Patterns and the changing role of the Global Burden of Disease categories in South Africa: 1997-2005

Barbara A. Anderson
(barba@umich.edu)
University of Michigan
and
Statistics South Africa

Heston E. Phillips
(hestonp@statssa.gov.za)
Statistics South Africa

A paper prepared for presentation at the
Union of African Population Studies Conference

Arusha, Tanzania
December 2007

INTRODUCTION

For any country, the health and survival of its citizens is one of its main concerns. Knowing the chances of dying at each age for either sex, how these risks have changed over time, and understanding the causes of death, are crucial to obtaining an accurate picture of mortality and to effective policy planning to improve rates of survival. This paper uses the three category Global Burden of Disease approach to examine changes over time in overall adult mortality risks by age and sex as well as the contribution of: 1) communicable and related diseases, 2) non-communicable diseases and 3) unnatural causes. We also look at what the overall mortality situation would have been if certain aspects of the three global burden of disease categories had not changed since 1997.

Over time mortality from infectious and parasitic and other communicable diseases has typically decreased, and an increased portion of deaths have resulted from non-communicable diseases, which include degenerative and chronic conditions that especially afflict the elderly.

In South Africa deaths from HIV have become a source of ever-increasing concern. HIV only appeared to any substantial extent in South Africa in the early 1990s. The average time from becoming HIV-positive to death is about 8-10 years in sub-Saharan Africa (Hunter and Williamson, 2000: 23). Large increases in the death rates of women in their twenties and thirties since the late 1990s are thought to result mainly from HIV. With the increases in HIV prevalence since 1990, and with the long average lag from infection to death, it seems likely that HIV deaths will continue to increase in South Africa for some years. In the Global Burden of Disease system, HIV mortality is mainly reflected in increased mortality from communicable diseases.

Traditional communicable causes of death, such as malaria, have not disappeared and in some cases present an increasing problem as drug-resistant strains of malaria and other diseases have emerged (World Health Organization, 2005).

Mortality from non-communicable diseases, such as cancer and stroke, which play a major role in mortality at older ages throughout the world, is also important in South Africa. However, in much of the developing world, unhealthy behaviours common in the developed countries, such as smoking, high levels of alcohol consumption, and consumption of high calorie foods with little nutritional value, have increased (Bah, 1993; Gwatkin, 1980; Kurylowicz and Kopczynski, 1986; Walker, 1996; World Health Organization, 1999).

These behaviours are expected to contribute to higher adult mortality for both sexes (Beaton, 1997; Gunawardene, 1999), as they already have in many parts of the world (Nizard and Munoz-Perez, 1993; Shkolnikov and Mesle, 1996; Shkolnikov *et al*., 1997). These behaviours and their mortality consequences have an especially large effect on men, since men tend to smoke and drink alcohol more than women (Waldron, 1986, 2000; Zhang, Sasaki, and Kesteloot, 1995). However, in much of the world, as women's status rises, women also increasingly adapt the negative health behaviours that are more typical of men. In many countries women's lung cancer rates have risen as an increasing proportion of women smoke (Dwyer *et al.,* 1994; Jemal *et al*., 2003).

Problems associated with a shift in diet toward more fat consumption have affected the South African population (Bourne, Lambert, and Steyn, 2002; Puoane *et al*., 2002). The South African Department of Health has been concerned about chronic diseases of lifestyle (South Africa, Department of Health, 2005b), including effects of diet, tobacco and alcohol consumption. Diabetes in particular seems to be a serious and increasing problem in South Africa (Levitt *et al*., 1997; Temple *et al*., 2001). In 1998, 30% of women in South Africa were obese (South Africa, Department of Health, 2002: 247). These behaviours contribute primarily to higher mortality from non-communicable diseases.

South Africa also has high death rates from unnatural causes and probably has the second highest homicide rate in the world, trailing only Colombia.[1] Although mortality from some unnatural causes, such as homicide, seems to have declined, little reduction in overall mortality from unnatural causes remains a source of concern.

For all these reasons, the South African government has long been concerned with reducing mortality and with understanding patterns and causes of mortality. Mortality analysis is an integral part of the South African Government Programme of Action, including directing specific attention to research and to programmes to reduce mortality from malaria, tuberculosis, non-communicable diseases such as diabetes, asthma and hypertension, and unnatural causes of death, as well as ongoing concern with HIV (South Africa, 2006).

Data and data quality considerations

In this paper, we examine the mortality conditions of adult South Africans age 15-64, over the period 1997-2005. People age 15-64 are those who have had their fifteenth birthday and have not yet had their sixty-fifth birthday. Our analysis is based primarily on data from the Death Notification Forms. Denominators to calculate death rates come from the Statistics South Africa Mid-Year population estimates.[2]

South Africa has come a long way since 1994 when a representative vital registration system was non-existent. We start the analysis with 1997 because the completeness of registration of deaths improved substantially from 1996 to 1997. It is estimated that in 1996, only 67% of all deaths were registered (Statistics South Africa, 2000: vi), while in 1997, 80% of all deaths to males and 78% of all deaths to females were registered. Although valuable work has been done using the death registration data from 1996 (Bradshaw *et al*., 2002), data from 1997 and later present many fewer problems.

Registration of deaths of children 0-14 is much less complete than registration of deaths of adults age 15-64. We estimated that for 1997, 92% of all deaths of males age 15-64 were registered, but only 41% of all deaths to males age 0-14; whilst for females, 84% of deaths of persons age 15-64 were registered but only 45% of deaths of children 0-14.

The estimated completeness of registration of deaths to those age 65 or older is much higher, sometimes estimated, implausibly, as greater than 100%. However,

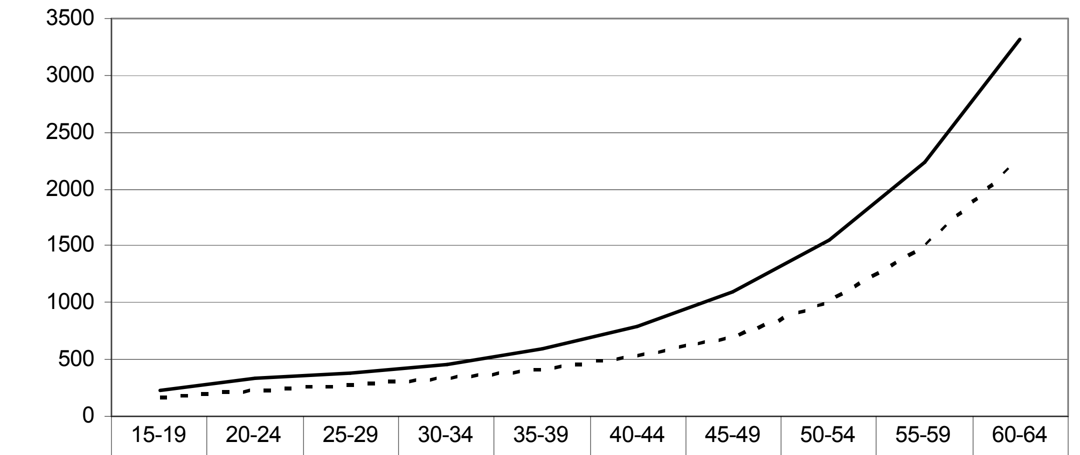
[1] It is estimated that in 2002 the homicide death rate in South Africa was 48 per 100,000 population (based on the number of homicides from the South African Police Service and the Statistics South Africa mid-year population estimates) and in Colombia was 66 per 100,000 population (Colombia, 2005).

[2] For more about the approach used in making mortality and cause of death estimates see Anderson and Phillips (2006). That publication presented results based on data for 1997-2004. The data upon which this paper is based include data for 2005 as well as revised estimates for earlier years.

we know that the elderly are chronically undercounted and their ages are often exaggerated in censuses (Anderson and Silver, 1994; Coale and Li, 1991; Phillips, Anderson and Tsebe, 2003; Rosenwaike and Preston, 1984).

ALL CAUSE MORTALITY

First we examine mortality by sex from all causes. In this section we look at death rates by age and sex and how they changed between 1997 and 2005.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Males	235	336	384	458	587	787	1091	1559	2238	3311
Females	165	226	275	335	415	526	705	1006	1489	2254

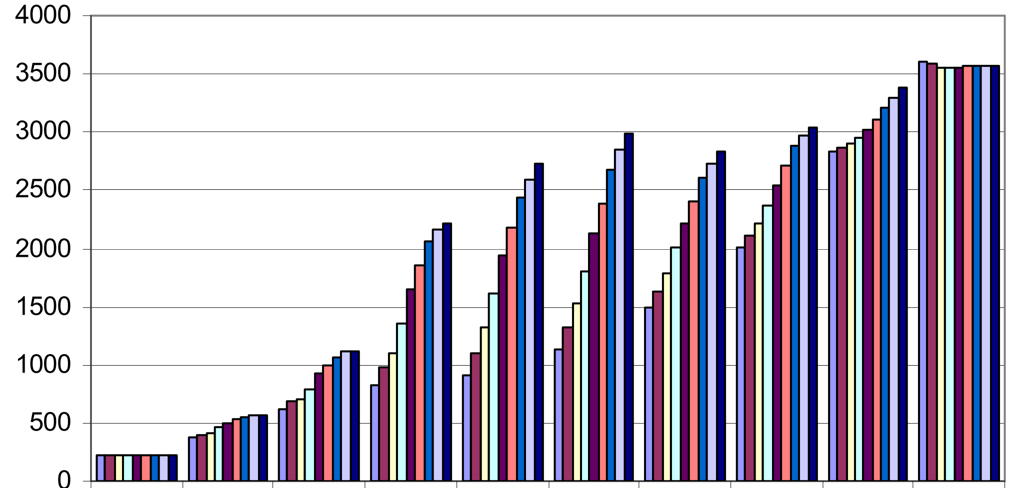
Figure 1. Death rates by age and sex per 100,000: UN general mortality pattern

It is useful to set a context for examination of mortality in South Africa by noting typical patterns of mortality by age and sex throughout the world. Figure 1 shows how death rates by age and sex have usually differed.[3] Typically, after age 15, death rates increase with age. After age 35 they rise at an increasing rate. Usually male death rates are higher at every age than female death rates.

Occasionally female death rates have been higher than male death rates at some ages, especially among infants and young children. But this has typically been in high male preference and female deprivation societies (Anderson and Liu, 1997; D'Souza and Chen, 1980; Dyson and Moore, 1983; Miller 1981), of which South Africa is not one. Higher female than male mortality has become increasing rare above age 15 (Tabutin, 1992).

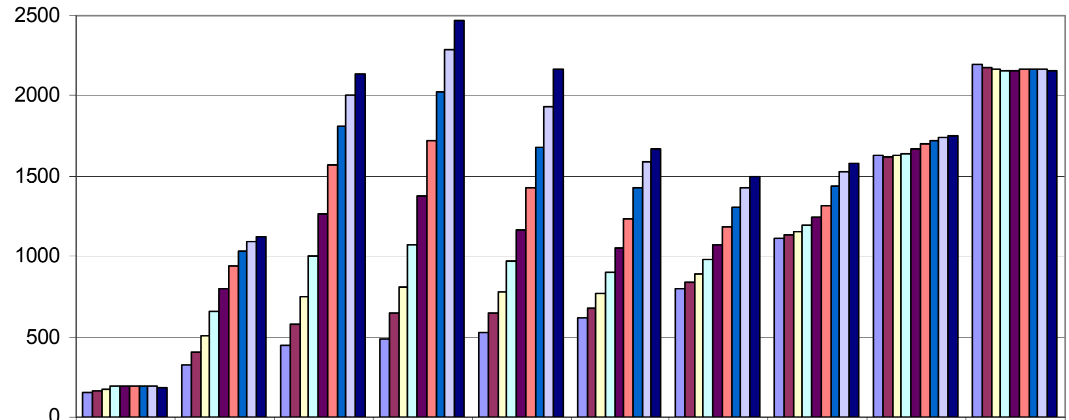
Usually, over time death rates for both sexes and at all ages have declined. However, in some societies at times other than wartime, death rates have increased for certain age-sex groups. For example after World War II, male death rates in the older working ages increased in the United States and much of Europe substantially due to cigarette smoking (Anderson and Silver, 1986; Preston, 1970). However, mortality increase over a sustained time has been fairly uncommon. A long-term increase in mortality of adult men and to a lesser extent of adult women in the former Soviet Union and parts of Eastern Europe has been an object of concern (Demko, Ioffe and Zayonchkovskaya, 1999; McKee and Shkolnikov, 2001; Mitchell, 1997).

[3] The death rates in Figure 1 are from United Nations (1982: 212-213, 236-237) with the same death rate at age 15-19 for both sexes as the estimated death rate at that age in South Africa in 1997. "Per 100,000" in all graphs and tables means "per 100,000 of the population".



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	221	372	615	817	918	1136	1485	2016	2838	3612
1998	224	398	694	984	1104	1326	1633	2111	2864	3586
1999	224	410	702	1097	1316	1527	1787	2216	2894	3561
2000	229	459	798	1358	1605	1810	2011	2373	2946	3548
2001	228	499	922	1650	1943	2128	2218	2546	3025	3557
2002	224	524	998	1851	2176	2390	2401	2708	3111	3564
2003	220	550	1071	2058	2436	2684	2610	2883	3218	3574
2004	218	562	1107	2163	2591	2852	2725	2974	3301	3568
2005	216	569	1122	2220	2723	2983	2839	3044	3387	3569

Figure 2. Male death rates by age per 100,000: 1997-2005

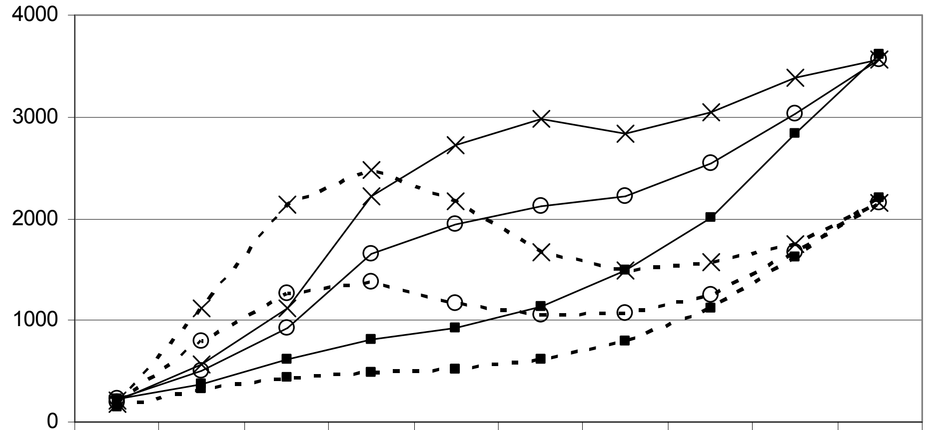


	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	151	320	442	488	526	616	800	1116	1626	2199
1998	163	407	579	651	651	681	841	1130	1624	2179
1999	172	508	744	807	779	767	895	1153	1626	2162
2000	192	657	998	1072	969	903	981	1199	1642	2154
2001	195	799	1269	1372	1168	1051	1071	1246	1668	2161
2002	194	941	1565	1720	1431	1235	1189	1313	1696	2165
2003	189	1035	1810	2027	1682	1432	1310	1438	1722	2167
2004	190	1089	2001	2283	1935	1588	1431	1533	1743	2167
2005	184	1119	2131	2472	2165	1668	1493	1577	1754	2157

Figure 3. Female death rates by age per 100,000: 1997-2005

Now we turn to the mortality situation in South Africa. First we consider mortality by age and sex from all causes. Figures 2 and 3 show age-specific death rates by sex for every year 1997-2005.

The presentations in Figures 2 and 3 make it easy to determine what the trend has been in death rates for a given sex and age. We see that except for those under age 20 and for those over age 60, death rates have increased in each year for each sex in every age group.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male 1997	221	372	615	817	918	1136	1485	2016	2838	3612
Male 2001	228	499	922	1650	1943	2128	2218	2546	3025	3557
Male 2005	216	569	1122	2220	2723	2983	2839	3044	3387	3569
Female 1997	151	320	442	488	526	616	800	1116	1626	2199
Female 2001	195	799	1269	1372	1168	1051	1071	1246	1668	2161
Female 2005	184	1119	2131	2472	2165	1668	1493	1577	1754	2157

Figure 4. Death rates by age per 100,000 by sex: 1997, 2001, and 2005

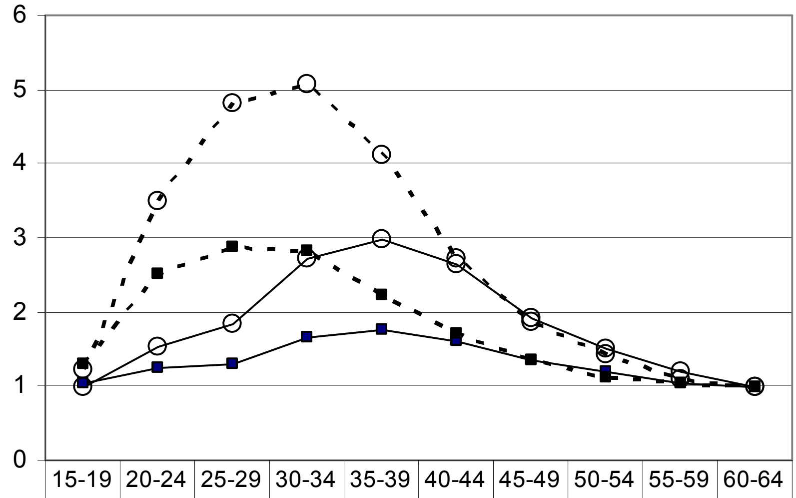
Figure 4 shows the death rates for each sex in 1997, 2001 and 2005. Focusing on 1997, 2001 and 2005 makes it easy to get a clear picture of the age pattern of death rates by sex and how these have changed over time. In Figure 4, and in other figures that show age-specific death rates by sex in 1997, 2001 and 2005, rates for males are indicated by a solid line for all dates, while rates for females are indicated by a dashed line for all dates. The marker for both sexes for the data referring to 1997 is a solid square, the marker for 2001 is a hollow circle and the marker for 2005 is an “X”.

In 1997, for each sex, death rates increase with each successively older age, as was shown in Figure 1. In 2001, the male death rate increases with each successively older age, while in 2005 the male death rate also increases with age, except for a small decline from the 40-44 to the 45-49 age group. However, in both 2001 and 2005, after a rapid increase up to age 30, there is a slower rise to age 50, and then a more rapid rise. In 2001, for females the death rate at age 25-39 is higher than at age 40-49, and for females in 2005, the death rate at age 25-39 is higher than at age 40-59, which is quite unusual.

The age pattern shown in Figure 4 above age 35 is very different for the two sexes. Above age 35, male death rates tend to continue to rise, while female death rates decline sharply and then rise after age 50. In 2005, the death rate for females at age 30-34 is higher than for females at age 60-64.

In 1997, at every age the male death rate was higher than the female death rate, as is seen in Figure 1 and as is usually found in the world. In 2001, for age 20-29 the female death rate was higher than the male death rate, and in 2005 for age 20-34 the female death rate was higher than the male death rate.

Figure 5 shows for each sex by age the death rates in 2001 and in 2005 relative to the value for the given age and sex in 1997. The much greater proportionate increase in female than male death rates below age 45 is striking. It is clear from Figure 9 that the increase in mortality between 1997 and 2005 has been concentrated in the younger ages, 20-44, especially for females.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male 2001/1997	1.035	1.234	1.297	1.661	1.748	1.594	1.354	1.177	1.038	0.982
Male 2005/1997	0.973	1.530	1.825	2.716	2.966	2.627	1.911	1.510	1.193	0.988
Female 2001/1997	1.293	2.501	2.874	2.811	2.219	1.707	1.339	1.117	1.026	0.982
Female 2005/1997	1.217	3.502	4.823	5.064	4.116	2.710	1.868	1.414	1.079	0.981

Figure 5. Death rates in 2001 and in 2005 by age and sex relative to value in 1997 (1997 value=1.00)

The large increase in mortality for women in their twenties, thirties and early forties is not part of a commensurate increase in female mortality at all ages. Although adult female death rates increased at all ages below 60 between 1997 and 2005, the increa above age 45 and especially above age 55 was much less. The increase in death rates for females in their twenties and thirties has been attributed to HIV by many people (Dorrington *et al*. 2001; Hosegood, Vanneste, and Timaeus, 2004; Tollman, *et al.,* 1999). Whether similar large increases in mortality will occur at older ages as those age 20-44 in 2005 (the cohort that was born in 1960-1989) grow older is yet to be seen.

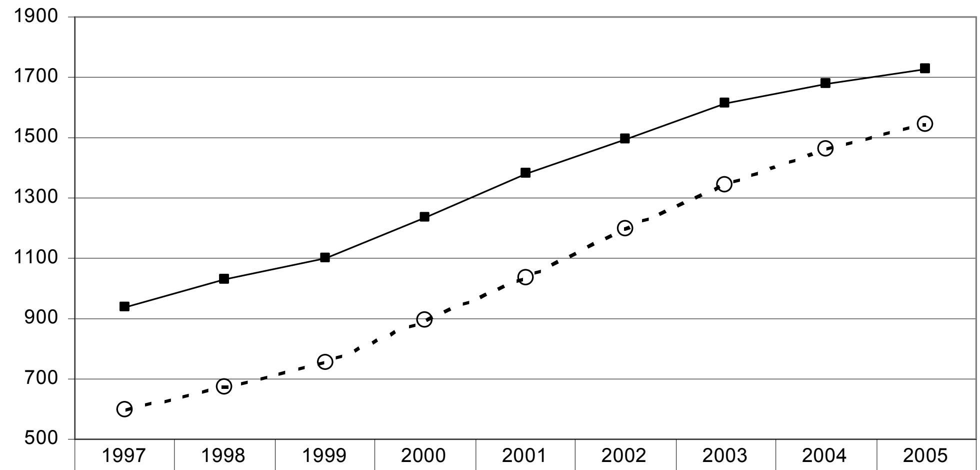
Age-standardised death rates

As we see in Figure 4, death rates differ greatly by age and by sex. We are considering people age 15-64 in this report. One could calculate a death rate for men age 15-64 from all causes or from some particular cause of death by dividing the total number of deaths to men age 15-64 from the given cause by the number of men age 15-64. However, the level of this rate would be affected by the age distribution of men within the 15-64 age range. For example, in Figure 4 the male death rate increases with age. If the male population grew older with time, the kind of simple death rate just described would increase even if the chance of men dying at each age were unchanged.

To take account of changes in the age distribution within the 15-64 age range over time, we calculate an age-standardised death rate for both sexes. To do this, first we choose a standard population. We use the 2001 mid-year population of South Africa for both sexes by five-year age group, as estimated by Statistics South Africa, as the standard population. We then take the actual death rate for the given sex by five-year age group and calculate how many deaths these rates would have produced in the 2001 population. We take the implied number of deaths to the 2001 population of the given sex and divide that number of deaths by the number of people of the given sex in mid-2001. We do this for each year. What results is a series of rates for which the age distribution (by sex) is held constant. Thus, the age-standardised rate does not go up or down because the population of the given sex has got older or younger over time. The age-standardised death rate for age 15-64 for a given sex is what the overall death rate would be for that sex in those ages per 100,000 population –

$$\frac{100{,}000\text{*(deaths to people of the given sex age 15-64)}}{\text{(number of people of the given sex age 15-64)}}$$

– if the people in that year of that sex had the same age distribution as people of that sex did in South Africa as a whole in 2001.



	1997	1998	1999	2000	2001	2002	2003	2004	2005
Male	940	1028	1100	1234	1383	1494	1613	1679	1729
Female	595	671	757	892	1034	1197	1343	1464	1546

Figure 6. Age-standardised death rates per 100,000 from all causes by sex, age 15-64: 1997-2005

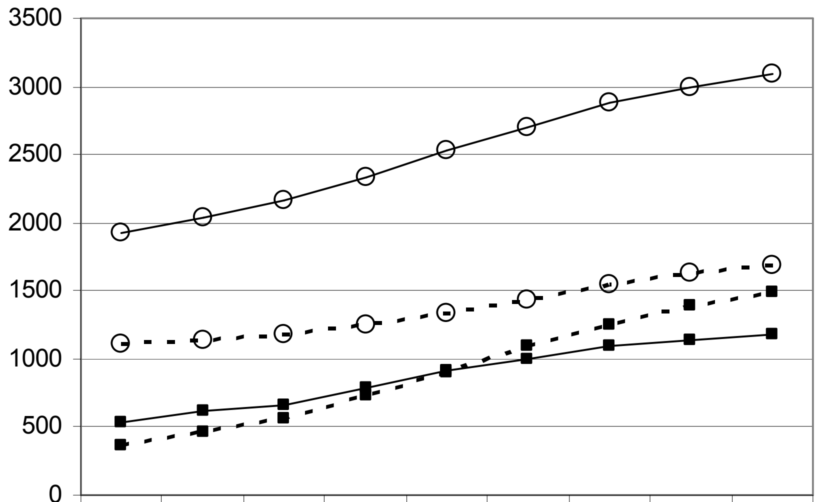
Figure 6 shows the age-standardised death rate per 100,000 population for each sex. The rate for each sex increases every year. Moreover, the rate is much lower for females than males in every year, although the gap has narrowed over time.

Looking at younger and older adults

It is clear in the figures we have already examined that the pattern of increase in mortality is very different for younger adults than for older adults and that the relation between male death rates and female death rates also differs according to the age range considered. In this section we divide the 15-64 50-year age span into two 25-year segments, those age 15-39 and those 40-64.

Besides being a convenient division, these two segments encompass very different stages of the life cycle. The 15-39 age range includes the completion of education and establishment of a career. For most women it includes all of their childbearing. It is the family formation part of the life cycle. The 40-64 age range encompasses the mature career and preparation for retirement. It often includes grandparenthood.

Just as Figure 6 showed age-standardised death rates over the entire 15-64 age range, we can calculate age-standardised death rates separately for the 15-39 age range and the 40-64 age range. In each of these age ranges we calculate for the given sex for a given year what the death rate in that age range would be if the group had the death rates by age and sex of the given year but had the age distribution that was present for the given sex in mid-2001.



	1997	1998	1999	2000	2001	2002	2003	2004	2005
Male Stand 15-29	537	615	667	784	916	1003	1094	1143	1175
Female Stand 15-39	362	460	566	731	901	1093	1254	1386	1484
Male Stand 40-64	1926	2039	2158	2335	2527	2695	2885	2993	3086
Female Stand 40-64	1113	1142	1182	1252	1329	1428	1542	1637	1684

Figure 7. Age-standardised death rates per 100,000 by sex, age 15-39 and age 40-64: 1997-2005

Figure 7 shows age-standardised death rates by sex for the younger and older age ranges. Figure 7 makes even clearer some things that were apparent in earlier figures. For the younger age range, the male rate is higher than the female rate in 1997-2001, but in 2002-2005 the female rate is higher than the male rate. For the older age range, the male rate is always higher than the female rate, and the gap increases over time. The age-standardised rate for the older age range for either sex is always higher than for the younger age range for either sex, although for females the gap between the older and the younger age ranges becomes very small by 2005. In 1997, the age-standardised death rate for females 40-64 was 3.0 times that for females age 15-39; in 2001 the value for the older age segment was 1.5 times that for the younger age segment, and by 2005, the rate for the female older age segment was only 1.1 times that of the younger female age segment.

Despite worsening younger female mortality between 1997 and 2005, the overall conclusion about which sex and which age segment had worse mortality is that even in 2005, the highest chance of dying in a 25-year period was for males 40-65, the next highest was for females age 40-65, third came females age 15-40 and the lowest chance of dying in a 25-year period was for males 15-40. However, if current trends continue, in the near future the female chance of dying in the 15-40 age range will exceed that of females in the 40-65 age range.

There was also a narrowing of the morality differential between the younger age segment and the older age segment for males, although not as drastically as for females. In 1997, males were 3.6 times more likely to die in the older age segment than in the younger age segment, in 2001 the value for the older age segment was 2.6 that of the younger age segment and by 2005, the rate for the male older age segment was 2.6 times that of the younger male age segment.

Comments

Age-specific death rates increased for each sex for almost every adult age group, 1997-2005. The increase for younger adult females is especially striking. However, even in 2005, age-standardised death rates 15-64 remained higher for males than females, and age standardised death rates for males age 40-64 remained higher for males age 15-39 or for females in either age segment. However, soon females age 15-39 are likely to have higher mortality than females age 40-64.

GLOBAL BURDEN OF DISEASE CATEGORISATION

The World Health Organization Global Burden of Disease project groups causes of death into three categories: (1) communicable diseases, maternal conditions, perinatal conditions, and nutritional deficiencies (ICD-10 categories A00-B99, G00-G04, N70-N73, J00-J06, J10-J18, J20-J22, H65-H66, O00-O99, P00-P96, E00-E02, E40-E46, E50, D50-D53, E51-E64. The reference also includes D64.9 in this classification, but since South Africa does not use 4-digit ICD-10 coding, we coded all of D64 as non-communicable), (2) non-communicable diseases (ICD-10 categories C00-C97, D00-D48, D55-D64, D65-D89, E03-E07, E10-E16, E20-E34, E65-E88, F01-F99, G06-G98, H00-H61, H68-H93, I00-I99, J30-J98, K00-K92, N00-N64, H75-N98, L00-L98, M00-M99, Q00-Q99), and (3) unnatural causes (ICD-10 categories V01-Y89).[4] For simplicity, we will refer to the first category as "communicable and related diseases".[5]

Communicable diseases can be spread from one person to another. Non-communicable diseases cannot be spread between people. They include the chronic debilitating diseases common among older people that often cause or contribute to death. Deaths from unnatural causes are sometimes called external cause deaths, accidental deaths or violent deaths.

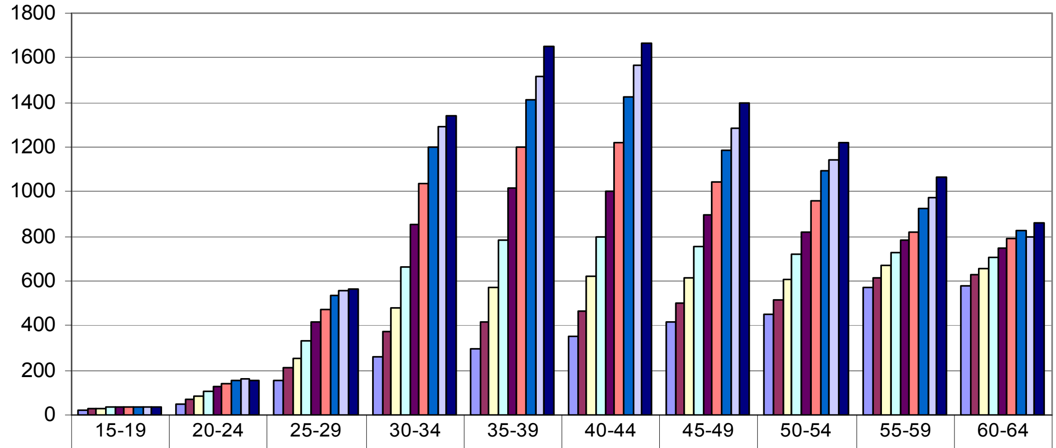
[4] ICD-10 categories for this classification are from Mathers *et al.*, 2003: Table 3, pp. 55-59.

[5] There is a list of natural causes of death (R00-R99) that are ill-defined – all you know about these causes is that they were natural. These ill-defined natural causes have been distributed among deaths by natural causes proportionately to their share in defined natural causes of death. This follows the recommendation of Mathers *et al.* (2003: 13). It is somewhat different than the procedure employed by Bradshaw *et al.* (2003: 19; 2006) in which they redistributed these ill-defined deaths based on a multivariate model.

In South Africa, this distinction between communicable and non-communicable diseases is especially useful because almost all of the causes of death thought to be mistakenly coded when HIV is the actual cause of death are communicable diseases. Although a few non-communicable diseases are likely sites of misclassification of HIV deaths (Kaposi's sarcoma for example (Peto, 2001; IARC, 1997)), non-communicable diseases are thought to play a smaller role in this misclassification than communicable and related diseases.

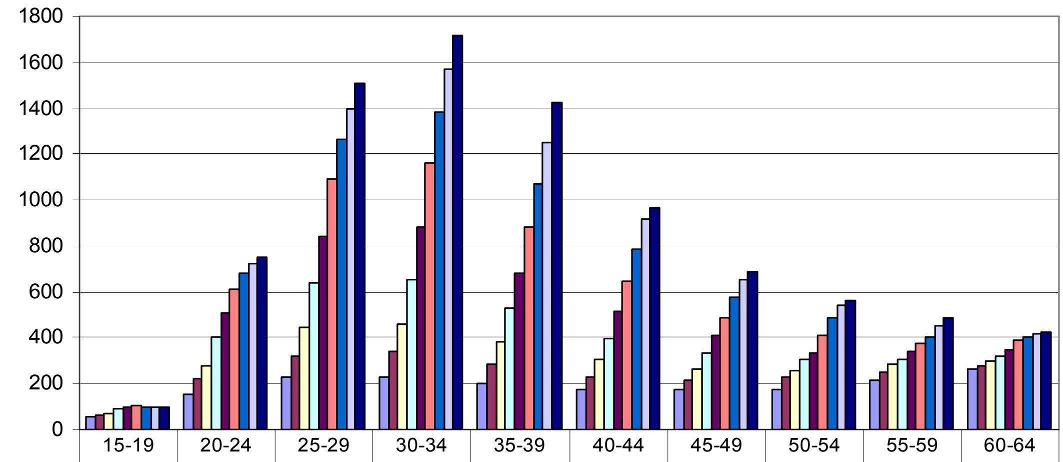
Communicable and related diseases

Figures 8 and 9 show death rates by age from communicable and related diseases for each sex. The rates increase for every year except for males age 15-24 and 60-64 (2003-2004) and females age 15-19.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	23	53	156	261	299	350	414	449	573	582
1998	29	71	214	374	416	467	499	517	616	630
1999	29	82	253	479	570	618	614	604	670	656
2000	36	107	329	665	786	799	756	722	725	702
2001	38	130	414	858	1014	1003	897	821	783	751
2002	37	140	475	1041	1202	1218	1041	958	822	789
2003	38	157	539	1201	1415	1428	1188	1092	926	828
2004	38	163	558	1292	1521	1568	1285	1143	975	797
2005	38	153	566	1340	1654	1663	1395	1223	1068	860

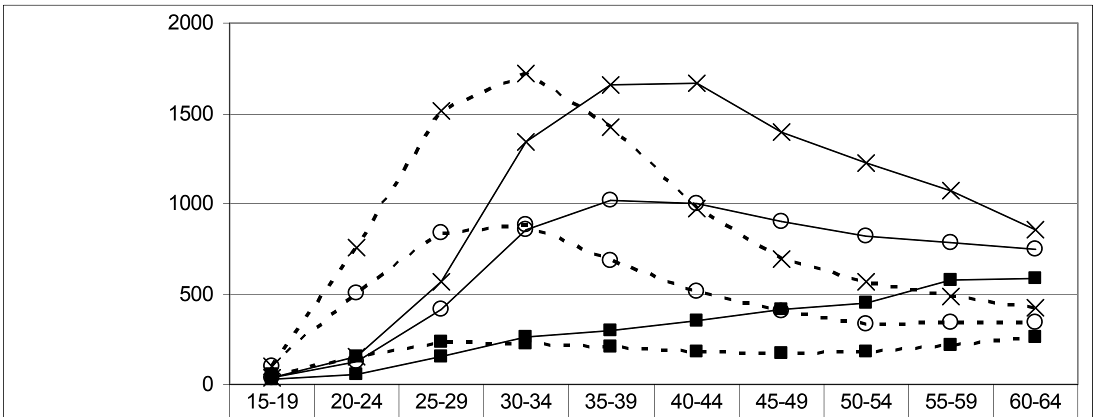
Figure 8. Male death rates by age per 100,000 from communicable and related diseases: 1997-2005



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	54	154	231	229	203	177	175	176	217	262
1998	64	221	322	340	285	227	216	231	250	278
1999	72	280	442	456	382	304	261	254	286	299
2000	88	401	640	650	529	398	331	306	302	320
2001	96	504	840	881	683	514	409	330	340	344
2002	101	613	1091	1163	880	647	488	408	378	391
2003	99	681	1268	1386	1073	784	579	488	405	405
2004	100	722	1398	1572	1251	914	654	542	453	414
2005	96	753	1510	1717	1422	969	689	566	489	423

Figure 9. Female death rates by age per 100,000 from communicable and related diseases: 1997-2005

Figure 10 shows the age-specific death rates from communicable and related diseases for both sexes in 1997, 2001 and 2005. It is clear that for each sex at each age, there has been a considerable increase in the death rate (except for males 15-19), especially between age 20 and age 55.



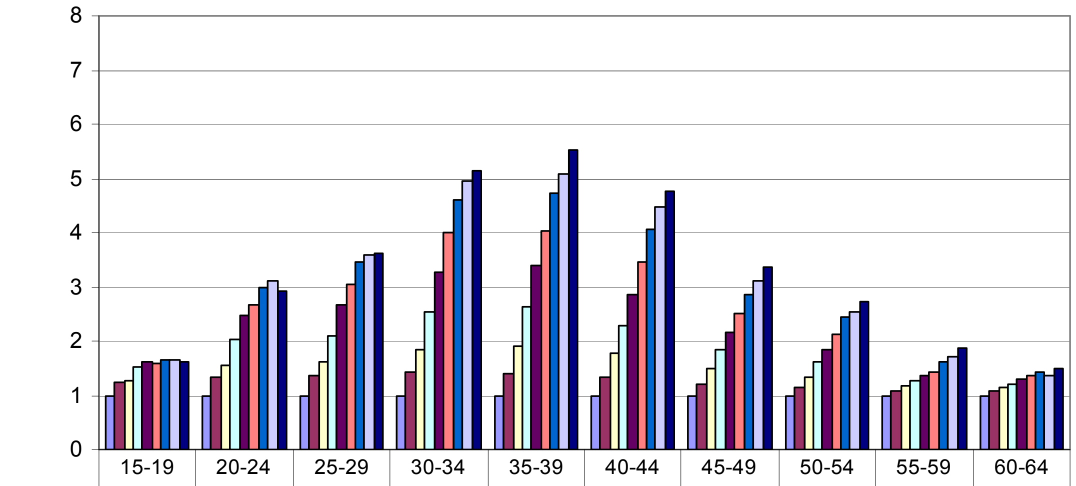
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male 1997	23	53	156	261	299	350	414	449	573	582
Male 2001	38	130	414	858	1014	1003	897	821	783	751
Male 2005	38	153	566	1340	1654	1663	1395	1223	1068	860
Female 1997	54	154	231	229	203	177	175	176	217	262
Female 2001	96	504	840	881	683	514	409	330	340	344
Female 2005	96	753	1510	1717	1422	969	689	566	489	423

Figure 10. Death rates by age and sex per 100,000 from communicable and related diseases: 1997, 2001 and 2005

The age pattern of the increase between 1997 and 2005 is different for the two sexes. For males, the increase is greatest at age 35-44 and only slowly declines until age 55. For females there is a rapid rise to age 25-34, after which the death rate drops sharply.

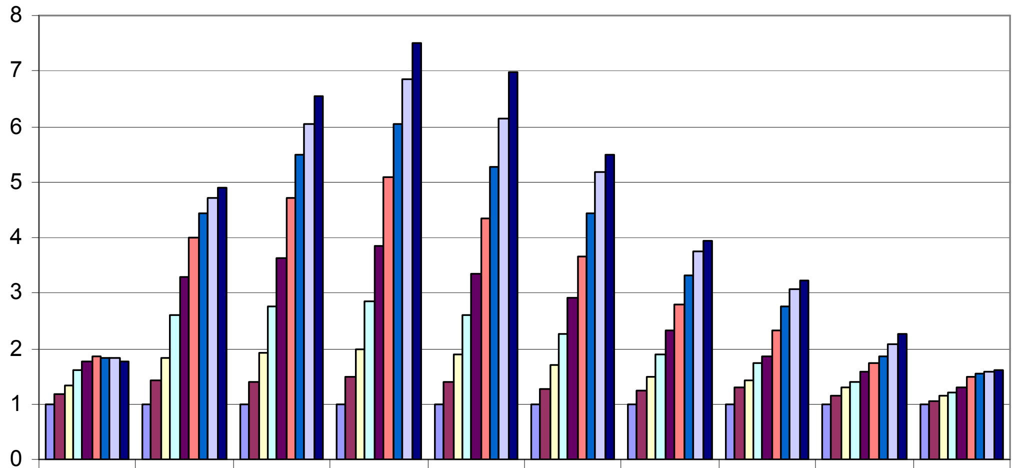
The age pattern in Figure 10 for 2005 also contrasts with that in Figure 4, which showed age-specific death rates by sex in 1997 and 2005 from all causes. For all causes, the rates for both sexes increased at the older ages, while for communicable and related causes, the rates decline at each successively older age after a peak at age 40-44 for males and age 30-34 for females.

Figures 11 and 12 show the values of the death rate from communicable and related diseases in a given year relative to its value in 1997. The rapid increases in death rates from communicable and related diseases are even clearer than in Figures 8 and 9.



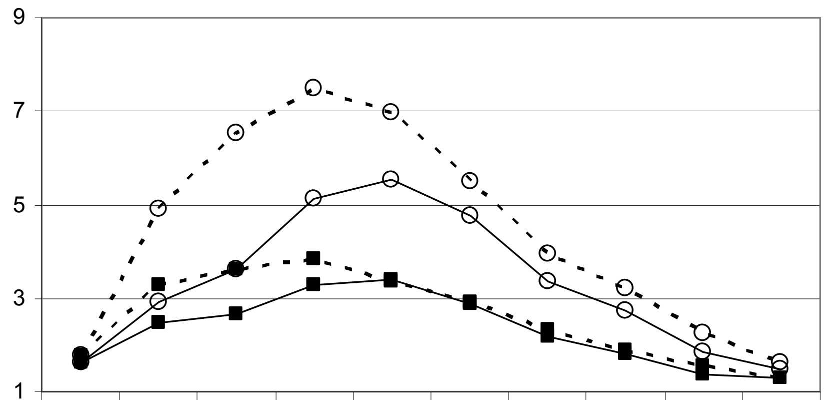
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1998	1.251	1.343	1.369	1.432	1.391	1.333	1.205	1.151	1.075	1.082
1999	1.255	1.560	1.619	1.834	1.908	1.765	1.484	1.345	1.169	1.128
2000	1.532	2.038	2.109	2.548	2.632	2.281	1.826	1.607	1.265	1.207
2001	1.625	2.482	2.653	3.285	3.394	2.863	2.165	1.829	1.366	1.291
2002	1.592	2.655	3.041	3.985	4.023	3.476	2.515	2.133	1.434	1.357
2003	1.643	2.987	3.449	4.600	4.735	4.076	2.869	2.430	1.616	1.424
2004	1.646	3.098	3.574	4.946	5.091	4.476	3.103	2.544	1.702	1.370
2005	1.628	2.910	3.622	5.133	5.536	4.747	3.370	2.723	1.865	1.478

Figure 11. Male death rates from communicable and related diseases by age relative to value by age in 1997 (1997 value=1.00): 1997-2005



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1998	1.174	1.440	1.390	1.487	1.400	1.283	1.237	1.309	1.151	1.058
1999	1.319	1.824	1.910	1.993	1.878	1.719	1.495	1.442	1.317	1.138
2000	1.609	2.612	2.769	2.840	2.603	2.249	1.893	1.739	1.394	1.220
2001	1.767	3.283	3.631	3.850	3.357	2.903	2.340	1.874	1.566	1.311
2002	1.856	3.990	4.716	5.080	4.328	3.659	2.793	2.317	1.741	1.491
2003	1.822	4.437	5.480	6.055	5.277	4.430	3.317	2.767	1.869	1.543
2004	1.833	4.704	6.045	6.866	6.153	5.170	3.745	3.077	2.088	1.578
2005	1.759	4.908	6.529	7.500	6.991	5.480	3.946	3.211	2.253	1.612

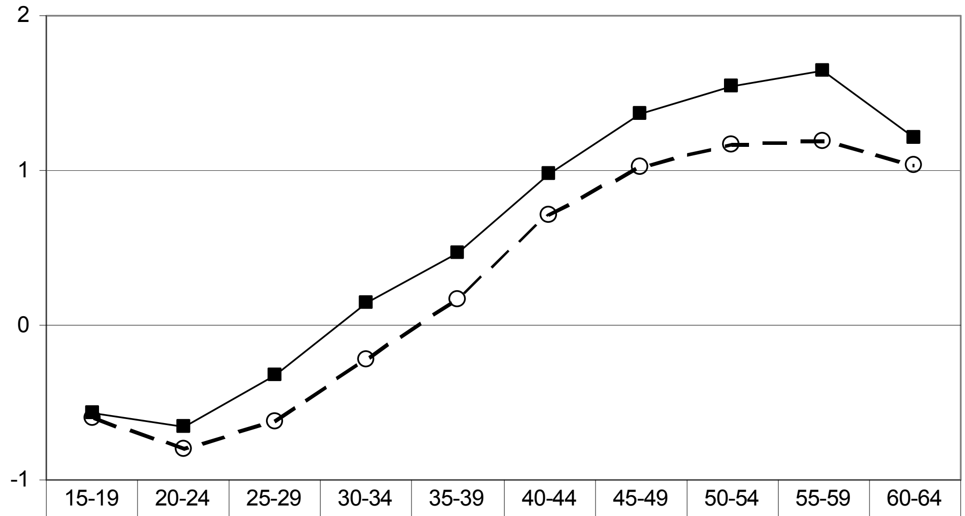
Figure 12. Female death rates from communicable and related diseases by age relative to value by age in 1997 (1997 value=1.00): 1997-2005



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male 2001/1997	1.625	2.482	2.653	3.285	3.394	2.863	2.165	1.829	1.366	1.291
Male 2005/1997	1.628	2.910	3.622	5.133	5.536	4.747	3.370	2.723	1.865	1.478
Female 2001/1997	1.767	3.283	3.631	3.850	3.357	2.903	2.340	1.874	1.566	1.311
Female 2005/1997	1.759	4.908	6.529	7.500	6.991	5.480	3.946	3.211	2.253	1.612

Figure 13. Death rates from communicable and related diseases by sex in 2001 and 2005 relative to value by age and sex in 1997 (1997 value=1.00)

Figure 13 shows the death rate in 2001 and in 2005 as a multiple of the value for the given sex in 1997. As for all causes shown in Figure 5, the increase in death rates from communicable and related diseases was concentrated in the 20-44 age range, especially for females. Unlike the situation in Figure 5, in Figure 13 the percentage increase in female death rates is larger in 2005 than the increase in male death rates at all ages.



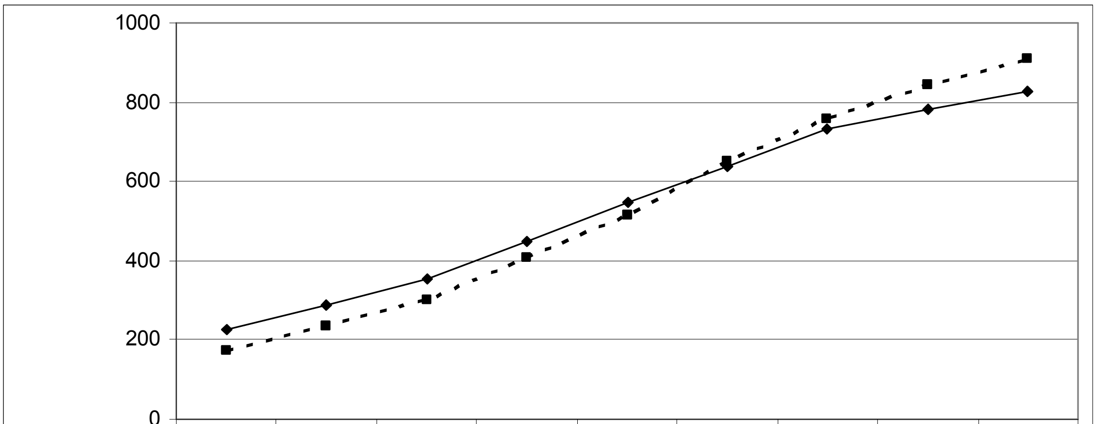
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	-0.571	-0.658	-0.325	0.141	0.469	0.981	1.370	1.549	1.641	1.216
2005	-0.603	-0.797	-0.625	-0.219	0.163	0.716	1.024	1.161	1.186	1.033

Figure 14. Proportion by which the male death rate from communicable and related diseases exceeds or falls short of the female death rate from communicable and related diseases ((MaleDR-FemaleDR)/FemaleDR): 1997 and 2005

Figure 14 shows the proportion by which the male death rate from communicable and related diseases exceeds or falls short of the female death rate from communicable and related diseases in 1997 and in 2005. When the value is greater than zero, the male rate is higher than the female rate; when the value is less than zero, the female rate is higher than the male rate.

In 1997, below age 30, the female death rate from communicable and related diseases was higher than the male death rate from communicable and related diseases. In 2005, the female rate was higher than the male rate below age 35. In both years, in the age range 35-59, the male death rate increased with age more rapidly than did the female death rate to age 60, after which the sex difference declined somewhat.

Figure 15 shows the age-standardised death rates by sex from communicable and related diseases. They have risen rapidly for both sexes. The male rate was higher than the female rate from 1997 to 2001, but from 2002 to 2005 the female rate was higher.

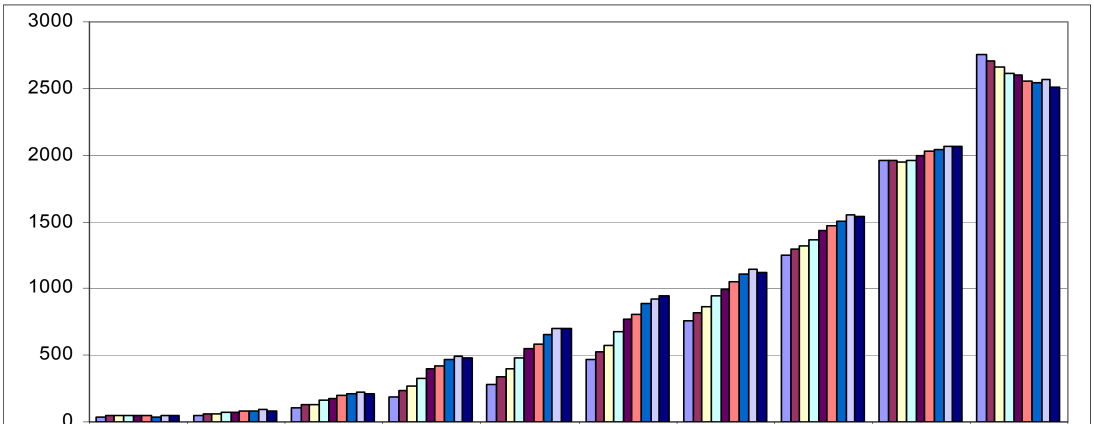


	1997	1998	1999	2000	2001	2002	2003	2004	2005
Male	226	287	352	448	548	638	733	781	826
Female	174	234	300	406	516	649	756	844	909

Figure 15. Age-standardised death rates per 100,000 from communicable and related diseases by sex, age 15-64: 1997-2005

Non-communicable diseases

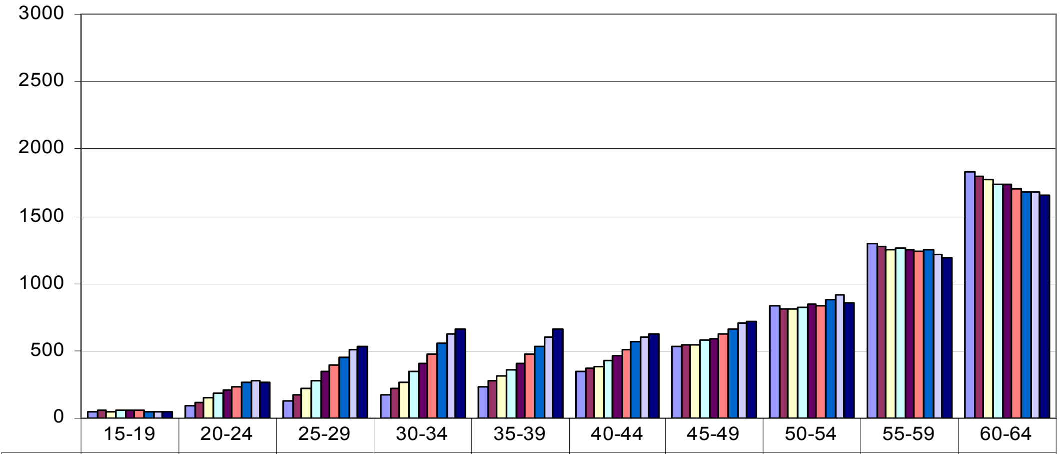
Before the onset of HIV and the emergence of more virulent forms of several infectious diseases, the picture of mortality decline in the world had been one of ever lower death rates from communicable diseases and increasing concern with non-communicable diseases, which were becoming an increasing portion of all mortality (Shigan, 1988). Despite the concern with HIV and other communicable diseases, levels and trends in non-communicable diseases in South Africa still deserve attention.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	38	48	104	190	283	461	756	1247	1963	2759
1998	45	59	131	237	337	524	820	1293	1963	2703
1999	42	64	132	268	392	572	860	1325	1945	2659
2000	45	74	158	330	474	678	949	1368	1957	2619
2001	42	74	181	393	546	771	995	1436	1995	2598
2002	43	78	195	422	588	806	1049	1467	2034	2551
2003	40	86	207	464	656	885	1112	1505	2043	2543
2004	43	88	226	486	697	922	1138	1556	2068	2568
2005	41	83	209	480	698	946	1120	1535	2069	2505

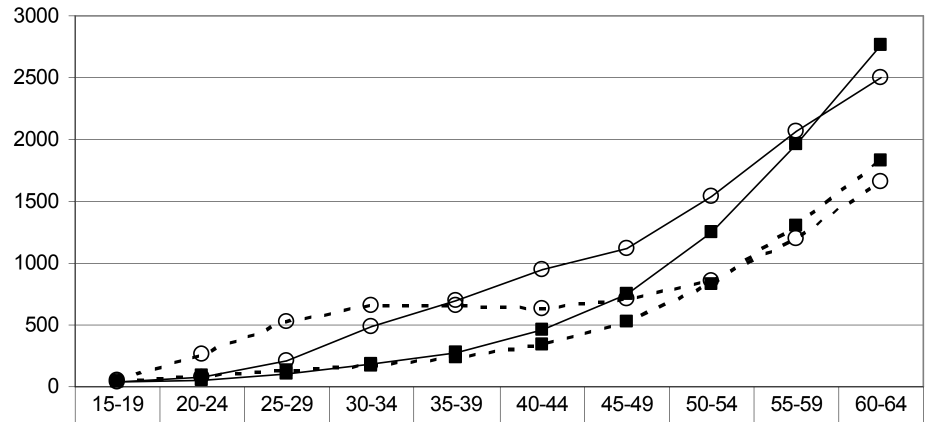
Figure 16. Male death rates by age per 100,000 from non-communicable diseases: 1997-2005

Non-communicable diseases show a very different pattern from that for communicable and related diseases. As seen in Figures 16 and 17, death rates from non-communicable diseases tend to increase with age.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	44	91	132	176	234	348	532	832	1302	1831
1998	53	112	176	225	275	368	541	808	1278	1801
1999	51	152	219	267	307	385	546	809	1246	1774
2000	59	185	280	342	362	431	578	819	1257	1742
2001	56	213	349	408	410	464	593	849	1251	1736
2002	53	235	393	471	469	513	630	834	1245	1697
2003	51	261	453	557	531	573	665	883	1246	1684
2004	51	276	515	625	601	599	706	920	1216	1677
2005	49	267	527	662	656	626	714	856	1198	1657

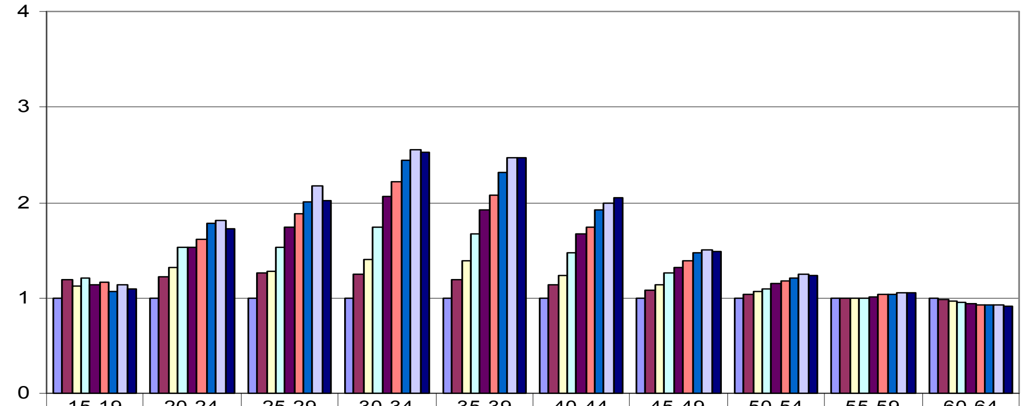
Figure 17. Female death rates by age per 100,000 from non-communicable diseases: 1997-2005



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male 1997	38	48	104	190	283	461	756	1247	1963	2759
Male 2005	41	83	209	480	698	946	1120	1535	2069	2505
Female 1997	44	91	132	176	234	348	532	832	1302	1831
Female 2005	49	267	527	662	656	626	714	856	1198	1657

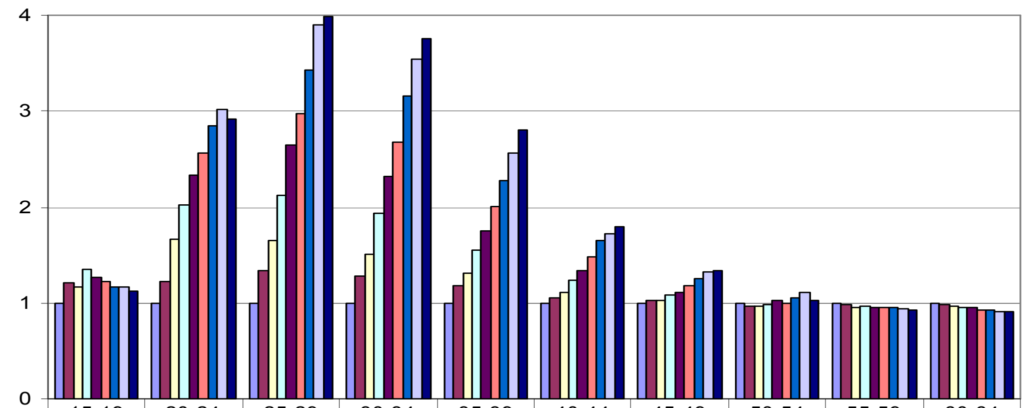
Figure 18. Death rates by age and sex per 100,000 population from non-communicable diseases: 1997 and 2005

Figure 18 shows death rates from non-communicable diseases by age and sex in 1997 and 2005. Non-communicable diseases increased somewhat at most ages over time, but male death rates increased at each successively older age. For females in 2005, the rates declined from the 30-34 age group through the 40-44 age group, before rising with age again from the 40-44 age group through the 60-64 age group.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1998	1.191	1.226	1.267	1.248	1.193	1.136	1.085	1.037	1.000	0.980
1999	1.119	1.314	1.279	1.407	1.387	1.241	1.138	1.063	0.991	0.964
2000	1.201	1.533	1.528	1.736	1.675	1.469	1.256	1.098	0.997	0.949
2001	1.131	1.533	1.744	2.067	1.930	1.672	1.316	1.152	1.016	0.942
2002	1.159	1.612	1.880	2.217	2.079	1.747	1.388	1.176	1.036	0.925
2003	1.069	1.781	2.000	2.440	2.321	1.918	1.472	1.207	1.041	0.922
2004	1.136	1.813	2.178	2.556	2.465	1.999	1.506	1.248	1.053	0.931
2005	1.094	1.724	2.018	2.526	2.467	2.051	1.482	1.232	1.054	0.908

Figure 19. Male death rates from non-communicable diseases by age relative to value in 1997 (1997 Value=1.00): 1997-2005

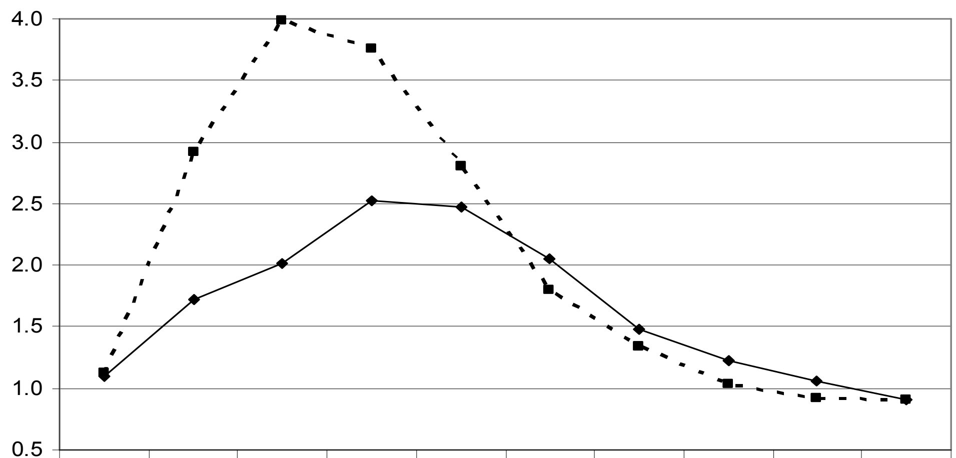


	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1998	1.209	1.226	1.334	1.281	1.179	1.058	1.019	0.971	0.981	0.983
1999	1.167	1.664	1.655	1.514	1.314	1.107	1.028	0.971	0.957	0.969
2000	1.353	2.023	2.118	1.943	1.551	1.240	1.087	0.983	0.965	0.951
2001	1.270	2.332	2.644	2.314	1.753	1.335	1.115	1.020	0.960	0.948
2002	1.220	2.569	2.976	2.678	2.008	1.476	1.185	1.003	0.956	0.927
2003	1.161	2.853	3.429	3.163	2.274	1.649	1.251	1.060	0.957	0.920
2004	1.170	3.013	3.895	3.551	2.569	1.724	1.329	1.105	0.934	0.916
2005	1.122	2.919	3.989	3.762	2.805	1.801	1.344	1.029	0.920	0.905

Figure 20. Female death rates from non-communicable diseases by age relative to value in 1997 (1997 Value=1.00): 1997-2005

Figures 19 and 20 show the values for each sex of the death rate from non-communicable diseases for the given sex in a given year relative to the value for that age and sex in 1997. Below age 20 for both sexes, at 55-59 for males and at 45-54 for females, there was only a small increase in death rates from non-communicable diseases. Above age 55, female death rates from non-communicable diseases declined over time.

Figure 21 shows the death rate from non-communicable diseases in 2005 relative to 1997 and for each sex. Below age 40, the percentage increase in death rates from non-communicable diseases between 1997 and 2005 was greater for females than males. At ages 40-64, it was greater for males than females. Although death rates from non-communicable diseases increased between 1997 and 2005 for each sex, except at the oldest ages, comparing Figure 21 with Figure 13 makes clear that at all ages the proportionate increase between 1997 and 2005 for non-communicable diseases was far less than for communicable and related diseases.

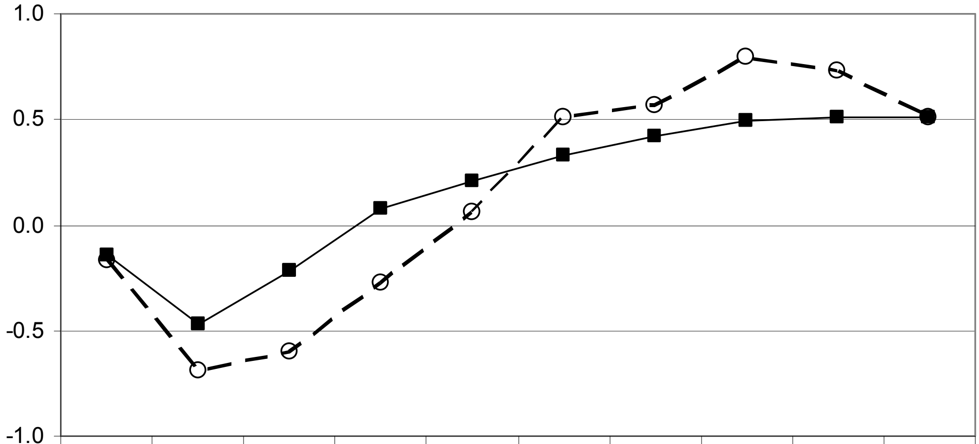


	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male	1.094	1.724	2.018	2.526	2.467	2.051	1.482	1.232	1.054	0.908
Female	1.122	2.919	3.989	3.762	2.805	1.801	1.344	1.029	0.920	0.905

Figure 21. Death rates by age and sex from non-communicable diseases in 2005 relative to value in 1997 (1997 Value=1.00)

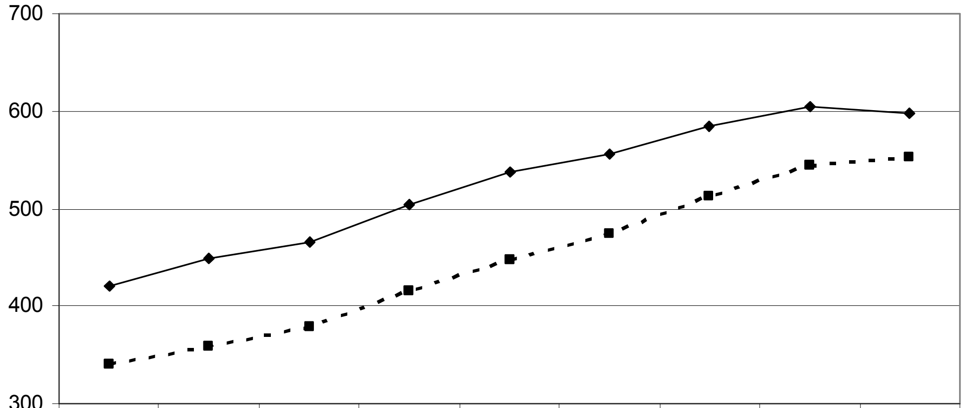
Figure 22 shows the proportion by which the male death rate from non-communicable diseases exceeds or falls short of the female death rate. When the value is greater than zero, the male rate is higher than the female rate; when the value is less than zero, the female rate is higher.

In 1997, below age 30, the female rate is higher than the male rate; in 2005, below age 35, the female rate is also higher than the male rate. At age 40-64, the male death rate from non-communicable diseases exceeded the female rate by a greater percentage in 2005 than in 1997.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	-0.144	-0.471	-0.216	0.080	0.210	0.327	0.422	0.498	0.508	0.507
2005	-0.165	-0.688	-0.603	-0.275	0.064	0.512	0.568	0.793	0.727	0.512

Figure 22. Proportion by which the male death rate from non-communicable diseases exceeds or falls short of the female death rate from non-communicable diseases ((MaleDR-FemaleDR)/FemaleDR): 1997 and 2005



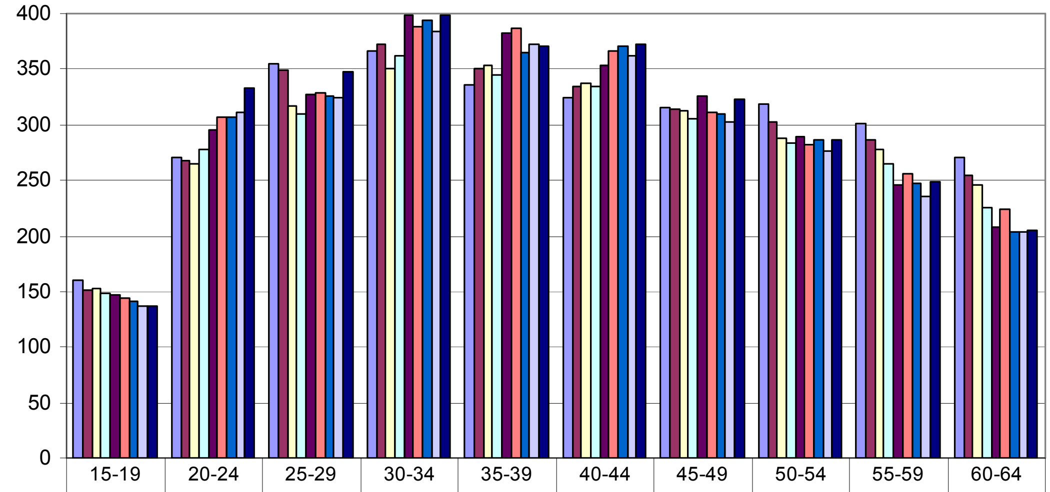
	1997	1998	1999	2000	2001	2002	2003	2004	2005
Male	420	449	465	504	538	557	585	605	598
Female	339	359	379	415	447	474	513	545	552

Figure 23. Age-standardised death rates per 100,000 from non-communicable diseases by sex, age 15-64: 1997-2005

Figure 23 shows the age-standardised death rates by sex from non-communicable diseases. If we compare Figure 23 to Figure 15 (for communicable and related diseases), it is again clear that communicable and related diseases have increased much more rapidly than non-communicable diseases. Also, at every date, the male age-standardised death rate from non-communicable diseases is substantially higher than the rate for females, and the gap between the rates for the two sexes only narrowed slightly until 2004, with a greater narrowing in 2005.

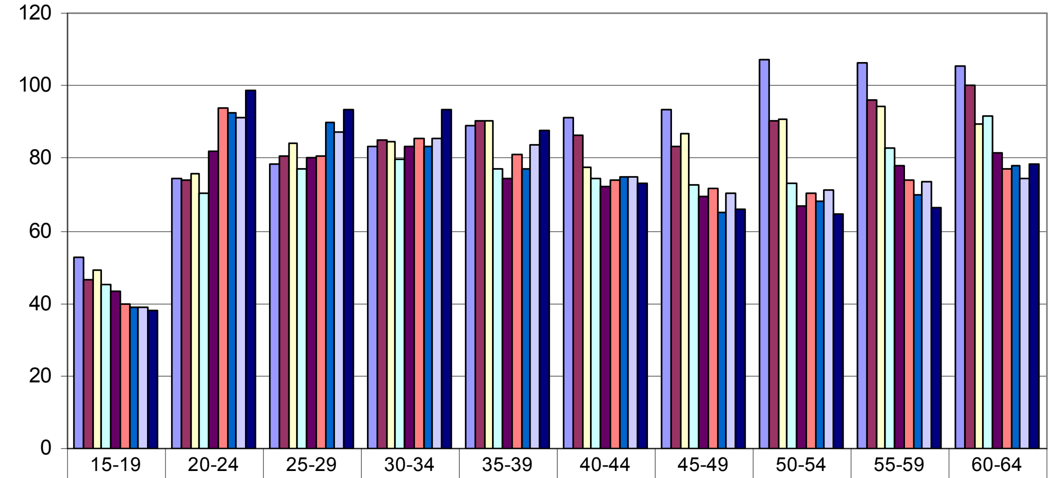
Unnatural causes of death

Unnatural causes of death are those in ICD-10 codes V01-Y89. Figure 24 shows age-specific death rates from unnatural causes for males, and Figure 25 shows similar information for females.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	161	271	355	366	337	324	316	319	301	271
1998	151	268	349	373	351	335	315	302	286	254
1999	152	264	317	350	353	337	313	288	278	245
2000	148	278	310	362	345	334	306	283	265	226
2001	147	295	327	399	383	353	326	289	246	208
2002	143	307	328	389	387	367	311	283	256	224
2003	141	306	326	394	366	370	310	287	248	203
2004	137	312	324	384	373	362	302	277	236	204
2005	137	333	348	399	371	373	322	287	249	205

Figure 24. Male death rates by age per 100,000 from unnatural causes: 1997-2005

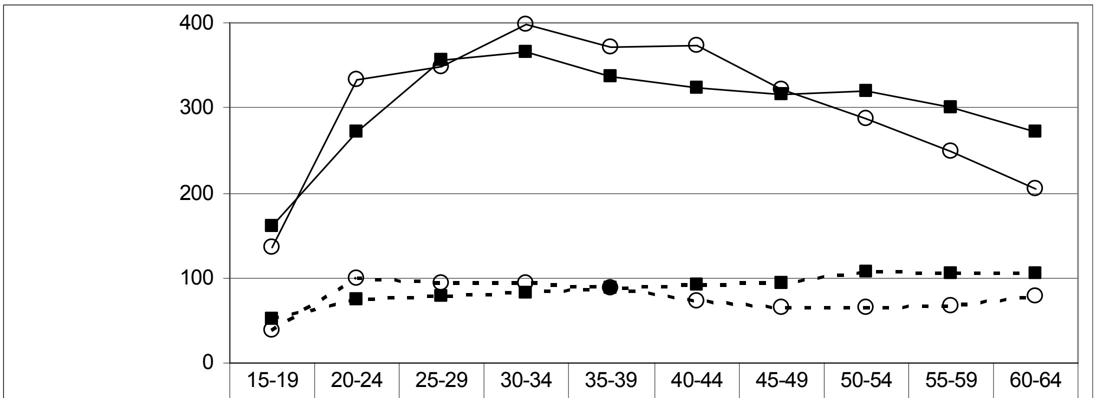


	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	53	75	78	83	89	91	94	107	106	105
1998	46	74	80	85	90	86	83	90	96	100
1999	49	76	84	84	90	77	87	91	94	89
2000	45	71	77	80	77	75	73	73	83	92
2001	43	82	80	83	75	72	70	67	78	82
2002	40	94	81	86	81	74	72	70	74	77
2003	39	93	90	83	77	75	65	68	70	78
2004	39	91	87	86	84	75	70	71	74	75
2005	38	99	93	93	88	73	66	64	66	78

Figure 25. Female death rates by age per 100,000 from unnatural causes: 1997-2005

In Figures 24 and 25 we do not see the steady rise in death rates over time that we saw for all cause mortality. For most age-sex groups unnatural cause death rates declined over time; for other age-sex groups, there were modest increases. In many countries death rates from unnatural causes are high for young men, due to their tendency to engage in risky behaviour. At the older ages unnatural mortality is usually mainly from accidents.

Figure 26 shows age-specific death rates from unnatural causes by sex for 1997 and 2005. As in most countries, male unnatural cause death rates are much higher than female unnatural cause death rates.

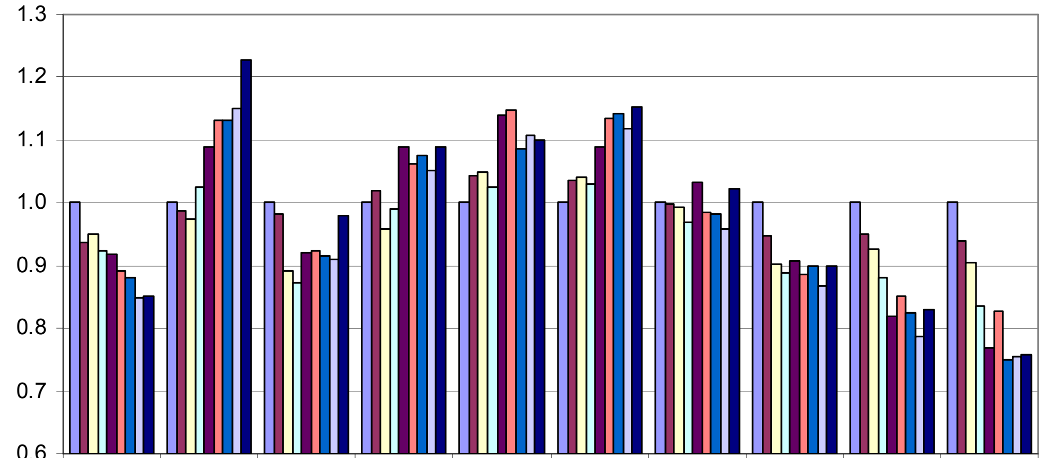


	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male 1997	161	271	355	366	337	324	316	319	301	271
Male 2005	137	333	348	399	371	373	322	287	249	205
Female 1997	53	75	78	83	89	91	94	107	106	105
Female 2005	38	99	93	93	88	73	66	64	66	78

Figure 26. Death rates per 100,000 from unnatural causes by age and sex: 1997 and 2005

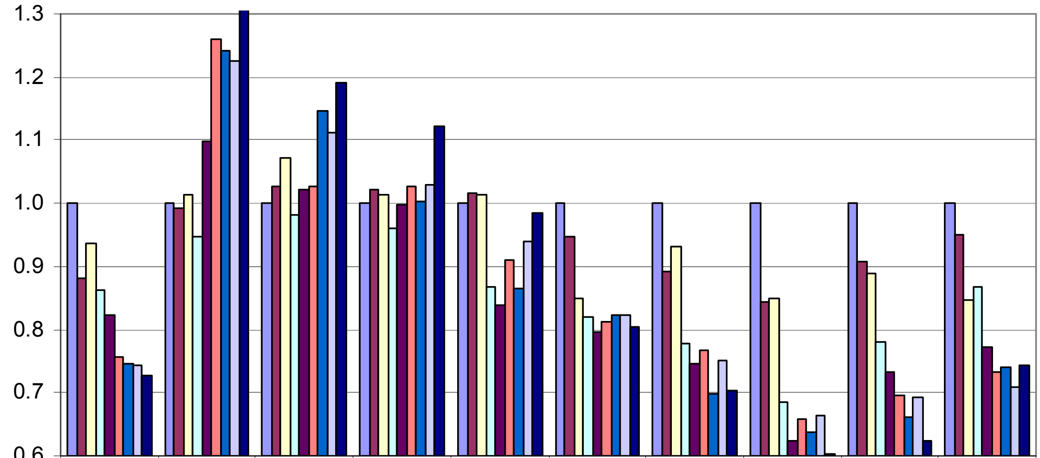
While the age profile of unnatural death rates for females is almost horizontal, for males there is a distinct pattern of increase in unnatural cause death rates until their twenties or thirties and then moderate declines with age. For both sexes, over time the rates increased slightly at some ages and decreased at other ages.

Figure 27 shows male death rates from unnatural causes relative to the value for 1997, and Figure 28 shows similar information for females. Death rates from unnatural causes tended to increase over time at younger ages (except for age 15-19) and to decrease at older ages.



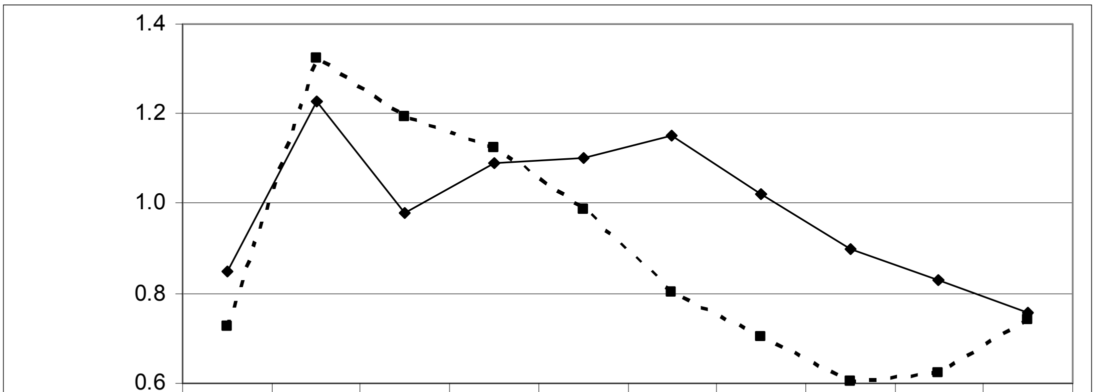
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1998	0.937	0.988	0.983	1.018	1.043	1.035	0.997	0.948	0.951	0.939
1999	0.949	0.975	0.892	0.957	1.049	1.040	0.992	0.903	0.925	0.906
2000	0.923	1.025	0.873	0.989	1.025	1.031	0.969	0.887	0.880	0.835
2001	0.917	1.088	0.922	1.090	1.138	1.090	1.033	0.907	0.819	0.769
2002	0.892	1.133	0.924	1.063	1.148	1.133	0.985	0.887	0.850	0.826
2003	0.879	1.131	0.916	1.075	1.086	1.144	0.983	0.900	0.824	0.750
2004	0.850	1.150	0.911	1.050	1.108	1.117	0.958	0.867	0.786	0.754
2005	0.850	1.227	0.979	1.090	1.101	1.152	1.022	0.899	0.829	0.758

Figure 27. Male death rates from unnatural causes relative to value by age in 1997 (1997 Value=1.00): 1997-2005



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1998	0.882	0.993	1.027	1.022	1.017	0.947	0.891	0.844	0.907	0.951
1999	0.936	1.014	1.071	1.014	1.013	0.850	0.930	0.848	0.890	0.847
2000	0.861	0.947	0.983	0.960	0.868	0.819	0.778	0.684	0.780	0.869
2001	0.823	1.099	1.022	0.998	0.838	0.795	0.745	0.625	0.733	0.773
2002	0.757	1.260	1.028	1.028	0.909	0.812	0.766	0.657	0.696	0.733
2003	0.745	1.241	1.146	1.003	0.866	0.822	0.698	0.636	0.660	0.741
2004	0.744	1.226	1.112	1.029	0.940	0.822	0.752	0.665	0.693	0.707
2005	0.727	1.325	1.192	1.123	0.985	0.804	0.705	0.602	0.624	0.743

Figure 28. Female death rates from unnatural causes by age relative to value by age in 1997 (1997 Value=1.00): 1997-2005

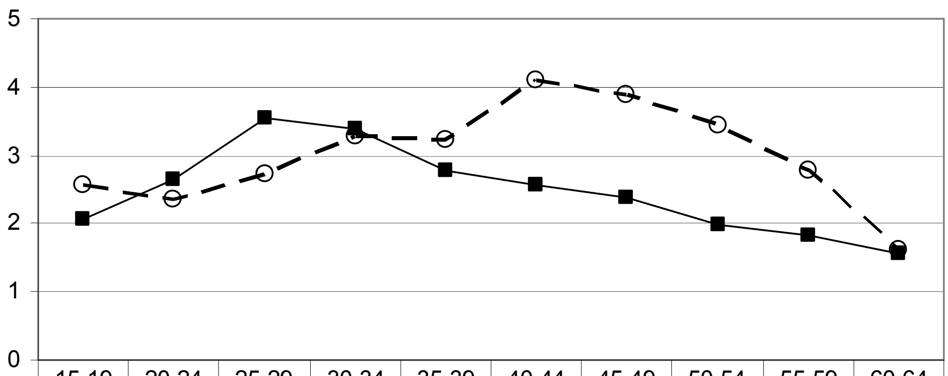


	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male	0.850	1.227	0.979	1.090	1.101	1.152	1.022	0.899	0.829	0.758
Female	0.727	1.325	1.192	1.123	0.985	0.804	0.705	0.602	0.624	0.743

Figure 29. Death rates from unnatural causes in 2005 by sex relative to value by age and sex in 1997 (1997 Value=1.00)

Figure 29 shows death rates from unnatural causes in 2005 relative to the value in 1997 for each sex. Below age 20 and above age 35 (for females) and above age 50 (for males) death rates from unnatural causes were lower in 2005 than in 1997. Males age 25-29 had a relatively high death rate from unnatural causes, but it declined by more than 11% between 1997 and 2005. The decline in the unnatural cause death rate for the 15-19 age group for both sexes is an encouraging trend. Perhaps teenagers have begun to engage in less risky behaviour. For both sexes at older ages, unnatural death rates declined substantially. This is probably due to a decrease in fatal accidents above age 50 for males and above age 40 for females, which is also an encouraging trend.

The unnatural cause death rate increased in the 20-24 age group between 1997 and 2005 by 23% for males and by 32% for females. For each sex the increase at age 20-24 was a larger proportionate increase than for any other age group. At this time, it is not clear what the cause of these increases might be. If these kinds of increases in death rates from other types of causes were seen for people in their early twenties, some people might have interpreted them as hidden HIV mortality, which is very unlikely in this case.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	2.060	2.634	3.534	3.399	2.783	2.557	2.374	1.980	1.832	1.570
2005	2.578	2.367	2.723	3.271	3.225	4.095	3.894	3.446	2.765	1.621

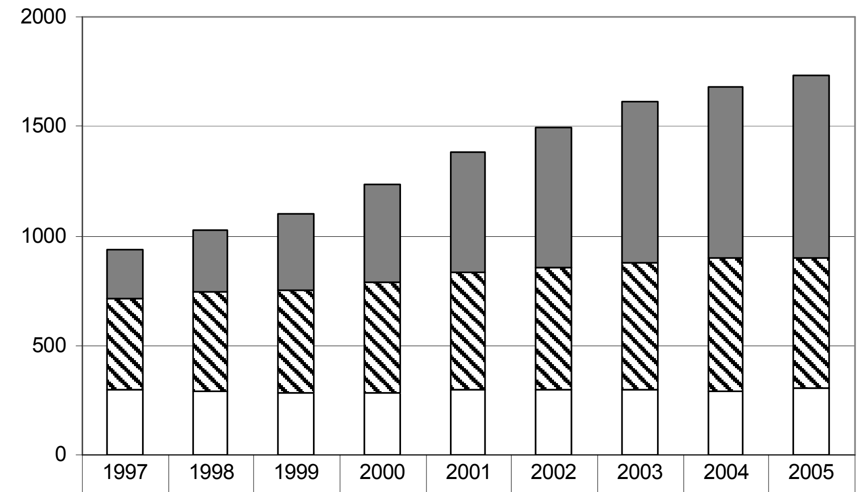
Figure 30. Proportion by which the male death rates from unnatural causes exceeds or falls short of the female death rates from unnatural causes ((MaleDR-FemaleDR)/FemaleDR): 1997 and 2005

Figure 30 shows for 1997 and 2005 the proportion by which the male death rate from unnatural causes exceeded (or fell short) of the female death rate from unnatural causes. In both years, at every age the male death rate from unnatural causes was much higher than the female death rate from unnatural causes. The smallest percentage differential was for age 60-64 in 1997, for which the male rate exceeded the female rate by 1.56 times. This means that the male rate was 2.56 times the value of the female rate at that age. In 2005, the proportionate female advantage was somewhat less at ages 20-29 than it was in 1997, while at 15-19 and above age 35, the female advantage was greater in 2005 than in 1997.

The changing contribution of the three Global Burden of Disease categories to mortality

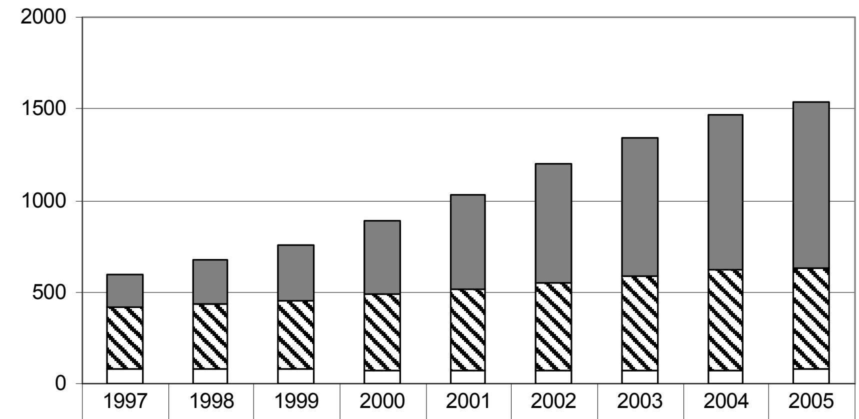
Figures 31 and 32 show one way of looking at the contribution of the three Global Burden of Disease categories to mortality over time. In each figure, the three categories sum to the overall age-standardised death rate.

We see that for both males and females, unnatural causes contributed to no change or a slight decline in mortality, while non-communicable diseases contributed somewhat to an increased age-standardised death rate. The bulk of the increase was due to communicable and related diseases.



	1997	1998	1999	2000	2001	2002	2003	2004	2005
Communicable and related	226	287	352	448	548	638	733	781	826
non-Communicable	420	449	465	504	538	557	585	605	598
Unnatural Causes	294	292	283	282	297	298	295	293	305

Figure 31. Contribution of the three Global Burden of Disease categories to the male age-standardised death rate per 100,000, age 15-64: 1997-2005



	1997	1998	1999	2000	2001	2002	2003	2004	2005
Communicable and related	174	234	300	406	516	649	756	844	909
non-Communicable	339	359	379	415	447	474	513	545	552
Unnatural Causes	81	78	78	71	72	74	74	75	77

Figure 32. Contribution of the three Global Burden of Disease categories to the female age-standardised death rates per 100,000, age 15-64: 1997-2005

Figures 33 and 34 show the percentage distribution of deaths in the three categories used in calculation of the age-standardised death rates. These diagrams clearly demonstrate the increasingly dominant role of communicable and related diseases.

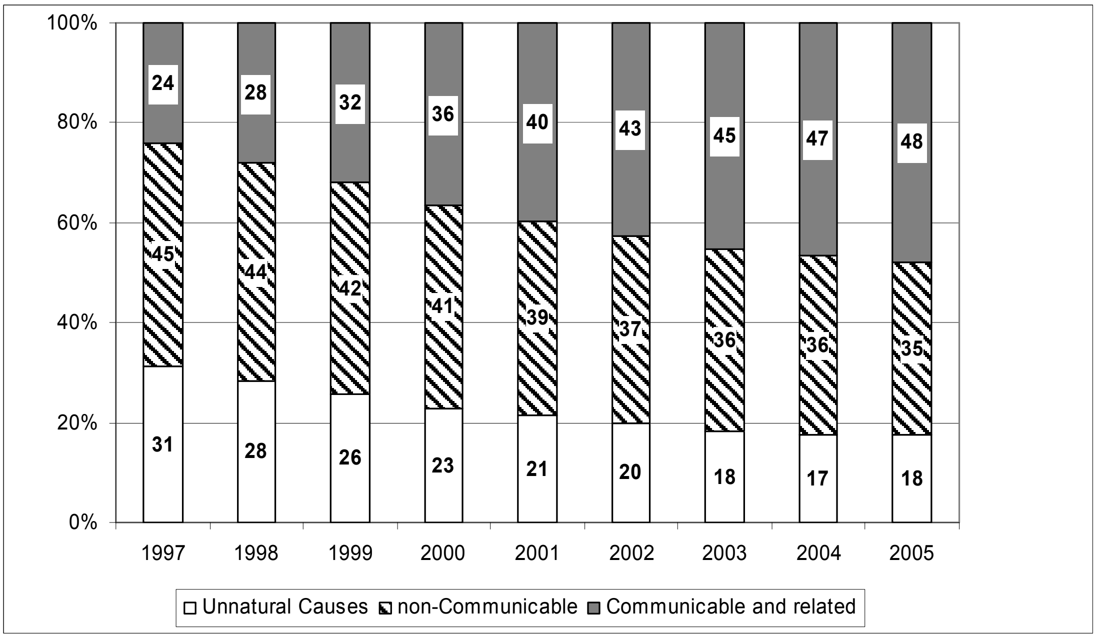


Figure 33. Percentage distribution of male age-standardised deaths among the three Global Burden of Disease categories, age 15-64: 1997-2005

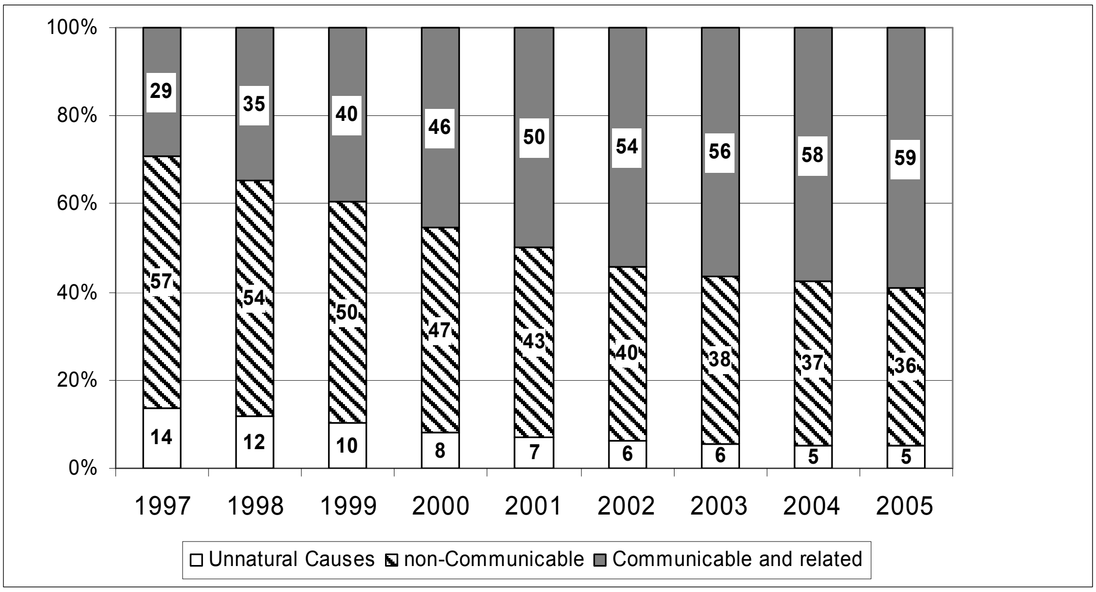
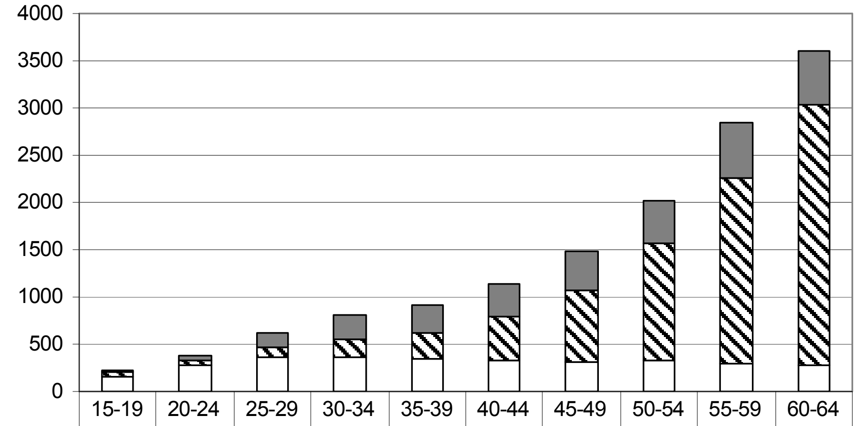


Figure 34. Percentage distribution of female age-standardised deaths among the three Global Burden of Disease categories, age 15-64: 1997-2005

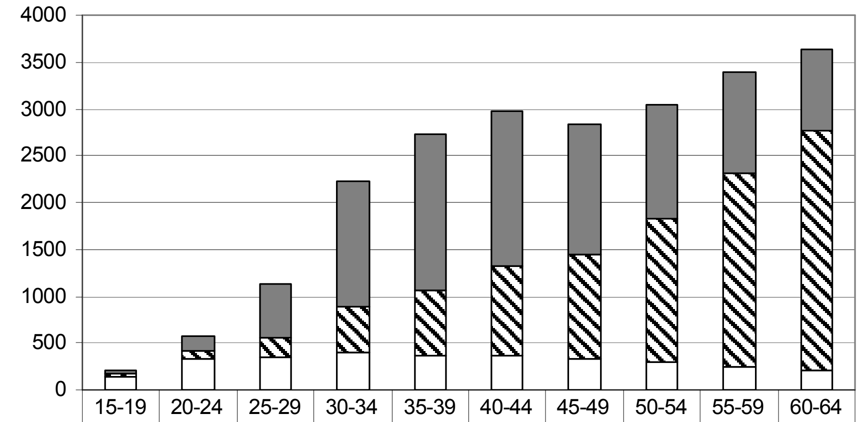
Again using the division into three kinds of causes of death, Figures 35-38 show the contribution of each of the three categories to death rates by age in 1997 and in 2005, for males and females separately.

For males at the younger ages, unnatural causes are the main source of deaths in both years. This is true up to age 40 in 1997 and up to age 25 in 2005. After age 40 in 1997 and after age 50 in 2005, non-communicable diseases are the main cause of death. Thus we see unnatural causes dominating among the young, and non-communicable diseases dominating at the older ages. In 1997, communicable and related diseases are not the major cause of death at any age; in 2005, they are dominant at ages 25-49.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Communicable and related	23	53	156	261	299	350	414	449	573	582
non-Communicable	38	48	104	190	283	461	756	1247	1963	2759
Unnatural Causes	161	271	355	366	337	324	316	319	301	271

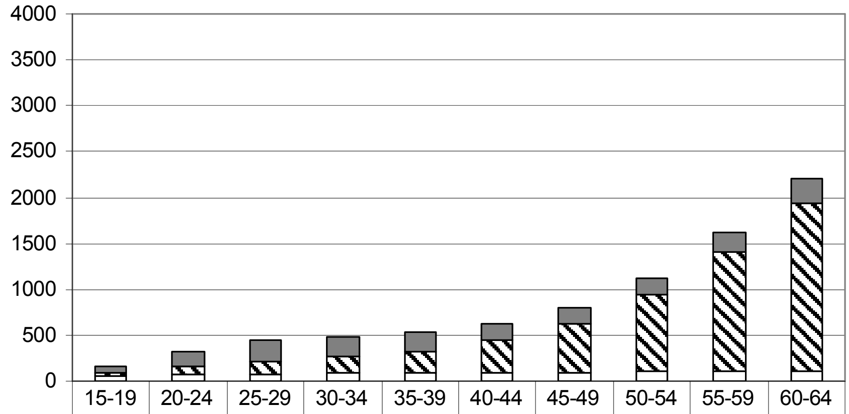
Figure 35. Contribution of the three Global Burden of Disease categories to male death rates by age per 100,000: 1997



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Communicable and related	38	153	566	1340	1654	1663	1395	1223	1068	860
non-Communicable	41	83	209	480	698	946	1120	1535	2068	2568
Unnatural Causes	137	333	348	399	371	373	322	287	249	205

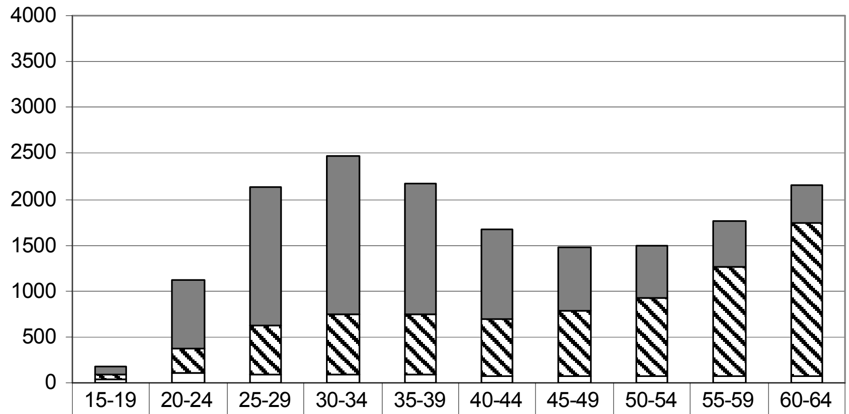
Figure 36. Contribution of the three Global Burden of Disease categories to male death rates by age per 100,000: 2005

For females, unnatural causes are the main cause of death only for age 20-34. Above age 35 in 1997 and above age 45 in 2005, non-communicable diseases are the main cause of death. It is interesting that non-communicable diseases become the major cause of death starting at a younger age for females than for males.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Communicable and related	54	154	231	229	203	177	175	176	217	262
non-Communicable	44	91	132	176	234	348	532	832	1302	1831
Unnatural Causes	53	75	78	83	89	91	94	107	106	105

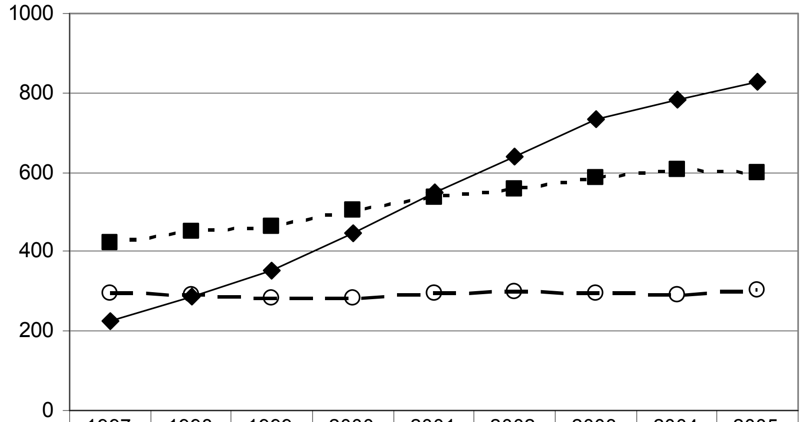
Figure 37. Contribution of the three Global Burden of Disease categories to female death rates by age per 100,000: 1997



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Communicable and related	96	753	1510	1717	1422	969	689	566	489	423
non-Communicable	49	267	527	662	658	626	714	856	1198	1657
Unnatural Causes	38	99	93	93	88	73	66	64	66	78

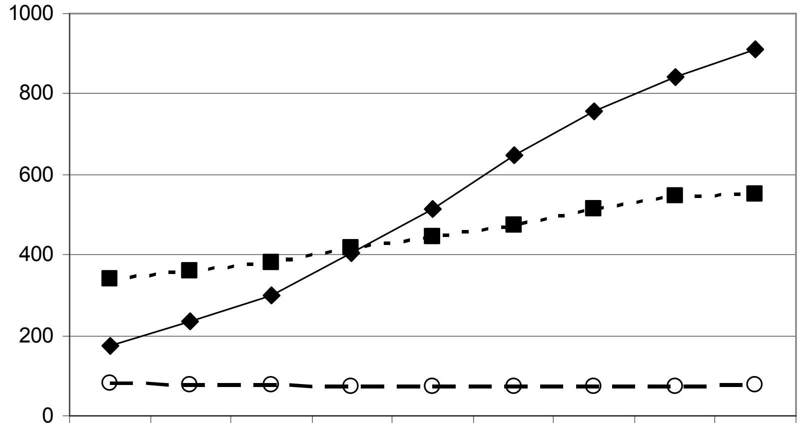
Figure 38. Contribution of the three Global Burden of Disease categories to female death rates by age per 100,000: 2005

Figures 39 and 40 show the role of the three categories of causes of death in age-standardised death rates by sex over time. Communicable and related diseases were less important than unnatural causes for males in 1997, and were about even with unnatural causes in 1998; in 2001, they became more important than non-communicable diseases. For females, communicable and related diseases were more important than unnatural causes even in 1997. They became more important than non-communicable diseases in 2001.



	1997	1998	1999	2000	2001	2002	2003	2004	2005
Communicable and related	226	287	352	448	548	638	733	781	826
non-Communicable	420	449	465	504	538	557	585	605	598
Unnatural	294	292	283	282	297	298	295	293	305

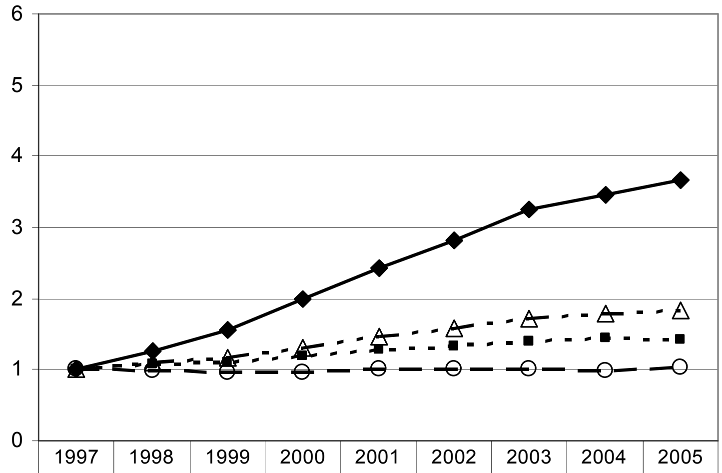
Figure 39. Male age-standardised death rates from the three Global Burden of Disease categories per 100,000, age 15-64: 1997-2005



	1997	1998	1999	2000	2001	2002	2003	2004	2005
Communicable and related	174	234	300	406	516	649	756	844	909
non-Communicable	339	359	379	415	447	474	513	545	552
Unnatural	81	78	78	71	72	74	74	75	77

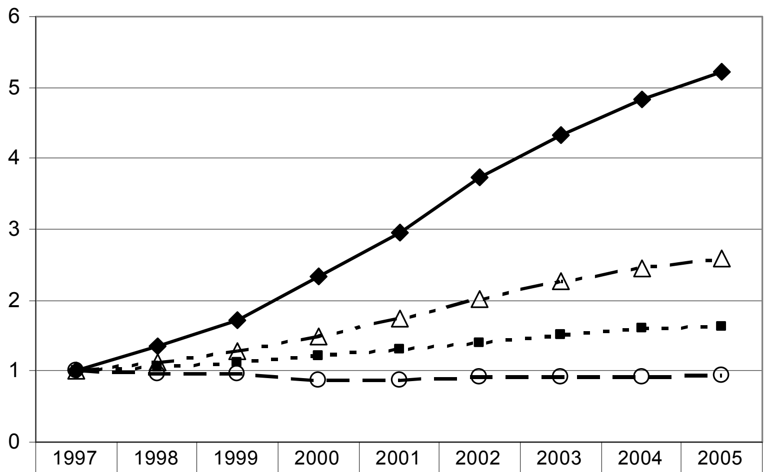
Figure 40. Female age-standardised death rates from the three Global Burden of Disease categories per 100,000, age 15-64: 1997-2005

Figures 41 and 42 show the age-standardised death rates from the three causes relative to the value of each in 1997. The age-standardised death rate from all causes relative to its value in 1997 is also shown. The rapid rise of communicable and related diseases is very clear in these figures.



	1997	1998	1999	2000	2001	2002	2003	2004	2005
Communicable and related	1.00	1.27	1.56	1.98	2.43	2.83	3.24	3.46	3.66
non-Communicable	1.00	1.07	1.11	1.20	1.28	1.33	1.39	1.44	1.42
Unnatural	1.00	0.99	0.96	0.96	1.01	1.01	1.00	0.99	1.04
All	1.00	1.09	1.17	1.31	1.47	1.59	1.72	1.79	1.84

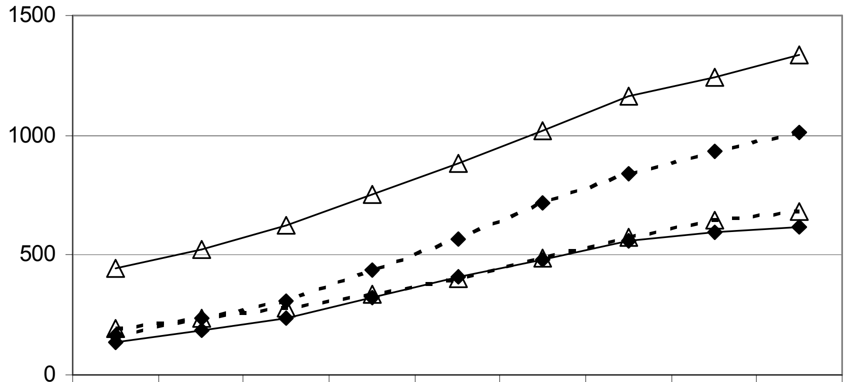
Figure 41. Male age-standardised death rates from the three Global Burden of Disease categories, age 15-64, relative to value in 1997 (1997 Value=1.00): 1997-2005



	1997	1998	1999	2000	2001	2002	2003	2004	2005
Communicable and related	1.00	1.34	1.72	2.33	2.96	3.72	4.34	4.84	5.22
non-Communicable	1.00	1.06	1.12	1.22	1.32	1.40	1.51	1.61	1.63
Unnatural	1.00	0.96	0.96	0.87	0.88	0.91	0.91	0.92	0.95
All	1.00	1.13	1.27	1.50	1.74	2.01	2.26	2.46	2.59

Figure 42. Female age-standardised death rates from the three Global Burden of Disease categories, age 15-64, relative to value in 1997 (1997 Value=1.00): 1997-2005

Figures 43, 44 and 45 show the age-standardised death rates from communicable and related diseases (Figure 43), from non-communicable diseases (Figure 44) and from unnatural causes (Figure 45) by sex for the younger ages (age 15-39) and for the older ages (age 40-64).

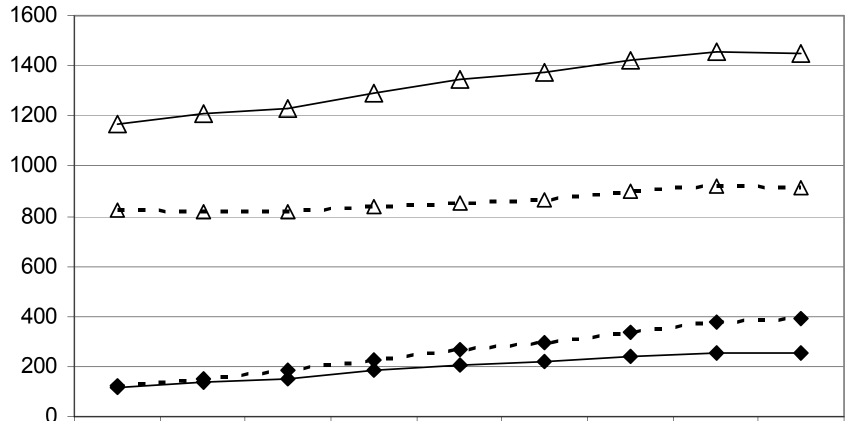


	1997	1998	1999	2000	2001	2002	2003	2004	2005
Male Stand 15-39	137	190	240	325	412	484	558	593	619
Male Stand 40-64	445	525	627	752	880	1017	1161	1241	1333
Female Stand 15-39	166	233	308	436	565	721	839	933	1012
Female Stand 40-64	193	235	281	339	405	489	571	646	681

Figure 43. Age-standardised death rates per 100,000 from communicable and related diseases by sex, age 15-39 and age 40-64: 1997-2005

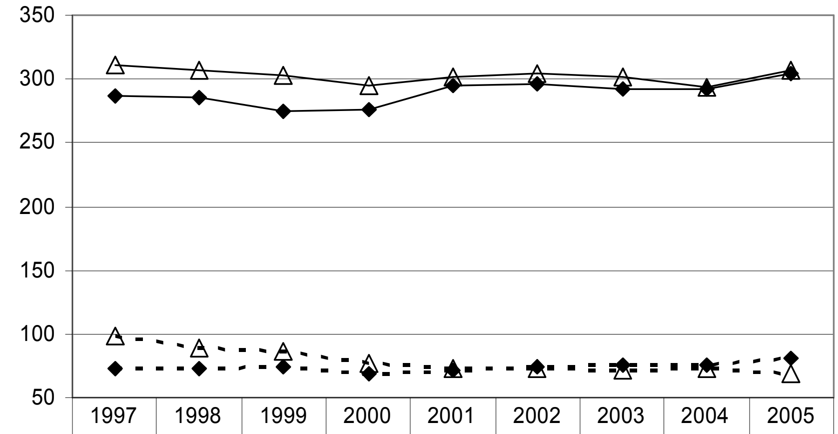
The age-standardised death rates from communicable diseases for males age 40-64 and for females age 15-39 rose more rapidly than for the younger males or the older females, although the rates for older males remained the highest, and the gap between the rate for the older males and the younger females remained almost constant.

Older males also maintained the highest age-standardised rates from non-communicable diseases, followed by older females. However, the gap between the rate for older males and for older females increased over time. Younger males and females had much lower rates, and the rate for younger females gradually increased compared to that for younger males over time.



	1997	1998	1999	2000	2001	2002	2003	2004	2005
Male Stand 15-39	114	139	153	183	208	223	243	257	251
Male Stand 40-64	1170	1207	1230	1289	1344	1374	1421	1455	1447
Female Stand 15-39	123	154	183	226	265	298	339	377	391
Female Stand 40-64	821	817	814	835	852	866	900	919	910

Figure 44. Age-standardised death rates per 100,000 from non-communicable diseases by sex, age 15-39 and age 40-64: 1997-2005



	1997	1998	1999	2000	2001	2002	2003	2004	2005
Male Stand 15-39	287	286	275	276	295	296	293	292	304
Male Stand 40-64	311	307	302	295	302	304	302	294	306
Female Stand 15-39	74	73	75	68	71	75	75	76	80
Female Stand 40-64	99	90	86	77	73	73	71	73	69

Figure 45. Age-standardised death rates per 100,000 from unnatural causes by sex, age 15-39 and age 40-64: 1997-2005

Comments

It is clear that communicable and related diseases are the major cause of increasing mortality for both sexes in South Africa. For males, unnatural causes of death dominate at the younger ages at all dates, and for both sexes non-communicable causes of death dominate at the older ages. However, the range of ages in which communicable and related diseases dominate has increased over time. Although the importance of communicable and related diseases should not be underestimated, unnatural causes of death and non-communicable diseases are still the most important causes of death in some age ranges and should not be ignored out of exclusive concern with communicable and related diseases.

It is interesting that at the younger ages, female death rates from both communicable and related diseases and from non-communicable diseases in both 1997 and 2005 are higher than male rates at the same ages. Further research is warranted to understand the mortality situation at the younger ages according to sex.

MORTALITY SCENARIOS

We now examine three different mortality scenarios. In each scenario we vary one aspect of the mortality situation in 2005, unnatural cause mortality, mortality from communicable and related diseases, or mortality from non-communicable diseases. In each scenario we leave the other two components of the global burden of disease framework at their 2005 level.[6]

---

[6] We follow the approach of Preston, Heuveline and Guillot (2001: 75-76) in calculating the effects of eliminating a given cause of death or of changing the impact of a particular cause of death.

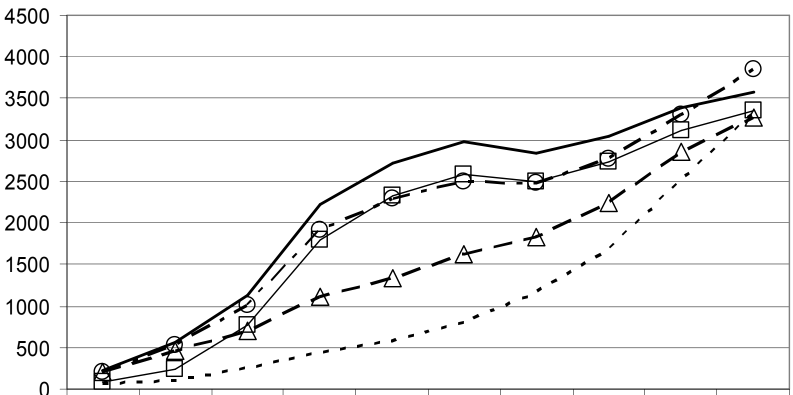
The first scenario is what mortality conditions would look like in 2005 if there were *no* unnatural deaths. South Africa is well-known for having high death rates from unnatural causes, and it is interesting to know what the impact would be if death rates from unnatural causes were not just low, but were zero.

In the second scenario, we leave unnatural cause death rates and non-communicable cause death rates unchanged, but we examine the impact on mortality if communicable and related death rates in 2005 had the values by age and sex that they had in 1997.

In the third scenario, we calculate what mortality would have looked like in 2005 if non-communicable mortality had been at the level by age and sex that it was in 1997, but the other two components were unchanged.

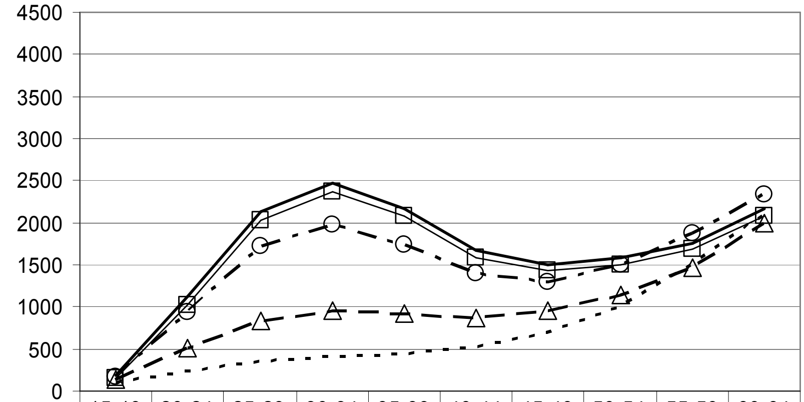
Figures 46 and 47 show the actual death rates by age in 1997 and 2005. They also show what the death rates in 2005 would have been under each of the three scenarios.

For both males and females returning to the communicable disease death rates of 1997 (Scenario 2) would have had the greatest effect on lowering death rates by age. For males, eliminating all unnatural deaths (Scenario 1) and returning death rates from non-communicable diseases to their 1997 values (Scenario 3) would have had almost identical effects on male death rates by age. For females, eliminating unnatural deaths (Scenario 1) would have had almost no effect on death rates by age. Above age 55, returning to the 1997 non-communicable disease situation (Scenario 3) results in higher death rates by age for females, because at those ages non-communicable disease death rates declined between 1997 and 2005.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
No Unnatural Deaths	79	234	768	1803	2331	2586	2496	2738	3118	3347
Communicable 1997 Values	201	468	708	1119	1336	1633	1827	2239	2864	3268
Non-Communicable 1997 Values	212	534	1015	1922	2297	2490	2477	2769	3300	3846
Actual 2005	216	569	1122	2220	2723	2983	2839	3044	3387	3569
Actual 1997	61	100	257	447	577	805	1161	1683	2518	3319

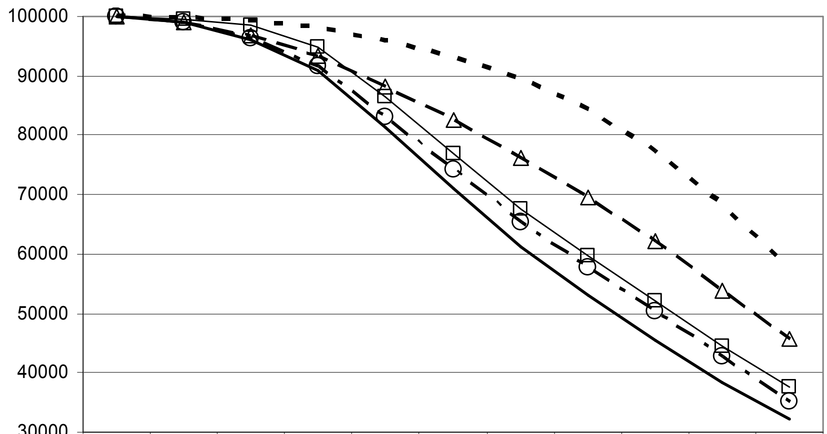
Figure 46. Male death rates by age per 100,000 according to three scenarios: 2005



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
No Unnatural Deaths	145	1018	2032	2374	2073	1592	1424	1506	1685	2075
Communicable 1997 Values	142	515	835	960	927	864	958	1143	1472	1989
Non-Communicable 1997 Values	178	941	1724	1971	1735	1390	1302	1508	1867	2341
Actual 2005	184	1119	2131	2472	2165	1668	1493	1577	1754	2157
Actual 1997	98	245	363	404	436	523	705	1006	1515	2088

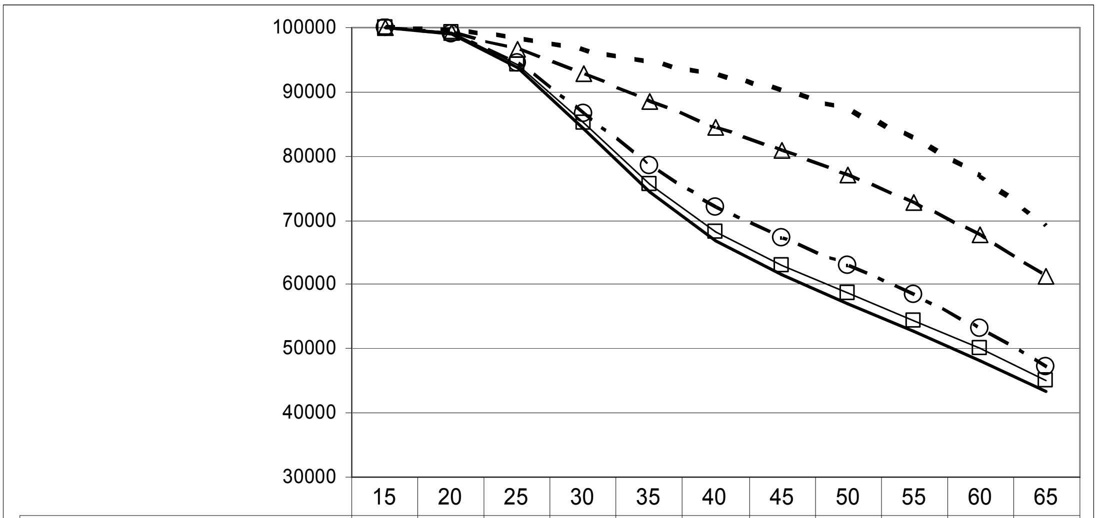
Figure 47. Female death rates by age per 100,000 according to three scenarios: 2005

Figures 48 and 49 show under the three scenarios and for the actual situations in 1997 and 2005 the number of survivors to given ages out of 100,000 on their 15th birthday. Below age 35, for males Scenario 1 (eliminating unnatural deaths) gives the best survival of all the alternatives considered. Above age 35, the actual 1997 situation yields the best survival, followed by Scenario 2 (communicable disease mortality at its 1997 level). Scenario 1 always results in better survival than Scenario 3. This is because unnatural deaths are common among the young and preventing deaths at young ages improves survival for all the rest of life. For females, only below age 25 does Scenario 1 yield the best survival. After that the actual 1997 situation has the best survival, followed by Scenario 2.



	15	20	25	30	35	40	45	50	55	60	65
No Unnatural Deaths	10000	99607	98447	94738	86566	77033	67678	59728	52075	44544	37666
Comm 1997 Values	10000	99001	96713	93351	88268	82564	76089	69443	62080	53785	45661
Non-Comm 1997 Values	10000	98945	96340	91570	83171	74136	65448	57814	50328	42656	35172
2005 Actual	10000	98928	96153	90905	81346	70976	61125	53024	45524	38417	32124
1997 Actual	10000	99697	99199	97930	95765	93042	89370	84330	77520	68337	57865

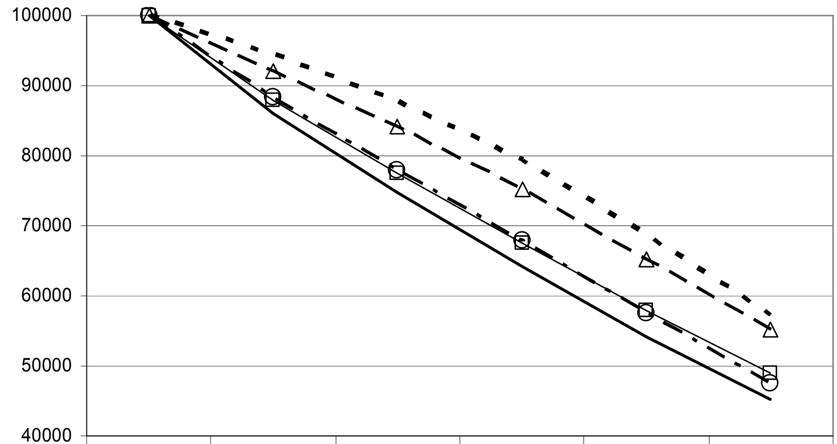
Figure 48. Male survivors to given ages out of 100,000 on their 15th birthday, according to three scenarios: 2005



	15	20	25	30	35	40	45	50	55	60	65
No Unnatural Deaths	10000	99277	94350	85225	75678	68220	62997	58665	54407	50010	45077
Comm 1997 Values	10000	99293	96770	92813	88461	84454	80884	77101	72817	67647	61239
Non-Comm 1997 Values	10000	99113	94555	86740	78592	72058	67219	62981	58404	53197	47314
2005 Actual	10000	99087	93693	84216	74411	66769	61422	57001	52676	48251	43313
1997 Actual	10000	99510	98301	96534	94603	92562	90171	87050	82779	76736	69121

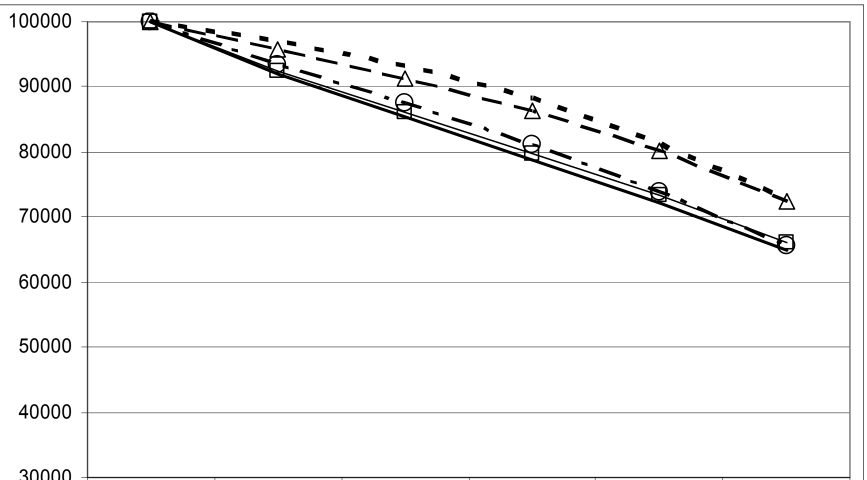
Figure 49. Female survivors to given ages out of 100,000 on their 15th birthday, according to three scenarios: 2005

By looking at Figures 48 and 49 and mentally drawing a vertical line at age 40, we can see the effects of the various scenarios on survival to age 40 among those who are alive on their 15th birthday. For both males and females the ordering of the effects of the scenarios is unchanged from when we looked at survival from age 15 to 65. However, for both sexes, the relative effects for survival from age 15 to age 40 are greater than for survival from age 15 to 65.



	40	45	50	55	60	65
No Unnatural Deaths	100000	87857	77536	67601	57825	48896
Comm 1997 Values	100000	92157	84108	75191	65143	55304
Non-Comm 1997 Values	100000	88280	77983	67885	57537	47443
2005 Actual	100000	86120	74707	64140	54127	45260
1997 Actual	100000	94479	87714	79299	68792	57396

Figure 50. Male survivors to given ages out of 100,000 on their 40th birthday, according to three scenarios: 2005



	40	45	50	55	60	65
No Unnatural Deaths	100000	92344	85994	79753	73307	66076
Comm 1997 Values	100000	95773	91293	86221	80099	72512
Non-Comm 1997 Values	100000	93285	87403	81052	73825	65662
2005 Actual	100000	91992	85370	78893	72266	64870
1997 Actual	100000	96969	93168	88112	81230	72763

Figure 51. Female survivors to given ages out of 100,000 on their 40th birthday, according to three scenarios: 2005

Figures 50 and 51 show the number of survivors to various ages out of 100,000 persons alive on their 40th birthday under the three scenarios and also with the actual mortality situation in 1997 and in 2005. The various scenarios make less difference for female survival from age 40 to 65 for females than for males. This is because there was relatively less change in female mortality between age 40 and 65 1997-2005 than in male mortality.

Figures 50 and 51 also make clear how very much better female survival between age 40 and 65 was than male survival between age 40 and 65. The best situation for males shown in Figure 50 is the1997 actual mortality situation, in which 57.4% of those alive at age 40 were still alive at age 65. In Figure 51 the worst survival scenario for females was the actual 2005 mortality situation, in which 65.3% of females survived from age 40 to age 65 – a considerably higher percentage than the best survival situation for males.

Table 1 shows the effects of the three scenarios on the number of years lived age between the 15th and the 65th birthday. For years lived from the 15th birthday, this is shown among those alive on their 15th birthday. For years lived between the 40th and 65th birthday, this is shown for those who survive to the 40th birthday, Then it shows the increase in the percentage surviving to the 65th birthday over the actual 2005 situation and the increase in the number of years lived age 15-65 compared to what was implied by the actual 2005 mortality situation. This is also shown for the 15-40 and the 40-65 age segments.

Table 1. Years lived in given age groups and increase in years lived according to three scenarios compared with actual mortality: 2005

	Years Lived 15-65	Increase in Years Lived 15-65 Compared to Actual 2005	Years Lived 15-40	Increase in Years Lived 15-40 Compared to Actual 2005	Years Lived 40-65	Increase in Years Lived 40-65 Compared to Actual 2005
Male						
No unnatural Deaths	37.5	2.4	23.4	0.7	18.3	0.7
1997 Communicable & related death rates	39.7	4.6	23.4	0.7	19.7	2.1
1997 Non-communicable death rates	36.4	1.3	22.9	0.2	18.3	0.7
Actual 2005	35.1		22.7		17.6	
Female						
No unnatural Deaths	36.1	0.6	22.1	0.2	20.7	0.2
1997 communicable & related death rates	42.1	6.6	23.5	1.6	22.0	1.5
1997 Non-communicable death rates	37.3	1.8	22.3	0.4	20.9	0.4
Actual 2005	35.5		21.9		20.5	

Mba (2000) estimated that the effect on years lived from the 15th to the 65th birthday of eliminating unnatural deaths for both sexes combined would be an increase of 1.97 years. Our estimates are generally consistent with that result.

Table 1 is helpful in putting the impact of mortality change 1997-2005 in perspective. Scenario 2 – returning to the 1997 mortality situation for communicable and related diseases – would have the largest impact on years lived for each sex for most age segments. However, for males 15-40, eliminating unnatural deaths and returning to the 1997 communicable and related diseases situation would have the same impact on the number of years lived between age 15 and 40. This is because deaths at relatively young ages within an age interval have a much larger impact on the number of years lived in the age interval than do deaths at older ages in an age interval, and unnatural deaths tend to come at young ages within the15-39 age range.

CONCLUDING THOUGHTS

South Africa is a member of a select but undesirable group of countries. McMichael *et al.* (2004: 1156) list 21 countries in which life expectancy at birth (both sexes combined) declined by 4 years or more between 1990 and 2001. This was looking at changes in mortality from all causes. The 21 countries include South Africa. All of the 21 countries are either in Africa or were formerly part of the Soviet Union. It is hoped that this report provides information and interpretations that will be helpful in understanding mortality change in South Africa and elsewhere.

Even though by the World Bank definition South Africa is an intermediate income country, it shares many mortality risks and challenges with other developing countries and especially with other sub-Saharan African countries. We hope that the patterns found will be helpful not just for understanding South Africa but will contribute to the understanding of sub-Saharan Africa more generally.

REFERENCES

Abid, A., Jamoussi, H., Kammoun, H., Blouza, S., and Nagati, K. 2000. "Relation entre l'obesite et le diabete (The relationship between obesity and diabetes)," *Cahiers du Medecin*, 3: 22-24.

Anderson, Barbara A., and Liu, Jinyun. 1997. "Son preference and excess female infant mortality among Koreans and non-Koreans in Yanbian Prefecture, Jilin Province, China, with implications for the Republic of Korea," in Doo-Sub Kim and Barbara A. Anderson, Eds. *Population process and dynamics for Koreans in Korea and China*. Seoul: Hanyang University Press: 189-243.

Anderson, Barbara A., and Phillips, Heston E. 2006. *Adult mortality (age 15-64) based on death notification data in South Africa: 1997-2004. Report No. 03-09-05.* Pretoria: Statistics South Africa.

Anderson, Barbara A., and Silver, Brian D. 1986. "Sex differentials in mortality in the Soviet Union: Regional differences in length of working life in comparative perspective," *Population Studies,* 40: 191-214.

Anderson, Barbara A., and Silver, Brian D. 1994. "Ethnicity and mortality in northern China," *1990 Population Census of China--Proceedings of international seminar*, Beijing: China Statistical Publishing House: 752-772.

Bah, S. M., 1993. "Social pathologies in Zimbabwe," *Central African Journal of Medicine*, 39: 201-213.

Beaton, G. 1997. "Prevention and the role of nutrition," *SCN News*, 14:14-17.

Bourne, L. T., Lambert, E. V., and Steyn, K. 2002. "Where does the black population of South Africa stand on the nutrition transition?" *Public Health Nutrition*, 5 (1A): 157-162.

Bradshaw, Debbie, Schneider, Michelle, Dorrington, Rob, Bourne, David E., and Laubscher, Ria. 2002. "South African cause-of-death profile in transition – 1996 and future trends," *South African Medical Journal*, 92: 618-623.

Bradshaw, Debbie, Groenewald, Pam, Laubscher, Ris, Nannan, Nadine, Nojilana, Beatrice, Norman, Rosana, Pieterse, Desiree, and Schneider, Michelle. 2003. *Initial burden of disease estimates for South Africa, 2000*. Cape Town: South African Medical Research Council.

Coale, A. J., and Li., S. 1991. "The effect of age misreporting in China on the calculation of mortality rates at very high ages," *Demography*. 28: 293-301.

Colombia. 2005. *Colombia, a positive country*. Available at http://www.embcol.or.at/Colombia/2005/febrero/04022005_ing.htm Accessed on March 17, 2006.

Demko, George J., Ioffe, Grigory, and Zayonchkovskaya, Zhanna. Eds. 1999. *Population under duress: The geodemography of post-Soviet Russia*. Boulder: Westview.

Dorrington, R., Bradshaw, D., Laubscher, R., and Timaeus, I. M. 2001. *The impact of HIV/AIDS on adult mortality in South Africa.* Cape Town: South African Medical Research Council.

D'Souza, Stan, and Chen, Lincoln C. 1980. "Sex differences in mortality in rural Bangladesh." *Population and Development Review,* 6: 257-270.

Dwyer, T., Blizzard, L., Shugg, D., Hill, D., and Ansari, M. Z. 1994. "Higher lung cancer rates in young women than young men: Tasmania, 1983 to 1992," *Cancer Causes Control,* 5: 351-358.

Dyson, T., and Moore, M. 1983. "On kinship structure, female autonomy, and demographic behavior in India," *Population and Development Review*, 9: 35-60.

Gunawardene, N. 1999. "Sri Lanka's double burden kills rich and poor alike," *Health for the Millions*, 25: 27.

Gwatkin, D. R. 1980. "Indications of change in developing country mortality trends: the end of an era?" *Population and Development Review*, 6: 615-644.

Hosegood, Victoria, Vanneste, Anna-Maria, and Timaeus, Ian M. 2004. "Levels and causes of adult mortality in rural South Africa: the impact of AIDS," *AIDS*, 18: 663-671.

Hunter, S., and Williamson, J. 2000. *Children on the brink: Updated estimates & recommendations for intervention.* United States Agency for International Development (USAID). Washington, D.C.: The Synergy Project.

IARC (International Agency for Research on Cancer). 1997. Epstein-Barr virus and Kaposi's sarcoma virus/human herpesvirus 8. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, 67. Lyon: IARC.

Jemal, Ahmedin, Travis, William D., Tarone, Robert E., Travis, Lois, and Devesa, Susan S. 2003. "Lung cancer rates convergence in young men and women in the United States: An analysis by birth cohort and histologic type," *International Journal of Cancer*, 105: 101-107.

Jung, R. T. 1997. "Obesity as a disease," *British Medical Bulletin*, 53: 307-321.

Kurylowicz, W., and Kopczynski, J. 1986. "Diseases of civilization, today and tomorrow," *World Journal of Microbiology and Biotechnology*, 2: 253-265.

Levitt, N. S., Bradshaw, D., Zwarenstein, M. F., Bawa, A. A., and Maphumolo, S. 1997. "Audit of public sector primary diabetes care in Cape Town, South Africa: High prevalence of complications, uncontrolled hyperglycaemia, and hypertension," *Diabetes Medicine*, 14: 1073-1077.

Mathers, Colin D., Bernard, Christina, Iburg, Kim Moesgaard,, Inoue, Mie, Fat, Doris Ma, Shibuya, Kenji, Stein, Claudia, Tomijina, Niels, and Xu, Hongyi. 2003. *Global burden of disease in 2002: Data sources, methods and results.* Global Programme on Evidence for Health Policy Discussion Paper No. 54, (December). Geneva: World Health Organization.

Mba, Chuks J. 2000. "The impact of external causes on South Africa's expectation of life," *African Population Studies*. Supplement B to Volume 19: 165-177.

McKee, Martin, and Shkolnikov, Vladimir. 2001. “Understanding the toll of premature death among men in eastern Europe,” *British Medical Journal*, 323: 1051-1055.

McMichael, Anthony J., McKee, Martin, Shkolnikov, Vladimir, and Valkonen, Tapani. 2004. “Mortality trends and setbacks: Global convergence or divergence?” *Lancet,* 363: 1155-1159.

Miller, B. D. 1981. *The endangered sex*. Ithaca: Cornell University Press.

Mitchell, Faith. Ed. 1997. *Premature death in the new independent states.* Washington: National Academy Press.

Nizard, A., and Munoz-Perez, F. 1993. “Alcool, tabac et mortalite en France depuis 1950: incidence de la consommation d'alcool et de tabac sur la mortalite (Alcohol, tobacco, and mortality in France since 1950: the effects on mortality of alcohol consumption and smoking),” *Population*, 48: 975-1014.

Peto, Richard, Lopez, Alan D., Boreham, Jillian, Thun, Michael, and Heath, Clark. 1994. *Mortality from smoking in developed countries 1950-2000: Indirect estimates from national vital statistics*. Oxford: Oxford University Press.

Philips Heston E., Anderson, Barbara A., and Tsebe, N. Phindiwe. 2003. “Sex ratios in South African censuses 1970-1996,” *Development Southern Africa,* 20: 387-404.

Popkin, B., Zohoori, N., Kohlmeier, L., Baturin, A., Martinchik, A., and Deev, A. 1997. “Nutritional Risk Factors in the Former Soviet Union,” in F. Mitchell, Ed., *Premature death in the new independent states*. Washington, D.C., National Academy Press: 314-334.

Preston, S. H. 1970. *Older male mortality and cigarette smoking: A demographic analysis*. Population Monograph #7, Institute of International Studies, Berkeley: University of California-Berkeley.

Preston, Samuel H., Heuveline, Patrick, and Guillot, Michel. 2001. *Demography: Measuring and modeling population processes.* Malden, Massachusetts: Blackwell.

Puoane, Thandi, Steyn, Krisela, Bradshaw, Debbie, Laubscher, Ria, Fourie, Jean, and Lambert, Ria. 2002. “Obesity in South Africa: The South African Demographic and Health Survey,” *Obesity Research*, 10: 1038-1048.

Rosenwaike, I., and Preston., S. H. 1984. “Age overstatement and Puerto Rican longevity,” *Human Biology.* 56: 503-525.

Shigan, E. N. 1988. “Integrated programme for noncommunicable diseases prevention and control (NCD),” *World Health Statistics Quarterly*, 41: 267-273.

Shkolnikov, V. M., and Mesle, F. 1996. “The Russian epidemiological crisis as mirrored by mortality trends,” in J. DaVanzo, Ed., *Russia’s demographic “crisis.”* Conference Report CF-124-CRES. Santa Monica: RAND: 113-161.

Shkolnikov, V. M., Mesle, F., and Vallin, J. 1997. “Recent trends in life expectancy and causes of death in Russia, 1970-1993,” in J. L. Bobadilla, C. A. Costello and F. Mitchell, Eds., *Premature death in the new independent states*. Washington, D.C.: National Academy Press: 34-54.

South Africa. 2006. *Government's Programme of Action – 2006; Social cluster.* Available at http://www.info.gov.za/aboutgovt/poa/report/social.htm Accessed on April 14, 2006.

South Africa, Department of Health. 2002. *South Africa Demographic and Health Survey 1998: Full Report*. Pretoria: Department of Health.

South Africa, Department of Health. 2004. *Report: National HIV and Syphilis Antenatal Sero-Prevalence Survey in South Africa 2003*. Pretoria: Department of Health. Available at http://www.doh.gov Accessed on March 9, 2006.

South Africa, Department of Health. 2005a. *Report: National HIV and syphilis Antenatal Sero-Prevalence Survey in South Africa 2004*. Pretoria: Department of Health. Available at http://www.doh.gov Accessed on March 9, 2006.

South Africa, Department of Health. 2005b. *National guideline on primary prevention of chronic diseases of lifestyle (CDL)*. Pretoria: Department of Health. Available at http://www.doh.gov Accessed on April 12, 2006

Statistics South Africa. 2000*. Recorded deaths, 1996*. Report No. 03-09-01 (1996). Pretoria: Statistics South Africa.

Tabutin, Dominique. 1992. "Excess female mortality in northern Africa since 1965: A description," *Population: An English Selection*, 4: 187-208.

Temple, N. J., Steyn, K., Hoffman, M., Levitt, N.S., and Lombard, C. J. 2001. "The epidemic of obesity in South Africa: a study in a disadvantaged community," *Ethnicity & Disease*, 11: 431-437.

Tierney, E. F., Geiss, L. S., Engelgau, M. M., Thompson, T. J., Schaubert, D., Shireley, L. A., Vukelic, P. J., and McDonough, S. L. 2001. "Population-Based estimates of mortality associated with diabetes: Use of a death certificate check box in North Dakota," *American Journal of Public Health*, 91: 84-92.

Tollman, Stephen M., Kahna, Kathleen, Garenne, Michel, and Gear, John S. S. 1999. "Reversal in mortality trends: Evidence from the Agincourt field site, South Africa, 1992-1995," *AIDS*, 13: 1901-1097.

United Nations. 1982. *Model life tables for developing countries*. New York: United Nations.

Waldron, I. 1986. "The contribution of smoking to sex differentials in mortality," *Public Health Reports*, 101: 163-173.

Walker, A. R. 1996. "Urbanisation of developing populations: What are the health/ill-health prospects regarding diseases of prosperity?" *Urbanisation and Health Newsletter*, Sep. (30): 20-28.

World Health Organization. 1998. *Report of a World Health Organization consultation on obesity: Obesity, prevention and managing the global epidemic*, Report WHO/NUT/NCD/98.1. Geneva: World Health Organization.

World Health Organization. 1999. *The World Health Report 1999: Making a difference*. Geneva: World Health Organization.

World Health Organization. 2005. *World Malaria Report 2005*. Report of the roll back malaria program. Available at http://rbm.who.int/wmr2005/html Accessed on April12 2006.

World Health Organization. 2006. WHO Mortality Database Available at http://www3.who.int/whosis/menu.cfm?path=whosis,mort&language=english Accessed on March 15, 2006

Zhang, X. H., Sasaki, S., and Kesteloot, H. 1995. “The sex ratio of mortality and its secular trends,” *International Journal of Epidemiology*, 24: 720-729.

Zohoori, N., Mroz, T. A., Popkin, B., Glinskaya, E., Lokshin, M., Mancini, D., Kozyreva, P., Kosolapov, M., and Swafford, M., 1998. “Monitoring the Economic transition in the Russian Federation and its implications for the demographic crisis-- the Russian Longitudinal Monitoring Survey,” *World Development*, 26: 1977-1993.