912	484	334	290	77877
30 Deficiency anaemias	1247	504	906	961	614	666	359	209	103	5570	1432	501	2416	2823	1641	1196	668	360	195	11233
31 Other nutritional deficiencies including pellagra and Vit A	65	0	172	134	246	347	366	111	49	1489	59	0	100	209	410	135	171	99	61	1244
32 Mouth and oropharynx Ca	0	0	496	539	1447	4668	3895	1828	357	13231	0	0	153	210	513	1552	1370	521	261	4580
33 Oesophageal Ca	0	0	234	836	5825	16336	13203	6500	1739	44673	0	0	109	613	3179	7053	7029	3445	1108	22537
34 Stomach Ca	0	0	234	820	2229	4755	4838	2634	802	16313	0	0	132	637	1128	2876	2264	1550	822	9407
35 Colo-rectal Ca	0	0	758	916	1325	2945	2876	2413	870	12102	0	0	307	808	1170	2257	3019	2410	1424	11395
36 Liver Ca	140	246	1754	2658	4056	6248	4810	2784	832	23528	219	183	591	657	1385	2530	2815	1831	688	10898

Appendix F continued/...		Male	Male	Male	Male	Male	Male	Male	Male	Male	Male	Female	Female	Female	Female	Female	Female	Female	Female	Female	
Disease	0-4	5 - 14	15 - 24	25 - 34	35 - 44	45 - 54	55 - 64	65 - 74	75+	Total	0-4	5 - 14	15 - 24	25 - 34	35 - 44	45 - 54	55 - 64	65 - 74	75+	Total	
37	Pancreas Ca	0	0	0	112	1109	3028	2960	1465	397	9072	0	0	0	138	700	1655	2024	1336	668	6521
38	Larynx ca	0	0	156	152	612	2503	2717	1213	295	7648	0	0	0	0	67	575	445	234	43	1364
39	Trachea/bronchi/lung Ca	0	0	106	1063	5348	17890	18264	9963	2301	54934	0	0	132	483	2486	6771	7042	4515	1327	22756
40	Bone and connective tissue Ca	279	786	3090	894	656	944	800	242	111	7803	219	1177	1330	463	584	705	551	488	115	5632
41	Melanoma	0	98	78	377	428	887	729	372	121	3089	0	71	0	55	374	607	419	335	174	2034
42	Other skin cancer	0	0	184	951	590	361	330	129	54	2598	0	71	132	479	187	271	150	123	54	1467
43	Breast Ca	0	0	0	28	27	167	228	86	14	550	0	0	307	1829	8202	13276	9013	4150	1738	38516
44	Cervix Ca	0	0	0	0	0	0	0	0	0	0	0	0	548	3811	12653	16396	10843	4580	1197	50027
45	Corpus uteri Ca	0	0	0	0	0	0	0	0	0	0	0	0	153	428	687	1823	1623	1257	513	6483
46	Ovary Ca	0	0	0	0	0	0	0	0	0	0	0	112	218	460	1454	2660	2004	1252	381	8540
47	Prostate Ca	0	0	0	107	148	1255	3963	5361	3294	14128	0	0	0	0	0	0	0	0	0	0
48	Bladder Ca	0	0	0	208	348	666	968	1034	463	3688	0	0	0	254	278	337	660	226	186	1941
49	Kidney Ca	874	297	184	107	253	585	1032	336	148	3816	1012	233	0	119	321	373	385	118	136	2696
50	Brain Ca	244	1092	551	445	401	722	1090	403	34	4982	274	335	479	237	412	980	579	410	96	3802
51	Lymphoma	664	1041	2411	1997	1544	1607	1281	606	249	11399	479	416	830	571	810	811	842	663	278	5700
52	Leukaemia	1574	3234	5252	1739	1164	1278	1376	942	322	16880	1436	1623	2159	816	1054	1082	1005	767	412	10353
53	Other malignant neoplasms	1120	149	762	557	1441	2332	2328	1391	411	10490	561	335	524	618	1395	2967	2603	1939	743	11686
54	Benign neoplasms	437	1396	2552	576	835	1123	784	345	124	8171	454	728	412	445	877	1221	805	478	171	5591
55	Diabetes mellitus	297	579	3447	3928	8264	16349	15197	8426	2780	59267	265	650	3229	4231	8246	20031	26197	16780	6526	86154
56	Albinism	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	Other endocrine and metabolic disorders	4183	1940	2868	2337	2583	2649	1773	694	281	19308	5095	1327	2442	1871	2529	2979	2346	1341	589	20519
58	Alcohol dependence	0	94	570	1479	3131	2978	1521	486	82	10340	0	0	122	429	1094	1226	486	209	30	3595
59	Drug abuse	0	0	0	72	52	77	18	8	0	227	0	0	0	0	0	0	21	0	0	21
60	Schizophrenia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	Affective disorders	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	Anorexia nervosa	0	0	0	0	0	26	0	8	0	34	0	0	41	25	54	0	0	0	6	125
63	Anxiety disorders	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	Hyperkinetic syndrome of childhood	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65	Adjustment reaction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	Mental disability (no defined aetiology)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67	Other mental disorders	0	0	0	26	0	0	0	11	0	37	0	0	0	0	0	0	0	0	0	0
68	Alzheimer and other dementias	227	145	346	262	470	230	528	677	446	3331	277	127	249	252	356	158	349	712	722	3201
69	Parkinson's disease	0	0	0	0	52	51	309	634	489	1535	0	0	0	25	0	31	203	418	464	1141
70	Multiple sclerosis	0	51	0	46	27	0	53	0	10	187	0	0	0	25	180	314	145	11	6	681
71	Epilepsy	2096	4434	13799	9655	7928	6745	2788	1104	253	48802	2028	2565	6543	4429	3295	3150	1721	690	259	24681
72	Encephalitis and brain abscess	1466	1361	2674	1172	799	738	244	19	19	8492	554	1097	1727	739	337	312	144	22	17	4948
73	Other nervous system disorders	7745	5377	6904	3124	2434	2549	1767	714	210	30824	6383	2553	2848	1476	1641	1832	1115	755	317	18921

Appendix F' continued/...

Disease	Male	Male	Male	Male	Male	Male	Male	Male	Male	Male	Female	Female	Female	Female	Female	Female	Female	Female	Female	Female	
	0-4	5 - 14	15 - 24	25 - 34	35 - 44	45 - 54	55 - 64	65 - 74	75+	Total	0-4	5 - 14	15 - 24	25 - 34	35 - 44	45 - 54	55 - 64	65 - 74	75+	Total	
74	Glaucoma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
75	Cataracts	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76	Other visual disorders	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
77	Hearing loss	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78	Rheumatic heart disease	276	2650	5668	2758	1201	1254	557	307	113	14785	289	2208	7169	4917	3173	2402	1959	747	299	23163
79	Ischaemic heart disease	0	0	2426	6785	21126	48177	50398	33015	13979	175906	0	236	890	2734	9210	22066	27885	25555	19956	108531
80	Stroke	78	1507	8526	9976	20630	37267	35202	24676	10123	147986	0	1058	5017	7883	20031	39849	42763	33057	20439	170097
81	Inflammatory heart disease	3100	1234	4049	6348	6097	7552	6477	3185	1564	39606	2199	1198	3255	5223	4738	6054	5406	3298	2289	33658
82	Hypertensive heart disease	0	0	1037	2439	6610	13996	12476	7779	3616	47954	0	0	1159	2983	9616	16691	20362	15953	12348	79112
83	Non-rheumatic valvular disease	198	1564	3693	2275	2029	1373	1070	600	393	13193	96	1114	2611	2671	1972	1737	1488	917	711	13318
84	Pulmonary embolism	0	94	529	1283	2033	3236	2681	1289	506	11652	0	64	1258	2098	3122	3740	2132	1780	804	14998
85	Aortic aneurism	0	0	82	118	391	690	1214	1149	616	4261	0	0	41	92	162	510	603	575	456	2439
86	Peripheral vascular disease	0	0	289	379	835	1259	1218	787	404	5170	0	0	244	529	736	945	820	568	531	4375
87	Other cardiovascular disease	78	94	834	747	625	687	502	305	147	4018	0	64	289	637	368	474	552	362	234	2980
88	Chronic obstructive pulmonary disease	1145	383	935	2277	6673	17614	22223	16768	6441	74459	617	102	1031	1352	3004	8444	10467	8941	5082	39041
89	Asthma	2468	1685	4465	4465	7374	12229	11227	5331	1790	51032	1499	1135	3488	4851	6895	9628	8118	5149	2274	43037
90	Aspiration pneumonia/ lung abscess	2135	383	559	1132	1420	1859	946	390	117	8941	1899	345	769	394	468	564	230	168	75	4911
91	Other respiratory diseases	5831	664	2319	3044	3660	5150	4088	1896	844	27496	3533	331	905	1838	2610	2922	1969	1474	831	16412
92	Peptic ulcer disease	0	0	1272	2403	2949	3579	2291	1094	316	13904	0	102	597	1217	1655	1507	1980	987	673	8717
93	Cirrhosis of the liver	490	1361	3590	6333	12440	17915	10373	4078	828	57408	316	1008	2975	3424	6628	7896	5201	2822	768	31038
94	Appendicitis	0	579	71	196	130	152	104	46	19	1298	0	204	393	184	0	126	37	10	14	969
95	Intestinal obstruction	1813	817	3244	3647	3376	3133	1560	835	386	18809	693	243	2158	3525	3030	2146	1343	1114	779	15032
96	Gall bladder and bile duct disease	0	51	0	52	236	280	187	193	111	1111	0	0	81	33	256	187	423	315	115	1411
97	Pancreatitis	0	51	570	2761	3753	2342	808	188	31	10505	0	64	145	252	473	659	306	211	85	2194
98	Other digestive system diseases	725	1166	2146	3506	3357	4511	2801	1204	379	19794	328	740	2921	1864	2286	2830	2052	1332	779	15132
99	Nephritis and nephrosis	2624	2213	6651	6108	8855	9909	7602	4647	2339	50948	1839	1748	3912	4371	8098	8683	6520	4434	3419	43025
100	Benign prostatic hypertrophy	0	0	0	0	0	26	191	278	222	716	0	0	0	0	0	0	0	0	0	0
101	Stress incontinence	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
102	Other genitourinary diseases	383	0	173	445	675	739	538	484	216	3653	202	102	606	336	432	531	520	435	475	3638
103	Skin diseases	70	0	0	98	25	76	53	11	4	336	0	0	41	117	122	31	91	41	11	454
104	Rheumatoid arthritis	0	0	0	26	27	0	18	11	0	82	0	0	0	0	32	126	54	41	8	260
105	Osteoarthritis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5
106	Other muscu-skeletal disorders	0	145	305	144	182	254	124	89	28	1271	0	64	620	613	738	600	256	74	74	3038
107	Neural tube defects	18618	1915	751	181	0	0	0	0	0	21465	15412	645	502	92	27	0	0	0	0	16677
108	Cleft lip and/or palate	286	0	0	0	0	0	0	0	0	286	469	0	0	0	0	0	0	0	0	469
109	Congenital heart disease	21884	1080	1146	273	227	25	16	0	0	24653	19427	1038	502	167	239	95	37	10	0	21515
110	Congenital disorders of GIT	7090	281	107	0	0	0	0	0	0	7479	5538	108	0	0	0	32	0	0	0	5679
111	Down' s syndrome and other chromosomal	7245	51	186	135	0	26	0	0	0	7643	7687	108	230	33	0	32	0	0	0	8092
112	Other congenital anomalies	8044	238	452	0	27	76	55	0	0	8893	5514	69	145	0	32	32	16	10	9	5826

Appendix F continued/...

		Male	Male	Male	Male	Male	Male	Male	Male	Male	Female	Female	Female	Female	Female	Female	Female	Female	Female	Female		
Disease		0-4	5 - 14	15 - 24	25 - 34	35 - 44	45 - 54	55 - 64	65 - 74	75+	Total	0-4	5 - 14	15 - 24	25 - 34	35 - 44	45 - 54	55 - 64	65 - 74	75+	Total	
113	Dental caries	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
114	Periodontal disease	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
115	Other oral health problems	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
116	Cot death	8303	0	0	0	0	0	0	0	0	8303	7992	0	0	0	0	0	0	0	0	0	7992
117	Road traffic accidents	23454	42752	72211	95340	69780	29035	9539	2243	514	344868	18925	19961	33978	31437	23836	10808	4075	1711	380	145111	
118	Other transport accidents	0	1445	6710	7099	6175	2482	690	53	0	24655	974	784	1001	1753	1650	246	215	74	23	6720	
119	Mining accidents	0	0	863	1570	3785	1259	0	0	0	7477	0	0	0	0	0	0	0	0	0	0	0
120	Poisoning	4822	670	2053	2303	1694	602	286	0	0	12429	2324	397	1065	2577	1020	463	198	39	13	8096	
121	Surgical / medical misadventure	2060	1159	384	737	891	1033	1290	801	222	8580	3175	710	1031	1842	590	1187	774	542	262	10113	
122	Falls	1607	2166	2378	3222	2680	2208	849	387	142	15639	2418	752	518	444	597	274	584	203	154	5945	
123	Fires	21722	6483	9511	14773	11266	5010	1235	419	116	70535	16059	2931	9442	11832	8159	2641	1112	496	193	52866	
124	Natural and environmental factors	861	282	676	473	629	405	107	30	0	3463	887	100	484	82	309	42	64	36	0	2004	
125	Drowning	12182	11803	4152	3607	3374	1252	502	22	1	36894	6331	2584	1443	607	457	318	66	26	0	11832	
126	Suffocation and foreign bodies	2884	135	207	388	361	226	0	0	0	4201	2782	261	469	100	175	213	126	22	0	4148	
127	Other unintentional injuries	4158	3338	4036	3544	1492	1100	427	173	12	18282	4056	1087	1062	773	695	428	94	82	0	8277	
128	Homicide and violence	12180	10986	265986	272127	140569	41379	10898	1893	466	756483	10152	5659	39086	48717	29938	8753	2490	992	323	146109	
129	Suicide and self-inflicted injuries	0	3985	37782	41172	22984	12613	3799	1249	238	123822	0	1842	13315	11236	8747	2781	1379	326	96	39721	
130	Legal intervention and war	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix F: Estimated YLLs by age group and sex, 2000 (persons)

Disease	Persons 0-4	Persons 5 - 14	Persons 15 - 24	Persons 25 - 34	Persons 35 - 44	Persons 45 - 54	Persons 55 - 64	Persons 65 - 74	Persons 75+	Persons Total
1 Tuberculosis	25532	7811	86970	157789	135115	104268	52451	19410	5932	595277
2 Sexually transmitted diseases excl HIV/AIDS	8557	0	1098	1595	1322	788	155	46	23	13583
3 HIV/AIDS	1454758	38248	283896	1466241	1151599	247465	22698	505	0	4665410
4 Diarrhoeal diseases	362708	11901	19262	19160	12939	11287	7596	4668	3306	452827
5 Childhood immunisable diseases	7771	1081	176	236	187	250	155	58	4	9917
6 Meningitis	38429	9866	15562	13860	7049	4198	1144	684	173	90964
7 Hepatitis	1846	1162	1995	2130	1801	1094	435	121	51	10634
8 Malaria	1253	2346	5774	5267	2769	2175	1091	376	86	21138
9 Schistosomiasis and other tropical diseases	0	0	113	160	31	88	0	27	5	424
10 Leprosy	0	0	0	0	31	80	70	10	17	209
11 Intestinal parasites	1338	230	0	0	0	0	0	0	0	1568
12 Septicaemia	32939	5533	13246	19770	14115	12961	8436	5128	3119	115247
13 Other infectious and parasitic diseases	3416	1506	3452	5391	3557	1665	459	173	23	19643
14 Lower respiratory tract infections	205611	12501	38791	60674	46497	35578	22667	14702	11990	449010
15 Upper respiratory tract infections	4343	856	277	227	287	53	110	69	43	6266
16 Otitis media	359	48	126	216	61	0	0	7	0	817
17 Maternal haemorrhage	0	0	4659	4474	2183	69	0	0	0	11386
18 Maternal sepsis	0	0	2356	1743	527	63	0	0	0	4688
19 Hypertension in pregnancy	0	122	6978	5934	2266	69	0	0	0	15370
20 Obstructed labour	0	0	0	231	0	0	0	0	0	231
21 Abortion	0	0	4302	4880	1874	264	0	0	0	11320
22 Other maternal conditions	0	0	4806	6483	2459	63	0	0	0	13811
23 Low birth weight	393763	0	0	0	0	0	0	0	0	393763
24 Birth asphyxia and trauma	85684	0	0	0	0	0	0	0	0	85684
25 Other respiratory conditions	183847	0	0	0	0	0	0	0	0	183847
26 Neonatal infections	96819	0	0	0	0	0	0	0	0	96819
27 Foetal alcohol syndrome	0	0	0	0	0	0	0	0	0	0
28 Other perinatal causes	147087	0	0	0	0	0	0	0	0	147087
29 Protein-energy malnutrition	155471	3193	1422	3084	2567	2672	1422	1071	533	171433
30 Deficiency anaemias	2679	1005	3323	3784	2255	1863	1028	568	298	16803
31 Other nutritional deficiencies including pellagra and Vit A	124	0	272	343	656	483	536	211	109	2733
32 Mouth and oropharynx Ca	0	0	649	749	1960	6220	5266	2348	618	17811
33 Oesophageal Ca	0	0	343	1449	9004	23389	20232	9945	2847	67210
34 Stomach Ca	0	0	366	1457	3357	7631	7102	4183	1623	25720
35 Colorectal Ca	0	0	1065	1724	2494	5201	5895	4824	2294	23498
36 Liver Ca	359	429	2345	3315	5441	8778	7625	4615	1520	34426
37 Pancreas Ca	0	0	0	251	1809	4683	4984	2801	1065	15593
38 Larynx ca	0	0	156	152	679	3078	3162	1446	338	9011

Appendix F continued/...		Persons	Persons	Persons	Persons	Persons	Persons	Persons	Persons	Persons	Persons
Disease	0-4	5 - 14	15 - 24	25 - 34	35 - 44	45 - 54	55 - 64	65 - 74	75+	Total	
39	Trachea/bronchi/lung Ca	0	0	237	1546	7833	24661	25306	14478	3628	77689
40	Bone and connective tissue Ca	497	1963	4420	1358	1240	1650	1351	729	226	13435
41	Melanoma	0	169	78	432	802	1494	1147	706	294	5123
42	Other skin cancer	0	71	315	1430	777	632	480	252	108	4065
43	Breast Ca	0	0	307	1857	8229	13444	9242	4236	1752	39067
44	Cervix Ca	0	0	548	3811	12653	16396	10843	4580	1197	50027
45	Corpus uteri Ca	0	0	153	428	687	1823	1623	1257	513	6483
46	Ovary Ca	0	112	218	460	1454	2660	2004	1252	381	8540
47	Prostate Ca	0	0	0	107	148	1255	3963	5361	3294	14128
48	Bladder Ca	0	0	0	462	626	1003	1628	1260	650	5628
49	Kidney Ca	1886	531	184	226	574	958	1417	454	284	6513
50	Brain Ca	518	1427	1030	682	813	1702	1669	813	130	8784
51	Lymphoma	1144	1457	3241	2568	2353	2418	2123	1268	527	17099
52	Leukaemia	3009	4857	7411	2555	2218	2360	2381	1708	734	27233
53	Other malignant neoplasms	1681	484	1286	1175	2836	5299	4931	3330	1154	22176
54	Benign neoplasms	891	2124	2963	1022	1712	2344	1589	824	295	13763
55	Diabetes mellitus	561	1228	6677	8159	16510	36380	41394	25206	9306	145421
56	Albinism	0	0	0	0	0	0	0	0	0	0
57	Other endocrine and metabolic disorders	9278	3267	5310	4209	5112	5628	4119	2035	870	39828
58	Alcohol dependence	0	94	692	1907	4225	4204	2007	695	111	13935
59	Drug abuse	0	0	0	72	52	77	40	8	0	248
60	Schizophrenia	0	0	0	0	0	0	0	0	0	0
61	Affective disorders	0	0	0	0	0	0	0	0	0	0
62	Anorexia nervosa	0	0	41	25	54	26	0	8	6	159
63	Anxiety disorders	0	0	0	0	0	0	0	0	0	0
64	Hyperkinetic syndrome of childhood	0	0	0	0	0	0	0	0	0	0
65	Adjustment reaction	0	0	0	0	0	0	0	0	0	0
66	Mental disability (no defined aetiology)	0	0	0	0	0	0	0	0	0	0
67	Other mental disorders	0	0	0	26	0	0	0	11	0	37
68	Alzheimer and other dementias	504	272	594	514	826	387	877	1389	1168	6532
69	Parkinson's disease	0	0	0	25	52	82	512	1052	953	2676
70	Multiple sclerosis	0	51	0	71	207	314	198	11	16	868
71	Epilepsy	4124	6998	20342	14084	11223	9896	4509	1794	512	73483
72	Encephalitis and brain abscess	2020	2458	4401	1910	1136	1049	387	41	36	13439
73	Other nervous system disorders	14128	7930	9753	4600	4075	4381	2881	1469	527	49745
74	Glaucoma	0	0	0	0	0	0	0	0	0	0
75	Cataracts	0	0	0	0	0	0	0	0	0	0
76	Other visual disorders	0	0	0	0	0	0	0	0	0	0

Appendix F continued/...		Persons	Persons	Persons	Persons	Persons	Persons	Persons	Persons	Persons	Persons
Disease	0-4	5 - 14	15 - 24	25 - 34	35 - 44	45 - 54	55 - 64	65 - 74	75+	Total	
77	Hearing loss	0	0	0	0	0	0	0	0	0	
78	Rheumatic heart disease	565	4859	12837	7675	4374	3656	2515	1054	413	37948
79	Ischaemic heart disease	0	236	3317	9519	30335	70243	78283	58570	33934	284438
80	Stroke	78	2565	13543	17860	40661	77116	77965	57733	30562	318083
81	Inflammatory heart disease	5298	2432	7305	11571	10835	13605	11883	6483	3852	73264
82	Hypertensive heart disease	0	0	2197	5422	16226	30687	32838	23731	15965	127066
83	Non-rheumatic valvular disease	294	2677	6304	4946	4001	3110	2558	1517	1104	26512
84	Pulmonary embolism	0	157	1787	3382	5155	6976	4813	3069	1310	26650
85	Aortic aneurism	0	0	123	210	554	1200	1818	1724	1071	6700
86	Peripheral vascular disease	0	0	533	908	1571	2204	2039	1355	934	9545
87	Other cardiovascular disease	78	157	1123	1384	994	1161	1053	667	381	6998
88	Chronic obstructive pulmonary disease	1762	485	1967	3628	9676	26058	32690	25709	11524	113499
89	Asthma	3967	2820	7952	9316	14269	21857	19345	10480	4064	94069
90	Aspiration pneumonia/ lung abscess	4033	728	1328	1526	1888	2423	1176	558	192	13852
91	Other respiratory diseases	9363	996	3224	4882	6270	8072	6057	3370	1674	43908
92	Peptic ulcer disease	0	102	1869	3620	4604	5085	4270	2081	989	22621
93	Cirrhosis of the liver	805	2369	6565	9757	19069	25812	15574	6900	1596	88446
94	Appendicitis	0	783	465	381	130	278	141	56	33	2267
95	Intestinal obstruction	2505	1060	5403	7171	6406	5279	2903	1949	1165	33841
96	Gall bladder and bile duct disease	0	51	81	86	492	467	610	508	226	2522
97	Pancreatitis	0	115	715	3013	4226	3001	1114	400	116	12699
98	Other digestive system diseases	1053	1906	5068	5370	5643	7341	4853	2535	1158	34926
99	Nephritis and nephrosis	4463	3960	10563	10480	16953	18592	14122	9081	5758	93973
100	Benign prostatic hypertrophy	0	0	0	0	0	26	191	278	222	716
101	Stress incontinence	0	0	0	0	0	0	0	0	0	0
102	Other genitourinary diseases	585	102	779	781	1106	1270	1059	919	691	7291
103	Skin diseases	70	0	41	216	147	107	144	51	15	790
104	Rheumatoid arthritis	0	0	0	26	59	126	72	51	8	342
105	Osteoarthritis	0	0	0	0	0	0	0	0	5	5
106	Other musculoskeletal disorders	0	208	924	757	920	854	380	163	102	4309
107	Neural tube defects	34030	2560	1252	274	27	0	0	0	0	38142
108	Cleft lip and/or palate	755	0	0	0	0	0	0	0	0	755
109	Congenital heart disease	41311	2118	1648	441	466	120	54	10	0	46168
110	Congenital disorders of GIT	12629	389	107	0	0	32	0	0	0	13157
111	Down' s syndrome and other chromosomal	14932	159	417	169	0	58	0	0	0	15735
112	Other congenital anomalies	13559	307	597	0	59	108	71	10	9	14719
113	Dental caries	0	0	0	0	0	0	0	0	0	0
114	Periodontal disease	0	0	0	0	0	0	0	0	0	0
115	Other oral health problems	0	0	0	0	0	0	0	0	0	0

Appendix F continued/...		Persons	Persons	Persons	Persons	Persons	Persons	Persons	Persons	Persons	Persons
Disease		0-4	5 - 14	15 - 24	25 - 34	35 - 44	45 - 54	55 - 64	65 - 74	75+	Total
116	Cot death	16294	0	0	0	0	0	0	0	0	16294
117	Road traffic accidents	42379	62713	106188	126777	93616	39843	13614	3954	894	489979
118	Other transport accidents	974	2230	7711	8852	7825	2728	905	127	23	31375
119	Mining accidents	0	0	863	1570	3785	1259	0	0	0	7477
120	Poisoning	7146	1066	3117	4880	2715	1065	483	39	13	20524
121	Surgical / medical misadventure	5236	1870	1415	2579	1481	2221	2064	1343	484	18693
122	Falls	4025	2919	2896	3666	3276	2482	1433	591	296	21584
123	Fires	37780	9414	18953	26605	19425	7651	2347	915	309	123400
124	Natural and environmental factors	1748	382	1160	556	939	447	170	65	0	5467
125	Drowning	18513	14386	5595	4214	3831	1571	568	48	1	48727
126	Suffocation and foreign bodies	5666	397	675	488	536	439	126	22	0	8349
127	Other unintentional injuries	8214	4425	5098	4318	2187	1528	521	255	12	26560
128	Homicide and violence	22332	16644	305072	320844	170507	50131	13388	2884	789	902592
129	Suicide and self-inflicted injuries	0	5827	51098	52408	31731	15393	5178	1574	335	163544
130	Legal intervention and war	0	0	0	0	0	0	0	0	0	0

Appendix G: Estimated YLDs, DALYs and DALYs/100 000 by age group and sex, 2000

Table G1: Estimated YLD by age groups and sex, 2000

YLDs																			
Group	Male 0-4	Male 5-14	Male 15-29	Male 30-44	Male 45-59	Male 60-69	Male 70-79	Male 80+	Male Total	Female 0-4	Female 5-14	Female 15-29	Female 30-44	Female 45-59	Female 60-69	Female 70-79	Female 80+	Female Total	Persons Total
I Communicable diseases, maternal and neonatal conditions	168899	15261	62846	30192	15692	5030	2115	715	293682	139077	5803	87343	38651	12043	7014	3855	1857	281256	574938
HIV/AIDS	799	1631	48280	59159	8065	298	0	0	181791	789	1829	109798	58595	3205	2	0	0	220290	402081
II. Non-communicable diseases	98848	126438	284598	170634	346916	155365	56416	10682	994925	79749	181759	155600	253314	299135	120845	57131	17465	905149	1900074
III. Injuries	46542	51254	136488	122318	34740	3906	789	84	410890	38974	25293	62961	54947	15277	2348	722	128	211023	621913
Total	315088	194585	532212	382304	405413	164599	59320	11481	1881287	258589	214684	415701	405507	329659	130209	61709	19449	1617719	3499006

Table G2: Estimated DALYs by age group and sex, 2000

DALYs																			
Group	Male 0-4	Male 5-14	Male 15-29	Male 30-44	Male 45-59	Male 60-69	Male 70-79	Male 80+	Male Total	Female 0-4	Female 5-14	Female 15-29	Female 30-44	Female 45-59	Female 60-69	Female 70-79	Female 80+	Female Total	Persons Total
I Communicable diseases, maternal and neonatal conditions	1116887	50996	249606	253302	174798	48194	19519	5358	1911592	950664	29229	293573	195487	90135	32892	18957	9294	1605846	3517438
HIV/AIDS	735243	20867	264997	1036304	203551	5343	6	0	2329870	721103	20841	818498	1057769	73313	24	0	0	2737620	5067490
II. Non-communicable diseases	213076	168962	445964	394762	789661	376652	161807	35506	2331418	174551	209458	264789	443662	661897	323832	178908	63049	2060297	4391715
III. Injuries	132472	136458	787676	590116	153019	18611	4497	599	1838217	107057	62361	221725	186651	50397	9320	3395	686	651967	2490184
Total	2197678	377283	1748243	2274485	1321030	448801	185829	41464	8411098	1953375	321889	1598585	1883569	875742	366068	201260	73030	7055730	15466828

Table G3: Estimate of DALYs per 100 000 by age groups and sex, 2000

DALY/100 000																			
Group	Male 0-4	Male 5-14	Male 15-29	Male 30-44	Male 45-59	Male 60-69	Male 70-79	Male 80+	Male Total	Female 0-4	Female 5-14	Female 15-29	Female 30-44	Female 45-59	Female 60-69	Female 70-79	Female 80+	Female Total	Persons Total
I Communicable diseases, maternal and neonatal conditions	42389	1072	3970	5518	6797	6093	5739	5611	8662	36904	625	4583	4011	3211	3356	3808	4782	6978	7802
HIV/AIDS	27905	439	4215	22575	7915	675	2	0	10558	27992	446	12778	21702	2612	2	0	0	11896	11241
II. Non-communicable diseases	8087	3552	7093	8599	30707	47619	47575	37183	10565	6776	4478	4134	9102	23580	33038	35934	32436	8953	9742
III. Injuries	5028	2868	12528	12855	5950	2353	1322	627	8330	4156	1333	3461	3829	1795	951	682	353	2833	5524
Total	83409	7931	27807	49547	51370	56740	54638	43421	38115	75828	6881	24956	38644	31198	37347	40424	37571	30660	34309