Adult Mortality (Age 15-64)

Based on Death Notification Data in South Africa: 1997-2004

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TABLE OFCONTENTS

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

In South Africa, the objective to reduce mortality is reflected in the Government Programme of Action. This programme identifies key areas of intervention and focuses on research and 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.

This report examines the mortality conditions of adult South Africans age 15-64, over the period 1997-2004. People age 15-64 are those who have had their fifteenth birthday and have not yet had their sixty-fifth birthday.

We describe the level and trends in mortality by age and sex over time and the composition and the changing composition of causes of death, in so far as it is knowable at this time. The report provides information to guide the assessment of programmes and the improvement of death notification in South Africa. It is based primarily on data from the Death Notification Forms. Although the report examines many issues related to HIV mortality, the report is not mainly about HIV and examines many non-HIV mortality issues.

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, while in 1997, 80% of all deaths to males and 78% of all deaths to females were registered. Death registration was therefore sufficiently complete by 1997 that the data can be reliably used.

Due to the incompleteness of death registration in South Africa, multipliers or weights by age and sex for each year were applied to the registered deaths. There are several ways of calculating such weights. Our approach provides the best estimates of completeness and gives better estimates than if the unadjusted data on deaths were used to estimate mortality rates.

Changes in death rates between 1997 and 2004 differed by sex and age. In this period, death rates for females age 20-39 more than tripled and for males age 30-44 more than doubled. By 2004, for those age 20-44, female death rates were higher than those for males. Female death rates rose to a peak at age 30-34, which was not surpassed until age 60-64. For both males and females at age 15-19 and 55-64 death rates declined (males age 15-19) or increased by 20% or less.

HIV death rates have a distinctive pattern by age in which there is an increase to a given age and then a rapid decline at older ages. This peak occurs at 30-34 for females and at 35-39 for males. Many HIV deaths are registered as being due to some other cause of death. This problem is aggravated by the fact that HIV is not a reportable disease in South Africa, unlike some other communicable diseases. Based on the age pattern of death rates by sex, it is likely that a high proportion of deaths registered as due to parasitic diseases, parasitic opportunistic infections, certain disorders of the immune mechanism and maternal conditions (females only) are actually caused by HIV.

Some registered causes of death rise to a peak with age but then decline at older ages more slowly than HIV, especially for males. For these registered causes of death, some of the deaths are likely actually due to HIV, but some of the deaths are likely due to something other than HIV. These causes of death include all infectious diseases, tuberculosis, malaria and nutritional deficiencies.

The importance of different causes of death differs by age and sex. In 2004 for males, at age 15-24, unnatural causes were the main cause of death, at age 25-49, communicable and related causes were the main cause of death, and at age 50-64 non-communicable causes were the main cause of death. In 2004 for females, at age 15-44 communicable and related causes were the main cause of death and at age 45-64 non-communicable diseases were the main cause of death.

There are trends in certain non-communicable diseases of special interest. Cancer death rates were unchanged 1997-2004. Death rates from cancer, stroke and other circulatory causes combined rose 12% over the same period. Death rates from diabetes and obesity rose for each sex – 35% for males and 18% for females.

Mortality rates from unnatural causes changed little 1997-2004, although they declined at age 15-19 and at older ages. Deaths from unnatural causes are due to homicide, suicide or accidents. Unnatural cause deaths are sometimes called external cause deaths, violent deaths or injury deaths.

The number of homicides in South Africa declined since the late 1990's. Homicide rates remain very high, especially for males 35-39.   Homicide comprises the majority of unnatural deaths for males 35-39. Male homicide rates are about 6 times higher than female homicide rates. The homicide rate in South Africa is very high, probably second only to that in Colombia.

There is much additional research to be done, both by researchers at Statistics South Africa and researchers elsewhere. It is therefore hoped that the report will stimulate use of the newly released mortality data that have been in the public domain since July 2006 and will encourage research into the many important questions about mortality in South Africa that need much additional work.

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.

In South Africa a special concern with mortality has stemmed from the HIV[1] epidemic. Levels of infection from HIV have risen rapidly. HIV only appeared to any substantial extent in South Africa in the early 1990s. At public antenatal clinics in South Africa, the percentage of pregnant women who were HIV-positive was 1% in 1990, 17% in 1997 and 30% in 2004 (South Africa, Department of Health, 2004: 6, 2005a: 6). 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 at antenatal clinics 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.

At the same time, traditional causes of death, such as malaria, have not disappeared and in some cases present an increasing problem as drug-resistant strains of malaria have emerged (World Health Organization, 2005).

Through 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). After World War II, increased smoking led to a rise in age-specific mortality rates of men in the older working ages in many Western countries (Preston, 1970), and the mortality effects of smoking continue to be a serious problem in most developed countries (Peto *et al.,* 1994). With economic improvements in formerly underprivileged parts of the population, overeating and obesity can lead to, complicate, or increase the death rates from many serious health problems, including diabetes (Abid *et al*., 2000; Jung, 1997; Popkin *et al*., 1997; Tierney *et al*., 2001; World Health Organization, 1998; Zohoori *et al*., 1998).

Problems associated with a shift in diet toward less carbohydrate and 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 also 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 and their mortality consequences have an especially large effect on men, since men tend to smoke and drink alcohol more than women

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[1] In most cases in this report, we use the term HIV to refer to all HIV-positive persons, whether or not the condition has developed into AIDS. Occasionally when discussing medical literature, we draw a distinction between those who are HIV-positive but have not developed AIDS and those who have AIDS.

(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).

The presence of these multiple mortality burdens of the traditional diseases of development along increased unnatural mortality threats has also been pointed out for South Africa (Bradshaw *et al.* 2002). Then when HIV becomes a threat, mortality from that cause is an additional burden and the population could be especially vulnerable because of the persistent mortality burden from other causes.

Analysis of mortality and determining what part of the increase in mortality is in fact due to HIV in a disguised form is complicated since increased mortality from these "new life-style" causes affects much the same ages as does increased mortality from HIV.

It is clear that many HIV deaths are not attributed to HIV on the Death Notification Forms. Thus, much effort has been devoted to an attempt to determine which other listed causes of death actually reflect these other HIV deaths.

South Africa has high death rates from unnatural causes and probably has the second highest homicide rate in the world, trailing only Colombia.[2] The trajectory of unnatural mortality in South Africa is also a subject of scientific and policy concern.

There is also interest throughout the world in deaths from non-communicable diseases. These are the major causes of death of older people, and are an increasing concern as the population ages, mainly due to declining fertility over many years.

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 report, we examine the mortality conditions of adult South Africans age 15-64, over the period 1997-2004. 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.

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

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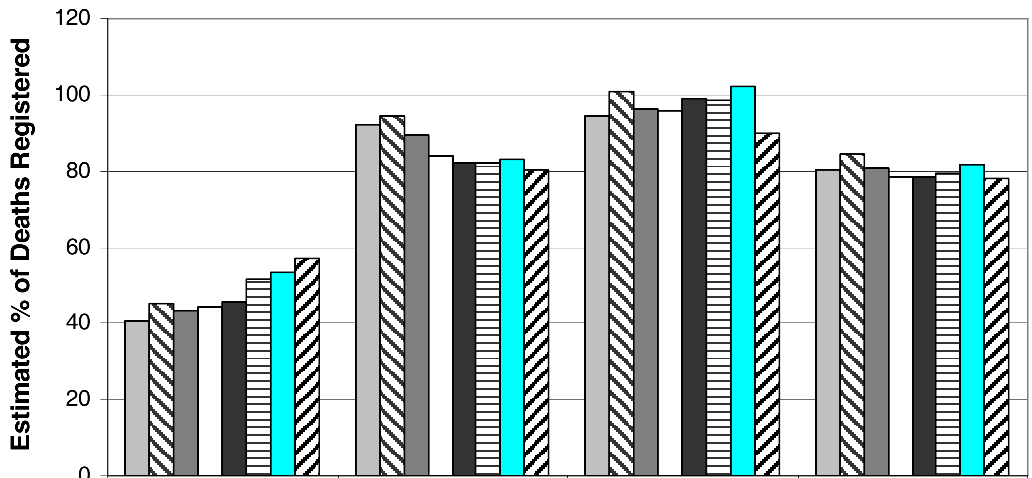
[2] It is estimated that in 2002 the homicide death rate in South Africa was 48 per 100,000 population (based on the number of homicides from the South African Police Service and the Statistics South Africa mid-year population estimates) and in Colombia was 66 per 100,000 population (Colombia, 2005).

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.

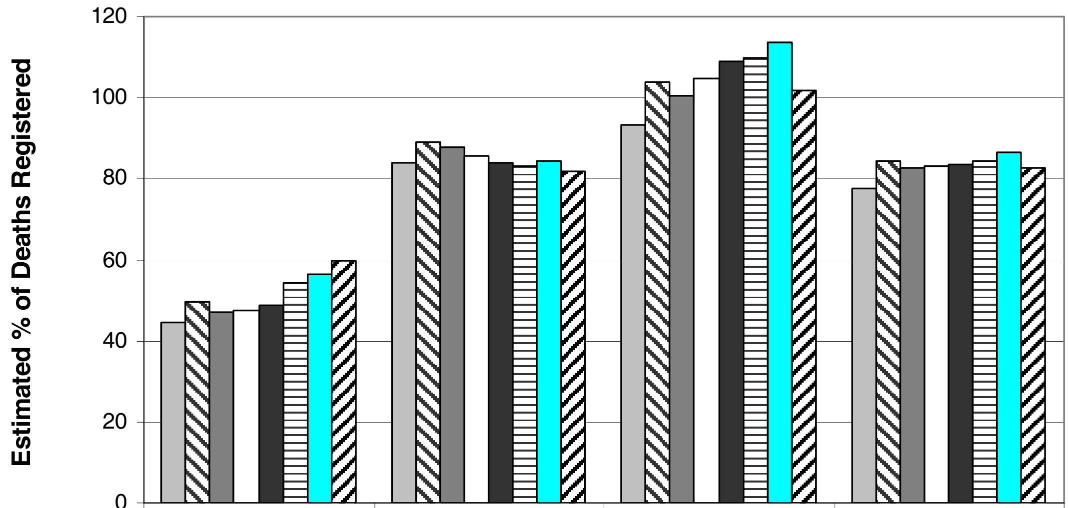
Figures 1 and 2 show the estimated percentage of all deaths that were recorded on the Death Registration forms 1997-2004 by sex, for the age groups 0-14, 15-64, and 65+. Registration of deaths of children 0-14 is much less complete than registration of deaths of adults age 15-64. We estimated that for 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, we know that the elderly are chronically undercounted and their ages are exaggerated in censuses (Anderson and Silver, 1994; Coale and Li, 1991; Phillips, Anderson and Tsebe, 2003; Rosenwaike and Preston, 1984). We do not believe that the estimated high completeness for those at older ages indicated in Figures 1 and 2 accurately reflects the completeness of the registration of their deaths – we think that the actual completeness of death registration for the elderly is lower than that indicated in Figures 1 and 2.



	0-14	15-64	65+	Total
1997	40.6	92.2	94.4	80.1
1998	45.4	94.3	101.0	84.3
1999	43.3	89.5	96.4	80.7
2000	44.4	84.2	96.0	78.4
2001	45.7	82.3	99.2	78.5
2002	51.4	82.2	98.6	79.5
2003	53.6	83.1	102.2	81.7
2004	56.9	80.2	89.9	78.0

Figure 1. Estimated completeness of death registration for males: 1997-2004



	0-14	15-64	65+	Total
1997	44.5	83.9	93.3	77.7
1998	49.4	89.0	103.7	84.4
1999	47.2	87.6	100.7	82.5
2000	47.5	85.6	104.9	83.1
2001	48.7	83.7	109.1	83.6
2002	54.2	83.1	109.8	84.3
2003	56.2	84.2	113.8	86.3
2004	59.8	81.8	101.8	82.6

Figure 2. Estimated completeness of death registration for females: 1997-2004

Because of the problems with death registration for the young and for the old, we restrict our analysis to those age 15-64. This age range covers the working ages and is of scientific and policy interest. An explanation of how completeness of death registration was estimated appears in Appendix A.[3]

When we look at cause of death, we consider the “underlying cause of death”, which is “the one that started the chain of events leading to the death” or “the circumstances of the accident or violence which produced the fatal injury” (Statistics Canada, 1999). Often many different causes contribute to death. For example, some people contract amyotrophic lateral sclerosis (ALS), which is a fatal motor neuron disease. There is no known cure. In the course of ALS, there is progressive paralysis, and most people with ALS die from respiratory failure within four years (NINDS, 2006). Although respiratory failure is the immediate cause of these deaths, ALS is the underlying cause of these deaths.

In the Death Notification Form used before 1998, only one cause of death could be listed. In 1999 and later, up to 5 causes that contributed to the death could be listed, although often only one was indicated. Although there has been useful work done using information on multiple causes of death (Bah, 2003; Bradshaw *et al.*, 2006), we discuss multiple causes of death only to a very limited extent.

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[3] Estimates of completeness of death registration appear in Appendix Table A2. Weights used for the Death Notification Data 1997-2004 to adjust for incompleteness of death registration by age, sex and year of death appear in Appendix Table A3.

A high proportion of all unnatural deaths are reported as such on the Death Notification Form with no further information. Statistics South Africa has begun cooperating with the Department of Transport and the South Africa Police Service in order to obtain more detailed information about unnatural deaths. These cooperative arrangements are expected to expand and become stronger in the future.

Plan of this report

First we look at mortality by age and sex from all causes. Next we look at the division into natural cause and unnatural cause mortality. Third, we examine South African mortality in the context of the Global Burden of Disease three-category classification into: (1) communicable, maternal, perinatal and nutritional diseases and conditions, (2) non-communicable diseases, and (3) unnatural causes.

Then we look at subcategories within communicable diseases, such as infectious diseases, including HIV and tuberculosis, and at parasitic diseases such as malaria. After that we examine subcategories within non-communicable causes, including stroke, other circulatory causes, and cancer. In the more detailed examination of natural causes, we identify causes of death that are likely candidates for including a substantial number of HIV deaths that are reported as due to a different cause. Then we look at divisions within unnatural causes. After that we compare the natural and unnatural mortality situation in South Africa with that in another country with very high rates of natural and unnatural mortality by world standards – Russia. Finally we examine the effects on survival in South Africa of three hypothetical mortality scenarios: (1) the elimination of all unnatural deaths; (2) if communicable and related death rates by age and sex were at their 1997 values, and (3) if non-communicable death rates by age and sex were at their 1997 values.

We describe the level and trends in mortality by age and sex over time and the composition and the changing composition of causes of death, in so far as it is knowable at this time. We describe some perhaps puzzling findings and offer possible explanations. Even when we are not certain of the explanation, hopefully the portrayal of the phenomena will encourage and help other analysts to delve into the explanations.

ALL CAUSE MORTALITY

In this section we examine mortality by sex from all causes. It is important to know what the chance of dying is at each age for either sex, apart from the distribution of the causes of death. In this section we look at death rates by age and sex and how they changed between 1997 and 2004. We also look at the implications of these death rates for the probability that a person age 15 will survive to age 65 and other related questions.

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 3 shows how death rates by age and sex have usually differed.[4] 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.

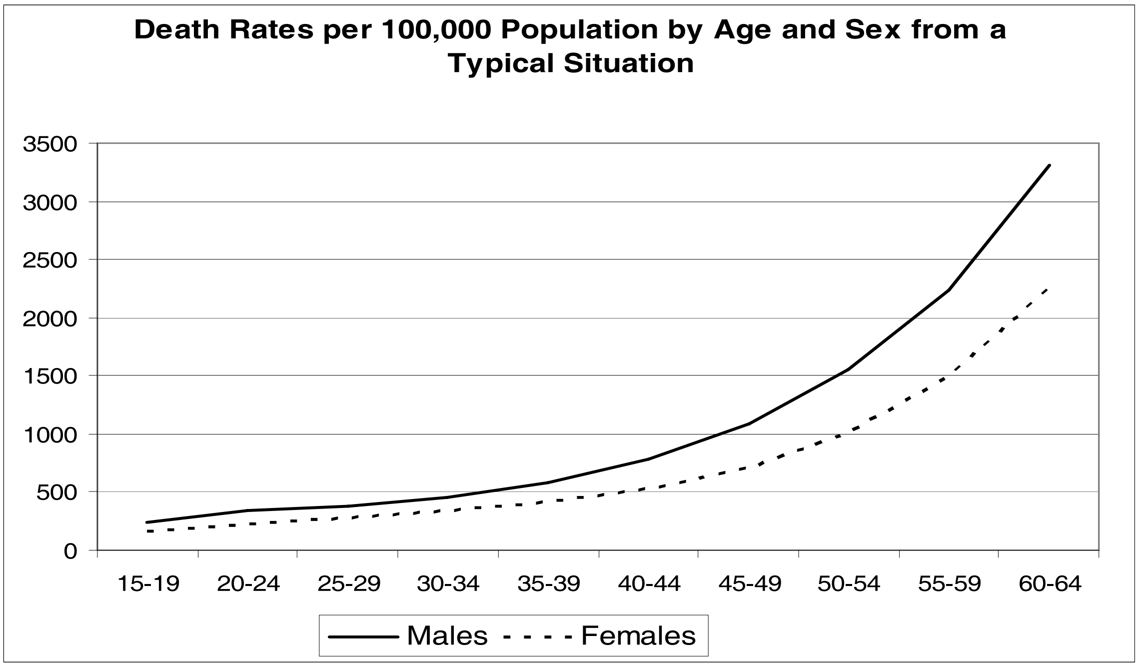


Figure 3. Death rates by age and sex per 100,000: UN general mortality pattern

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).

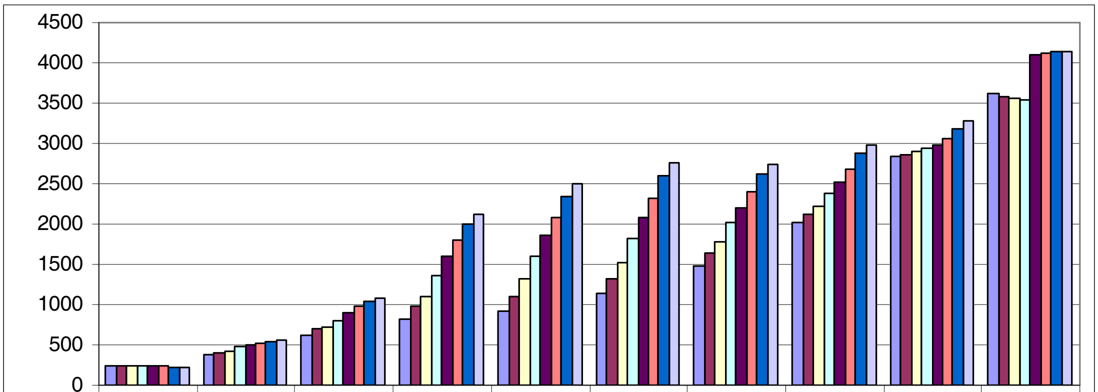
Usually, over time death rates for both sexes and at all ages have declined. However, in some societies at times other than wartime, death rates have increased for certain age-sex groups. For example after World War II, male death rates in the older working ages increased in the United States and much 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

[4] The death rates in Figure 3 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".

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).

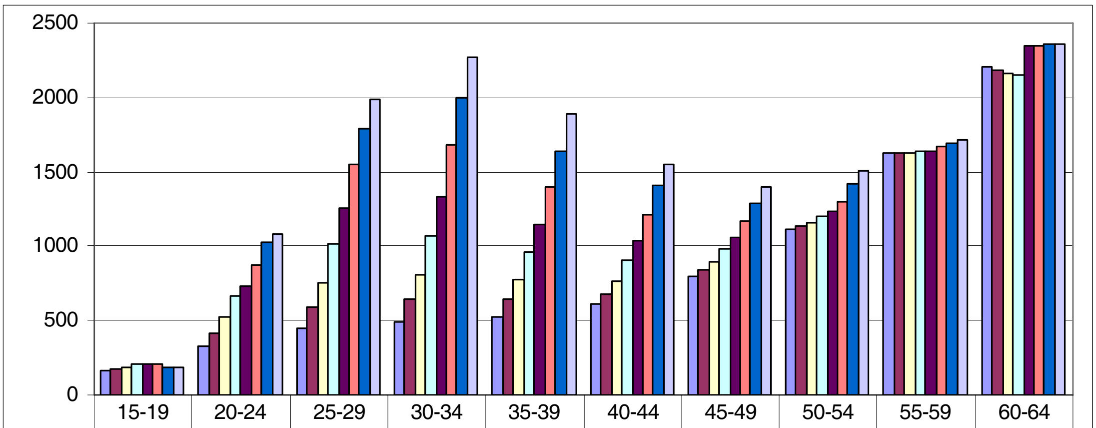
Now we turn to the mortality situation in South Africa. First we consider mortality by age and sex from all causes. Figures 4 and 5 show age-specific death rates by sex for every year 1997-2004.

The presentations in Figures 4 and 5 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 both sexes in every age group.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	235	381	625	817	916	1136	1486	2016	2838	3614
1998	238	408	703	985	1104	1327	1634	2113	2862	3584
1999	239	421	712	1097	1315	1527	1789	2217	2895	3560
2000	244	471	808	1359	1604	1811	2010	2373	2944	3548
2001	238	502	903	1592	1859	2077	2207	2519	2978	4104
2002	234	527	977	1792	2083	2323	2395	2684	3059	4122
2003	218	542	1043	2007	2343	2607	2620	2877	3177	4148
2004	216	555	1081	2118	2498	2765	2744	2979	3270	4146

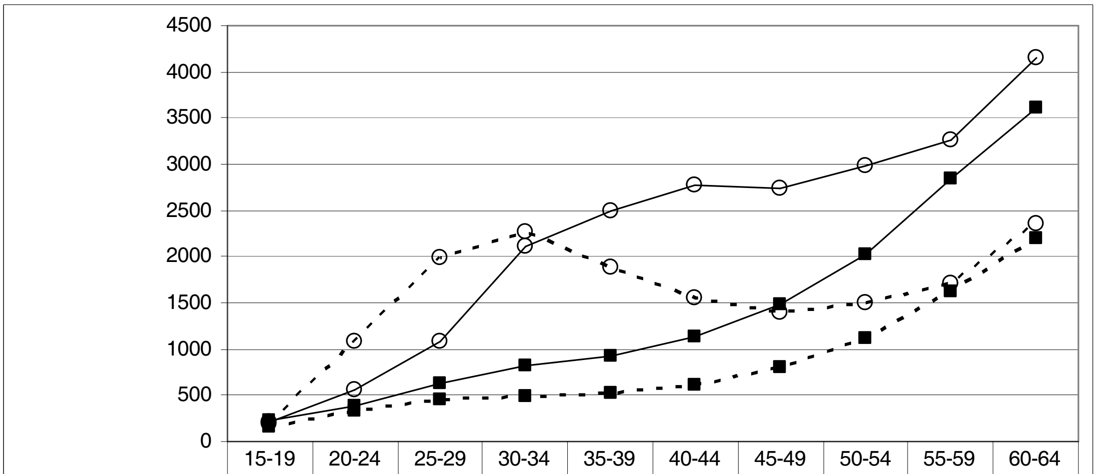
Figure 4. Male death rates by age per 100,000: 1997-2004



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	165	331	452	489	526	615	800	1116	1626	2201
1998	176	420	589	648	648	681	841	1130	1624	2179
1999	185	521	756	803	773	767	895	1154	1626	2163
2000	206	670	1011	1073	960	902	981	1199	1642	2155
2001	206	728	1254	1336	1143	1032	1059	1231	1642	2348
2002	203	870	1547	1680	1396	1210	1173	1297	1668	2352
2003	187	1026	1789	1997	1642	1404	1291	1423	1695	2363
2004	187	1085	1985	2267	1890	1548	1400	1506	1717	2360

Figure 5. Female death rates by age per 100,000: 1997-2004

Figure 6 shows the death rates for both sexes in 1997 and in 2004. Focusing on 1997 and 2004 makes it easier to get a clear picture of the age pattern of death rates and how these have changed over time. In Figure 6, and in many other figures that show age-specific death rates by sex in 1997 and 2004, rates for males are indicated by a solid line for both dates, while rates for females are indicated by a dashed line for both dates. The marker for both sexes for the data referring to 1997 is a solid square, and the marker referring to 2004 is a hollow circle.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male 1997	235	381	625	817	916	1136	1486	2016	2838	3614
Male 2004	216	555	1081	2118	2498	2765	2744	2979	3270	4146
Female 1997	165	331	452	489	526	615	800	1116	1626	2201
Female 2004	187	1085	1985	2267	1890	1548	1400	1506	1717	2360

Figure 6. Death rates by age per 100,000 by sex: 1997 and 2004

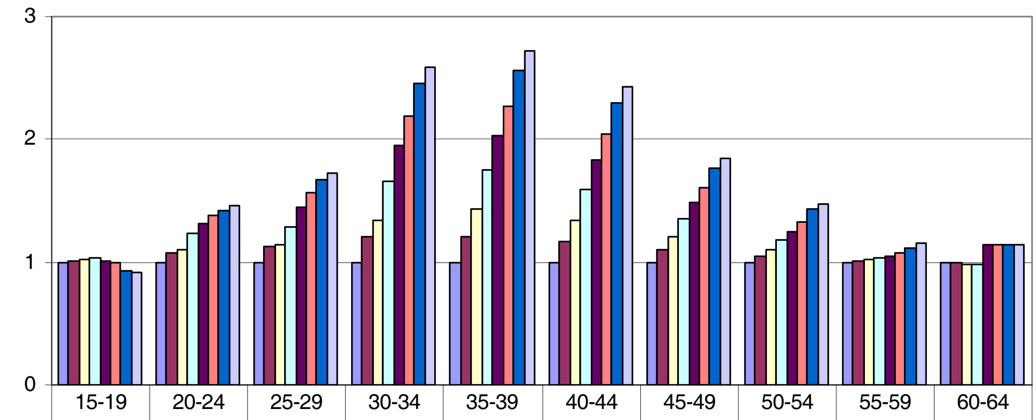
In 1997, for both sexes, death rates increase with each successively older age, as was shown in Figure 3. In 2004, the male death rate increases with each successively older age (except for a small decline from the 40-44 to the 45-49 age group), but after a rapid increase up to age 30, there is a slower rise to age 50, and then a more rapid rise. In 2004, for females the death rate age 25-44 is higher than at age 45-54, which is quite unusual.

The age pattern shown in Figure 6 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 2004, only for age 60-64 does the female death rate exceed that for females at age 30-34.

In 1997, at every age the male death rate was higher than the female death rate, as is seen in Figure 3 and as is usually found in the world. In 2004, for age 20-34 the female death rate was higher than the male death rate, but above age 35, the male death rate in 2004 was higher than the female death rate.

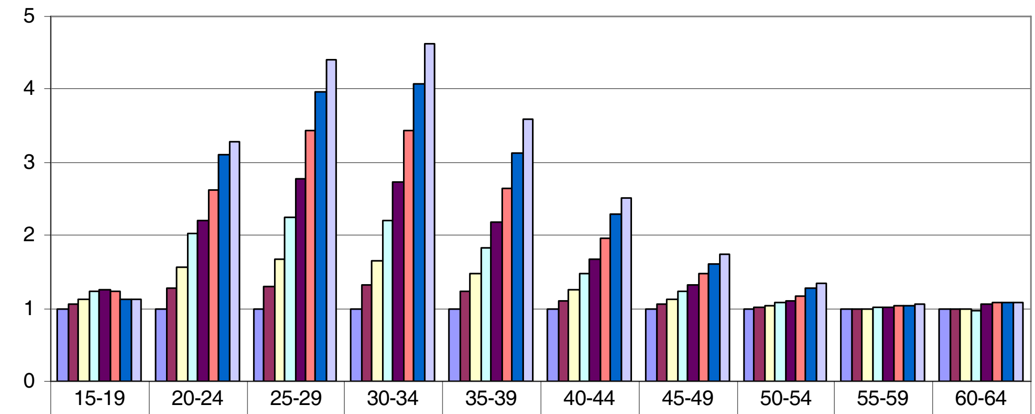
Figures 7 and 8 show trends in death rates in another way. In these figures the values of the death rates for both sexes are shown relative to the value for the same age and sex in 1997. That is, the death rate for a given age and sex in a particular year is divided by the value for that age and sex in 1997. If the rate is the same in a given year as in 1997, the value for the given year is 1.00. This was close to the situation for men age 55-59 in 2000. That value in Figure 7 is 1.037, which means the death rate for males age 55-59 in 2000 was 3.7% higher than the death rate for males age 55-59 in 1997. A value below 1.00 means that the rate in the given year for a particular age-sex group is lower than the rate was for that age-sex group in 1997. This was the situation for females age 60-64 in 1999.

The type of presentation in Figures 7 and 8 is a useful way to compare the pace of change in death rates at different ages and for the two sexes. Except for males age 15-19, the death rate was higher in 2004 than in 1997 for both sexes and every age group. For males age 15-19 and 55-64, there was no increase or a small increase over time. For females over age 55, there also was a small increase over time. For all other sex and age groups, there was a large, steady increase in the death rate over time. The proportionate increase was especially large for women age 20-39, for whom the death rate in 2004 was more than three times its value in 1997.



	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	1.011	1.072	1.124	1.206	1.205	1.168	1.100	1.048	1.009	0.992
1999	1.016	1.106	1.138	1.343	1.435	1.345	1.204	1.100	1.020	0.985
2000	1.037	1.237	1.292	1.664	1.750	1.595	1.353	1.177	1.037	0.982
2001	1.013	1.320	1.443	1.949	2.029	1.828	1.485	1.250	1.050	1.136
2002	0.994	1.384	1.562	2.194	2.273	2.045	1.612	1.331	1.078	1.141
2003	0.927	1.424	1.667	2.458	2.557	2.295	1.764	1.427	1.120	1.148
2004	0.920	1.457	1.729	2.593	2.726	2.434	1.847	1.478	1.152	1.147

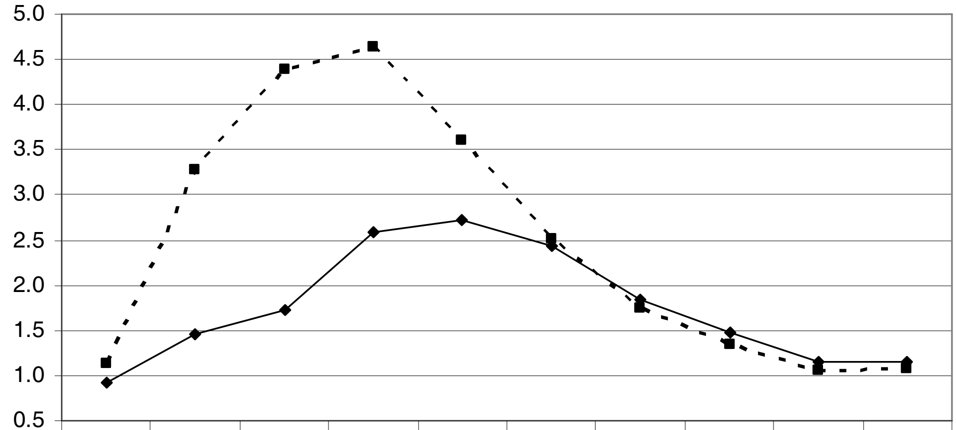
Figure 7. Male death rates by age relative to value by age in 1997 (1997 value=1.00): 1997-2004



	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	1.066	1.267	1.305	1.325	1.231	1.107	1.051	1.013	0.999	0.990
1999	1.119	1.572	1.674	1.642	1.470	1.246	1.118	1.034	1.000	0.983
2000	1.244	2.020	2.240	2.193	1.825	1.467	1.226	1.074	1.010	0.979
2001	1.245	2.197	2.778	2.731	2.173	1.678	1.323	1.103	1.010	1.067
2002	1.225	2.625	3.425	3.434	2.654	1.967	1.465	1.162	1.026	1.069
2003	1.131	3.095	3.963	4.083	3.121	2.283	1.613	1.275	1.043	1.074
2004	1.129	3.274	4.396	4.636	3.593	2.516	1.749	1.350	1.056	1.073

Figure 8. Female death rates by age relative to value by age in 1997 (1997 value=1.00): 1997-2004

Figure 9 shows the same information as in Figures 7 and 8 but for 2004 and for both sexes. The much greater proportionate increases in female than male death rates below age 40 are striking. It is clear from Figure 9 that the increase in mortality between 1997 and 2004 has been concentrated in the younger ages, 20-44, and especially for females. For males 15-19 the death rate declines, and for females 15-19, the death rate increased by only 13%. At age 40-64 the increase for both sexes by age was about equal, and at age 45-64, the female death rate increased at a slightly lower rate than did the male death rate. At age 55-64, the death rates for both sexes increased modestly.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male	0.920	1.457	1.729	2.593	2.726	2.434	1.847	1.478	1.152	1.147
Female	1.129	3.274	4.396	4.636	3.593	2.516	1.749	1.350	1.056	1.073

Figure 9. Death rates in 2004 by age and sex relative to value in 1997 (1997 value=1.00)

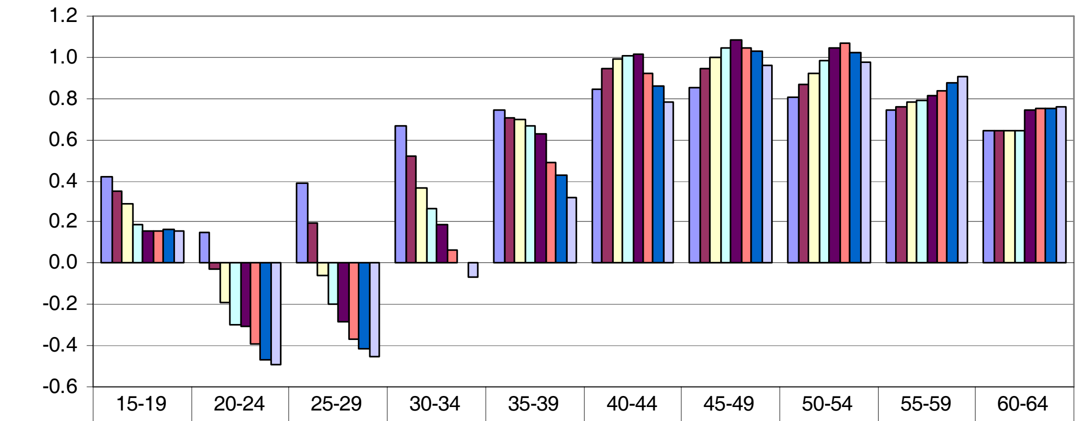
The large increase in mortality for women in their twenties and thirties is not part of a commensurate increase in female mortality at all ages. The increase in death rates for females in their twenties and thirties has been attributed to HIV by many people (Dorrington *et al*. 2001; Hosegood, Vanneste, and Timaeus, 2004; Tollman, *et al.,* 1999). Whether similar large increases in mortality will occur at older ages as those age 20-39 in 2004 (the cohort that was born in 1964-1984) grow older is yet to be seen.

Sex differences in age-specific death rates

Figure 10 shows the sex difference in mortality in a different way. In this figure, the proportion by which the male age-specific death rate in a given year exceeds or falls short of the female age-specific death rate for that year is shown. A value above zero means that the male death rate at that age is higher than the female death rate at that age; a value below zero means that the female death rate at that age is higher than the male death rate at that age.

Thus, in 2000 the male death rate at age 45-49 was 105% higher than the female death rate – the male rate was 2.05 times the female rate. In 2004 the male death rate at age 20-24 was 49% lower than the female death rate at age 20-24.

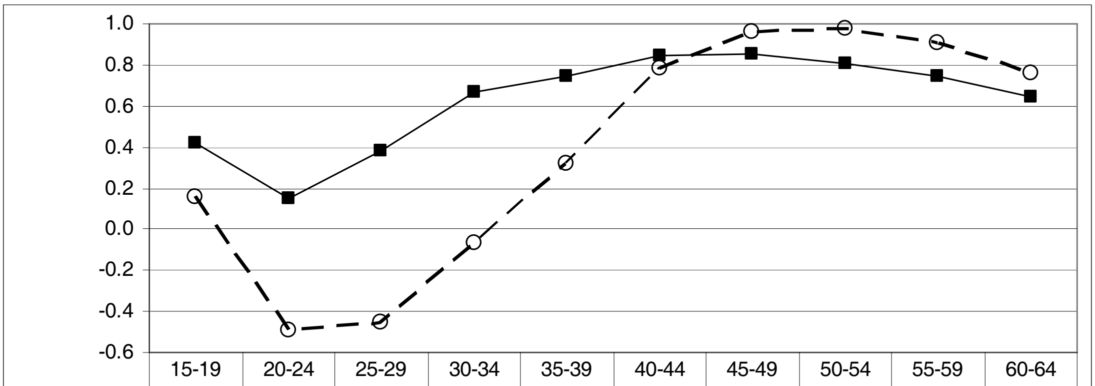
Below age 39, the excess in the male death rate over the female death rate declined over time. For those age 20-34, the female death rate became larger than the male death rate some time between 1998 and 2004. Between age 40 and 54, the excess of the male death rate over the female death rate increased for 4 to 6 years after 1997and then decreased. Above age 55, the excess of the male death rate over the female death rate continued to increase over time.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	0.422	0.148	0.385	0.670	0.741	0.846	0.856	0.807	0.746	0.642
1998	0.349	-0.029	0.193	0.520	0.704	0.947	0.942	0.870	0.763	0.645
1999	0.291	-0.192	-0.058	0.366	0.700	0.992	1.000	0.922	0.780	0.646
2000	0.185	-0.297	-0.201	0.267	0.670	1.007	1.048	0.980	0.793	0.646
2001	0.157	-0.310	-0.280	0.192	0.626	1.011	1.084	1.046	0.814	0.748
2002	0.154	-0.394	-0.368	0.067	0.491	0.919	1.042	1.069	0.834	0.752
2003	0.166	-0.472	-0.417	0.005	0.427	0.857	1.029	1.022	0.874	0.755
2004	0.159	-0.489	-0.455	-0.066	0.321	0.786	0.960	0.978	0.905	0.757

Figure 10. Proportion by which the male death rate exceeds or falls short of the female death rate ((MaleDR-FemaleDR)/FemaleDR) by age: 1997-2004

Figure 11 shows the same information as in Figure 10 but only for 1997 and 2004. The changing situation in the sex differential in mortality between 1997 and 2004 is even clearer in Figure 11. In 1997 at every age the male death rate was higher than the female death rate. By 2004, this was only true below age 20 and above age 35. Above age 45, the male death rate was higher than the female death rate by a larger proportion in 2004 than in 1997.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	0.422	0.148	0.385	0.670	0.741	0.846	0.856	0.807	0.746	0.642
2004	0.159	-0.489	-0.455	-0.066	0.321	0.786	0.960	0.978	0.905	0.757

Figure 11.Proportion by which the male death rate exceeds or falls short of the female death rate ((MaleDR-FemaleDR)/FemaleDR) by age: 1997 and 2004

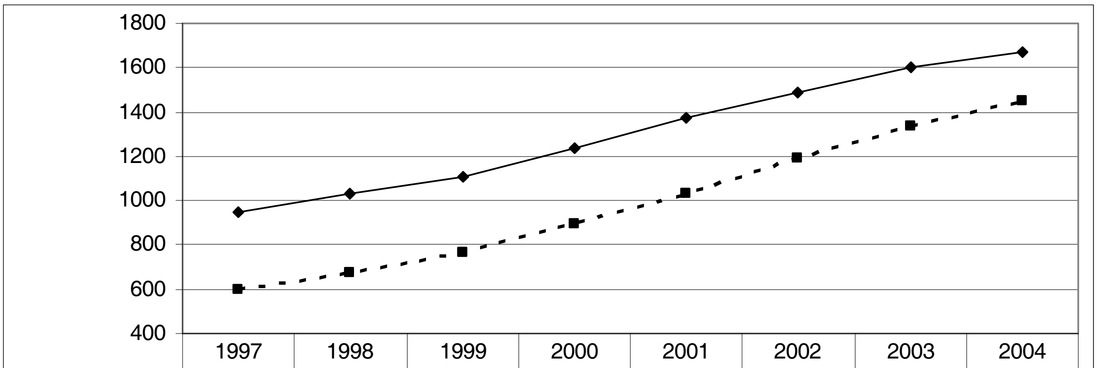
Age-standardised death rates

As we see in Figure 6, 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 6 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.



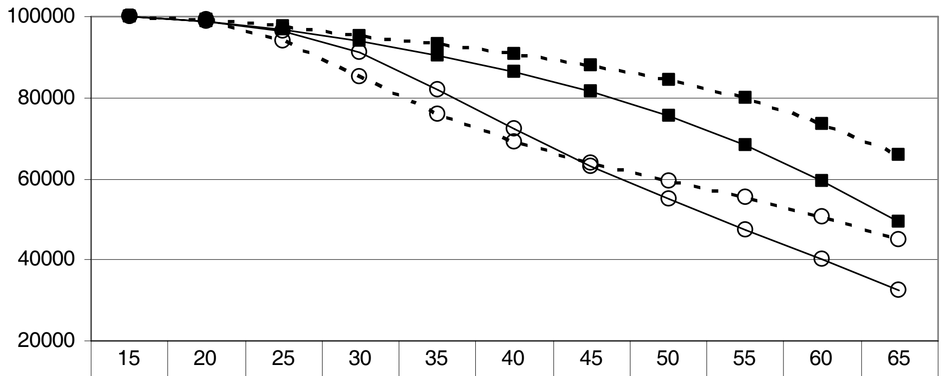
	1997	1998	1999	2000	2001	2002	2003	2004
Male	946	1033	1106	1240	1376	1484	1603	1671
Female	601	677	762	898	1028	1188	1332	1453

Figure 12. Age-standardised death rates per 100,000 from all causes by sex, age 15-64: 1997-2004

Figure 12 shows the age-standardised death rate per 100,000 population for both sexes. The rate for both sexes increases every year. Moreover, the rate is much lower for females than males in every year, although the gap has narrowed over time.

Survival chances

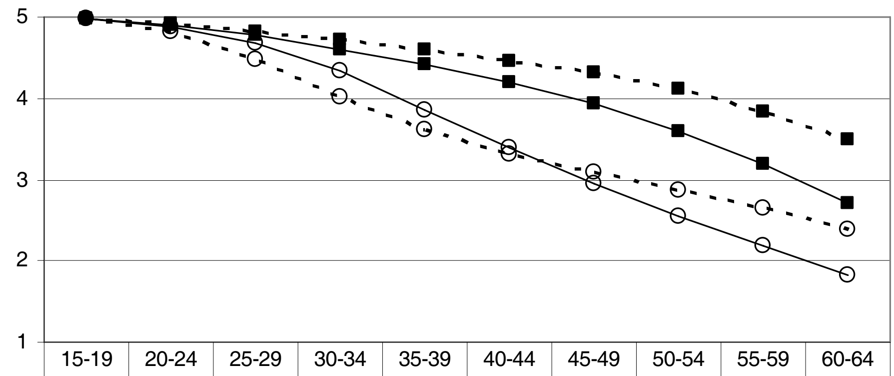
Figure 13 shows for both sexes, for 1997 and 2004, out of 100,000 people alive on their 15^{th} birthday, the number who would survive to successive ages, given the mortality conditions of that year (1997 or 2004). In demographic life table terms, what is shown in Figure 13 is l_x/l_{15}.



	15	20	25	30	35	40	45	50	55	60	65
Male 1997	100000	98830	96967	93981	90220	86179	81420	75589	68336	59282	49458
Male 2004	100000	98924	96218	91152	81984	72347	62991	54904	47293	40145	32604
Female 1997	100000	99176	97546	95368	93064	90647	87901	84453	79869	73630	65951
Female 2004	100000	99070	93836	84963	75848	69002	63861	59542	55221	50676	45028

Figure 13. Number of survivors to a given age from 100,000 people alive on their 15th birthday by sex: 1997 and 2004

Across all ages, the best survival conditions obtained for females in 1997. In 2004, to age 20, females had better survival than males. However, this survival advantage for females in 2004 was lost by age 25; of the four groups considered in Figure 13, females in 2004 had the lowest number surviving to age 25 out of 100,000 people alive at age 15. Above age 20, the second best survival to all ages was for males in 1997. Females in 2004 had a higher proportion surviving to age 65 than males in 1997. From age 25 through 40, females in 2004 had slightly worse survival than males in 2004, but after age 40, females in 2004 had better survival than males in 2004.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male 1997	4.971	4.895	4.774	4.605	4.410	4.190	3.925	3.598	3.190	2.719
Male 2004	4.973	4.879	4.684	4.328	3.858	3.383	2.947	2.555	2.186	1.819
Female 1997	4.979	4.918	4.823	4.711	4.593	4.464	4.309	4.108	3.837	3.490
Female 2004	4.977	4.823	4.470	4.020	3.621	3.322	3.085	2.869	2.647	2.393

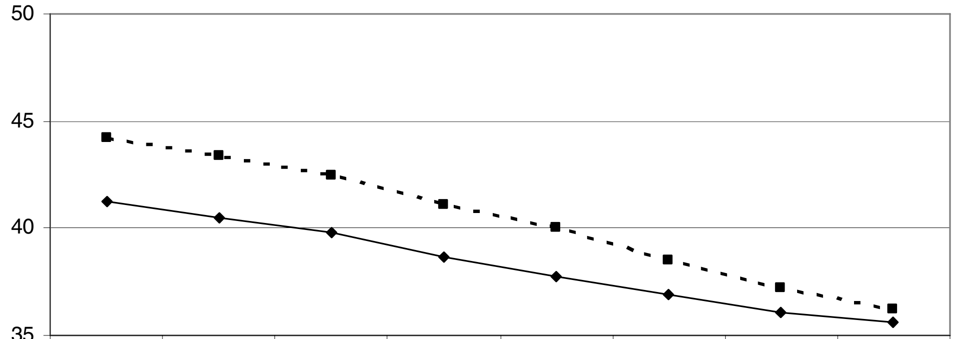
Figure 14. Number of years lived in each five-year age group, among those alive on their 15th birthday by sex: 1997 and 2004

Figure 14 shows for both sexes in 1997 and 2004, the number of years lived in each five-year age interval among those alive on their 15th birthday. In demographic life table terms, what is shown in Figure 14 is ${}_5L_x/l_{15}$.

The maximum that could be lived in any five-year interval is five years. If half the people died after 2.5 years and the other half lived through the interval, then they would have lived on average 3.75 years (half lived 5 years and half lived 2.5 years – .5*5=2.5, .5*2.5=1.25, 2.5+1.25=3.75). The picture shown in Figure 14 is very similar to that in Figure 13.

Figure 15 shows for both sexes the number of years lived from age 15 through age 65 among those alive on their 15th birthday. In demographic life table terms, Figure 15 shows $(T_{15}-T_{65})/l_{15}$.

A maximum of 50 years could be lived between the 15th birthday and the 65th birthday. What is shown in Figure 15 is an analogue to the expectation of life at birth. The expectation of life at birth is the average number of years that a person would live after he or she were born, subject to the mortality risks that were present in that year.



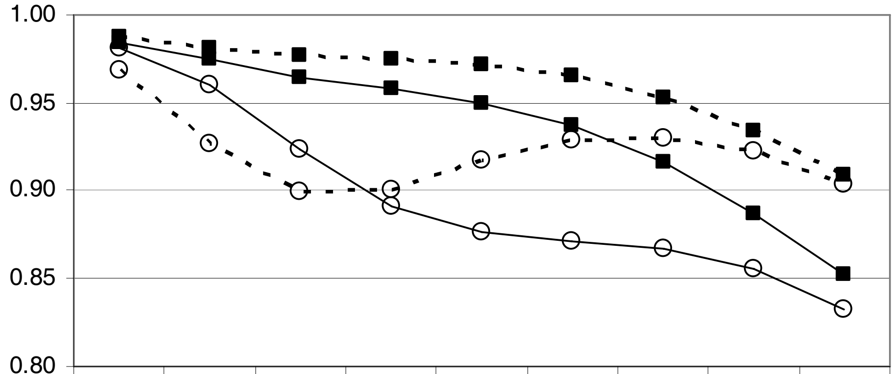
	1997	1998	1999	2000	2001	2002	2003	2004
Male	41.28	40.47	39.83	38.69	37.71	36.90	36.08	35.61
Female	44.23	43.39	42.49	41.10	39.99	38.53	37.21	36.23

Figure 15. Number of years lived from the 15th Birthday through the 65th birthday, among those alive on their 15th Birthday by sex: 1997-2004

We cannot calculate an expectation of life at birth since that requires information on mortality at all ages, and we are not considering people age 0-14 or people age 65 or older. This "temporary life expectation" between age 15 and 65, with a maximum of 50 years, looks at how many years out of the theoretical maximum a person on average would live between age 15 and age 65 under the mortality conditions in South Africa at a given date. We also use this temporary life expectation later when we examine hypothetical mortality scenarios and their overall effect on survival in South Africa.

For both sexes the number of years lived for those age 15-64 declined in each year 1997-2004. Female survival was better than male survival in every year, although the female advantage declined from almost three years in 1997 to less than one year in 2004.

Figure 16 shows the chance of living five more years among people who are alive and in a given five-year age group in 1997 and 2004 for both sexes. In demographic life table terms, Figure 16 shows ${}_5L_{x+5}/{}_5L_x$. For example, of females age 30-34 in 1997, 97.2% of them will be alive five years later, when they will be in the 35-39 age group, assuming the mortality conditions in 1997.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59
Male 1997	0.985	0.975	0.965	0.958	0.950	0.937	0.917	0.887	0.852
Male 2004	0.981	0.960	0.924	0.891	0.877	0.871	0.867	0.856	0.832
Female 1997	0.988	0.981	0.977	0.975	0.972	0.965	0.953	0.934	0.909
Female 2004	0.969	0.927	0.899	0.901	0.917	0.929	0.930	0.923	0.904

Age Group at First Date

Figure 16. Among people in a given age group, the proportion alive five years later by sex: 1997 and 2004

The kind of calculation in Figure 16 looks not at survival from a given age, such as age 15, to a later age such as 20, 45 or 65. Rather it considers for those who are alive at a given age (no matter what proportion survived to that age), what the probability is of subsequent survival for five more years.

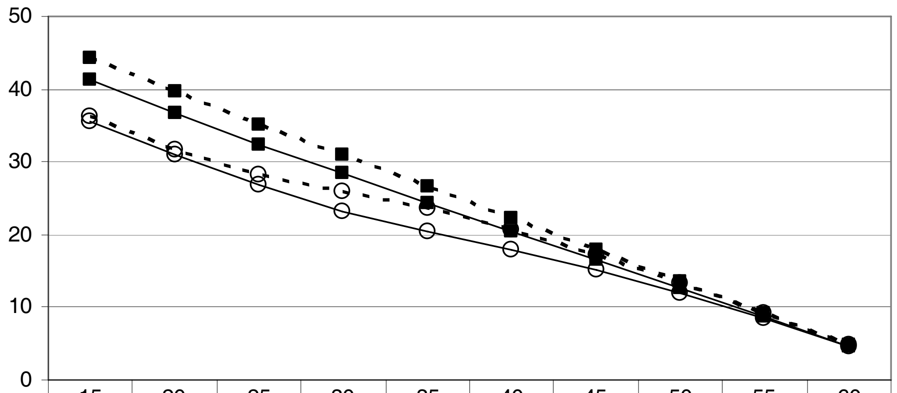
The values shown in Figure 13 have to decrease with each successively older age. This is because Figure 13 showed survivors to a given age from 100,000 people alive at age 15. Once people had died in their twenties, they couldn't return to life in their thirties. In Figure 16, since we are looking at the proportion surviving five years in the future among those alive in a given age group, the values can rise as well as fall. Figure 16 shows that for females in 2004, among those 30-34, only 90% would survive five years to the 35-39 age group (under the mortality conditions in 2004). However, for those alive in the 35-39 age group, 92% would survive five years to the 40-44 age group.

The measure shown in Figure 16 can be considered a conditional probability of survival – the probability of surviving to a subsequent age interval, given you have already survived to a certain age interval. This is the kind of question asked when people are planning a population projection: What proportion of those age 40-44 in 2001 will be alive (and age 45-49) in 2006?

At all ages, the conditional survival probability was best for females in 1997. In 1997, conditional survival for males was much lower from every age group, and in 1997 the gap between males and females increased with age. Also, in 1997, for both sexes, the chance of surviving five more years declined with every successively older age group. This is the pattern that is usually found in the world.

In 2004, for males, the probability of surviving for five more years also declined with each successively older age group. For females in 2004, the chance of surviving five more years from the 25-29, the 30-34, and the 35-39 age groups was lower than for the 40-54 age groups. If a woman survived to the 45-49 age group under the 2004 mortality conditions, her chance of surviving five more years was almost as high as it had been in 1997. In fact, for females, in 1997, 81% of those alive in the 45-49 age group would have survived to the 60-64 age group – by 2004, the proportion surviving from the 45-49 to the 60-64 age group had declined only slightly to 78%. In 2004, below age 30, males had a higher probability of surviving five more years than females, but above age 30, females had a higher probability of surviving five more years than males.

Figure 17 looks at survival in yet another way. It shows for people alive at a given age the number of years they could expect to live between that age and their 65th birthday. For example, those alive on their 30th birthday could live at most 35 years between that age and their 65th birthday. In 1997, males alive on their 30th birthday could expect to live 28.3 years before their 65th birthday. In 2004, males on their 30th birthday could expect to live 23.1 years before their 65th birthday. In demographic life table terms, Figure 17 shows $(T_x\text{-}T_{65})/l_x$.



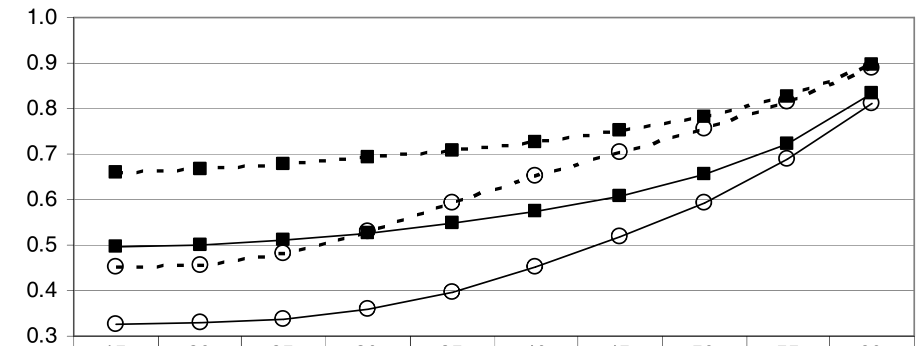
	15	20	25	30	35	40	45	50	55	60
Male 1997	41.3	36.7	32.4	28.3	24.4	20.4	16.5	12.6	8.6	4.6
Male 2004	35.6	31.0	26.8	23.1	20.4	17.8	15.1	11.9	8.5	4.5
Female 1997	44.2	39.6	35.2	30.9	26.6	22.3	17.9	13.5	9.2	4.7
Female 2004	36.2	31.5	28.2	25.8	23.6	20.7	17.2	13.3	9.1	4.7

Figure 17. For people alive at a given birthday, the average number of years they will live between that birthday and their 65th birthday by sex: 1997 and 2004

For both sexes and at every age, the number of years lived before the 65th birthday declined between 1997 and 2004, except for females age 60, for whom there was no change. Also, in both 1997 and 2004, females at each age could expect to live more years before their 65th birthday than could males of the same age in the same year. Even in 2004, a female at age 20 could expect to live half a year more before age 65 than could a male at age 20.

It also is clear in Figure 17 that if a female survived to age 45, her subsequent survival chances were not much worse in 2004 than they were in 1997. As noted earlier, a person on his or her 15th birthday could live at most 50 years to age 65. A person alive on his or her 50th birthday could live at most 15 years to age 65.

Figure 18 shows the proportion of people alive on a given birthday who will survive to age 65, given the mortality conditions in the given year. In demographic life table terms, Figure 18 shows l_{65}/l_x.



	15	20	25	30	35	40	45	50	55	60
Male 1997	0.495	0.500	0.510	0.526	0.548	0.574	0.607	0.654	0.724	0.834
Male 2004	0.326	0.330	0.339	0.358	0.398	0.451	0.518	0.594	0.689	0.812
Female 1997	0.660	0.665	0.676	0.692	0.709	0.728	0.750	0.781	0.826	0.896
Female 2004	0.450	0.455	0.480	0.530	0.594	0.653	0.705	0.756	0.815	0.889

Figure 18. Proportion alive on a given birthday who will survive to their 65th birthday by sex: 1997 and 2004

Figure 13 showed that between 1997 and 2004, the percentage of females who survived from age 15 to age 45 declined from 88% to 64%. However, we see from Figure 18 that for those females who survived to age 45, the percentage who then survived to age 65 declined only from 75% to 71% between 1997 and 2004.

We also see in Figure 18 the proportion surviving from a given age to age 65 declined somewhat between 1997 and 2004 for both sexes. However, at both dates, females had substantially higher chances of surviving to age 65 from every age than did males.

Even in 2004, while 45% of females who were alive on their 15th birthday survived to age 65, this was true of only 33% of males who were alive on their 15th birthday. The gap between the sexes in survival to age 65 is especially large in 2004 for those age 40. While 65% of females who live to age 40 will survive to age 65, this is only true of 45% of males who survive to age 40. Thus, despite the justifiable concern with elevated mortality of females in their twenties through forties, survival to a fairly advanced age remains a more serious problem for males than females.

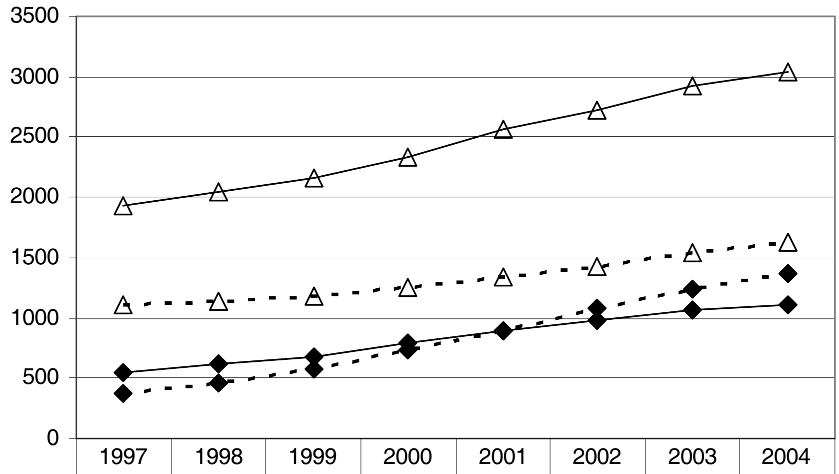
Looking at younger and older adults

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 12 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.

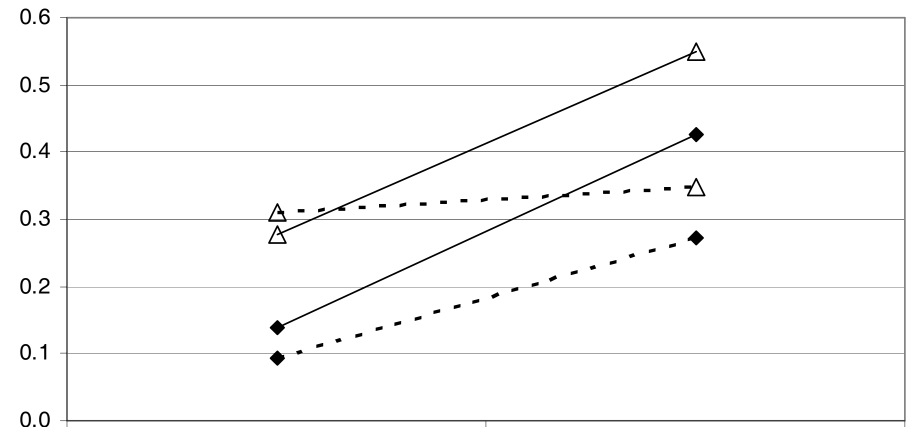
Figure 19 shows age-standardised death rates by sex for the younger and older age ranges. Figure 19 makes even clearer some things that were apparent in earlier figures. For the younger age range, the male rate is higher than the female rate in 1997-2001, but in 2002-2004 the female rate is higher than 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 2004. In 1997, the age-standardised death rate for females 40-64 was 3.0 times that for females age 15-39; by 2004, the rate for the female older age segment was only 1.2 times that of the younger female age segment.



	1997	1998	1999	2000	2001	2002	2003	2004
Male Stand 15-39	545	622	676	793	893	978	1064	1115
Male Stand 40-64	1926	2039	2159	2334	2557	2723	2921	3032
Female Stand 15-39	371	468	573	739	889	1078	1236	1372
Female Stand 40-64	1113	1142	1182	1251	1337	1433	1547	1633

Figure 19. Age-standardised death rates per 100,000 by sex, age 15-39 and age 40-64: 1997-2004

Figure 20 examines these two age segments in another way. It shows for both sexes in 1997 and in 2004 the proportion of those who died between the beginning and the end of the younger adult age segment and the proportion who died between the beginning and the end of the older adult age segment, among those who were alive at the beginning of each age segment. In demographic life table terms, Figure 20 shows l_{40}/l_{15} by sex for the younger age range and l_{65}/l_{40} by sex for the older age range.



	Chance of Dying from Age 15 to Age 40	Chance of Dying from Age 40 to Age 65
1997 Female	0.094	0.272
1997 Male	0.138	0.426
2004 Female	0.310	0.347
2004 Male	0.277	0.549

Figure 20. Chance of dying from 15th to 40th birthday and from 40th to 65th birthday by sex: 1997 and 2004

We noted in Figure 13 that the proportion of females who survived from their 15th to their 40th birthday declined greatly between 1997 and 2004. This is seen in Figure 20 in the leftmost point being much higher for females in 2004 than for females in 1997. The lines for both sexes in each year connect the chance of surviving from the beginning to the end of the younger age segment to the chance of surviving from the beginning to the end of the older age segment. The steep upward slant for females in 1997 and for males in both 1997 and 2004 shows a typical pattern of higher chances of death at older than at younger ages. Although the line for females in 2004 still slants upward, it is at an angle that is close to horizontal. This is because in 2004 for females survival through the younger age segment was only slightly better than survival through the older age segment.

Despite worsening younger female mortality between 1997 and 2004, the overall conclusion about which sex and which age segment had worse mortality is the same according to Figure 20 as it was according to Figure 19. In 2004, 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.

It is possible that in the future the female chance of dying in the 15-40 age range could exceed that of females in the 40-65 age range. In 1997, females were 2.9 times as likely to die before their 65th birthday given they were alive on their 40th birthday, as they were to die before their 40th birthday given they were alive on their 15th birthday. By 2004, they were only 1.1 times more likely to die in the older age range than in the younger 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 3.1 times more likely to die in the older age segment than in the younger age segment. By 2004, males were 2.0 times more likely to die in the older age segment than in the younger age segment.

Main findings on all cause mortality

- Overall mortality of those age 15-64 increased substantially between 1997 and 2004 for both sexes.
- In 2004, the age-standardised death rate for those age 15-64, which controls for changes over time in the age distribution, was 1.8 times its 1997 value for males and 2.4 times its 1997 value for females. For both sexes for every age group 15-64 death rates increased between 1997 and 2004, except for males age 15-19. Death rates more than tripled for females 20-39 and more than doubled for males 30-44.
- For males above age 55 and for females below age 20 and above age 55 death rates by age increased between 1997 and 2004 by less than 20%. The decline or modest increase in death rates for both sexes for those below age 20 and for those age 55 and older is notable in the context of overall mortality increases.
- Female survival from age 15 to 40 dropped from 91% in 1997 to 69% in 2004. Death rates for females age 20-44 rose so markedly that in 2004 the chance of females in a given five-year age group surviving five more years, a measure that usually declines steadily in the adult ages, was lowest for females age 25-29, of whom only 89.9% could expect to live five more years. This measure rose steadily with increasing age to the 45-49 age group, of whom 93.0% could expect to live five more years, before falling to 90.4% in the 55-59 age group.
- Even in 2004, female survival from the 15th birthday to the 65th birthday (45%) remained higher than that for males (33%). However, female survival from 45 to 65 was almost unchanged – 75% in 1997 and 71% in 2004.
- When one looks separately at the 15-39 age group and the 40-64 age group, a traditional ordering of mortality by age segment is found for 1997. The highest mortality is for older males, followed by older females, and then younger males, while the best survival is for younger females. In 2004, older males still have the worst survival, followed by older females. However, by 2004, younger females come next, and younger males have the best survival.

Comments

The increase in death rates between 1997 and 2004 in every age-sex group except males 15-19 is disturbing in a world in which the main direction of mortality change in the last century has been ever lower death rates over time. The increase between 1997 and 2004 by more than three times in the death rates for females age 20-39, and the more than doubling of death rates for males age 30-44 is alarming. In addition, the narrowing, and for some ages disappearance, of the traditional female survival advantage is disturbing.

There is some encouragement in the small mortality worsening for those under age 20 and those above age 55. In light of the large mortality increase for younger women, the much smaller increase for women over age 40 is also encouraging. Time will reveal whether mortality deterioration for females continues to occur mainly for those in their twenties and thirties, or whether large mortality deterioration will move up the age range as cohorts age. The loss of more than 4.5 years lived out of the 50 years possible between age 15 and 65 for males between 1997 and 2004 and the loss of 8 years of life for females between age 15 and 65 between 1997 and 2004 is a striking illustration of the extent of mortality increase for both sexes.

Female survival from age 15 to ages 20-45 has dropped drastically since 1997. However, among those alive starting at any age, even age 15, females have a better chance of living to age 65 than do males. Also, even in 2004, mortality age 40-64 is worse for both sexes than it is for either sex in the age range 15-39. However, while in 1997 males age 15-39 had higher mortality than females age 15-39, by 2004, female mortality in the younger age segment was higher than male mortality in the same age range. High mortality at the older ages, especially for males, remains a problem that should not be ignored.

NATURAL AND UNNATURAL CAUSE MORTALITY

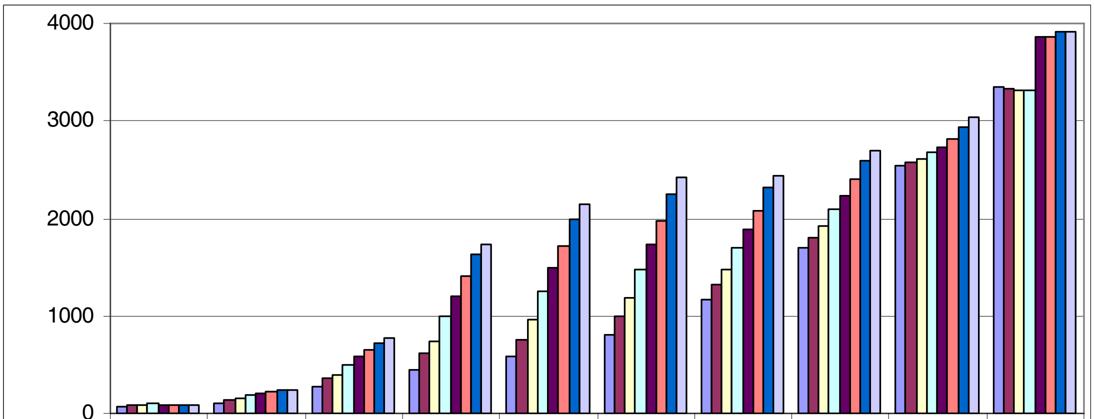
Next we examine the division of mortality into natural and unnatural causes of death. Natural causes include disease, whether infectious or not and whether acute or chronic. Deaths from unnatural causes are the result of intentional harm by others, intentional self-harm, or accidents. Natural causes of death are those in ICD-10 codes A00-R99, and unnatural causes of death those in ICD-10 codes V01-Y89.

The division into natural and unnatural causes is important partly because the policies to decrease natural cause and unnatural cause mortality are quite different. To attack natural cause mortality requires things such as immunization programmes, development of new drugs to treat diseases, and health promotion campaigns to reduce smoking, improve diet and encourage safe sex practices. To attack unnatural cause mortality involves promotion of safe driving practices and safe walking practices for pedestrians, policing programmes to reduce homicide, help lines to decrease suicides, and safer housing conditions to reduce fatal accidents in the home.

Natural causes of death

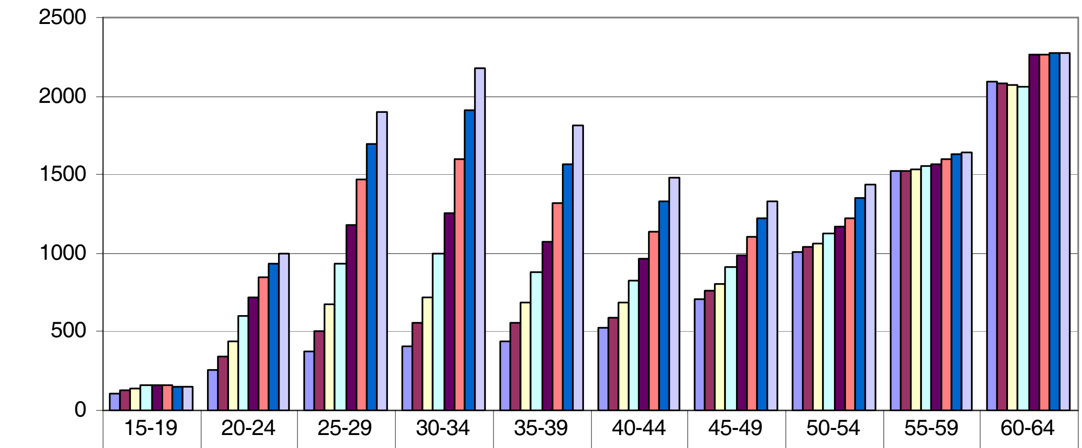
Age-specific death rates from natural causes are shown in Figure 21 for males and in Figure 22 for females.

Death rates from natural causes increased in every year for both sexes at every age except for those 15-19 and males 60-64. For both sexes, there was little increase in death from natural causes after 2001 for those age 60-64.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	74	110	270	451	580	812	1169	1697	2537	3342
1998	87	140	353	612	753	991	1318	1811	2577	3330
1999	86	156	395	747	962	1190	1475	1929	2617	3314
2000	95	192	497	995	1259	1476	1704	2089	2679	3320
2001	92	212	585	1207	1491	1731	1882	2233	2734	3864
2002	92	225	659	1415	1711	1966	2085	2404	2807	3862
2003	78	240	726	1624	1991	2247	2309	2591	2932	3912
2004	81	247	765	1742	2139	2415	2439	2701	3036	3909

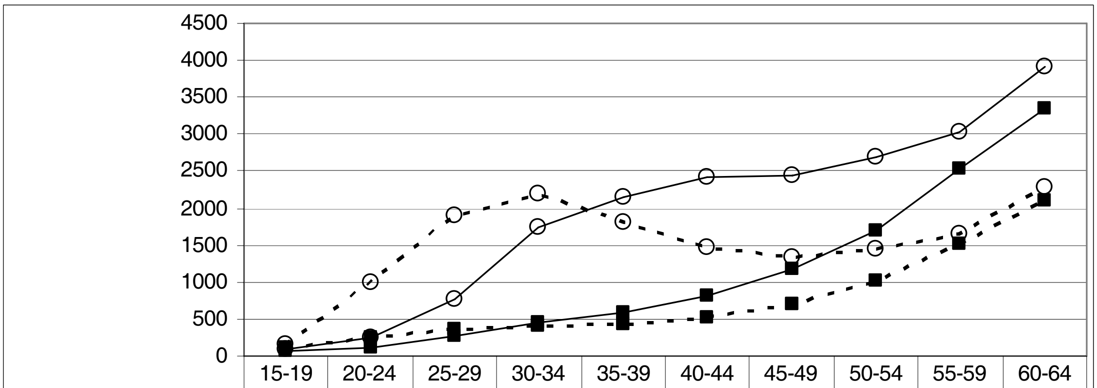
Figure 21. Male death rates by age per 100,000 from natural causes: 1997-2004



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	112	256	372	406	437	524	706	1009	1519	2095
1998	129	345	508	563	557	595	758	1040	1527	2079
1999	135	445	671	719	683	689	808	1063	1532	2074
2000	160	597	933	993	881	828	908	1125	1559	2062
2001	162	715	1175	1255	1070	961	990	1165	1565	2259
2002	163	848	1467	1597	1317	1138	1103	1227	1595	2269
2003	148	934	1700	1915	1567	1331	1227	1355	1626	2278
2004	148	994	1899	2182	1809	1475	1331	1436	1644	2279

Figure 22. Female Death Rates by Age per 100,000 from Natural Causes: 1997-2004

Figure 23 shows age-specific death rates from natural causes by sex for 1997 and 2004. The highest death rates from natural causes occur for older males. The male death rates above age 55 in 1997 were higher than the female death rates age 30-34 in 2004. In 2004, the male rates above age 40 were higher than the female rate in every age group.

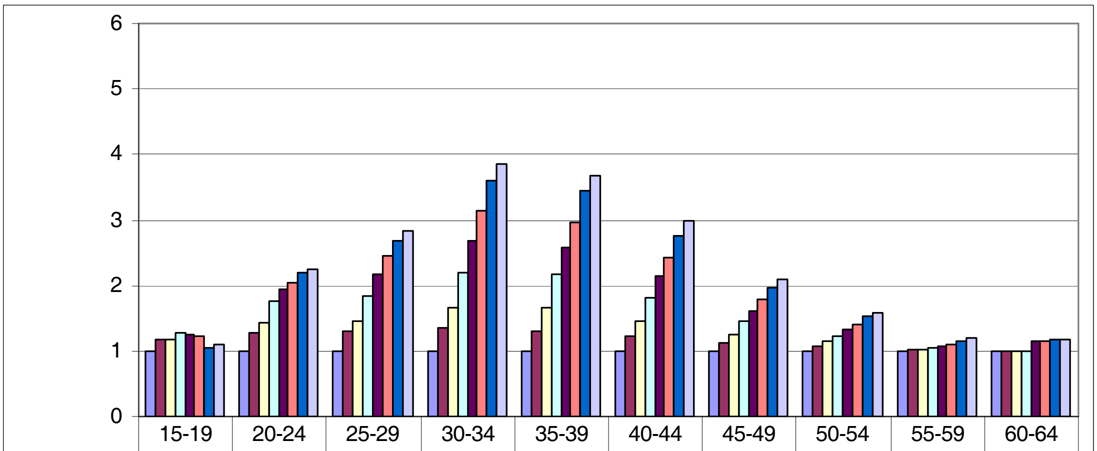


	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male 1997	74	110	270	451	580	812	1169	1697	2537	3342
Male 2004	81	247	765	1742	2139	2415	2439	2701	3036	3909
Female 1997	112	256	372	406	437	524	706	1009	1519	2095
Female 2004	148	994	1899	2182	1809	1475	1331	1436	1644	2279

Figure 23. Death rates by age and sex per 100,000 from natural causes: 1997 and 2004

The most striking feature of Figure 23 is the sharp increase in female death rates in 2004 for the 30-34 age group followed by a decline in death rates through the

45-49 age group. The male death rate in 2004 increases with every successively older age, although the pace of increase slows between age 40 and 54.



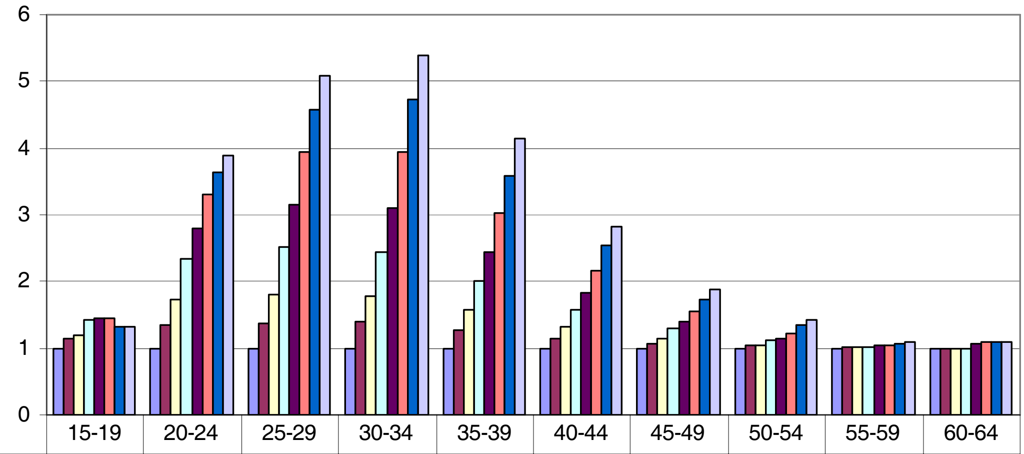
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1998	1.169	1.280	1.311	1.358	1.298	1.221	1.128	1.067	1.016	0.996
1999	1.162	1.425	1.465	1.655	1.660	1.466	1.261	1.137	1.031	0.991
2000	1.280	1.754	1.844	2.207	2.171	1.819	1.458	1.231	1.056	0.993
2001	1.239	1.939	2.170	2.675	2.572	2.133	1.610	1.316	1.078	1.156
2002	1.237	2.053	2.443	3.136	2.952	2.423	1.784	1.417	1.107	1.156
2003	1.049	2.189	2.692	3.599	3.435	2.769	1.975	1.527	1.156	1.171
2004	1.088	2.257	2.839	3.862	3.689	2.976	2.086	1.592	1.197	1.169

Figure 24. Male death rates from natural causes by age relative to value by age in 1997 (1997 Value=1.00): 1997-2004

Figure 24 shows male death rates from natural causes relative to the value for males of the given age in 1997, and Figure 25 shows similar information for females. The rapid increase in death rates from natural causes for males and females age 20-54 is clear.

Figure 24 looks similar to Figure 7, although the increases shown in Figure 24 are more extreme. The largest increase in Figure 7 (for all cause mortality) was for males age 35-39 in 2004, whose death rate in 2004 was 2.7 times its value in 1997; when death rates only from natural causes are considered, the 2004 rate is 3.7 times its 1997 value.

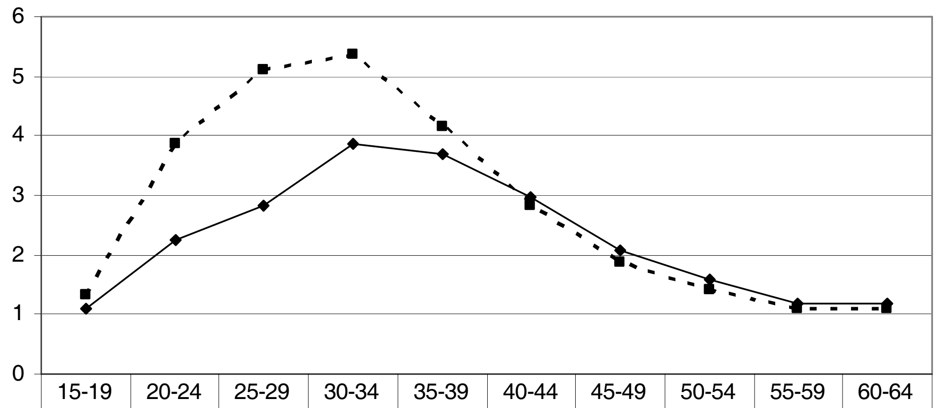
Figure 25 looks similar to Figure 8, but again the increases in Figure 25 (when only natural cause mortality is considered) are larger than when all cause mortality is examined. The largest value in Figure 8 is 4.636, which is found for females age 30-34 in 2004; the largest value in Figure 25 (for natural cause mortality) is for females age 30-34 in 2004. That value is 5.380, and the value for females age 25-29 in 2004 is only slightly lower at 5.097.



	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	1.152	1.346	1.363	1.388	1.277	1.135	1.073	1.031	1.006	0.992
1999	1.208	1.736	1.802	1.772	1.565	1.315	1.144	1.054	1.008	0.990
2000	1.425	2.331	2.505	2.448	2.019	1.580	1.286	1.115	1.026	0.985
2001	1.448	2.791	3.156	3.093	2.450	1.833	1.402	1.154	1.031	1.079
2002	1.452	3.308	3.937	3.936	3.016	2.171	1.561	1.216	1.050	1.083
2003	1.322	3.646	4.565	4.721	3.589	2.540	1.738	1.343	1.071	1.088
2004	1.322	3.880	5.097	5.380	4.143	2.816	1.885	1.424	1.082	1.088

Figure 25. Female death rates from natural causes relative to value by age in 1997 (1997 Value=1.00): 1997-2004

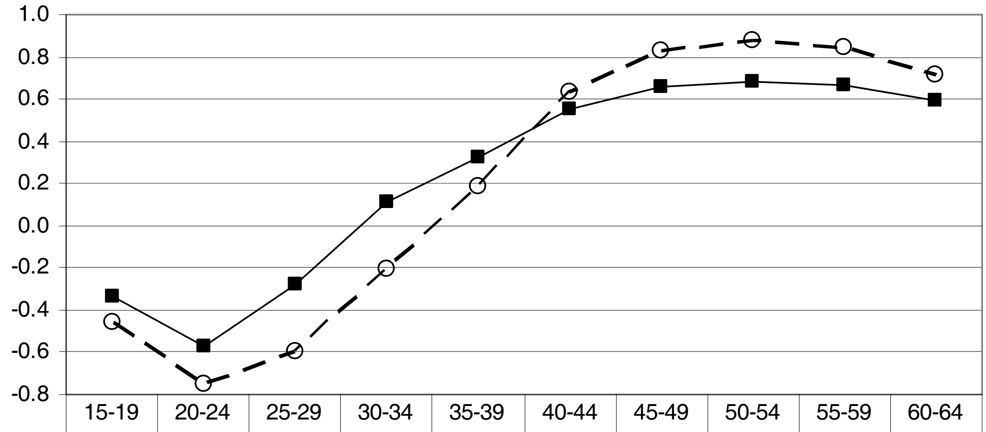
Figure 26 shows the same information as in Figures 24 and 25 but for 2004 relative to the 1997 value and for both sexes. Figure 26 looks similar to Figure 9 which considered the death rate in 2004 relative to 1997 for all cause mortality. As for all cause mortality, the increases are largest for those age 20-44 and especially for females. As for all cause mortality, above age 40 the percentage increase in the death rate for females between 1997 and 2004 was less than for males.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male	1.088	2.257	2.839	3.862	3.689	2.976	2.086	1.592	1.197	1.169
Female	1.322	3.880	5.097	5.380	4.143	2.816	1.885	1.424	1.082	1.088

Figure 26. Death rates from natural causes by sex in 2004 relative to value by age and sex in 1997 (1997 Value=1.00)

Figure 27 shows the sex differential in mortality from natural causes in 1997 and 2004. It graphs the proportion by which the male death rate from natural causes exceeds (or falls short of) the female rate from natural causes. In Figure 27, a value above zero means that the male rate was higher than the female rate; a value less than zero means that the female rate was higher than the male rate.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	-0.338	-0.573	-0.276	0.112	0.328	0.549	0.656	0.682	0.670	0.596
2004	-0.455	-0.751	-0.597	-0.202	0.182	0.637	0.833	0.880	0.847	0.715

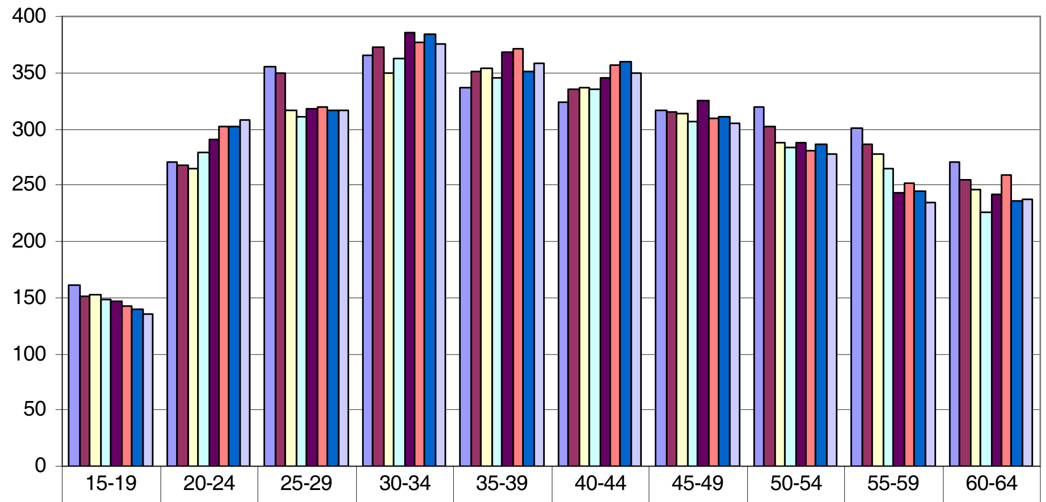
Figure 27. Proportion by which the male death rate from natural causes exceeds or falls short of the female death rate from natural causes ((MaleDR-Female DR)/FemaleDR): 1997 and 2004

In Figure 27 we see that, in both 1997 and 2004, the female death rate from natural causes was higher than the male rate at ages 15-29. In both years above age 35, the male rate was higher than the female rate. Above age 40, the male death rate from natural causes exceeded the female rate by a larger percentage in 2004 than in 1997.

Unnatural causes of death

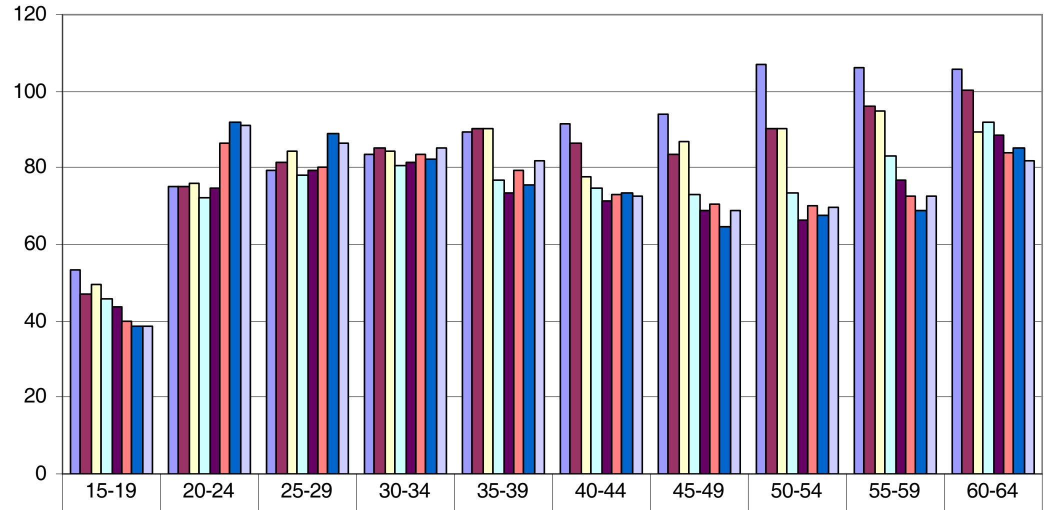
When we look at mortality from unnatural causes, the picture is very different than for natural causes. Figure 28 shows age-specific death rates from unnatural causes for males, and Figure 29 shows similar information for females.

In Figures 28 and 29 we do not see the steady rise in death rates over time that we saw for all cause mortality and for natural 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.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	161	271	356	366	336	324	316	319	301	270
1998	151	268	349	373	352	335	315	303	286	254
1999	153	265	317	350	353	337	314	288	278	246
2000	149	279	311	363	346	335	307	283	265	227
2001	146	290	318	386	368	346	325	287	243	241
2002	142	302	319	377	371	357	310	281	251	259
2003	140	302	317	384	352	360	311	286	245	236
2004	136	307	316	376	359	350	305	278	234	238

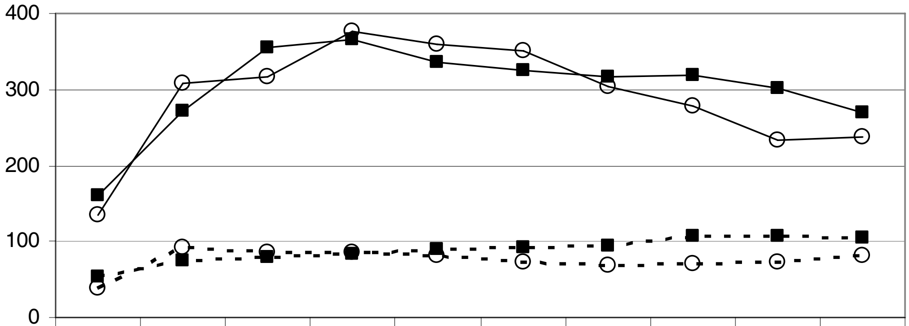
Figure 28. Male Death Rates by Age per 100,000 from Unnatural Causes: 1997-2004



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	53	75	79	84	89	91	94	107	106	106
1998	47	75	82	85	90	87	84	90	96	100
1999	50	76	84	84	90	78	87	90	95	89
2000	46	72	78	80	77	75	73	73	83	92
2001	44	74	79	81	74	71	69	66	77	89
2002	40	86	80	84	79	73	71	70	73	84
2003	39	92	89	82	75	73	64	68	69	85
2004	38	91	86	85	82	72	69	70	73	82

Figure 29. Female death rates by age per 100,000 from unnatural causes: 1997-2004

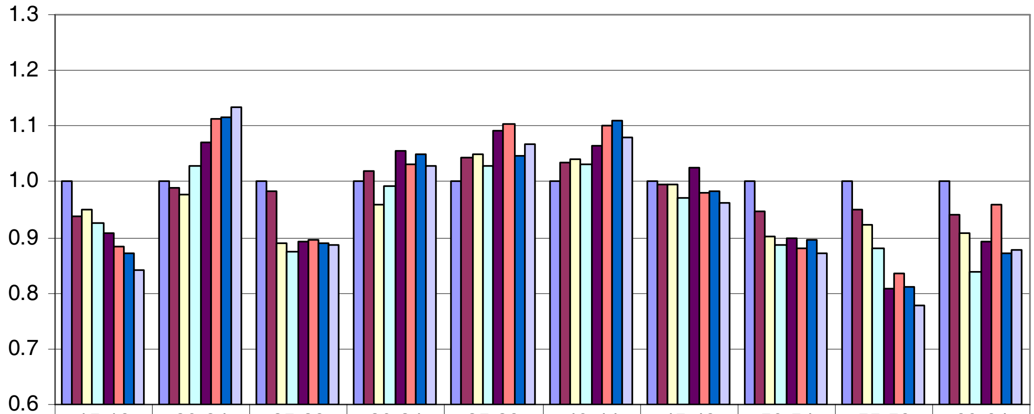
Figure 30 shows age-specific death rates from unnatural causes by sex for 1997 and 2004. As in most countries, male unnatural cause death rates are much higher than female unnatural cause death rates.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male 1997	161	271	356	366	336	324	316	319	301	270
Male 2004	136	307	316	376	359	350	305	278	234	238
Female 1997	53	75	79	84	89	91	94	107	106	106
Female 2004	38	91	86	85	82	72	69	70	73	82

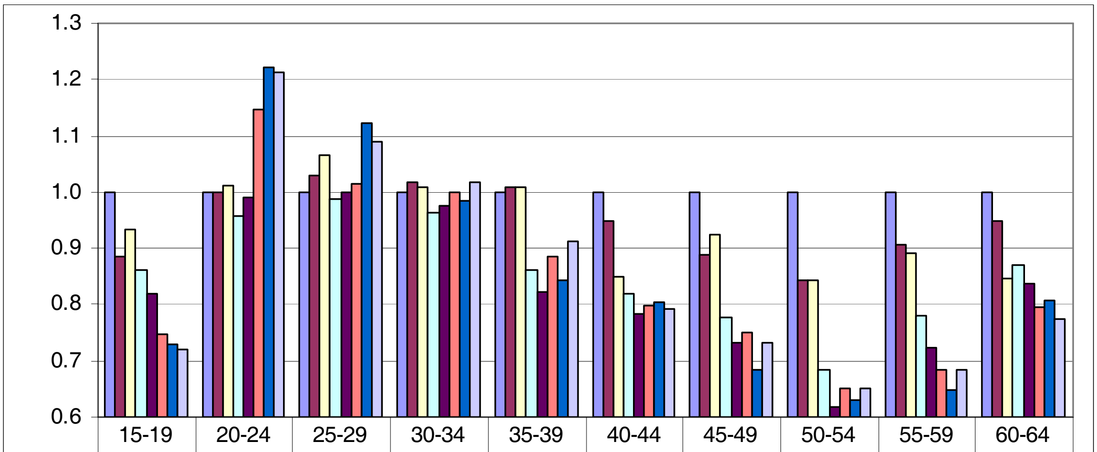
Figure 30. Death rates per 100,000 from unnatural causes by age and sex: 1997 and 2004

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 31 shows male death rates from unnatural causes relative to the value for 1997, and Figure 32 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	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1998	0.938	0.988	0.982	1.019	1.045	1.033	0.996	0.948	0.949	0.940
1999	0.949	0.977	0.891	0.958	1.050	1.040	0.994	0.903	0.922	0.909
2000	0.925	1.028	0.874	0.993	1.027	1.032	0.970	0.887	0.880	0.838
2001	0.909	1.070	0.892	1.054	1.093	1.065	1.027	0.899	0.808	0.891
2002	0.882	1.114	0.896	1.031	1.103	1.101	0.980	0.880	0.835	0.958
2003	0.871	1.115	0.891	1.049	1.045	1.109	0.984	0.895	0.812	0.873
2004	0.842	1.134	0.888	1.029	1.067	1.079	0.963	0.870	0.778	0.879

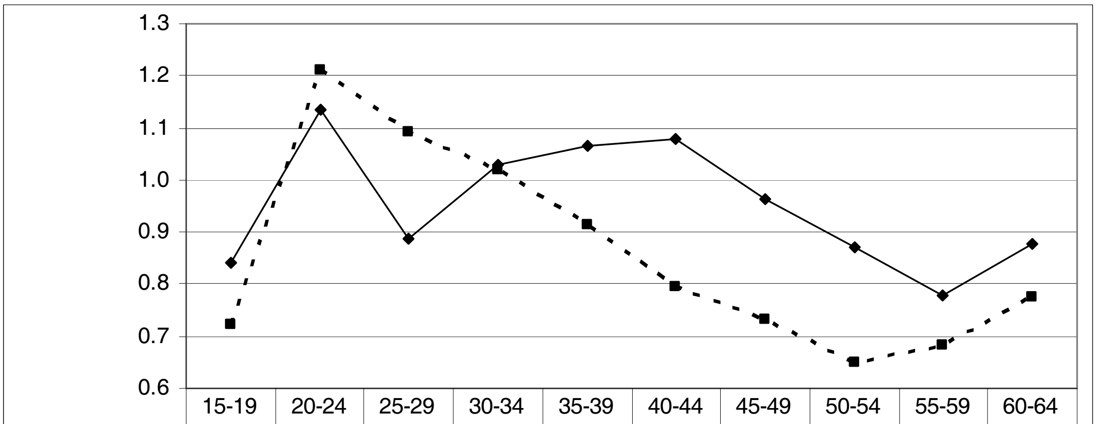
Figure 31. Male death rates from unnatural causes relative to value by age in 1997 (1997 Value=1.00): 1997-2004



	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	0.885	0.999	1.030	1.017	1.010	0.947	0.889	0.844	0.905	0.949
1999	0.933	1.011	1.064	1.008	1.007	0.850	0.924	0.844	0.890	0.847
2000	0.862	0.956	0.986	0.963	0.861	0.818	0.777	0.685	0.781	0.871
2001	0.818	0.990	0.999	0.974	0.823	0.782	0.732	0.618	0.722	0.839
2002	0.747	1.148	1.014	1.001	0.886	0.797	0.751	0.652	0.684	0.794
2003	0.729	1.221	1.123	0.985	0.843	0.804	0.685	0.630	0.649	0.807
2004	0.721	1.212	1.091	1.018	0.913	0.793	0.732	0.651	0.684	0.775

Figure 32. Female death rates from unnatural causes by age relative to value by age in 1997 (1997 Value=1.00): 1997-2004

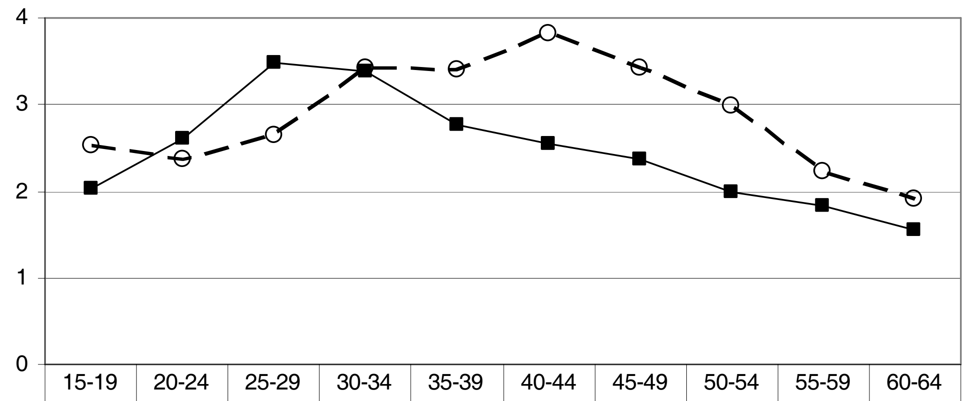
Figure 33 shows similar information to that in Figures 31 and 32 but only for 2004 relative to 1997 and for both sexes. Males age 25-29 had a relatively high death rate from unnatural causes, but it declined by more than 11% between 1997 and 2004. The decline in the unnatural cause death rate for the 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.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male	0.842	1.134	0.888	1.029	1.067	1.079	0.963	0.870	0.778	0.879
Female	0.721	1.212	1.091	1.018	0.913	0.793	0.732	0.651	0.684	0.775

Figure 33. Death rates from unnatural causes in 2004 by sex relative to value by age and sex in 1997 (1997 Value=1.00)

The unnatural cause death rate increased in the 20-24 age group between 1997 and 2004 by 13% for males and by 12% for females. For both sexes 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	2.025	2.603	3.492	3.378	2.765	2.550	2.362	1.982	1.833	1.561
2004	2.532	2.370	2.656	3.423	3.397	3.828	3.424	2.985	2.221	1.906

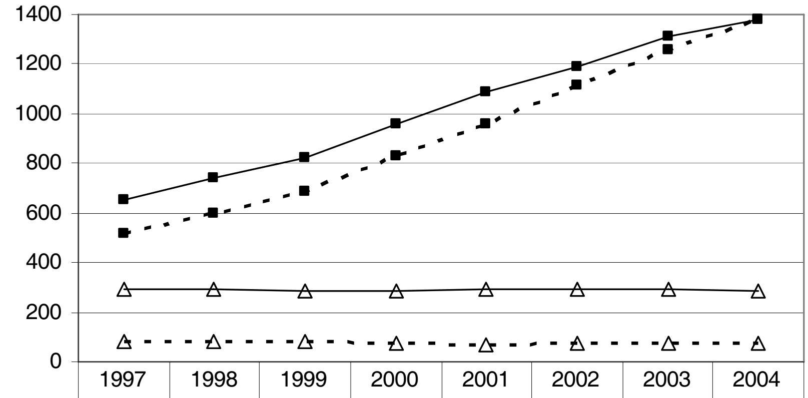
Figure 34. Proportion by which the male death rates from unnatural causes exceeds or falls short of the female death rates from unnatural causes ((MaleDR-FemaleDR)/FemaleDR): 1997 and 2004

Figure 34 shows for 1997 and 2004 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 2004, 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 2004 than in 1997.

Age-standardised death rates from natural and unnatural causes

Figure 35 shows the age-standardised death rates from natural causes and from unnatural causes for those age 15-64. For both sexes, while the age-standardised rate from natural causes increased rapidly over time, the age-standardised rate from unnatural causes declined slightly over time.

The male rate is higher than the female rate for both natural and unnatural causes, although by 2004, the female rate is very close to the male rate for natural causes. Figure 35 makes it clear that natural cause mortality has come to play an increasing role in the mortality of both males and females.



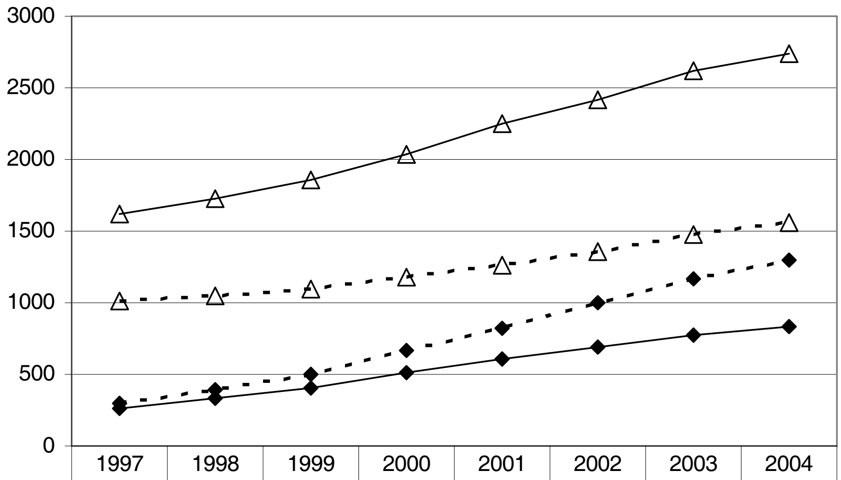
	1997	1998	1999	2000	2001	2002	2003	2004
Male Natural Cause	651	741	823	958	1084	1192	1312	1383
Female Natural Cause	519	598	683	826	958	1116	1259	1379
Male Unnatural Cause	294	292	283	282	292	293	291	288
Female Unnatural Cause	82	79	78	72	70	72	73	74

Figure 35. Age-standardised death rates per 100,000 from natural causes and from unnatural causes by sex, age 15-64: 1997-2004

The role of natural and unnatural mortality on younger and older adults

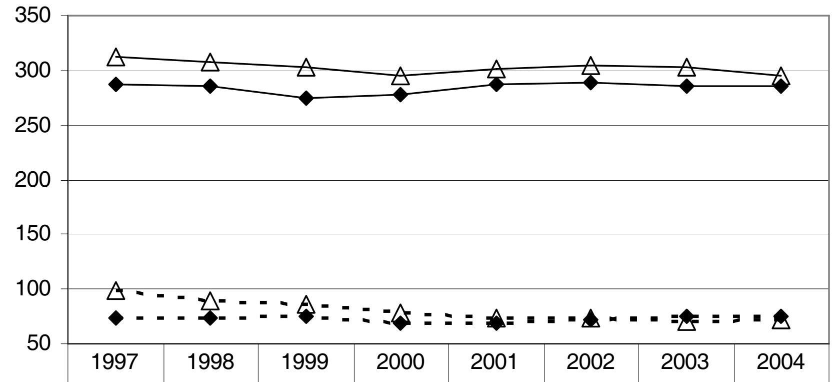
Figure 36 shows age-standardised death rates from natural causes by sex for the younger age segment (15-39) and the older age segment (40-64). Age-standardised death rates rose over time for both sexes and for both age segments.

Age-standardised death rates rose most quickly for females age 15-39 and for males age 40-64. After 1998, for the younger age segment, the female rate was always higher than the male rate. For the older age segment, the male rate was always higher than the female rate, and the gap increased with time.



	1997	1998	1999	2000	2001	2002	2003	2004
Male Stand 15-39	257	337	400	516	606	690	778	829
Male Stand 40-64	1615	1731	1856	2039	2255	2419	2619	2737
Female Stand 15-39	297	394	498	670	820	1006	1161	1297
Female Stand 40-64	1014	1052	1095	1174	1265	1360	1476	1561

Figure 36. Age-standardised death rates per 100,000 from natural causes by sex, age 15-39 and age 40-64: 1997-2004



	1997	1998	1999	2000	2001	2002	2003	2004
Male Stand 15-39	287	286	275	277	287	288	286	286
Male Stand 40-63	312	307	303	295	302	304	302	295
Female Stand 15-39	74	74	75	69	69	72	74	75
Female Stand 40-64	99	90	86	78	73	73	71	72

Figure 37. Age-standardised death rates per 100,000 from unnatural causes by sex, age 15-39 and age 40-64: 1997-2004

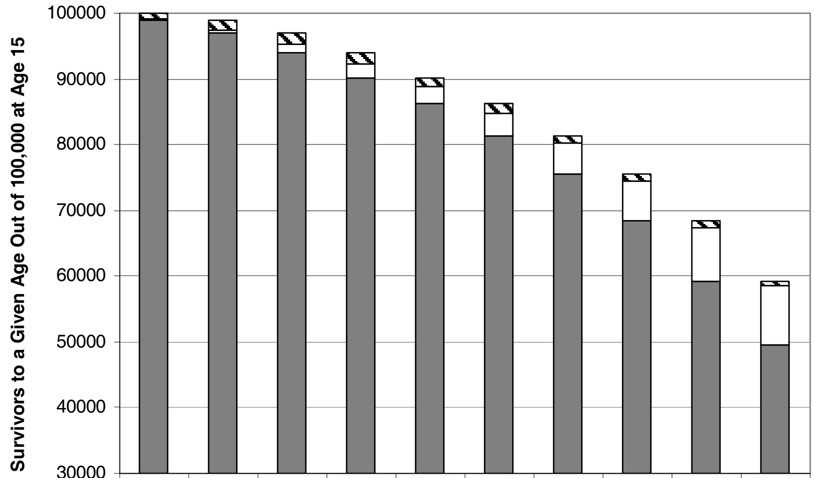
In Figure 37 we see the age-standardised death rates from unnatural causes by sex for the younger and the older age segments. For males, the older age segment always had a higher rate than the younger age segment, although the gap declined over time. While the rate for the younger age segment was virtually unchanged, the rate for the older age segment declined over time. For females, until 2002, the older age segment had a higher rate. In 2003 and 2004, the younger age segment had a higher rate. As for males, this was because the rate for the younger age segment was virtually unchanged, while the rate for the older age segment declined. Even though the unnatural cause death rates rose between 1997 and 2004 for both males and females age 20-24, this had essentially no effect on the age-standardised rate for those age 15-39 of either sex.

Effects of mortality conditions on survival from natural and unnatural causes of death

Figures 38-41 show survival in a different way. In each figure for a given sex in a given year, the fate of people alive at their 15^{th} birthday is shown, given the mortality conditions in a given year.

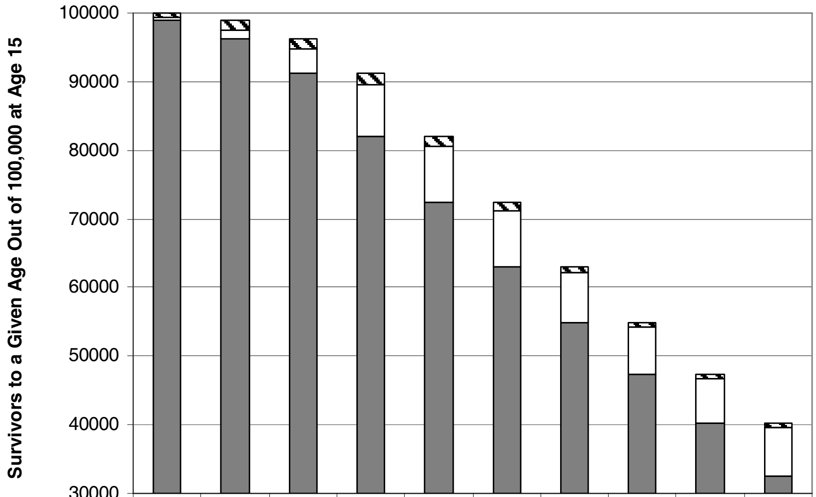
Starting with 100,000 people of a given sex on their 15^{th} birthday, each bar or column shows the total number of people surviving to that age. Within the column, the number who will survive five more years is shown in dark grey. For example, in Figure 38, in the column for age 20, out of 98830 males who survived from their 15^{th} birthday to their 20^{th} birthday, 96967 will survive five more years to their 25^{th} birthday. In demographic life table terms, 96967 is l_{25}/l_{15}. The number who will die from unnatural causes in the next five years is indicated by a diagonal stripe. That number is 1327 in the same column. Lastly, the number who will die from natural causes is shown in white. That number is 536 for the same age interval.[5]

[5] This division of deaths by cause follows the suggestions of Siegel and Swanson (2004: 328) and Spencer and Trickett (1980).



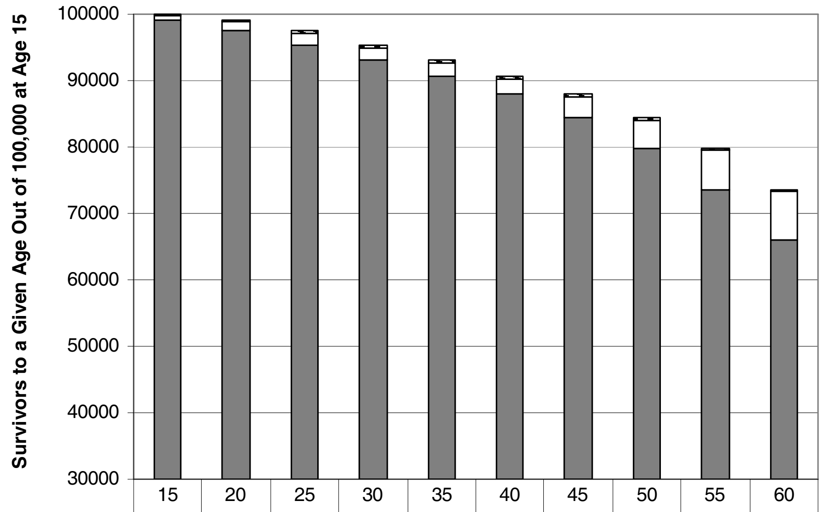
	15	20	25	30	35	40	45	50	55	60
Deaths from Unnatural Causes in Next 5 Years	801	1327	1699	1684	1484	1359	1242	1149	960	738
Deaths from Natural Causes in Next 5 Years	369	536	1287	2077	2557	3401	4589	6104	8094	9086
Survivors to Beginning of Next Interval	98830	96967	93981	90220	86179	81420	75589	68336	59282	49458

Figure 38. Male 1997 Survivors to a Given Age, Survivors for 5 More Years, Deaths from Natural Causes in the Next 5 Years and Deaths from Unnatural Causes in the Next 5 Years Starting with 100,000 on their 15th Birthday



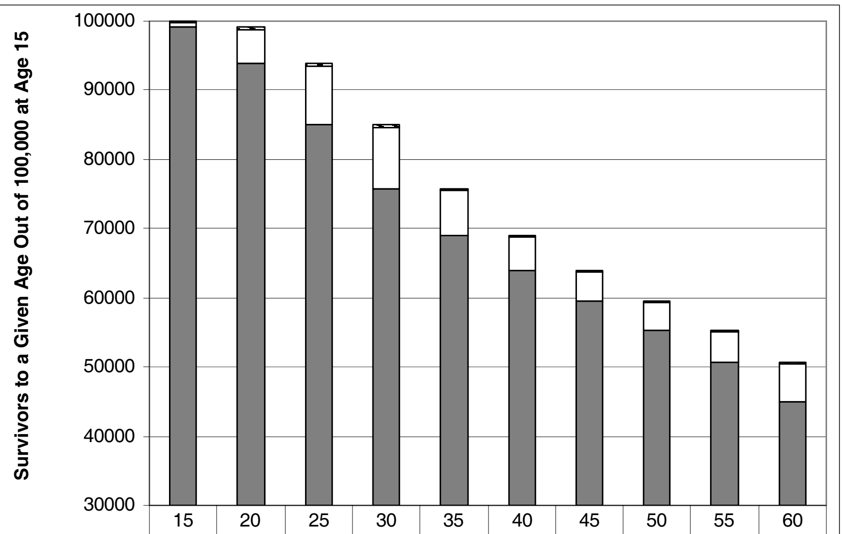
	15	20	25	30	35	40	45	50	55	60
Deaths from Unnatural Causes in next 5 Years	675	1500	1480	1629	1385	1185	898	710	512	432
Deaths from Natural Causes in Next 5 Years	402	1206	3585	7540	8252	8171	7189	6901	6636	7109
Survivors to Beginning of Next Interval	98924	96218	91152	81984	72347	62991	54904	47293	40145	32604

Figure 39. Male 2004 Survivors to a Given Age, Survivors for 5 More Years, Deaths from Natural Causes in Next 5 Years and Deaths from Unnatural Causes in Next 5 Years Starting with 100,000 on their 15th Birthday



	15	20	25	30	35	40	45	50	55	60
Deaths from Unnatural Causes in Next 5 Years	265	370	381	393	411	407	406	440	409	370
Deaths from Natural Causes in Next 5 Years	559	1260	1796	1911	2005	2339	3043	4144	5829	7309
Survivors to Beginning of Next Interval	99176	97546	95368	93064	90647	87901	84453	79869	73630	65951

Figure 40. Female 1997 Survivors to a Given Age, Survivor for 5 More Years, Deaths from Natural Causes in Next 5 Years and Deaths from Unnatural Causes in Next 5 Years Starting with 100,000 on their 15th Birthday



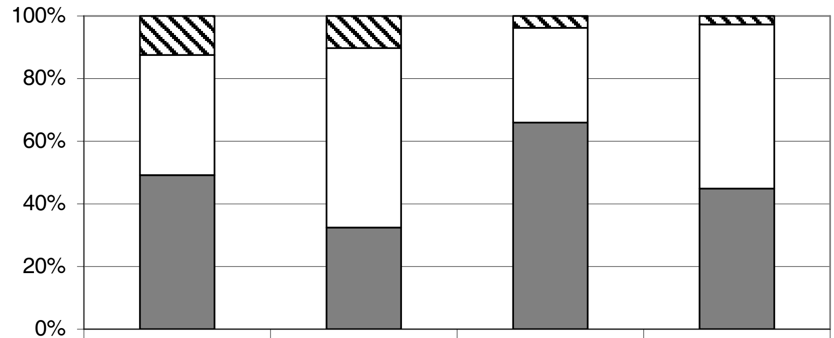
	15	20	25	30	35	40	45	50	55	60
Deaths from Unnatural Causes in Next 5 Years	191	440	386	342	296	241	212	200	193	196
Deaths from Natural Causes in Next 5 Years	738	4794	8487	8773	6550	4900	4106	4121	4353	5452
Survivors to Beginning of Next Interval	99070	93836	84963	75848	69002	63861	59542	55221	50676	45028

Figure 41. Female 2004 Survivors to a Given Age, Survivors for 5 More Years, Deaths from Natural Causes in Next 5 Years and Deaths from Unnatural Causes in Next 5 Years Starting with 100,000 on their 15th Birthday

If the mortality conditions in a given year had caused all people alive on their 15th birthday to die before they reached their 65th birthday, the vertical scale in Figures 38-41 would need to go down to zero. However, given the actual mortality conditions, in none of the figures shown does it go below 30000. The lower bound of the figures is thus 30000. This makes it easier to see the effects of natural morality at the younger ages when the implied number of deaths is small, and it also makes it easier to see the effects of unnatural mortality for females, for whom the implied number of deaths is often small.

We can see in Figures 38-41 the much greater role that unnatural mortality plays for males than for females. In 1997, for each age group 15-29, unnatural causes were a source of more male deaths than natural causes. In 2004, unnatural causes were a source of more male deaths 15-24. Thus, although unnatural causes comprised a small proportion of all deaths, they were the main source of mortality for young adult males in both 1997 and 2004. The increased role of natural mortality between 1997 and 2004 for both sexes is also clear.

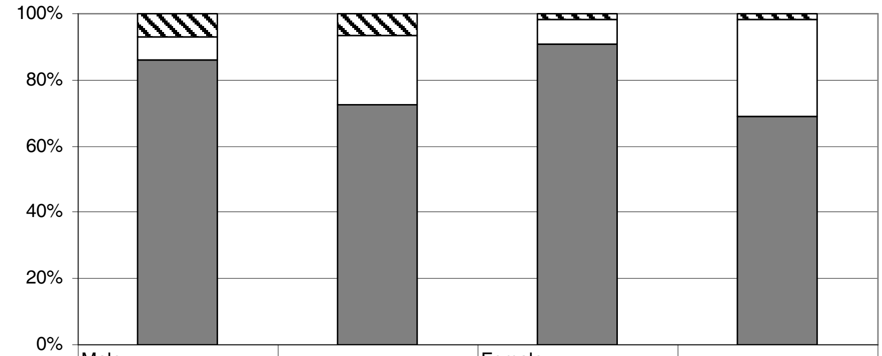
Figure 42 examines the role of unnatural and natural mortality for those who are alive on their 15th birthday. It shows what their situation will be by the time they reach (or would have reached) their 65th birthday. The percentage of males who would have died from unnatural causes before their 65th birthday declined from 12.4% in 1997 to 10.4% in 2004. For females, the percentage who would have died from unnatural causes declined from 3.9% in 1997 to 2.7% in 2004. The decline in the percentage surviving to age 65 for both sexes between 1997 and 2004 is entirely accounted for by increases in natural cause mortality.



	Male 1997	Male 2004	Female 1997	Female 2004
Died from Unnatural Causes	12442	10405	3854	2697
Died from Natural Causes	38099	56991	30195	52275
Survivors to Age 65	49458	32604	65951	45028

Figure 42. Out of 100,000 on their 15th birthday, number surviving to age 65, number dying from natural causes by age 65 and number dying from unnatural causes by age 65 by sex: 1997 and 2004

Figures 43 and 44 are similar to Figure 42 but show the situation considered for the two twenty-five year age segments, those 15-40 and those 40-65. Figure 43 shows for 100,000 alive on their 15th birthday what their fate would have been by the time they reached (or would have reached) their 40th birthday – how many would have survived, how many would have died from natural causes and how many would have died from unnatural causes, assuming the mortality conditions of the given year.

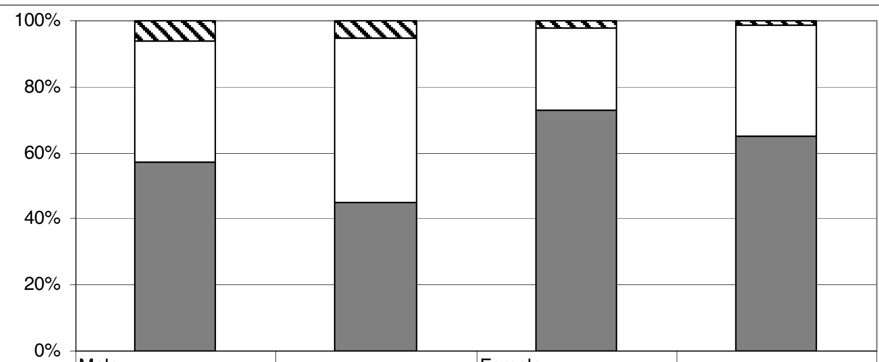


	Male 1997	Male 2004	Female 1997	Female 2004
Died from Unnatural Causes	6995	6668	1821	1655
Died from Natural Causes	6826	20985	7531	29343
Survivors to Age 40	86179	72347	90647	69002

Figure 43. Out of 100,000 on their 15th birthday, number surviving to age 40, number dying from natural causes by age 40 and number dying from unnatural causes by age 40 by sex: 1997 and 2004

We see in Figure 43 that for this younger age group, even in 1997, among those alive on their 15th birthday, females had a higher chance than males of dying from natural causes in the subsequent 25 years (7.5% of females versus 6.8% of males). It was only the higher chance for males than females of dying from unnatural causes in the 25 years after the 15th birthday (7.0% of males versus 1.8% of females) that resulted in a higher percentage of females than males surviving from age 15 to 40 in 1997 (86.2% of males versus 90.6% of females).

By 2004, the chance of dying from natural causes for females had increased even more than the chance of dying from natural causes for males (29.3% for females versus 21.0% for males) and the female advantage in unnatural cause mortality had declined enough that by 2004, males had a higher chance of surviving 25 years after their 15th birthday than females (72.3% for males versus 69.0% for females).



	Male 1997	Male 2004	Female 1997	Female 2004
Died from Unnatural Causes	6321	5165	2242	1510
Died from Natural Causes	36289	49769	25002	33234
Survivors to Age 65	57390	45066	72755	65257

Figure 44. Out of 100,00 on their 40th birthday, number surviving to age 65, number dying from natural causes by age 65 and number dying from unnatural causes by age 65 by sex: 1997 and 2004

Figure 44 is similar to Figure 43. It shows for 100,000 people alive on their 40th birthday what their fate would have been by the time they reached (or would have reached) their 65th birthday – how many would have survived, how many would have died from natural causes and how many would have died from unnatural causes.

In Figure 44 we see that, in both 1997 and 2004, females in the older age segment had lower chances of dying from both natural causes and from unnatural causes in the 25 years after they reached their 40th birthday than did males. Thus both lower natural cause mortality and lower unnatural cause mortality for females than males contributed to the better survival from age 40 to 65 for females than males in each year.

Main findings on natural and unnatural mortality

- Mortality from natural causes increased substantially between 1997 and 2004 for both sexes.
- In 2004, the age-standardised death rate age 15-64 from natural causes was 2.1 times its 1997 value for males and 2.7 times its 1997 value for females. Male age-standardised death rates age 15-64 from natural causes were higher than female rates for all the years under review. However, in 2004, the male rate was only 0.3% higher than the female rate.
- Below age 20 and above age 55 for males and above age 55 for females natural cause death rates increased modestly between 1997 and 2004 – by less than 20%.
- Although deaths from unnatural causes comprised a small proportion of all deaths, such deaths formed the larger proportion of deaths for males aged 15-29 in 1997 and 15-24 in 2004.
- Age-standardised death rates from unnatural causes for those age 15-64 declined slightly from 1997 to 2004 – by 2% for males and 10% for females. However for those below age 20 the rates declined substantially for both sexes (by 16% for males and 28% for females). Death rates from unnatural causes also declined for males over age 50 and for females over age 40.
- In 1997, females had higher death rates from natural causes than males at ages 15-29, while males had higher death rates from natural causes than females at ages 30-64. In 2004, females had higher rates than males at ages 15-34, while males had higher rates than females at ages 35-64.
- In both 1997 and 2004 males alive on their 15th birthday had a higher chance than females of dying before their 65th birthday from both natural and unnatural causes.
- The decline or modest increase in all cause mortality for the youngest and the oldest ages of males within the15-64 age group was contributed to by changes in the rates of deaths from both natural and unnatural causes. For older females, changes in both natural and unnatural cause death rates also played a role, while for females 15-19, declines in unnatural cause death rates were especially important.
- In 1997, among those alive on their 15th birthday, females had a better chance of living 25 years to their 40th birthday than males. In 2004, males had a better chance than females. The only reason that females had a better chance in 1997 (of living from their 15th to their 40th birthday) was that they

had lower unnatural cause mortality. Even in 1997, females were more likely to die from natural causes in the 25 years after their 15th birthday than were males, but the impact was masked in all cause mortality by their lower unnatural cause mortality.

- Among those alive on their 40th birthday, females had a higher chance of surviving 25 years to their 65th birthday than males both in 1997 and in 2004. In both years, females age 40 had a lower chance of dying both from natural causes and from unnatural causes in the subsequent 25 years than did males. Thus both lower natural cause mortality and lower unnatural cause mortality contributed to better survival from the 40th to the 65th birthday for females than males in both 1997 and 2004.

Comments

It is clear that increases in natural cause mortality are the source of the increase in all cause mortality between 1997 and 2004. The increase in age-specific death rates from natural causes for females age 25-34 of more than fivefold between 1997 and 2004 is astounding. Despite concern with high levels of violence in South Africa, the unchanging level and at times decline in unnatural cause mortality has muted the overall increase in mortality in South Africa for both sexes. Declines in the death rates from unnatural causes for those age 15-29 and for the elderly are also encouraging. Perhaps teenagers in South Africa have come to engage in somewhat less risky behaviour.

While large increases in female death rates at the younger ages between 1997 and 2004 are important, and while these increases are due to increases in death rate from natural causes, it is important to note that even in 1997 below age 30 females had higher death rates than males. Also, although all cause mortality is often interpreted as reflecting mainly mortality from natural causes, if male unnatural mortality had not been much higher than female unnatural mortality in 1997, the chance of survival from the15th birthday to the 40th birthday would have been lower for females than males.

Thus, although the female mortality advantage at younger ages had disappeared at the younger ages by 2004, examination of mortality from natural causes reveals that the female mortality situation at younger ages was not very good in comparison to males even in 1997. The roots of this situation in 1997 deserve further examination by scholars and analysts.

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).[6] For simplicity, we will refer to the first category as "communicable and related diseases".

This classification is a step beyond the natural/unnatural distinction examined in the previous section. Communicable diseases are diseases that 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.

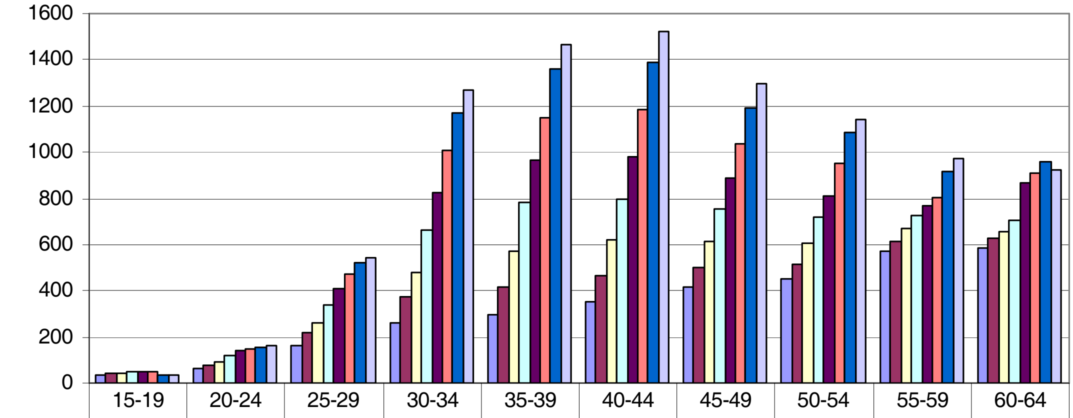
In South Africa, this distinction is especially useful because almost all of the causes of death thought to be mistakenly coded when HIV is the actual cause of death are communicable diseases. Although a few non-communicable diseases are likely sites of misclassification of HIV deaths (Kaposi's sarcoma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

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.[7]

Communicable and related diseases

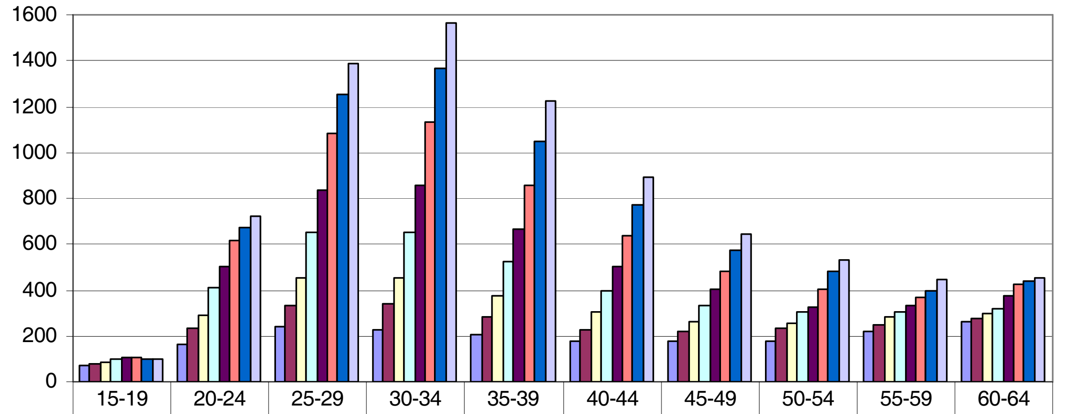
Figures 45 and 46 show death rates by age from communicable and related diseases for both sexes. The rates increase for every year except for those age 15-19 of both sexes and males age 60-64. The increase for males 20-24 after 2001 is modest.

[6] ICD-10 categories for this classification are from Mathers *et al.*, 2003: Table 3, pp. 55-59.
[7] Weights to be used to redistribute these ill-defined natural causes in the Death Notification Data 1997-2004 by age, sex and year of death appear in Appendix Table A 5.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	36	61	165	261	298	350	414	450	573	582
1998	42	80	222	375	415	467	498	518	615	629
1999	44	92	262	480	570	618	614	604	671	654
2000	50	117	338	666	785	799	756	721	724	701
2001	49	139	409	828	969	978	891	812	769	864
2002	48	148	470	1007	1148	1182	1038	948	806	910
2003	38	155	524	1171	1361	1387	1192	1089	914	961
2004	38	160	545	1266	1467	1522	1294	1145	973	925

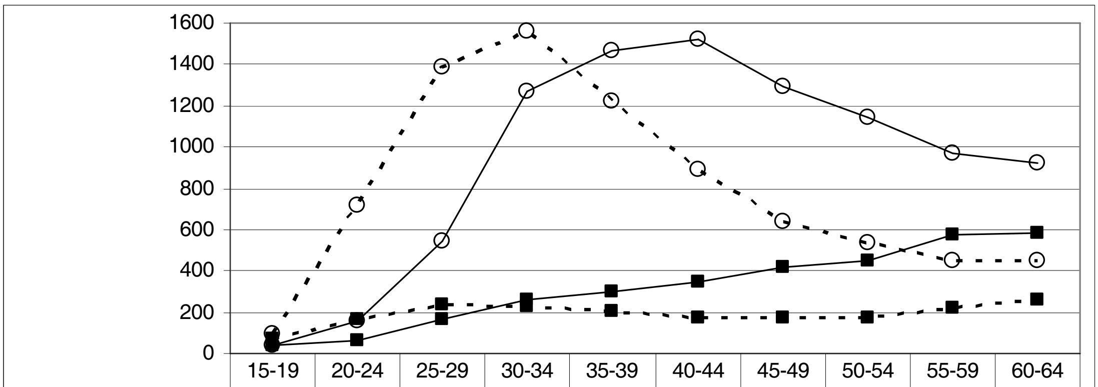
Figure 45. Male death rates by age per 100,000 from communicable and related diseases: 1997-2004



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	68	164	240	230	203	177	175	176	217	262
1998	75	232	331	339	283	227	216	231	250	277
1999	83	292	451	455	378	304	261	254	285	299
2000	100	411	652	651	524	397	331	306	302	320
2001	106	505	832	858	668	504	404	326	334	372
2002	109	616	1081	1136	859	634	481	402	370	423
2003	98	676	1252	1366	1048	768	571	482	399	441
2004	98	720	1388	1562	1223	892	641	534	446	452

Figure 46. Female death rates by age per 100,000 from communicable and related diseases: 1997-2004

Figure 47 shows the age-specific death rates from communicable and related diseases for both sexes in 1997 and 2004. It is clear that for both sexes 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.



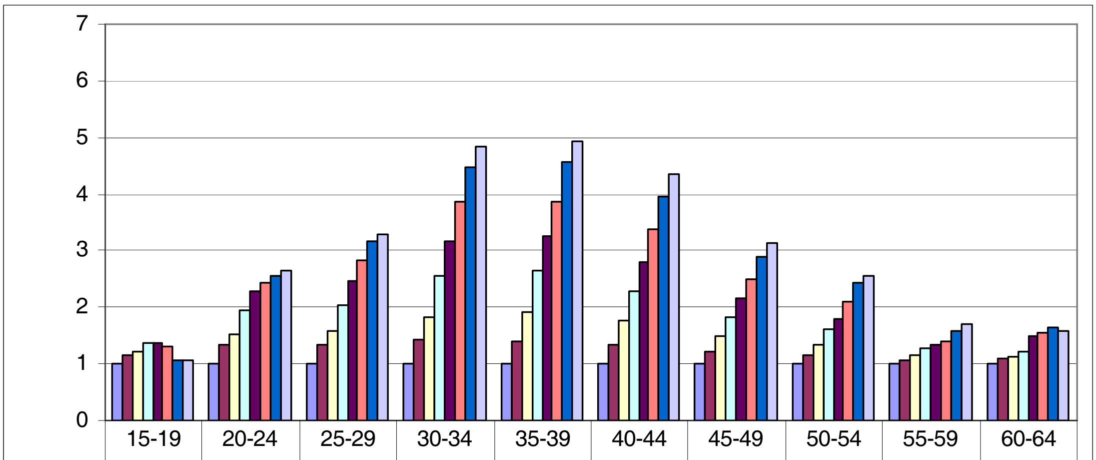
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male 1997	36	61	165	261	298	350	414	450	573	582
Male 2004	38	160	545	1266	1467	1522	1294	1145	973	925
Female 1997	68	164	240	230	203	177	175	176	217	262
Female 2004	98	720	1388	1562	1223	892	641	534	446	452

Figure 47. Death rates by age and sex per 100,000 from communicable and related diseases: 1997 and 2004

The age pattern of the increase between 1997 and 2004 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.

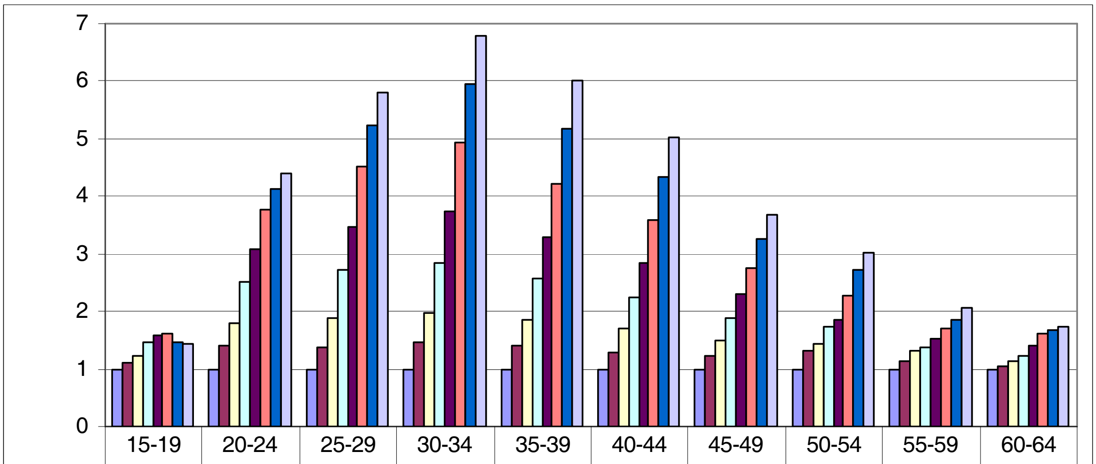
The age pattern in Figure 47 for 2004 also contrasts with that in Figure 23, which showed age-specific death rates by sex in 1997 and 2004 from all natural causes. For natural causes, the rates for both sexes increased at the older ages, while for communicable and related causes, the rates decline at each successively older age after a peak at age 40-44 for males and age 30-34 for females, except for a very slight increase from the 55-59 age group to the 60-64 age group for females.

Figures 48 and 49 show the values of the death rate from communicable and related diseases in a given year relative to its value in 1997. The death rates from communicable and related diseases increased in every year except for those age 15-19 and for males 60-64.



	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	1.150	1.324	1.340	1.435	1.396	1.333	1.203	1.151	1.075	1.082
1999	1.203	1.515	1.584	1.834	1.916	1.764	1.481	1.343	1.171	1.125
2000	1.367	1.934	2.044	2.547	2.639	2.281	1.825	1.602	1.265	1.206
2001	1.358	2.292	2.477	3.167	3.256	2.793	2.152	1.804	1.343	1.486
2002	1.318	2.445	2.840	3.851	3.860	3.377	2.506	2.107	1.408	1.565
2003	1.051	2.554	3.171	4.479	4.573	3.962	2.879	2.420	1.597	1.651
2004	1.057	2.648	3.296	4.840	4.929	4.346	3.123	2.544	1.699	1.590

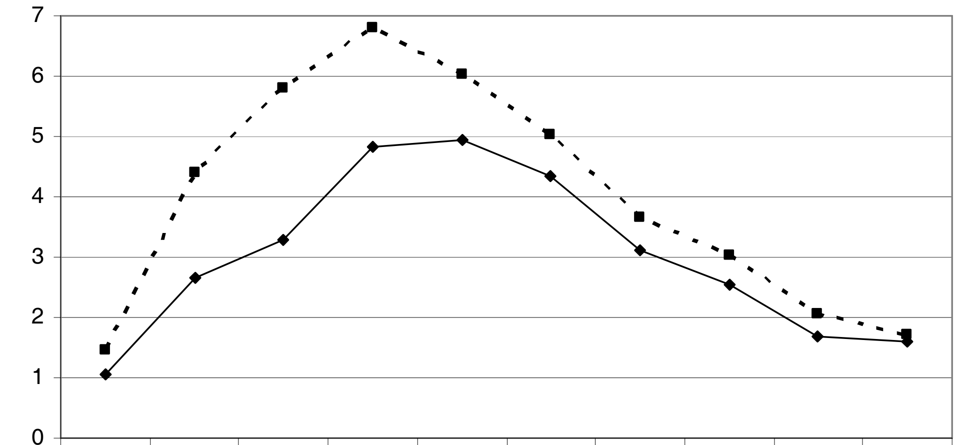
Figure 48. Male death rates from communicable and related diseases by age relative to value by age in 1997 (1997 value=1.00): 1997-2004



	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	1.113	1.419	1.381	1.477	1.395	1.281	1.236	1.309	1.150	1.058
1999	1.228	1.788	1.881	1.979	1.863	1.719	1.495	1.441	1.315	1.141
2000	1.475	2.512	2.718	2.834	2.581	2.243	1.893	1.737	1.391	1.223
2001	1.572	3.090	3.470	3.736	3.292	2.849	2.312	1.851	1.539	1.419
2002	1.606	3.764	4.506	4.946	4.229	3.584	2.755	2.279	1.705	1.616
2003	1.451	4.130	5.223	5.947	5.162	4.341	3.270	2.735	1.841	1.683
2004	1.450	4.401	5.789	6.800	6.025	5.039	3.668	3.029	2.056	1.725

Figure 49. Female death rates from communicable and related diseases by age relative to value by age in 1997 (1997 value=1.00): 1997-2004

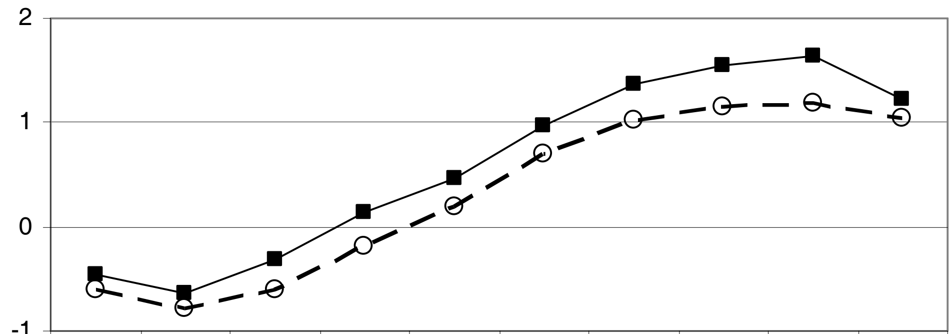
Figure 50 shows the information in Figures 48 and 49 but only for 2004 relative to 1997 and for both sexes. As for natural causes shown in Figure 26, the increase in death rates from communicable and related diseases was concentrated in the 20-44 age range, especially for females. Unlike the situation in Figure 26, in Figure 50, the percentage increase in female death rates is larger 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
Male	1.057	2.648	3.296	4.840	4.929	4.346	3.123	2.544	1.699	1.590
Female	1.450	4.401	5.789	6.800	6.025	5.039	3.668	3.029	2.056	1.725

Figure 50. Death rates from communicable and related diseases by sex in 2004 relative to value by age and sex in 1997 (1997 value=1.00)

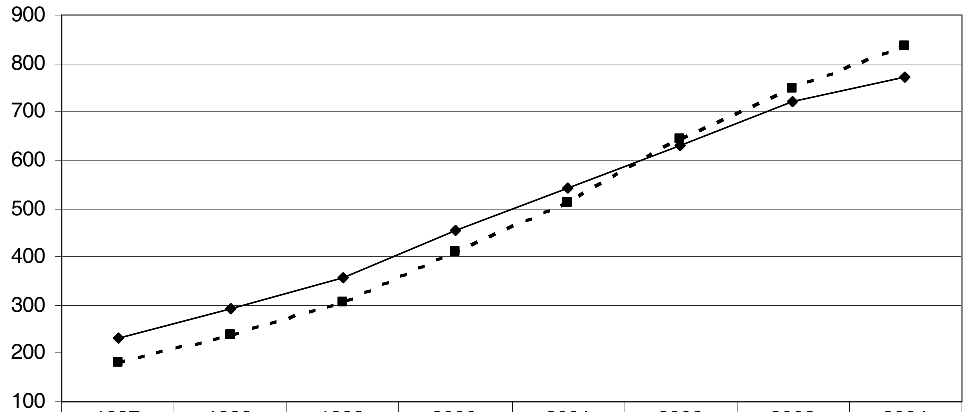
Figure 51 shows the proportion by which the male death rate from communicable and related diseases exceeds or falls short of the female death rate from communicable and related diseases. When the value is greater than zero, the male rate is higher than the female rate; when the value is less than zero, the female rate is higher than the male rate.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	-0.463	-0.630	-0.311	0.138	0.466	0.978	1.371	1.553	1.639	1.219
2004	-0.609	-0.777	-0.607	-0.190	0.199	0.706	1.018	1.145	1.181	1.045

Figure 51. 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 2004

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 2004, 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.



	1997	1998	1999	2000	2001	2002	2003	2004
Male	231	292	357	454	543	631	722	771
Female	179	239	304	411	512	643	747	836

Figure 52. Age-standardised death rates per 100,000 from communicable and related diseases by sex, age 15-64: 1997-2004

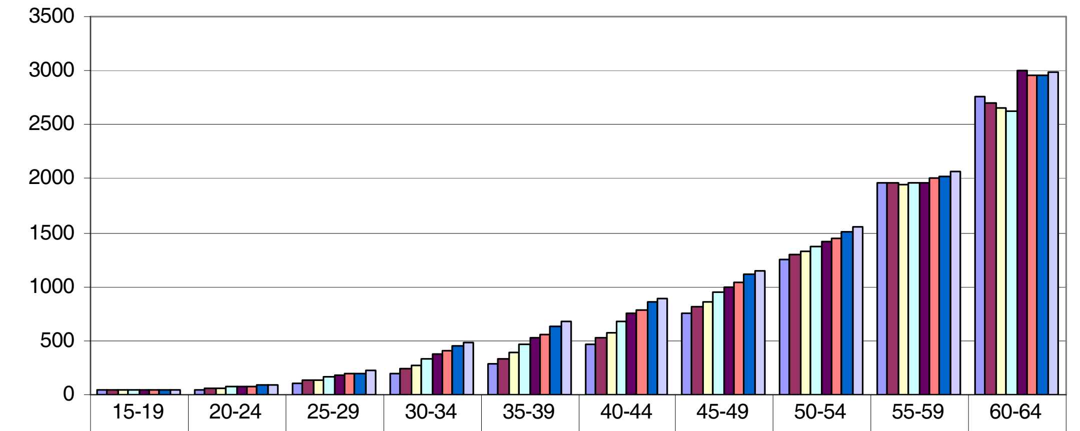
Figure 52 shows the age-standardised death rates by sex from communicable and related diseases. They have risen rapidly for both sexes. The male rate was higher than the female rate from 1997 to 2001, but from 2002 to 2004 the female rate was higher.

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.

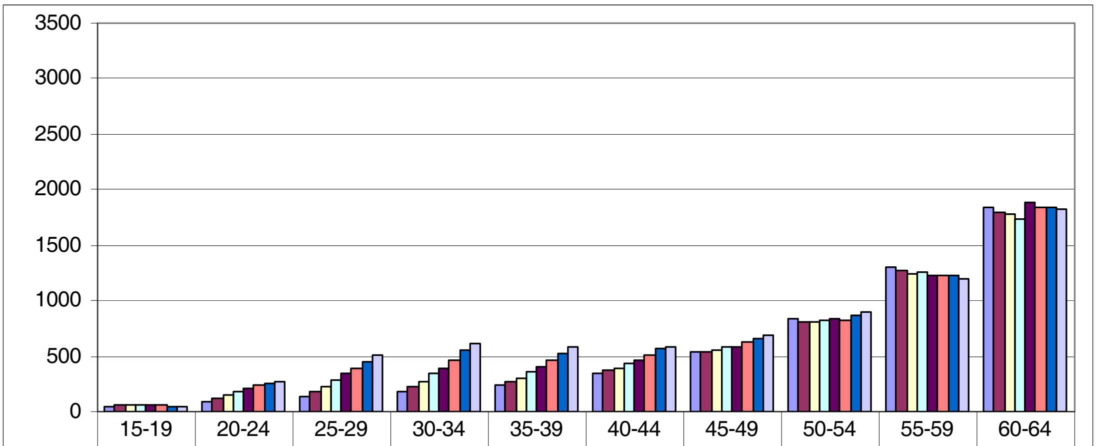
Non-communicable diseases show a very different pattern from that for communicable and related diseases. As seen in Figures 53 and 54, death rates from non-communicable diseases tend to increase with age, and the rate of increase is much slower than for communicable and related diseases.

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.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	38	49	104	190	282	461	755	1247	1964	2761
1998	45	60	132	237	337	524	820	1293	1961	2701
1999	43	64	133	267	392	573	861	1325	1946	2659
2000	45	75	159	330	474	677	949	1368	1955	2618
2001	43	74	176	379	522	753	991	1421	1965	3000
2002	44	77	189	408	563	784	1048	1455	2001	2952
2003	40	85	202	453	631	860	1117	1502	2018	2952
2004	42	87	220	476	672	893	1146	1556	2063	2984

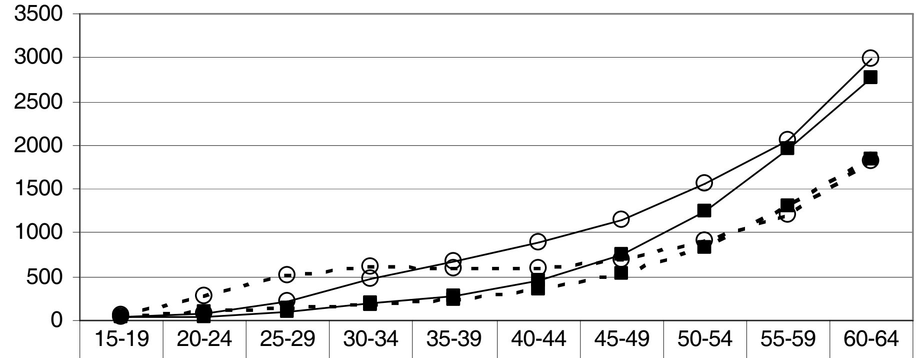
Figure 53. Male Death Rates by Age per 100,000 from Non-Communicable Diseases: 1997-2004



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	45	93	133	176	234	347	531	833	1302	1832
1998	54	113	177	224	274	368	542	809	1278	1801
1999	52	153	220	264	305	385	547	809	1246	1775
2000	60	186	281	342	358	431	577	819	1257	1742
2001	56	210	343	396	401	457	586	838	1232	1887
2002	54	232	386	460	458	503	621	826	1225	1846
2003	50	259	448	549	519	562	656	873	1227	1837
2004	50	274	511	620	586	584	690	903	1198	1826

Figure 54. Female death rates by age per 100,000 from non-communicable diseases: 1997-2004

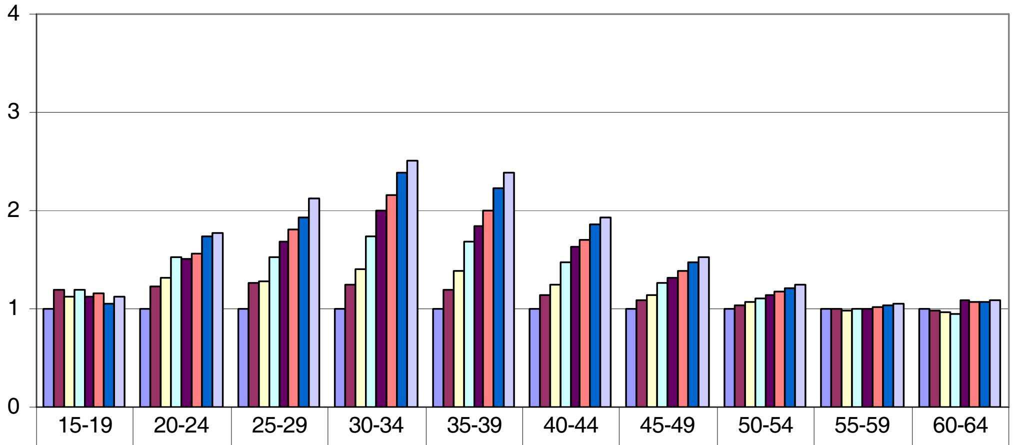
Figure 55 shows death rates from non-communicable diseases by sex in 1997 and 2004. Non-communicable diseases increased somewhat at most ages over time, but male death rates increased at each successively older age. For females in 2004, the rates declined from the 30-34 age group through the 40-44 age 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
Male 1997	38	49	104	190	282	461	755	1247	1964	2761
Male 2004	42	87	220	476	672	893	1146	1556	2063	2984
Female 1997	45	93	133	176	234	347	531	833	1302	1832
Female 2004	50	274	511	620	586	584	690	903	1198	1826

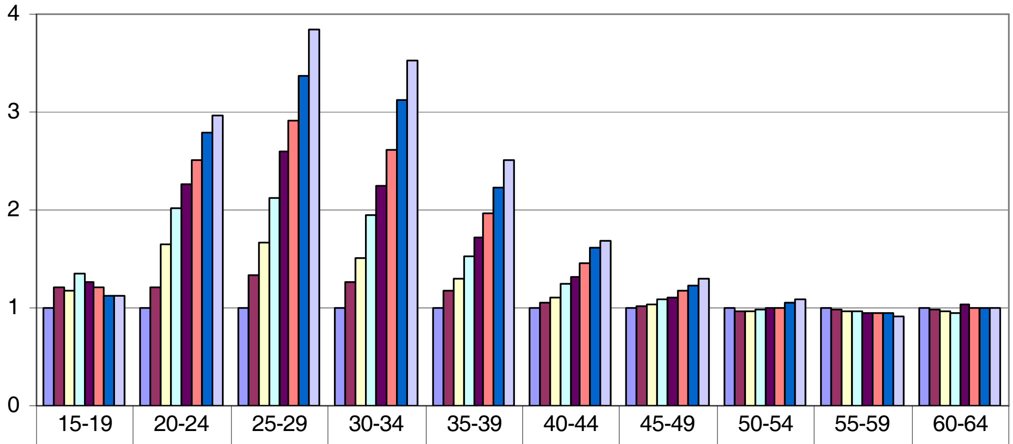
Figure 55. Death rates by age and sex per 100,000 population from non-communicable diseases: 1997 and 2004

Figures 56 and 57 show the values for both sexes 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.



	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	1.186	1.225	1.266	1.250	1.195	1.136	1.086	1.037	0.999	0.978
1999	1.123	1.313	1.276	1.409	1.389	1.241	1.141	1.063	0.991	0.963
2000	1.197	1.530	1.528	1.738	1.678	1.468	1.256	1.098	0.995	0.948
2001	1.127	1.502	1.684	1.997	1.850	1.632	1.313	1.140	1.001	1.087
2002	1.161	1.568	1.813	2.151	1.994	1.698	1.388	1.168	1.019	1.069
2003	1.048	1.737	1.933	2.387	2.235	1.864	1.479	1.205	1.027	1.069
2004	1.119	1.773	2.115	2.512	2.382	1.936	1.518	1.248	1.050	1.081

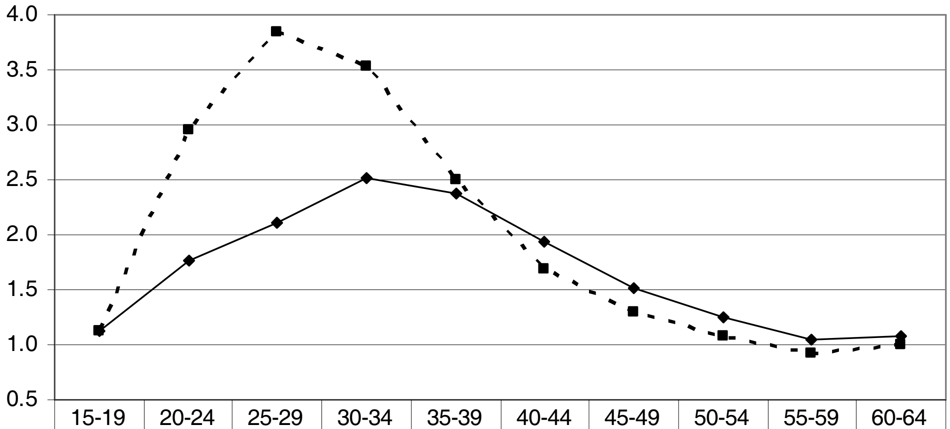
Figure 56. Male death rates from non-communicable diseases by age relative to value in 1997 (1997 Value=1.00): 1997-2004



	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	1.210	1.218	1.331	1.272	1.174	1.060	1.019	0.972	0.982	0.983
1999	1.175	1.646	1.659	1.501	1.306	1.109	1.029	0.972	0.957	0.969
2000	1.348	2.013	2.119	1.942	1.530	1.242	1.086	0.984	0.965	0.951
2001	1.259	2.262	2.588	2.252	1.718	1.316	1.102	1.007	0.946	1.030
2002	1.217	2.502	2.909	2.616	1.961	1.450	1.169	0.992	0.941	1.007
2003	1.125	2.791	3.377	3.118	2.221	1.621	1.234	1.049	0.942	1.002
2004	1.127	2.960	3.848	3.524	2.506	1.682	1.298	1.084	0.920	0.997

Figure 57. Female death rates from non-communicable diseases by age relative to value in 1997 (1997 Value=1.00): 1997-2004

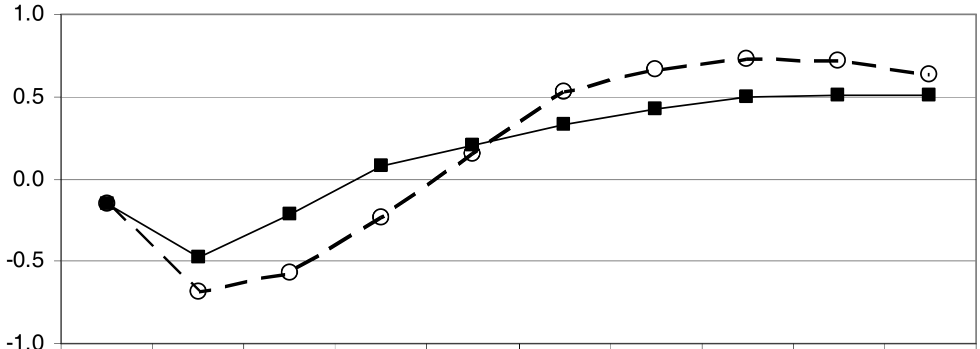
Figure 58 shows information similar to that in Figures 56 and 57 but only for 2004 relative to 1997 and for both sexes. Below age 40, the percentage increase in death rates from non-communicable diseases between 1997 and 2004 was greater for females than males. At ages 40-64, it was greater for males than females. This greater increase in death rates for males than females from non-communicable diseases above age 40 is the reason why in Figure 26 the increase in male death rates from natural causes above age 40 was greater than the increase in female death rates from natural causes.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male	1.119	1.773	2.115	2.512	2.382	1.936	1.518	1.248	1.050	1.081
Female	1.127	2.960	3.848	3.524	2.506	1.682	1.298	1.084	0.920	0.997

Figure 58. Death rates by age and sex from non-communicable diseases in 2004 relative to value in 1997 (1997 Value=1.00)

Figure 59 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.

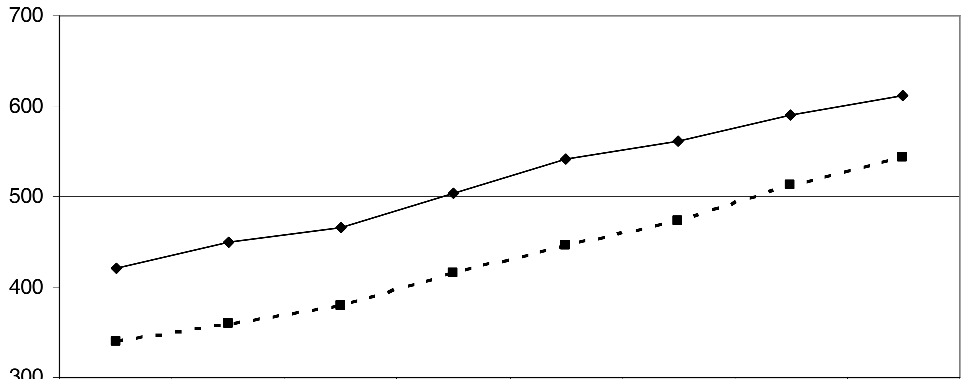


	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	-0.150	-0.472	-0.214	0.077	0.208	0.330	0.421	0.497	0.509	0.506
2004	-0.156	-0.684	-0.568	-0.232	0.148	0.531	0.660	0.724	0.722	0.634

Figure 59. 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 2004

In 1997, below age 30, the female rate is higher than the male rate; in 2004, 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 2004 than in 1997.

Figure 60 shows the age-standardised death rates by sex from non-communicable diseases. If we compare Figure 60 to Figure 52 (for communicable and related diseases), it is 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 is virtually unchanged over time.

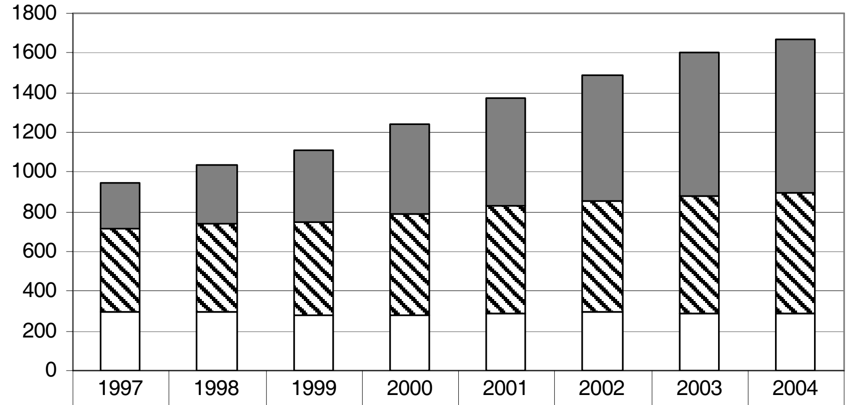


	1997	1998	1999	2000	2001	2002	2003	2004
Male	420	449	466	504	542	561	590	611
Female	340	359	379	415	446	473	512	543

Figure 60. Age-standardised death rates per 100,000 from non-communicable diseases by sex, age 15-64: 1997-2004

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

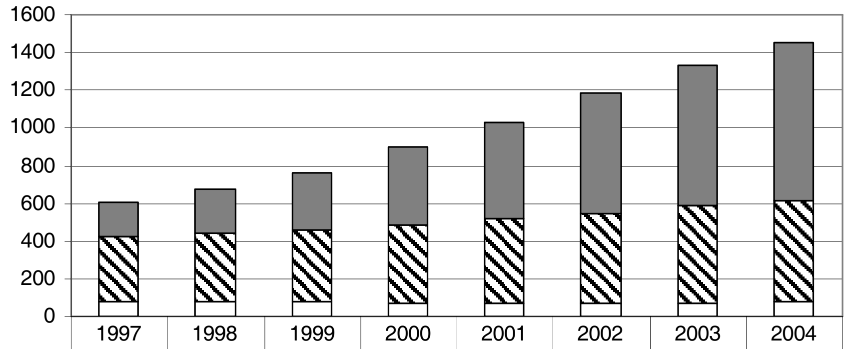
Figures 61 and 62 show one way of looking at the contribution of the three Global Burden of Disease categories to mortality over time. In each figure, the three categories sum to the overall age-standardised death rate.



	1997	1998	1999	2000	2001	2002	2003	2004
Communicable and related	231	292	357	454	543	631	722	771
non-Communicable	420	449	466	504	542	561	590	611
Unnatural Causes	294	292	283	282	292	293	291	288

Figure 61. Contribution of the three Global Burden of Disease categories to the male age-standardised death rate per 100,000, age 15-64: 1997-2004

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
Communicable and related	179	239	304	411	512	643	747	836
non-Communicable	340	359	379	415	446	473	512	543
Unnatural Causes	82	79	78	72	70	72	73	74

Figure 62. Contribution of the three Global Burden of Disease categories to the female age-standardised death rates per 100,000, age 15-64: 1997-2004

Figures 63 and 64 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.

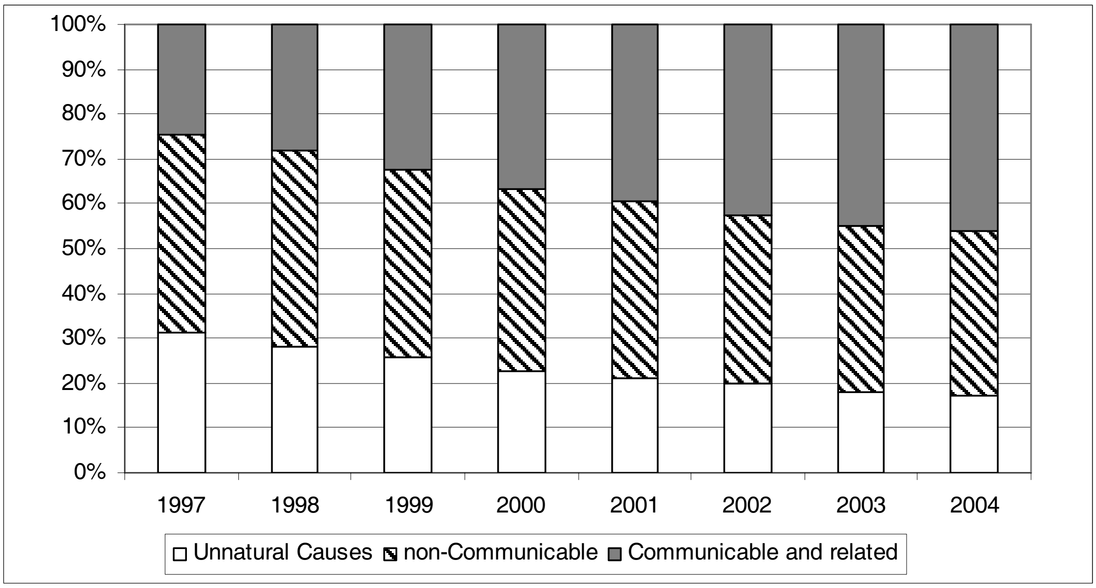


Figure 63. Percentage distribution of male age-standardised deaths among the three Global Burden of Disease categories, age 15-64: 1997-2004

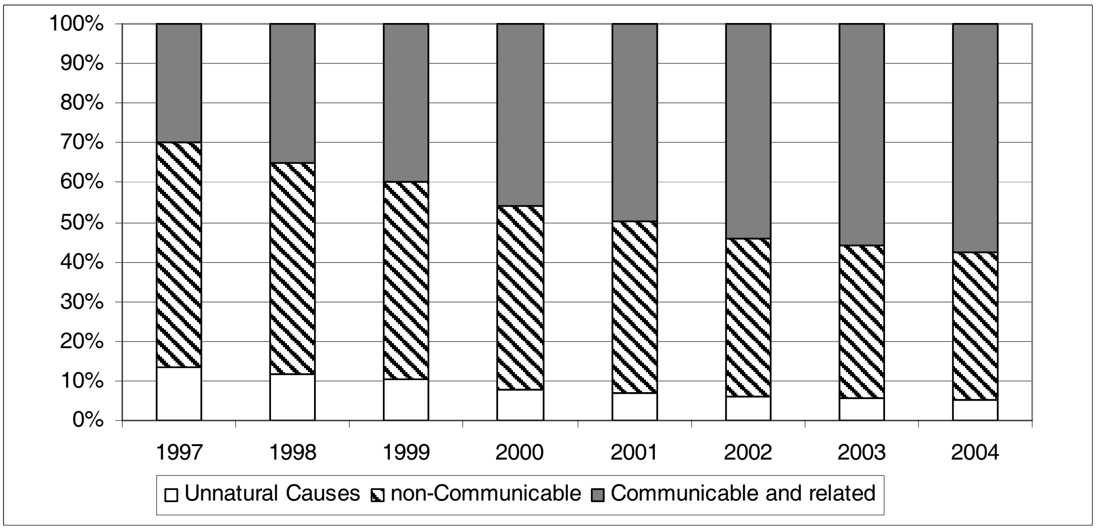


Figure 64. Percentage distribution of female age-standardised deaths among the three Global Burden of Disease categories, age 15-64: 1997-2004

Table 1 presents the percentage distribution of deaths used in calculation of the age-standardised death rate among the three Global Burden of Disease categories for 1997 and 2004. For both sexes, in 2004, communicable and related diseases accounted for the greatest portion of deaths. However, even in 2004, for both sexes, non-communicable diseases accounted for 37% of deaths, which means that they remained quite important.

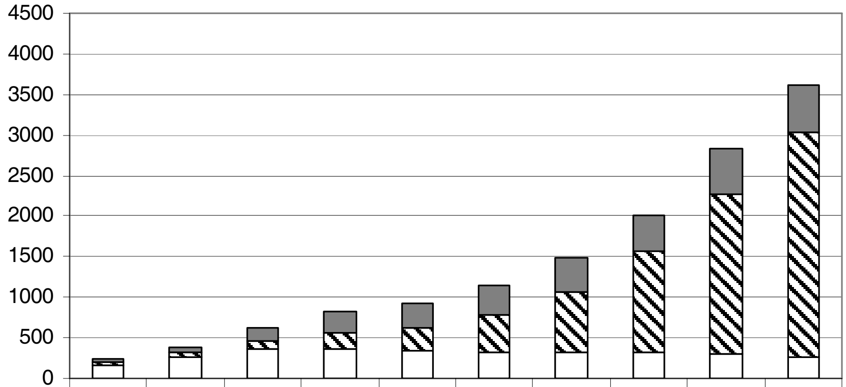
Table 1. Percentage distribution of deaths in the age-standardised death rate among the three Global Burden of Disease categories by sex: 1997 and 2004

	Male		Female	
	1997	**2004**	**1997**	**2004**
Communicable and related	24%	46%	30%	58%
Non-communicable	44%	37%	57%	37%
Unnatural causes	31%	17%	14%	5%
Total	100%	100%	100%	100%

Again using the division into three kinds of causes of death, Figures 65-68 show the contribution of each of the three categories to death rates by age in 1997 and in 2004, for males and females separately.

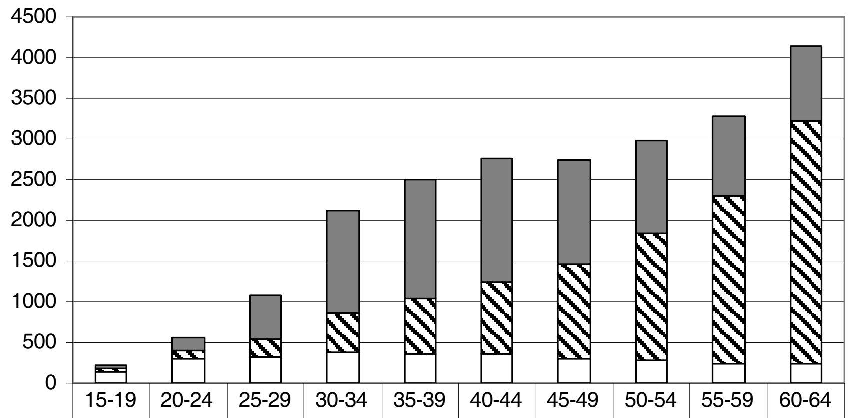
For males at the younger ages, unnatural causes are the main source of deaths in both years. This is true through age 39 in 1997 and through age 24 in 2004. After age 40 in 1997 and after age 50 in 2004, non-communicable diseases are the main cause of death. Thus we see unnatural causes dominating among 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 2004, they are dominant at ages 25-49.

For females, unnatural causes are not the main cause of death at any age. Above age 35 in 1997 and above age 45 in 2004, 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.



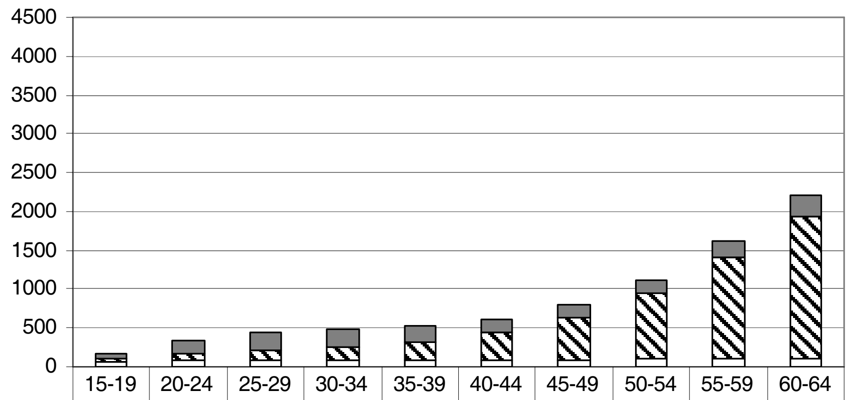
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Communicable and related	36	61	165	261	298	350	414	450	573	582
non-Communicable	38	49	104	190	282	461	755	1247	1964	2761
Unnatural Causes	161	271	356	366	336	324	316	319	301	270

Figure 65. Contribution of the three Global Burden of Disease categories to male death rates by age per 100,000: 1997



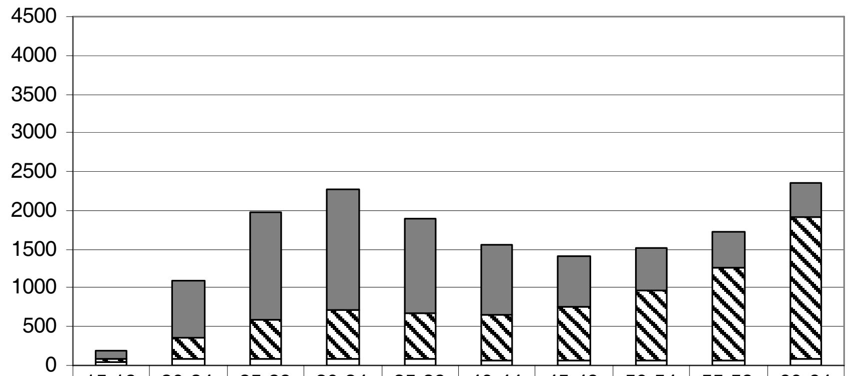
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Communicable and related	38	160	545	1266	1467	1522	1294	1145	973	925
non-Communicable	42	87	220	476	672	893	1146	1556	2063	2984
Unnatural Causes	136	307	316	376	359	350	305	278	234	238

Figure 66. Contribution of the three Global Burden of Disease categories to male death rates by age per 100,000: 2004



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Communicable and related	68	164	240	230	203	177	175	176	217	262
non-Communicable	45	93	133	176	234	347	531	833	1302	1832
Unnatural Causes	53	75	79	84	89	91	94	107	106	106

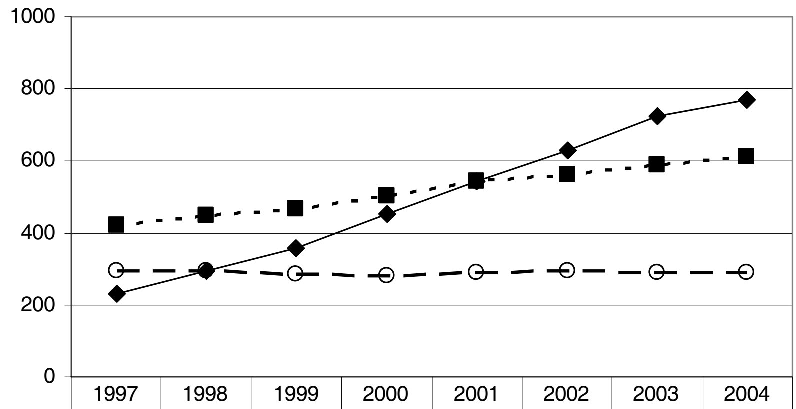
Figure 67. Contribution of the three Global Burden of Disease categories to female death rates by age per 100,000: 1997



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Communicable and related	98	720	1388	1562	1223	892	641	534	446	452
non-Communicable	50	274	511	620	586	584	690	903	1198	1826
Unnatural Causes	38	91	86	85	82	72	69	70	73	82

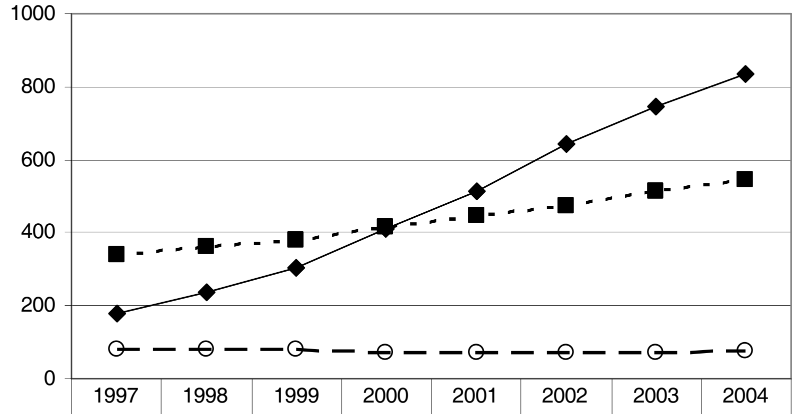
Figure 68. Contribution of the three Global Burden of Disease categories to female death rates by age per 100,000: 2004

Figures 69 and 70 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
Communicable and related	231	292	357	454	543	631	722	771
non-Communicable	420	449	466	504	542	561	590	611
Unnatural	294	292	283	282	292	293	291	288

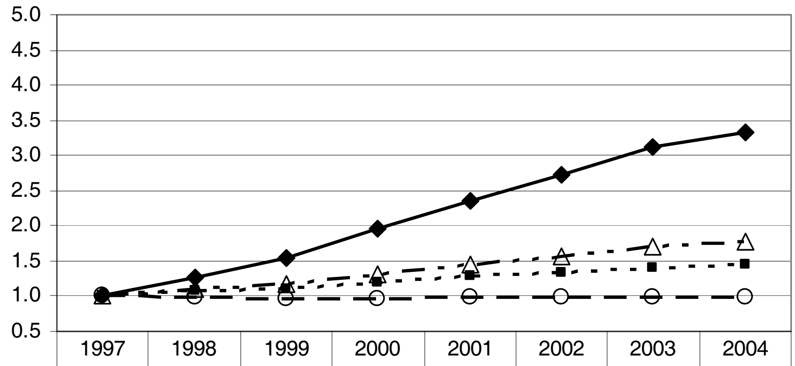
Figure 69. Male age-standardised death rates from the three Global Burden of Disease categories per 100,000, age 15-64: 1997-2004



	1997	1998	1999	2000	2001	2002	2003	2004
Communicable and related	179	239	304	411	512	643	747	836
non-Communicable	340	359	379	415	446	473	512	543
Unnatural	82	79	78	72	70	72	73	74

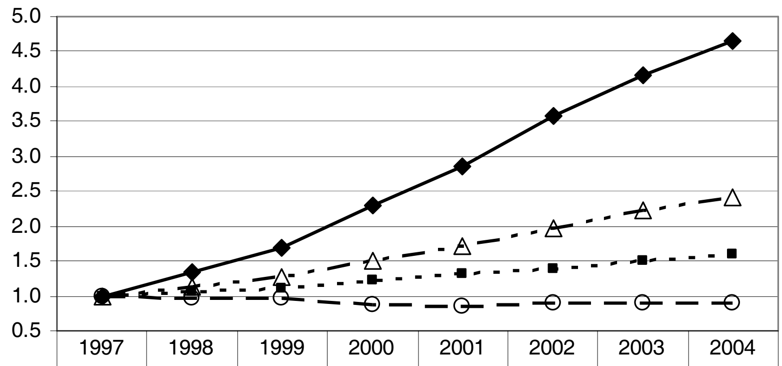
Figure 70. Female age-standardised death rates from the three Global Burden of Disease categories per 100,000, age 15-64: 1997-2004

Figures 71 and 72 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
Communicable and related	1.00	1.26	1.55	1.96	2.35	2.73	3.13	3.34
non-Communicable	1.00	1.07	1.11	1.20	1.29	1.33	1.40	1.45
Unnatural	1.00	0.99	0.96	0.96	0.99	1.00	0.99	0.98
All	1.00	1.09	1.17	1.31	1.46	1.57	1.69	1.77

Figure 71. 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): 1997-2004

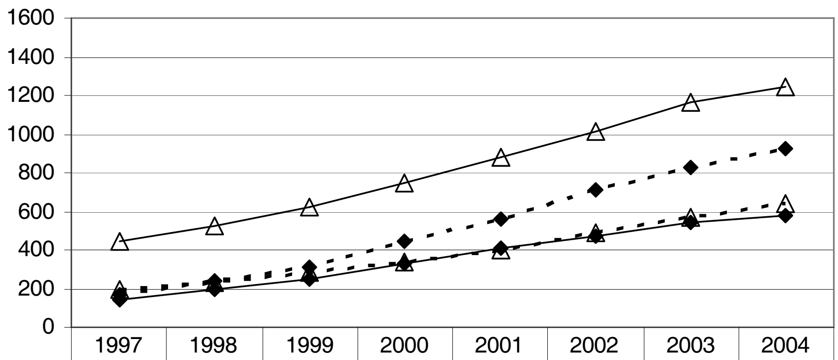


	1997	1998	1999	2000	2001	2002	2003	2004
Communicable and related	1.00	1.33	1.70	2.29	2.85	3.58	4.16	4.66
non-Communicable	1.00	1.06	1.12	1.22	1.31	1.39	1.51	1.60
Unnatural	1.00	0.96	0.96	0.88	0.86	0.88	0.89	0.90
All	1.00	1.13	1.27	1.49	1.71	1.98	2.22	2.42

Figure 72. 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): 1997-2004

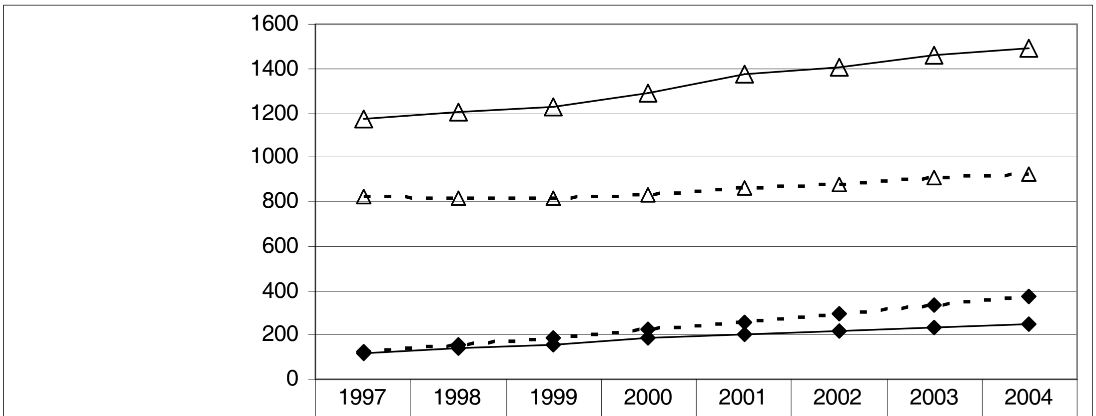
Figures 73 and 74 show the age-standardised death rates from communicable and related diseases (Figure 73) and from non-communicable diseases (Figure 74) by sex for the younger ages (age 15-39) and for the older ages (age 40-64).

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.



	1997	1998	1999	2000	2001	2002	2003	2004
Male Stand 15-39	143	197	247	332	405	474	542	578
Male Stand 40-64	445	525	626	751	880	1014	1163	1243
Female Stand 15-39	173	240	315	443	561	714	827	924
Female Stand 40-64	193	235	281	339	403	485	567	638

Figure 73. Age-standardised death rates per 100,000 from communicable and related diseases by sex, age 15-39 and age 40-64: 1997-2004



	1997	1998	1999	2000	2001	2002	2003	2004
Male Stand 15-39	114	140	153	184	201	215	236	251
Male Stand 40-64	1170	1206	1230	1288	1375	1405	1456	1494
Female Stand 15-39	124	154	183	226	260	292	334	373
Female Stand 40-64	821	817	815	835	862	875	909	923

Figure 74. Age-standardised death rates per 100,000 from non-communicable diseases by sex, age 15-39 and age 40-64: 1997-2004

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.

Table 2 shows the values of the age-standardised death rates for 1997 and 2004 by sex and by age group for all causes of death and for each of the three global burden of disease categories.

Table 2. Values of age-standardised death rates by sex and age group per 100,000, all causes and for the three Global Burden of Disease categories: 1997 and 2004

	Age 15-64		**Age 15-39**		**Age 40-64**	
Males	**1997**	**2004**	**1997**	**2004**	**1997**	**2004**
All causes	946	1671	545	1115	1926	3032
Communicable and related	231	771	143	578	445	1243
Non-communicable	420	611	114	251	1170	1494
Unnatural causes	294	288	287	286	312	295
Females						
All causes	601	1453	371	1372	1113	1633
Communicable and related	179	836	173	924	193	638
Non-communicable	340	543	124	373	821	923
Unnatural causes	82	74	74	75	99	72

Table 3 shows the value of the age-standardised death rate in 2004 divided by its value in 1997. This is shown for all causes of death as well as for the three separate categories.

The age-standardised death rate is shown for the 15-64 age range, as well as for the younger and older age segments. The influence of increases in communicable and related diseases is clear. However, for the older age segment, although communicable and related death rates increased more for females than for males, the lesser increase in the non-communicable diseases and unnatural cause death rates for females than males led the overall age-standardised death rate for older females to increase slightly less than for older males.

Table 3. Value of age-standardised death rate in 2004, divided by its value in 1997 by sex and age group, all causes and for the three Global Burden of Disease categories

	Age 15-64	Age 15-39	Age 40-64
Males			
All causes	1.8	2.0	1.6
Communicable and related	3.3	4.0	2.6
Non-communicable	1.5	2.2	1.3
Unnatural causes	1.0	1.0	0.9
Females			
All causes	2.4	3.7	1.5
Communicable and related	4.7	5.3	3.3
Non-communicable	1.6	3.0	1.1
Unnatural causes	0.9	1.0	0.7

Table 4 shows the percentage contribution of the change in each of the three global burden of disease categories between 1997 and 2004 to the overall change in the age-standardised death rate by sex and age group 1997-2004. Increases in communicable and related causes 1997-2004 accounted for about three-quarters of the increase 1997-2004, and increases in non-communicable causes accounted for about a quarter of the increase in the age-standardised death rate between 1997 and 2004.

Table 4. Percentage contribution of change in each Global Burden of Disease category 1997-2004 to total change in age-standardised death rate: 1997-2004

	Age 15-64	Age 15-39	Age 40-64
Males			
Communicable and related	74.5%	64.8%	72.2%
Non-communicable	26.3%	35.3%	29.3%
Unnatural causes	-0.8%	-0.1%	-1.5%
Total	100.0%	100.0%	100.0%
Females			
Communicable and related	77.1%	75.0%	85.6%
Non-communicable	23.8%	24.9%	19.6%
Unnatural causes	-0.9%	-0.1%	-5.2%
Total	100.0%	100.0%	100.0%

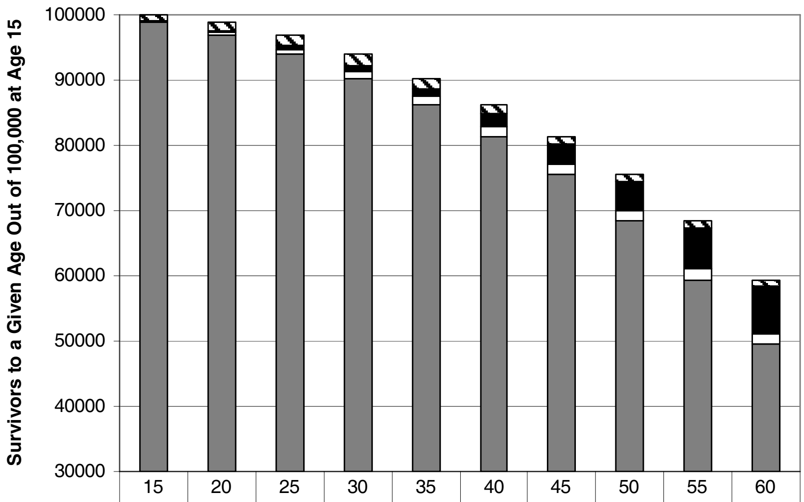
Table 5 shows the sex ratio of the age-standardised rates, that is the male rate for a given year, age group and cause of death divided by the female rate for the same grouping. For those age 15-64, the male death rate is higher than the female death rate except for communicable and related diseases in 2004, for which the male rate was 90% of the female rate. For the younger age grouping (age 15-39) the male rates were lower than the female rates for communicable and related diseases and for non-communicable diseases in both 1997 and 2004. The overall male rate was also lower than the overall female rate for those age 15-39 in 2004. For the older age grouping (40-64) all of the male rates were higher than the female rates at both dates.

For death rates from all causes, the female advantage decreased between 1997 and 2004 for those age 15-64 and those age 15-39, but the female advantage increased for those age 40-64. For all age groupings, the female advantage decreased or disappeared for communicable and related causes. For non-communicable causes, the female advantage decreased for those age 15-64 and agd 15-39 and increased for those age 40-64. The female advantage increased for unnatural causes for those age 15-64 and those age 40-64 but decreased for those 15-39. Thus over time, for those age 15-64 the situation of females compared to males worsened in every area except unnatural cause mortality, and for those age 15-39, the situation for females compared to males worsened in every area. For those age 40-64, the situation for females compared to males improved overall and worsened only for communicable and related causes.

Table 5. Male age-standardised death rate divided by female age-standardised death rate by age group, all causes and for the Global Burden of Disease categories: 1997 and 2004

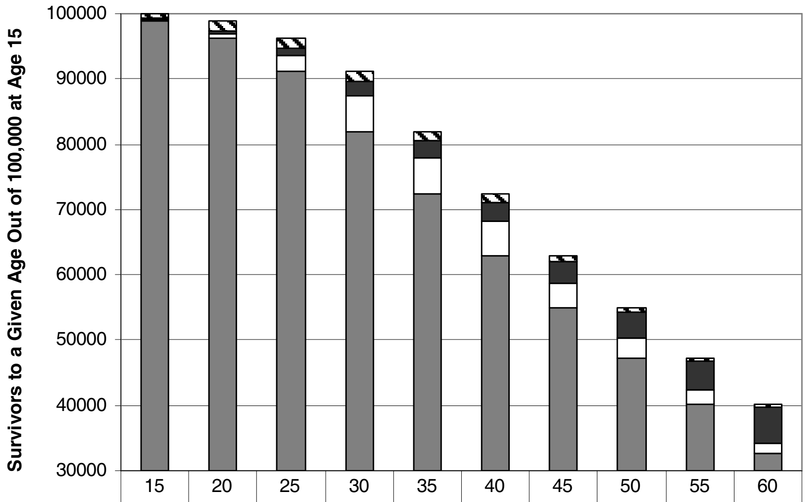
	Age 15-64		Age 15-39		Age 40-64	
	1997	**2004**	**1997**	**2004**	**1997**	**2004**
All causes	1.6	1.2	1.5	0.8	1.7	1.9
Communicable and rRelated	1.3	0.9	0.8	0.6	2.3	1.9
Non-communicable	1.2	1.1	0.9	0.7	1.4	1.6
Unnatural causes	3.6	3.9	3.9	3.8	3.2	4.1

Figures 75-78 are similar to Figures 36-39. However, Figures 75-78 divide natural mortality into its communicable and related diseases and non-communicable diseases components.



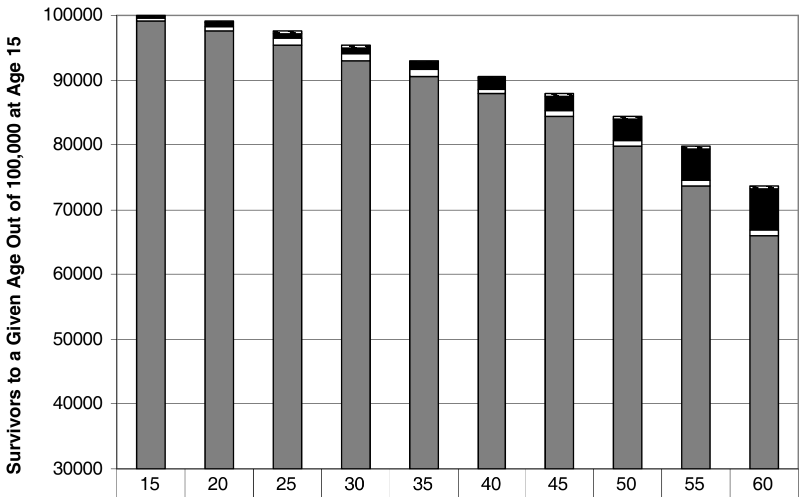
	15	20	25	30	35	40	45	50	55	60
Deaths from Unnatural Causes in Next 5 Years	801	1327	1699	1684	1484	1359	1242	1149	960	738
Deaths fron Non-Communicable Causes in Next 5 Years	189	240	498	873	1244	1934	2963	4486	6267	7505
Deaths from Communicable and Related Causes in Next 5 Years	180	297	789	1204	1312	1467	1626	1619	1827	1581
Survivors to Beginning of Next Interval	98830	96967	93981	90220	86179	81420	75589	68336	59282	49458

Figure 75. Male 1997 Survivors to a Given Age, Survivors for 5 More Years, and Deaths in Next 5 Years from Each of the Three Global Burden of Disease Categories Starting with 100,000 on their 15th Birthday



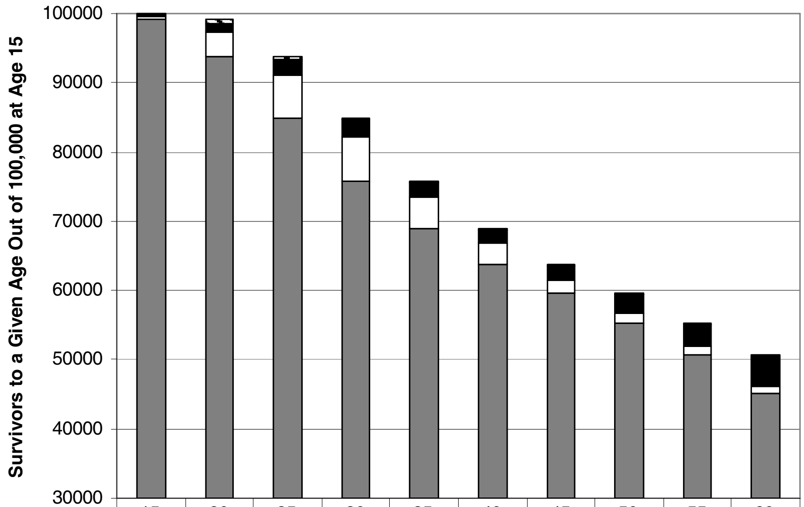
	15	20	25	30	35	40	45	50	55	60
Deaths from Unnatural Causes in Next 5 Years	675	1500	1480	1629	1385	1185	898	710	512	432
Deaths from Non-Communicable Causes in Next 5 Years	211	423	1033	2062	2593	3023	3377	3976	4509	5426
Deaths from Communicable and Related Causes in Next 5 Years	191	782	2553	5478	5659	5148	3813	2925	2127	1682
Survivors to Beginning of Next Interval	98924	96218	91152	81984	72347	62991	54904	47293	40145	32604

Figure 76. Male 2004 Survivors to a Given Age, Survivors for 5 More Years and Deaths in Next 5 Years from Each of the Three Global Burden of Disease Categories Starting with 100,000 on their 15th Birthday



	15	20	25	30	35	40	45	50	55	60
Deaths from Unnatural Causes in Next 5 Years	265	370	381	393	411	407	406	440	409	370
Deaths from Non-Communicable Causes in Next 5 Years	222	456	640	829	1073	1549	2290	3421	4997	6394
Deaths from Communicable and Related Causes in Next 5 Years	337	804	1157	1082	932	790	753	724	833	915
Survivors to Beginning of Next Interval	99176	97546	95368	93064	90647	87901	84453	79869	73630	65951

Figure 77. Female 1997 Survivors to a Given Age, Survivors for 5 More Years and Deaths in Next 5 Years from Each of the Three Global Burden of Disease Categories Starting with 100,000 on their 15th Birthday

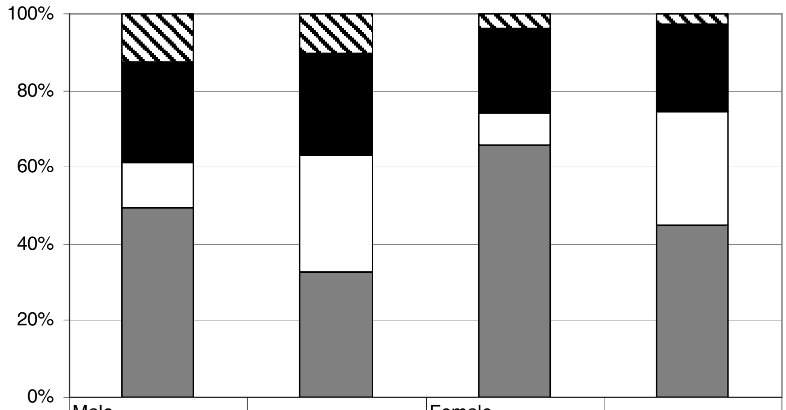


	15	20	25	30	35	40	45	50	55	60
Deaths from Unnatural Causes	191	440	386	342	296	241	212	200	193	196
Deaths from Non-Communicable Causes in Next 5 Years	251	1323	2282	2494	2120	1938	2129	2590	3172	4370
Deaths from Communicable and Related Causes in Next 5 Years	488	3471	6205	6280	4430	2962	1977	1531	1181	1082
Survivors to Beginning of Next Interval	99070	93836	84963	75848	69002	63861	59542	55221	50676	45028

Figure 78. Female 2004 Survivors to a Given Age, Survivors for 5 More Years and Deaths in Next 5 Years from Each of the Three Global Burden of Disease Categories Starting with 100,000 on their 15th Birthday

As in Figures 38-41, the height of each column shows the number of survivors to a given age starting from 100,000 persons on their 15th birthday. The fate of these 100,000 people of the given sex in a given year is tracked to their 65th birthday, to show what would have happened to them if the mortality conditions for that sex in that year persisted over time. Again, the dark grey column shows the number surviving five more years. The white segment shows the number dying from communicable and related causes in the subsequent five years, the black segment shows the number dying from non-communicable causes in the next five years and the black diagonal striped segment shows the number dying from unnatural causes in the subsequent five years. Again the lower bound of the vertical scale in the figures is set at 30000 rather than at 0 to make the distinctions in the figures easier to see.

Figure 79 is similar to Figure 42. Figure 79 shows for 100,000 people alive on their 15th birthday how many will still be alive on their 65th birthday, how many will have died from unnatural causes, how many will have died from non-communicable causes and how many will have died from communicable and related causes before they reach their 65th birthday. This is shown for both sexes in 1997 and in 2004.

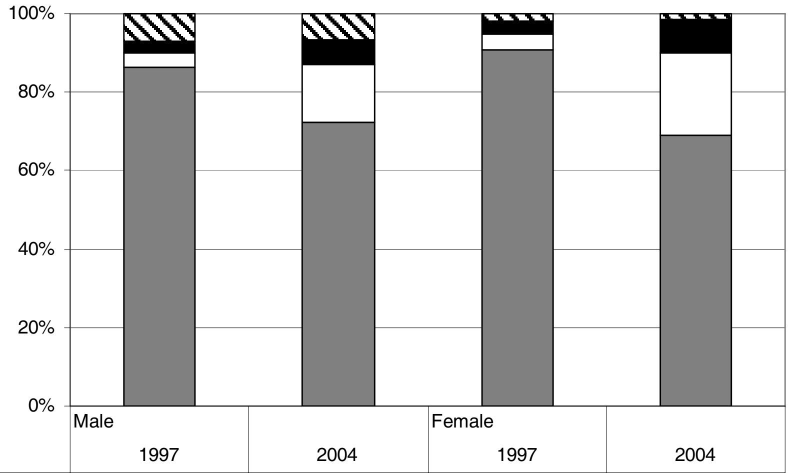


	Male 1997	Male 2004	Female 1997	Female 2004
Died from Unnatural Causes	12442	10405	3854	2697
Died from Non-Communicable Causes	26197	26634	21870	22668
Died from Communicable and Related Causes	11902	30357	8326	29607
Survivors to Age 65	49458	32604	65951	45028

Figure 79. Out of 100,000 on their 15th birthday, number surviving to age 65 and number dying from each of the three Global Burden of Disease categories before reaching their 65th birthday by sex: 1997 and 2004

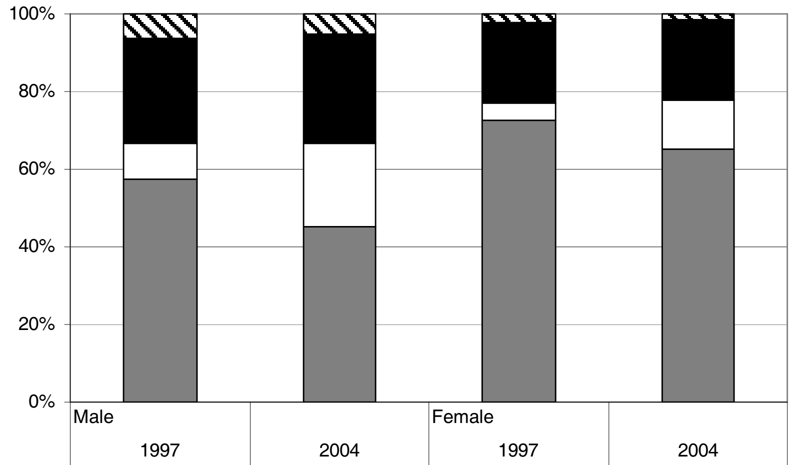
In both 1997 and 2004, males alive at age 15 were more likely to die before their 65th birthday than females. Males were more likely than females in both 1997 and in 2004 to die from each of the Global Burden of Disease categories. This means that even in 2004, a male age 15 was more likely to die from a communicable or related disease before age 65 than was a female. Also, for both sexes, the chance of dying from a non-communicable disease increased slightly between the two years, while the chance for both sexes of dying from a communicable or related disease increased by a great deal. The chance of dying from an unnatural cause between age 15 and 65 decreased for both sexes between 1997 and 2004.

Figures 80 and 81 are similar to Figures 42 and 43. Figure 80 considers the fate of 100,000 people alive at age 15 and what will have happened to them by the time they reached (or would have reached) their 40th birthday. Figure 81 considers the fate of 100,000 people alive on their 40th birthday and sees what would have happened to them by their 65th birthday.



	Male 1997	Male 2004	Female 1997	Female 2004
Died from Unnatural Causes	6995	6668	1821	1655
Died from Non-Communicable Causes	3044	6323	3220	8470
Died from Communicable and Related Causes	3782	14662	4312	20873
Survivors to Age 40	86179	72347	90647	69002

Figure 80. Out of 100,000 on their 15th birthday, number surviving to age 40 and number dying from each of the three Global Burden of Disease categories before reaching their 40th birthday by sex: 1997 and 2004



	Male 1997	Male 2004	Female 1997	Female 2004
Died from Unnatural Causes	6321	5165	2242	1510
Died from Non-Communicable Causes	26867	28075	20574	20577
Died from Communicable and Related Causes	9422	21694	4428	12657
Survivors to Age 65	57390	45066	72755	65257

Figure 81. Out of 100,000 on their 40th birthday, number surviving to age 65 and number dying from each of the three Global Burden of Disease categories before reaching their 65th birthday by sex: 1997 and 2004

For the younger age segment shown in Figure 80, the chance of dying from a non-communicable cause before age 40 (among those alive at age 15) more than doubled between 1997 and 2004 for both sexes, and the chance of dying from a communicable or related cause by age 40 more than tripled for males and increased almost fivefold for females. In 1997, females had a better chance of surviving from age 15 to 40 than males; in 2004, males had a better chance of surviving from age 15 to 40 than females. In 1997, females had a greater chance than males of dying from a non-communicable cause between age 15 and 40 and also a greater chance of dying from a communicable or related cause. As noted earlier, it was only the lesser chance for females of dying from an unnatural cause that allowed females in 1997 to have a better overall chance than males of surviving from age 15 to 40.

For the older age segment shown in Figure 81, the chance of dying from a non-communicable cause between their 40th and 65th birthdays (among those alive on their 40th birthday) was almost unchanged. The chance of dying from a communicable or related cause more than doubled for males and almost tripled for females. However, in both 1997 and in 2004, males in the older age segment had a worse mortality situation than females no matter how one looks at it. Males had a greater chance of dying from a non-communicable cause than females at both dates, and males also had a greater chance of dying from a communicable or related cause than females, as well as having a greater chance of dying from an unnatural cause.

Putting all of these mortality disadvantages for males in the older age segment together, the mortality situation of males age 40-64 compared to females age 40-64 was even worse in 2004 than in 1997. In 1997, males age 40 had 79% of the chance that females had of surviving to age 65 (57390/72755=0.79). In 2004, males at age 40 had only 69% of the chance that females had of surviving to age 65 (45066/65257=0.69).

Table 6 is similar to Table 1. However, rather than being based on the age-standardised death rate, it is based on the distribution of deaths to people starting from their 15th birthday and progressing to their 65th birthday or to their 40th birthday and on the distribution of deaths to people starting on their 40th birthday and progressing to their 65th birthday.

Table 6. Percentage distribution of causes of death among the three Global Burden of Disease categories for deaths occurring in given age intervals by sex: 1997 and 2004

	From 15th Birthday to 65th Birthday		From 15th Birthday to 40th Birthday		From 40th Birthday to 65th Birthday	
	1997	2004	1997	2004	1997	2004
Male						
Communicable and related	24%	45%	27%	53%	22%	39%
Non-communicable	52%	40%	22%	23%	63%	51%
Unnatural causes	25%	15%	51%	24%	15%	9%
Total	100%	100%	100%	100%	100%	100%
Female						
Communicable and related	24%	54%	46%	67%	16%	36%
Non-communicable	64%	41%	34%	27%	76%	59%
Unnatural causes	11%	5%	19%	5%	8%	4%
Total	100%	100%	100%	100%	100%	100%

We see in Table 6 that for every sex and age grouping, the chance of death being due to communicable and related diseases increased between 1997 and 2004. We also see that even in 2004 over 40% of the deaths for both sexes by 50 years after reaching their 15th birthday would be from non-communicable diseases. Also, at both dates, over 50% of the deaths in the subsequent 25 years to people after their 40th birthday would be from non-communicable diseases. The decline in deaths from unnatural causes is striking.

Major findings on the Global Burden of Disease categorisation

- Overall mortality from communicable and related diseases and from non-communicable diseases increased for both sexes between 1997 and 2004, but the increase was much greater for communicable and related diseases.
- For both of these categories overall mortality increased more for females than for males between 1997 and 2004. In 2004, the age-standardised death rate 15-64 for communicable and related diseases was 3.3 times its 1997 value for males and 4.7 times its 1997 value for females. For non-communicable diseases it was 1.5 times its 1997 value for males and was 1.6 times its 1997 value for females.
- In every year from 1997 to 2001 the male age-standardised death rate age 15-64 from communicable and related diseases was higher than the female rate; in each of the following three years the female rate was higher than the male rate. However, the male age-standardised death rate age 15-64 from non-communicable diseases was higher than the female rate in all the years under review. The gap between the rates for the two sexes narrowed only slightly over time.
- Death rates from communicable and related diseases were higher in 2004 than in 1997 for both sexes for every age group from 15 to 64. Only for males age 15-19 was the increase less than 20%. For males 20-54 and for females 20-59, the rates more than doubled. For males 30-44 and females 20-44, the rates increased more than fourfold, while for females 30-39 they increased more than sixfold.
- In 1997, death rates from communicable and related diseases below age 30 were higher for females than males, while from 30 to 64 they were higher for males. In 2004, these rates were higher for females than males up to age 34, and only from age 35 were they higher for males.
- Death rates from non-communicable diseases were higher in 2004 than in 1997 for both sexes and for every age group studied except for females 55-59. However it was less than 20% higher than in 1997 for males below age 20 and above age 55, and for females below age 20 and above age 50.
- For males age 25-39 and for females age 20-39, the death rate from non-communicable diseases in 2004 was more than twice its 1997 value. The greatest proportionate increases in the death rate from non-communicable diseases were for females age 25-34 for whom the rate for 2004 was more than 3.5 times the 1997 value.
- For both sexes, the increase in the death rate 1997-2004 was about three-quarters due to increases in deaths from communicable and related diseases and about a quarter due to increases in deaths from non-communicable diseases. For both males and females, non-communicable diseases accounted for the largest portion of deaths among the three Global Burden of Disease categories in the age-standardised death rate age 15-64 in every year from 1997 to 2000. In 2001 and later years, communicable and related diseases accounted for the largest portion of deaths.
- In 1997, for males, unnatural causes accounted for the largest portion of deaths for ages 15-39, and non-communicable diseases accounted for the largest portion of deaths for ages 40-64. Communicable and related diseases accounted for a larger portion of deaths than did non-communicable diseases for ages 20-39, even though unnatural causes accounted for the most deaths at those ages.

- In 2004, for males, unnatural causes accounted for the largest portion of deaths for ages 15-24, communicable and related diseases accounted for the largest portion of male deaths for age 25-49, and non-communicable diseases accounted for the largest portion of male deaths at ages 50-64. Communicable and related diseases accounted for a larger portion of deaths than did non-communicable diseases at age 20-24, even though unnatural causes accounted for the most deaths at that age.
- For females, unnatural causes did not account for the largest portion of deaths in either 1997 or 2004 for any age group. In 1997, communicable and related diseases accounted for the largest portion of deaths for ages 15-34, while for ages 35-64 non-communicable diseases accounted for the largest portion of deaths. In 2004, communicable and related diseases accounted for the largest portion of deaths for ages 15-44, and non-communicable diseases accounted for the largest portion at ages 45-64.
- Female death rates from non-communicable diseases were higher than male rates below age 30 in 1997 and below age 35 in 2004.
- When one considers the two 25-year age segments, 15-39 and 40-64, in the highest age-standardised death rate from both communicable and related diseases and from non-communicable diseases was for males in the older age group. For communicable and related diseases, the age-sex segment with the second highest age-standardised death rate was females age 15-39; for non-communicable diseases, it was females age 40-64.

Survival rates

- In both 1997 and 2004, males alive on their 15th birthday were more likely than females to die before their 65th birthday. This was due to a higher chance for males than females in each year to die from each of the Global Burden of Disease categories, although the gap between the sexes in the chance of dying from a communicable and related disease narrowed greatly between 1997 and 2004.
- In 1997, females alive on their 15th birthday had a greater chance of being alive on their 40th birthday than males. However, the chance of dying in the 25 years after the 15th birthday both from communicable and related diseases and from non-communicable diseases was greater for females than males. Only the much greater chance of dying from unnatural causes for males than females made their 25-year survival from age 15 worse than that for females.
- In 2004, females alive on their 15th birthday had a lesser chance of survival to their 40th birthday than males. This was due to a greater chance for females than males of dying both from communicable and related diseases and from non-communicable diseases. A small female advantage in unnatural cause mortality was not enough to offset the higher female mortality from both categories of natural causes.
- Among those alive on their 40th birthday, females had a greater chance of surviving 25 years to their 65th birthday than males in both 1997 and 2004. In both 1997 and 2004, females had a lesser chance of dying in the 25 years after their 40th birthday than males from each of the three categories.

Comments

Within natural causes of death, it is clear that communicable and related diseases are the major cause of increasing mortality for both sexes in South Africa. While communicable and related diseases increased 3.3 times for males and 4.7

times for females over the period 1997-2004, non-communicable causes increased by 45% for males and by 60% for females. 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 2004 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.

FURTHER DIVISION OF NATURAL CAUSES OF DEATH

In this section we further divide natural causes of death. First we look at communicable and related diseases and then at non-communicable diseases. These two broad categories are then further subdivided to examine specific causes of death of special interest, such as cancer or stroke, and also to obtain an idea of what categories could include a substantial portion of deaths that are actually due to HIV.

Communicable and related diseases

The communicable and related diseases category comprises infectious diseases, parasitic diseases, maternal-related diseases, causes if death that originated in the perinatal period, and nutritional deficiencies. We look at each of these five components of communicable and related diseases in turn.

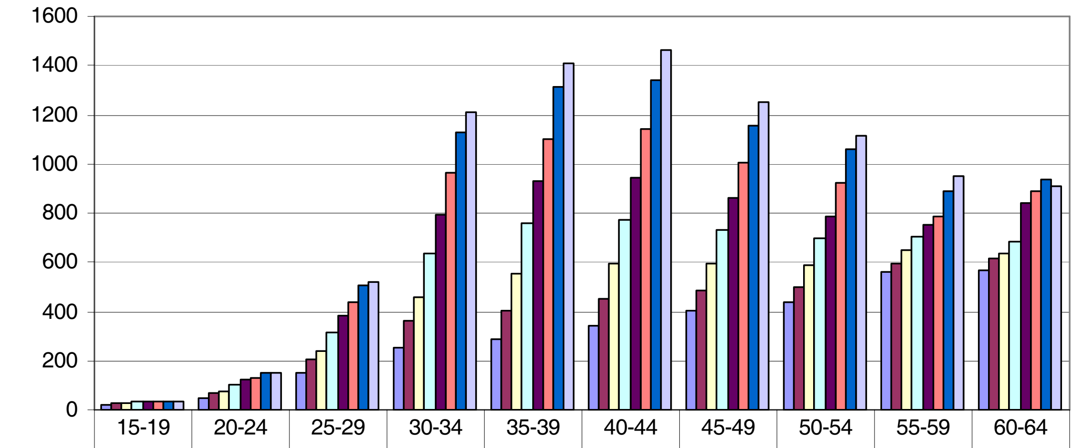
The main effects of HIV on death rates are seen in death rates from communicable diseases. There has been concern about interaction between HIV and other diseases, especially tuberculosis, malaria and STD's (Corbett *et al.*, 2002).

Infectious diseases

First we examine infectious diseases. This category includes many common diseases such as measles and influenza, as well as HIV, tuberculosis, and many other ailments. It spans the ICD-10 categories A00-B34, B90-B99, J00-J22, G00-G04, N70-N73, and H65-H66.

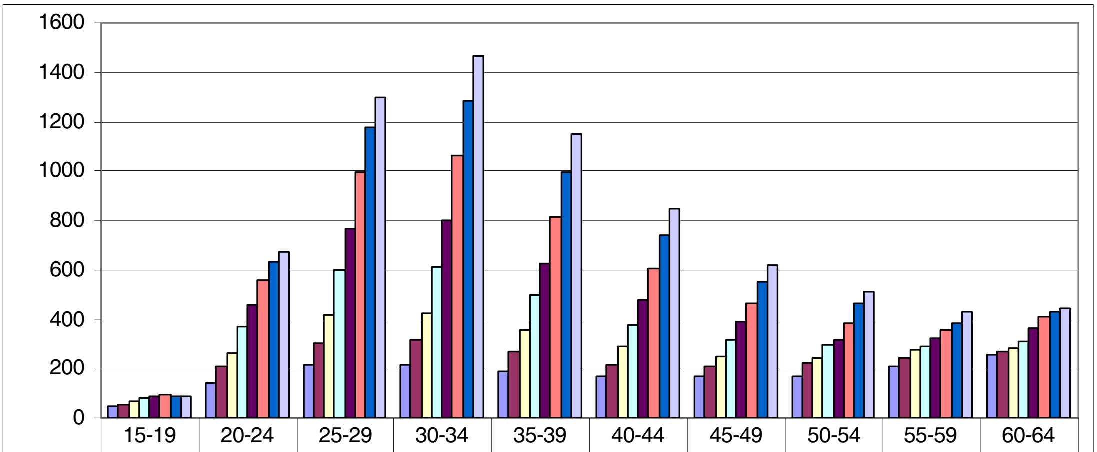
Infectious diseases are mainly addressed by vaccination, and death rates from many such diseases declined in the last century. An infectious disease that was a major threat to human survival, smallpox, was eliminated from the human population in the 1970s. However, besides HIV, other new infectious diseases, such as dengue fever and SARS, have become problems in some parts of the world.

Figures 82 and 83 show age-specific death rates from infectious diseases by sex from 1997 to 2004. Death rates from infectious diseases increased for every age-sex group, although the increases under age 20 were fairly small. There were especially large increases for males age 30-54 and for females age 25-39.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	22	50	150	253	289	340	403	440	557	565
1998	27	67	206	361	401	453	485	501	598	618
1999	27	77	242	458	551	598	593	585	648	635
2000	34	102	315	637	757	771	732	700	703	683
2001	36	122	381	791	932	944	865	785	752	843
2002	35	131	439	962	1104	1143	1004	920	785	886
2003	36	149	504	1125	1311	1340	1154	1061	892	939
2004	37	153	522	1211	1408	1464	1250	1112	948	907

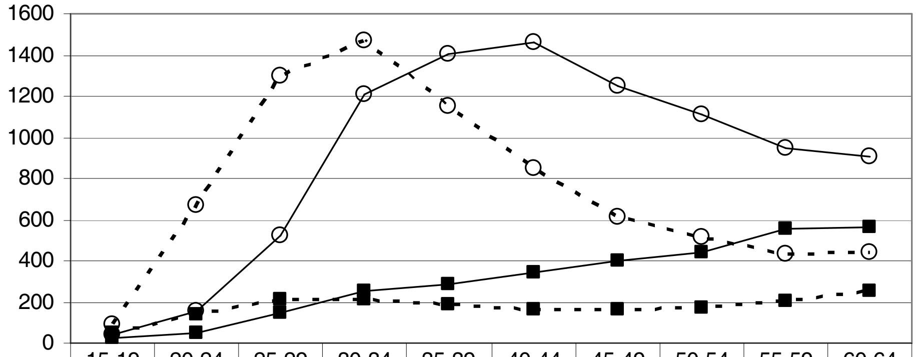
Figure 82. Male death rates by age per 100,000 from infectious diseases: 1997-2004



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	48	139	214	213	189	165	167	170	208	253
1998	56	206	302	318	266	217	209	223	243	267
1999	64	259	414	425	358	288	249	244	274	285
2000	78	373	601	613	496	379	319	294	292	308
2001	88	458	769	801	626	479	390	315	324	360
2002	91	561	996	1065	814	603	462	386	358	410
2003	90	631	1177	1283	993	736	550	466	386	431
2004	89	671	1296	1466	1152	848	615	513	433	443

Figure 83. Female death rates by age per 100,000 from infectious diseases: 1997-2004

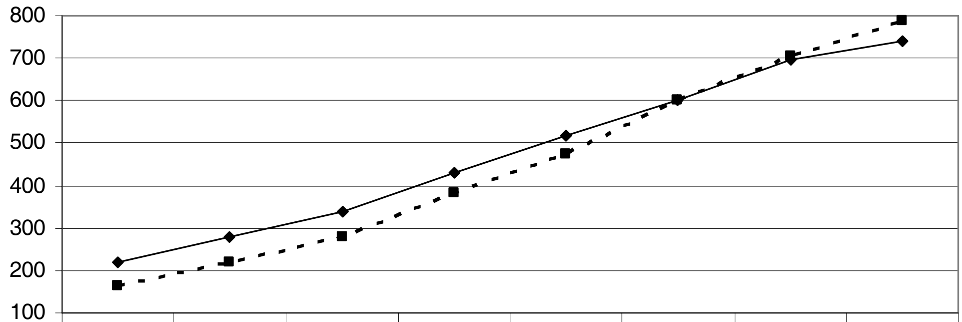
Figure 84 shows age-specific death rates from infectious diseases by sex in 1997 and 2004. For both sexes, there was a substantial increase in death rates over time. The death rates from infectious diseases for females increased especially at age 25-34, after which the death rates dropped rapidly with age. The increase for males began at a slightly later age but the rates remained high until the fifties.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male 1997	22	50	150	253	289	340	403	440	557	565
Male 2004	37	153	522	1211	1408	1464	1250	1112	948	907
Female 1997	48	139	214	213	189	165	167	170	208	253
Female 2004	89	671	1296	1466	1152	848	615	513	433	443

Figure 84. Death rates by age and sex per 100,000 from infectious diseases: 1997 and 2004

Figure 85 shows age-standardised death rates from infectious diseases by sex 1997-2004. The male age-standardised rate is higher than the female age-standardised rate until 2003, after which the female rate exceeds the male rate.



	1997	1998	1999	2000	2001	2002	2003	2004
Male	219	278	339	432	518	602	697	742
Female	162	220	281	382	476	600	706	786

Figure 85. Age-standardised death rates per 100,000 from infectious diseases by sex, age 15-64: 1997-2004

Deaths registered as due to HIV on the death notification forms

It is clear that many deaths due to HIV are registered as due to another underlying cause. Still, it is worthwhile to examine the death rates and the age pattern by sex from deaths reported as due to HIV. In this section, we consider only deaths for which the underlying cause was coded as HIV (ICD-10 codes B20-B24), based on information on the Death Notification Form. We do not include other reported causes of death for which HIV is almost certainly the underlying cause, such as parasitic opportunistic infections such as candidiasis, which is rarely fatal in people who do not have a compromised immune system.

We know that the age-specific death rates that we obtain in this section are too low, but we think it is useful to look at the age and sex patterns from these narrowly-reported HIV deaths.

There have been several somewhat different approaches to seeking to identify all deaths actually due to HIV.

Dorrington *et al.* (2001) estimated HIV deaths by age and sex in two ways. Using a growth balance approach, underregistration of deaths in South Africa by age and sex was estimated. In one part, death rates are projected to have declined about 3% per year from non-AIDS causes. Then the difference between the total estimated deaths by age and sex and the deaths estimated as not due to HIV is taken as an estimate of AIDS deaths. As another way to estimate AIDS deaths, Dorrington *et al.* (2001) used the results of a model of mortality which incorporates the effects of HIV in South Africa. The model is based on division of persons into various groups by risk of HIV infection and then uses transition probabilities for estimating the number who have become HIV-positive. Then there is estimation of the portion who die from HIV after given periods of time. With assumptions about the trajectory of non-AIDS mortality, the model yields estimates of HIV deaths by age, sex and year. This model has undergone many modifications. Such a model is useful but is built on many assumptions, the accuracy of which can only be checked indirectly.

Udjo (2005) estimated the number of HIV or tuberculosis deaths by age and sex in South Africa. First he estimated the completeness of death registration in South Africa 1997-2001 using a growth balance approach. He also adjusted the reported age-specific death rates by fitting a life table to a modification of a standard life table thought to be appropriate for sub-Saharan Africa. He then took deaths from ICD-10 codes that he considered to actually reflect HIV and tuberculosis mortality. He used B20-B24, A15-A19 and J65. Basically this covers deaths registered as due to HIV or tuberculosis. The proportion of all deaths in a given group by age, sex and year from these causes was taken from their proportion in the Death Notification data for that year. He then applied that proportion to his total estimated number of deaths by age, sex and year of death. This was an interesting application of life table modelling, but it does not directly address the issue of deaths actually due to HIV or tuberculosis that were registered as due to some other cause.

Bah (2005) took a somewhat different approach to estimating deaths due to HIV by age and sex for the years 1996 through 2000. He made these estimates for the 15-49 age range. Although he estimated deaths due to HIV from the cause of death data available for 1996 with estimates and projections for later years, in another part of his paper, he made estimates using data from a 15% sample of death notification forms for 1997-2001. He used the United States Center for Disease Control (CDC) list of conditions attributable to HIV or complicated by HIV and their list of AIDS indicator conditions. He then converted these conditions into the condition in the Statistics South Africa categorisation of codes that most closely matched each one. He discussed the issue that, with conditions associated with HIV, a problem is what portion of those deaths should be attributed to HIV rather than to the stated condition. Bah then obtained estimates of deaths due to HIV by age, sex and year by cumulating deaths reported as due either to conditions attributable to AIDS or to causes of death seen as AIDS indicator conditions. One obtains estimates of HIV deaths in this way, but, as Bah acknowledges, it does not address the question of deaths due to HIV that are attributed to some completely different cause, nor does it address the question of what portion of deaths from a particular cause should be attributed to HIV. Bah comments that he plans to pursue these issues using the possibilities for listing of multiple causes of death in on the 1998 Death Notification Form. To this end, he lists the causes of death frequently given on Death Notification Forms together with HIV.

Groenewald *et al*. (2005) explicitly sought to identify HIV deaths for which the stated underlying cause of death on the Death Notification Form was something other than HIV. They started by looking at death rates from deaths reported as being due to HIV on the Death Notification Forms from 1996 and from 2001.[8] They identified 22 other causes of death that had an increase in death rates between 1996 and 2000-2001. They then eliminated from consideration for hidden HIV deaths those causes that did not exhibit a similar pattern of change in death rates as did the rates for reported HIV. There remained nine causes of death that they identified as including a substantial number of deaths that were actually due to HIV. These nine causes were: tuberculosis, lower respiratory infections, diarrhoeal diseases, bacterial meningitis, other respiratory disease, non-infective gastroenteritis, other infectious and parasitic disease, deficiency anaemias, and protein energy malnutrition. Later in this report, we also identify causes of death that likely include a substantial proportion of actual HIV deaths.

The Groenewald *et al*. (2005) paper is interesting and addresses an important problem, but there remain some concerns. First, it is not clear what criterion was used to determine whether the age and sex pattern of increases in death rates from a particular cause was sufficiently similar to that shown from reported HIV death rates to qualify. Some causes were originally considered but rejected as not including any substantial proportion of actual HIV deaths, such as melanoma. The age-sex pattern of change in death rates for melanoma shows no resemblance to that for HIV, but how the determination was made in cases that were less clear is not stated.

Second, some rule for the pattern of change in death rates by age and sex seems to have been the only criterion used. Protein-energy malnutrition was identified as a source of unreported HIV deaths, but the evidence for that seems weak. The article referenced for a connection between protein-energy malnutrition and HIV mortality (Sebastian *et al.,* 1996) examined only children. However, for adults age 15-64, Groenewald *et al.* (2005) attributed 49% of male deaths from protein-energy malnutrition and 70% of such female deaths to HIV.

This leads to a third issue. Groenewald *et al.* (2005) do not explain how they estimated the number of deaths from each of the nine causes that they attributed to HIV or how these were distributed by age and sex. Hopefully their paper is a first effort toward more specification of ways in which these decisions can be made.

The years that this study covers, 1997-2004, span a wide variation in the prevalence of HIV. According to the antenatal clinic data, in 1997 17% of pregnant women at the clinics were HIV positive, while in 2004 30% were HIV positive (South Africa, Department of Health, 2004, 2005a).

Figure 86 shows the age-specific death rates from deaths reported on the Death Notification Form as due to HIV in 1997 and 2004. Both male and female death rates in 2004 increase rapidly with age to a peak and then fall. This occurs about five years later for males than for females. The decline with age after the peak

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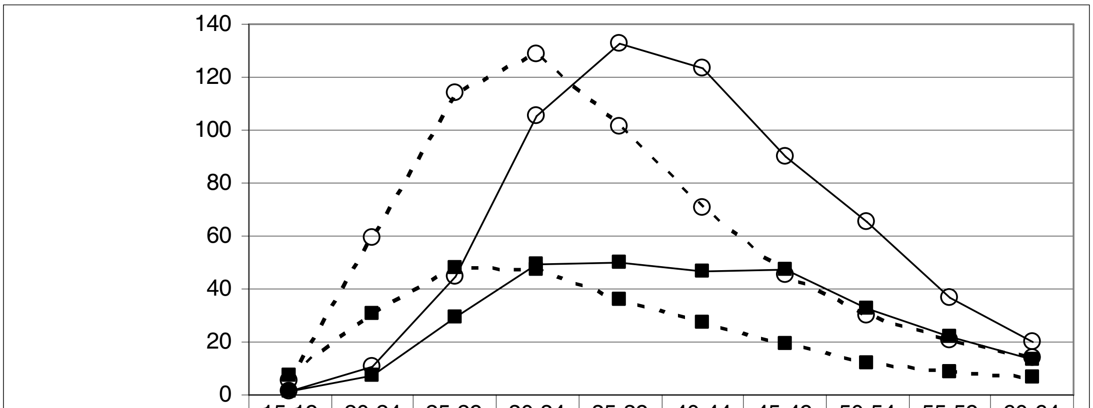
[8] Groenewald *et al.* (2005) used a slightly broader definition of HIV deaths by also including deaths from Kaposi's sarcoma (ICD-10 code C46).

is slightly slower for males than for females. This kind of age pattern has often been identified as typical of HIV mortality (Blacker, 2004: S24).



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male 1997	1.1	7.4	29.4	49.1	49.8	46.4	47.2	32.9	21.8	13.4
Male 2004	1.2	10.8	45.0	105.2	132.4	123.0	90.0	65.4	36.4	19.8
Female 1997	7.5	30.6	47.9	47.2	35.7	27.6	19.5	12.2	8.4	6.6
Female 2004	5.6	59.0	114.2	129.0	101.4	71.0	45.3	30.0	20.5	13.9

Figure 86. Death rates by age and sex per 100,000 from deaths registered as due to HIV: 1997 and 2004

The pattern by sex in Figure 86 contrasts somewhat with what we saw in Figure 47 (for communicable and related diseases) and in Figure 23 (for natural causes). In both of those earlier graphs, we saw male rates continue to rise with age (for natural causes) or to decline much more gradually with age (for communicable and related diseases) than we see in Figure 86.

Tuberculosis

It is known that among those who have tuberculosis and then become HIV-positive, the speed of progression from HIV to AIDS and from AIDS to death is more rapid (Badri, *et al.*, 2001), and death rates from tuberculosis are also increased (Connolly *et al.,* 1998; Corbett *et al.*, 2000). Moreover, being HIV-positive increases the chance of acquiring tuberculosis due to a weakened immunologic system (Churchyard and Grant, 2000).

Tuberculosis has long been endemic in much of South Africa, especially in Western Cape. Among the coloured [mixed-race] population in Western Cape, it was estimated that the incidence rate was 365 per 100,000 in 1958 (Donald, 1998). Tuberculosis has often been considered an AIDS-defining illness, but Badri *et al.* (2002) argue that in areas with high tuberculosis prevalence, this should be reconsidered. It is estimated that in 1997/1998, in South Africa as a whole, 33% of all persons who were positive for tuberculosis were also positive for HIV, but in Western Cape, 17% of those who were positive for tuberculosis were also positive for HIV (South Africa, Department of Health, 2000b).

It has often been thought that all deaths in which the person was positive for both HIV and tuberculosis should be attributed to HIV. That is, HIV should be assigned as the underlying cause of death. But recall that the definition of the underlying cause of death is “the one that started the chain of events leading to the death". Many people in South Africa die from tuberculosis who are not HIV-positive. Thus, tuberculosis is not like several parasitic opportunistic infections from which almost no one dies who does not have a compromised immune system. If a person is positive for tuberculosis and then becomes HIV-positive and then dies, HIV has increased the chance of death, but it seems that tuberculosis would properly be assigned as the underlying cause of death.

Thus, it seems that it would be good to know in how many deaths by age, sex and year HIV played *any* role, even if it was not the underlying cause of death. (In a similar way, people who are interested in the mortality effects of cigarette smoking or alcohol consumption usually want to know not just the role of these behaviours in the underlying cause of death but also all deaths in which these behaviours played any part in leading to death.) This is not possible at this time both because multiple causes of death only began to be recorded on the death notification form after the new form was issued in 1998, and also because it seems certain that HIV is still underreported as playing any role on the death notification forms.

The death notification form used in 1997 and most of 1998 had only one line for entry of the cause of death. Although more than one cause could be written on that line, if only one cause were entered, then that had to be identified as the underlying cause of death. The form introduced in 1998 facilitated the recording of as many as five contributing causes of death.[9] When more than one cause of death is stated, the underlying cause is determined by a programme that was jointly developed by the World Health Organization and Statistics South Africa.

For the data used for this study, when two or more contributing causes of death were given of which HIV was one, HIV was designated by this method as the underlying cause of death in 98.9% of cases 1999-2004 (adjusted deaths). Thus, the rules almost always designated HIV as the underlying cause of death when it was recorded that HIV played any role in the death.

Medical researchers are interested in "pre-AIDS mortality". This occurs when a person dies who is HIV-positive but for whom HIV has not yet developed into AIDS. It has become a research topic whether particular deaths in pre-AIDS mortality are or are not related to HIV status. This has become a crucial issue as the development of highly active antiretroviral therapy (HAART) has moved HIV in the direction of becoming a chronic disease in some parts of the world. In those situations, HIV-positive persons will at some point die of some cause, but it would not necessarily be reasonable to attribute all of those deaths to HIV (Laurichesse *et al.*, 1998; Louie *et a*l., 2002; Prins *et al.*, 1997; Prins *et al.*, 2000).

Tuberculosis is a disease that, like HIV, has long had especially high death rates among young adults. Figure 87 shows death rates age 15-64 from tuberculosis in the United States in 1900 (White 1999: 290). The graph shows a typical pattern for tuberculosis by age when the death rate from this disease is high: the rates increase to when people are in their twenties or thirties and then decline somewhat at older ages (Collins, 1982; Downes, 1931; Frost, 1940).

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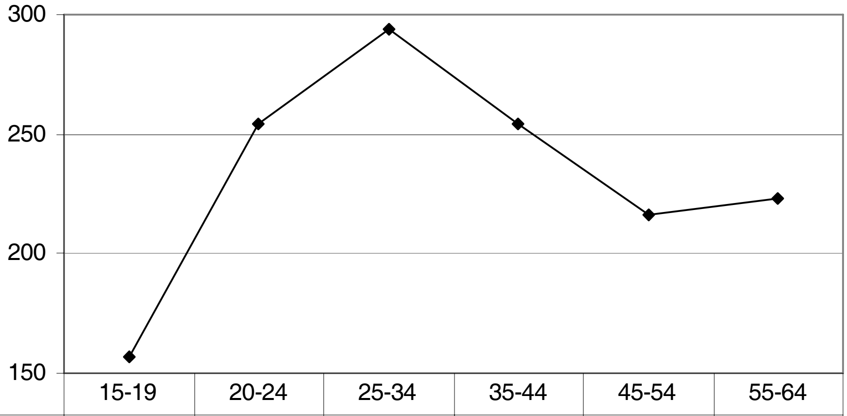
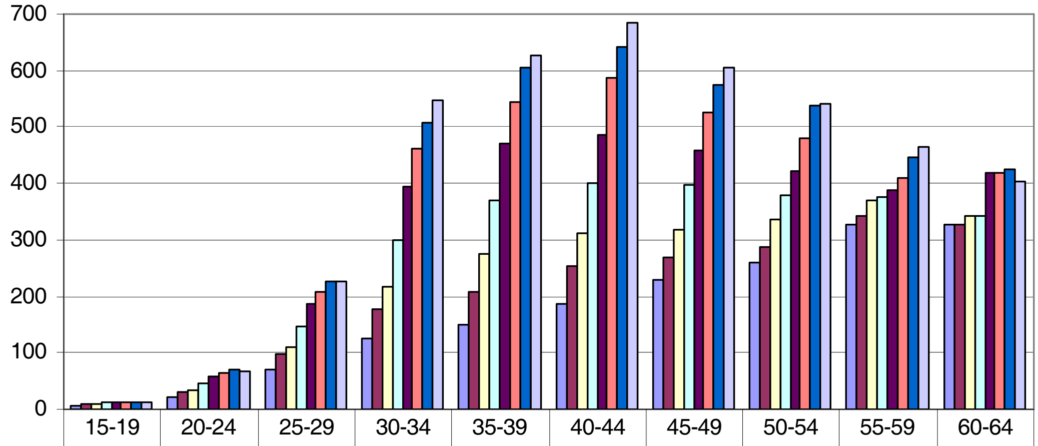
[9] The older death notification form and the newer form introduced in 1998 appear in Appendix B.



	15-19	20-24	25-34	35-44	45-54	55-64
United States 1900	157	254	294	254	216	223

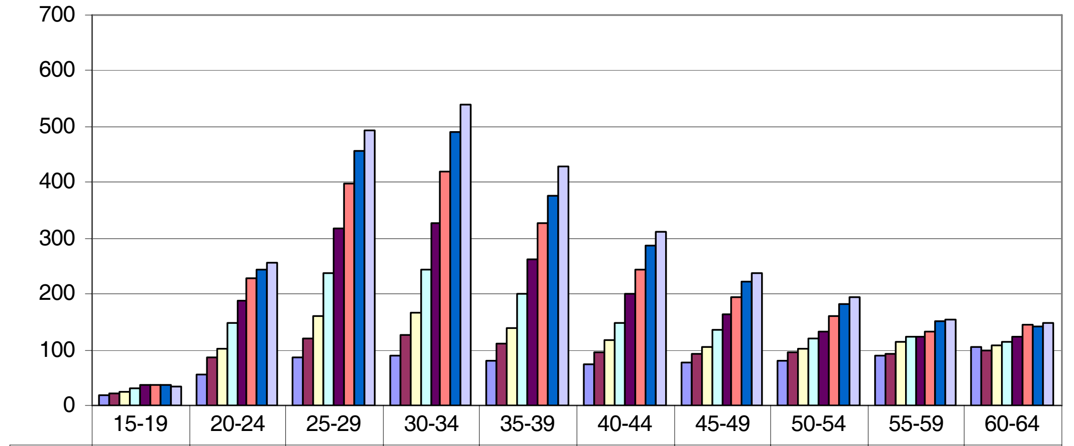
Figure 87. Death rates by age per 100,000 from tuberculosis: United States 1900

Figures 88 and 89 show age-specific death rates in South Africa 1997-2004 from tuberculosis (ICD-10 codes A15-A19). Death rates have risen over time for every age and sex group. The rates increased every year for females age 20-59 and for males age 25-59.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	7.1	22.5	70.2	126.4	151.1	186.2	228.6	260.2	328.5	326.1
1998	8.0	30.2	98.9	178.2	208.6	253.6	268.6	286.3	342.2	326.9
1999	8.1	33.6	110.6	217.4	276.2	312.7	317.9	336.2	370.8	342.1
2000	11.9	46.3	146.4	299.5	368.5	399.5	397.5	377.9	375.6	342.7
2001	12.7	57.5	185.9	393.1	469.5	486.8	458.2	421.6	388.6	417.5
2002	12.1	63.4	207.7	460.8	545.4	587.2	526.5	478.6	410.4	420.1
2003	12.5	69.9	227.3	506.9	604.5	640.9	574.1	539.2	445.1	425.3
2004	13.1	67.3	227.7	545.7	626.1	685.6	605.3	539.9	464.7	404.6

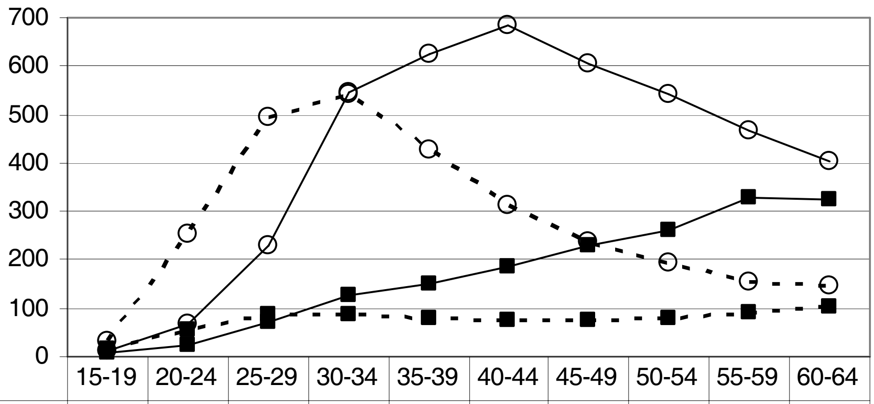
Figure 88. Male death rates by age per 100,000 from tuberculosis: 1997-2004



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	17.0	56.8	86.1	88.7	79.3	75.1	77.0	79.1	90.9	104.7
1998	20.3	86.4	119.6	126.9	112.4	95.0	93.5	96.5	93.9	99.1
1999	25.7	100.9	161.7	165.3	138.4	117.8	104.5	101.4	114.9	107.7
2000	31.5	147.5	237.8	244.9	199.3	147.3	134.3	119.9	122.2	112.9
2001	36.0	188.2	318.2	327.0	261.3	199.5	163.5	133.6	122.5	123.4
2002	37.1	227.9	399.0	420.6	326.2	244.2	193.1	158.9	134.0	145.9
2003	36.3	243.7	457.8	490.4	377.6	285.2	220.8	181.4	149.6	141.3
2004	33.6	254.6	493.3	540.8	427.9	312.9	236.3	193.2	154.3	146.7

Figure 89. Female death rates by age per 100,000 from tuberculosis: 1997-2004

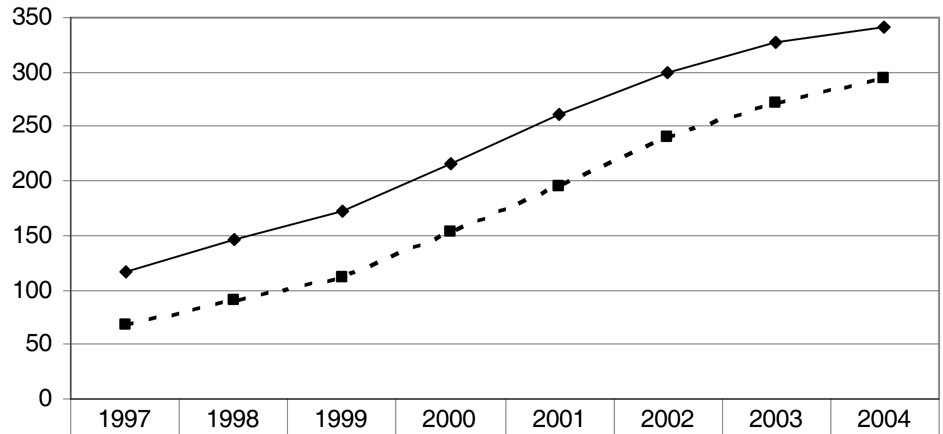
Figure 90 shows the age-specific death rates by sex from tuberculosis in 1997 and 2004. In 1997, the male rate increased with each successively older age except for a slight decline in the last age group. For females in 1997, the rate increased to age 30-34 and then remained almost constant, with a slight increase in the oldest age group.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male 1997	7.1	22.5	70.2	126.4	151.1	186.2	228.6	260.2	328.5	326.1
Male 2004	13.1	67.3	227.7	545.7	626.1	685.6	605.3	539.9	464.7	404.6
Female 1997	17.0	56.8	86.1	88.7	79.3	75.1	77.0	79.1	90.9	104.7
Female 2004	33.6	254.6	493.3	540.8	427.9	312.9	236.3	193.2	154.3	146.7

Figure 90. Death rates by age and sex per 100,000 from tuberculosis: 1997 and 2004

For 2004, the death rate for females begins to rise sharply at an earlier age than does the death rate for males. But the male rates by age become much higher than the female rates (more than double the female rates above age 40), and the male rates decline gradually with age. The 2004 male rate at age 60-64 is 67% of the peak male rate for that year (at age 40-44), while the 2004 female rate at age 60-64 is only 17% of the peak female rate for that year (at age 30-34).



	1997	1998	1999	2000	2001	2002	2003	2004
Male	117	146	173	215	262	299	328	341
Female	68	90	111	152	195	240	272	294

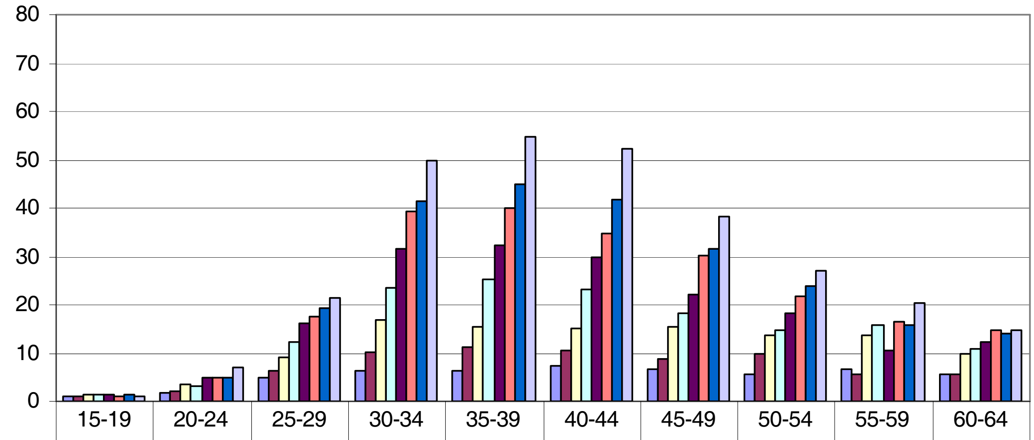
Figure 91. Age-standardised death rates per 100,000 from tuberculosis by sex, age 15-64: 1997-2004

Figure 91 shows age-standardised death rates by sex from tuberculosis. The rates rise over time for both sexes, with a deceleration beginning in 2003. The male rates are always higher than the female rates, and the gap between the rates for the two sexes is almost constant over time.

Parasitic diseases

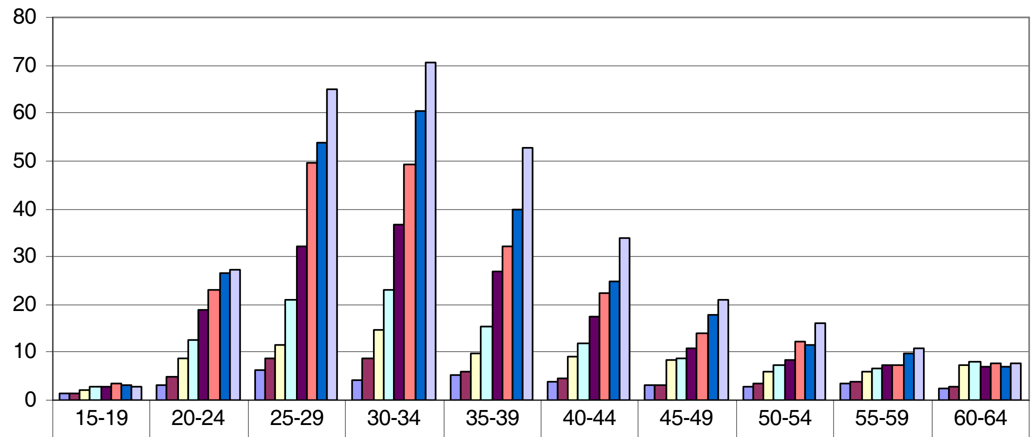
Parasitic diseases include protozoal diseases, such as malaria, as well as toxoplasmosis and many others. Many parasitic diseases are debilitating but usually not fatal, since the survival of the parasite is dependent on the survival of the host. However, some parasitic diseases, such as malaria, often result in death. Parasitic causes of death are covered by the ICD-10 categories B35-B89.

Figures 92 and 93 show age-specific death rates from parasitic diseases by sex 1997-2004. Death rates from parasitic diseases increase for both sexes for all age groups above age 20.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	0.9	1.6	4.8	6.2	6.5	7.2	6.6	5.7	6.8	5.7
1998	0.9	2.2	6.4	10.1	11.1	10.5	8.8	9.7	5.6	5.7
1999	1.3	3.7	9.2	16.7	15.5	15.0	15.5	13.7	13.7	9.9
2000	1.3	3.2	12.3	23.4	25.1	23.1	18.2	14.6	15.8	10.8
2001	1.4	4.9	16.2	31.7	32.3	29.7	22.2	18.4	10.6	12.1
2002	1.0	4.8	17.5	39.4	39.9	34.9	30.1	21.6	16.5	14.7
2003	1.5	5.1	19.2	41.5	44.9	41.9	31.6	23.7	15.6	14.1
2004	1.2	7.2	21.4	49.8	54.9	52.1	38.4	27.1	20.4	14.6

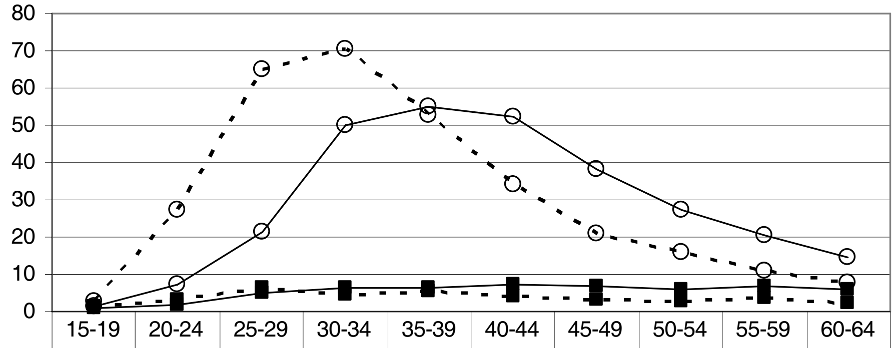
Figure 92. Male death rates by age per 100,000 from parasitic diseases: 1997-2004



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	1.3	3.2	6.4	4.4	5.2	4.0	3.2	2.9	3.5	2.4
1998	1.5	5.0	8.6	8.7	6.0	4.6	3.2	3.4	3.8	2.7
1999	2.1	8.7	11.6	14.7	9.9	9.2	8.3	5.9	6.0	7.4
2000	2.8	12.6	21.0	23.2	15.5	12.0	8.7	7.3	6.7	8.0
2001	2.7	18.9	32.0	36.7	26.9	17.3	10.9	8.5	7.5	7.1
2002	3.4	23.0	49.7	49.4	32.1	22.2	14.1	12.3	7.4	7.6
2003	3.1	26.7	53.8	60.4	39.9	24.7	17.8	11.6	9.7	7.1
2004	2.7	27.4	64.9	70.4	52.7	34.0	21.0	16.0	10.7	7.8

Figure 93. Female death rates by age per 100,000 from parasitic diseases: 1997-2004

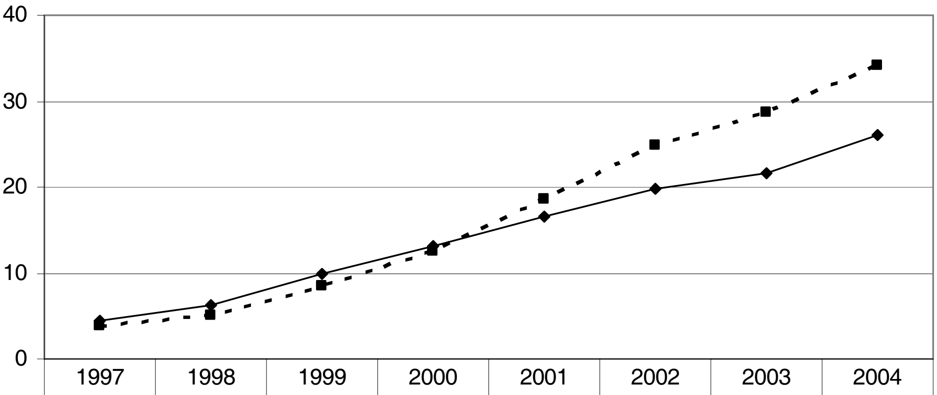
Figure 94 shows age-specific death rates from parasitic diseases by sex in 1997 and in 2004. As for other natural causes of death, the death rates increase from a younger age for females than for males but the rates for females also begin to decline at an earlier age than for males.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male 1997	0.9	1.6	4.8	6.2	6.5	7.2	6.6	5.7	6.8	5.7
Male 2004	1.2	7.2	21.4	49.8	54.9	52.1	38.4	27.1	20.4	14.6
Female 1997	1.3	3.2	6.4	4.4	5.2	4.0	3.2	2.9	3.5	2.4
Female 2004	2.7	27.4	64.9	70.4	52.7	34.0	21.0	16.0	10.7	7.8

Figure 94. Death rates by age and sex per 100,000 from parasitic diseases: 1997 and 2004

Figure 95 shows age-standardised death rates from parasitic diseases by sex 1997-2004. From 2001, the female age-standardised rate is higher than the male age-standardised rate.



	1997	1998	1999	2000	2001	2002	2003	2004
Male	4.4	6.3	9.8	13.0	16.5	19.8	21.7	26.1
Female	3.7	5.0	8.5	12.6	18.6	24.9	28.6	34.1

Figure 95. Age-standardised death rates per 100,000 from parasitic diseases by sex, age 15-64: 1997-2004

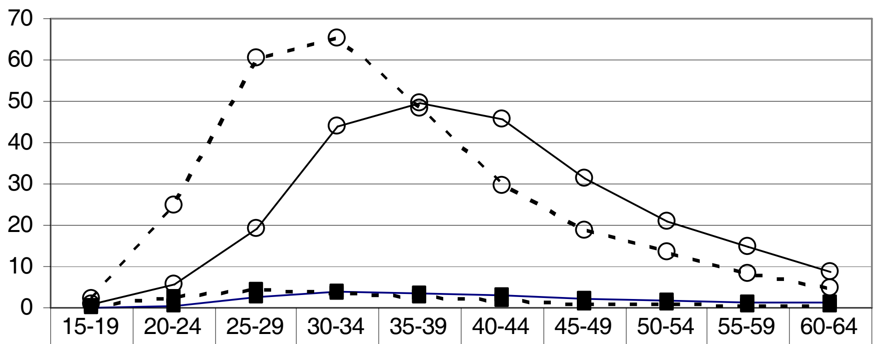
Parasitic opportunistic infections

The total adjusted number of deaths of both sexes combined from parasitic diseases increased from 1032 in 1997 to 8833 in 2004. This increase was mainly due to increases in candidiasis ICD-10 code B37 (42 deaths in 1997 to 790 deaths in 2004), cryptococcosis ICD-10 code B45 (272 deaths to 2668 deaths), toxoplasmosis

ICD-10 code B58 (50 deaths to 300 deaths) and pneumocytosis ICD-10 code B59 (148 deaths to 4076 deaths).

Candidiasis is a mucus infection that is usually not serious, except in patients with a compromised immune system (Gallant, Moore and Chaisson, 1994). Cryptococcosis is a fungal disease, which is one of several that are viewed as opportunistic infections that have increasingly appeared in people who are HIV-positive (McCarthy *et al*., 2005: 16).[10] Toxoplasmosis is also an opportunistic ailment that is associated with HIV (Holmes *et al.,* 2005). Pneumocytosis is “a respiratory infection which appears only in immunodepressed humans and can be fatal if treatment is not given” (HivNetNordic.WorldNews: May 2004). It seems that the increase in death rates from parasitic diseases since 1997 is mainly the result of increased deaths from parasitic opportunistic infections that take advantage of people who are HIV-positive. It is likely that these deaths should have been attributed to HIV. Groenewald *et al.* (2005) also note that these diseases are opportunistic infections.

Figure 96 shows the death rates by sex in 1997 and 2004 from candidiasis, cryptococcosis, toxoplasmosis and pneumocytosis considered together.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male 1997	0.2	0.5	2.5	3.9	3.6	3.2	2.1	1.7	1.1	1.1
Male 2004	0.9	5.9	19.2	44.0	49.5	45.5	31.3	20.9	14.7	8.6
Female 1997	0.6	2.5	4.2	3.4	2.8	1.9	0.9	0.7	0.6	0.6
Female 2004	2.1	24.9	60.5	65.2	48.3	29.7	18.6	13.6	8.3	4.7

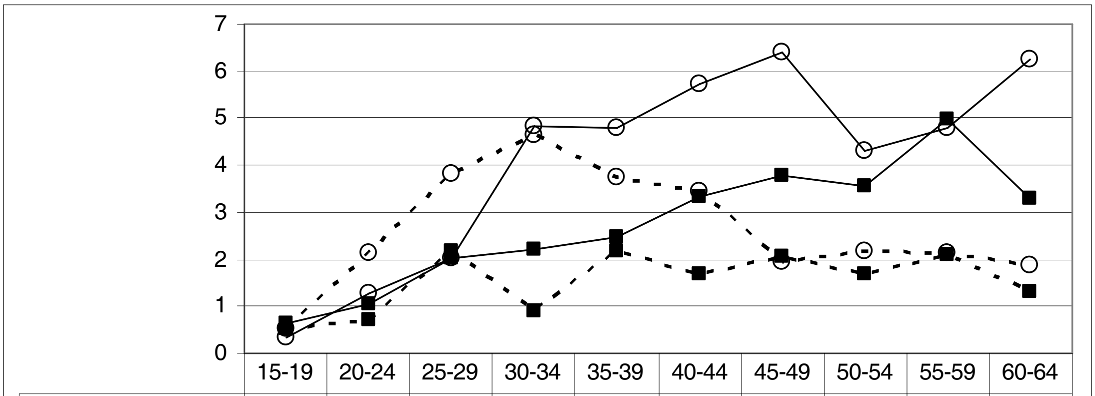
Figure 96. Death rates by age and sex per 100,000 from four parasitic opportunistic infections: Candidiasis, cryptococcosis, toxoplasmosis and pneumocytosis: 1997 and 2004

Malaria

There has been great concern about the emergence of strains of malaria that are resistant to the drugs that have typically been used to prevent the disease (World Health Organization, 2005). There has been specific evidence of resistant strains of malaria in South Africa (Hargreaves *et al*., 2000).

Figure 97 shows the death rates by sex from malaria in 1997 and 2004. Malaria is ICD-10 codes B50-B54. The rates increased at most ages, but in a somewhat erratic manner.

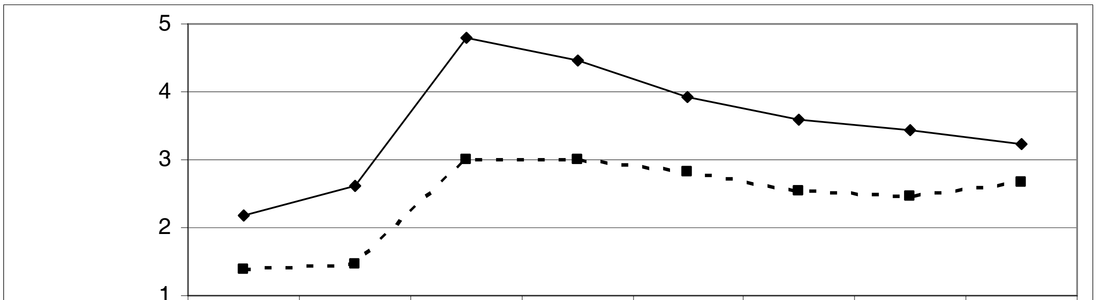
[10] Cryptococcosis and other parasitic diseases are conventionally referred to as “opportunistic infections”, even though they are parasitic diseases rather than infectious diseases.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male 1997	0.6	1.0	2.0	2.2	2.5	3.3	3.8	3.6	5.0	3.3
Male 2004	0.3	1.3	2.0	4.8	4.8	5.7	6.4	4.3	4.8	6.3
Female 1997	0.5	0.7	2.2	0.9	2.2	1.7	2.1	1.7	2.1	1.3
Female 2004	0.5	2.1	3.8	4.7	3.8	3.5	1.9	2.2	2.1	1.9

Figure 97. Death rates by age and sex per 100,000 from malaria: 1997 and 2004

Figure 98 shows the age-standardised death rates from malaria, 1997-2004. The increase from 1998 to 1999 is very large for a single year. It is not clear what led to this large reported increase. Although the age-standardised rates increased 1997-1999, after 1999 they declined somewhat. Once the deaths from the four opportunistic infections discussed above were removed, 86% of the remaining parasitic deaths in 2004 were due to malaria.



	1997	1998	1999	2000	2001	2002	2003	2004
Male	2.2	2.6	4.8	4.5	3.9	3.6	3.4	3.2
Female	1.4	1.5	3.0	3.0	2.8	2.5	2.5	2.7

Figure 98. Age-standardised death rates per 100,000 from malaria by sex, age 15-64: 1997-2004

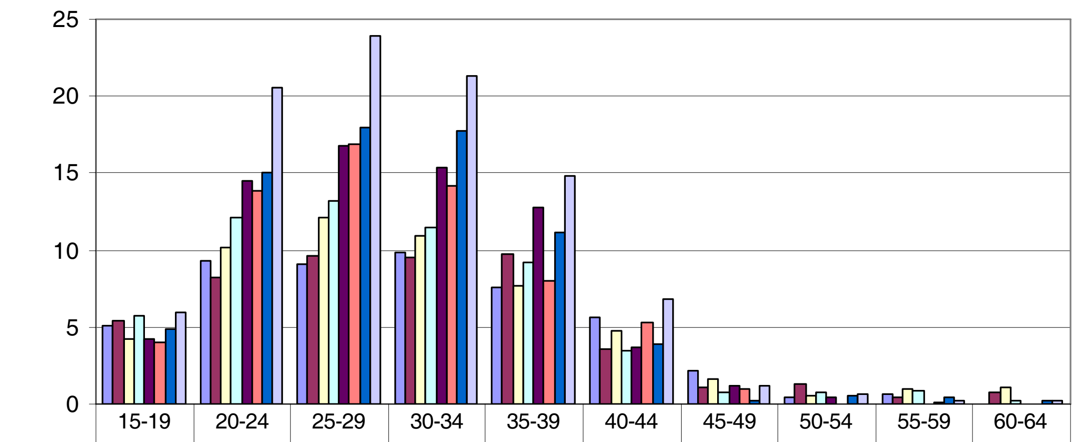
Maternal conditions

Maternal conditions do not lead directly to the deaths of males. Thus, we only look at deaths resulting from maternal conditions for females. A maternal death is typically defined as "the death of a woman while pregnant or within 42 days of the termination of the pregnancy from any cause related to or aggravated by the pregnancy or its management" (South Africa, Department of Health, 2000a: 2). Maternal conditions refer to the ICD-10 codes O00-O99.

Death from maternal conditions can only occur to women who are or have been pregnant. In order to look at the risk of death from maternal conditions to women who are at risk for this, one should look at maternal deaths relative not to all women but only relative to the number of pregnant women. However, one can examine the number of maternal deaths by age relative to the total number of women by age in order to gauge the magnitude of the risk of maternal mortality to women overall. In what follows we examine maternal deaths by age group relative to the total number of women in the given age group.

Due to concern about maternal mortality, in 1997 the South Africa Department of Health launched a confidential inquiry into maternal deaths. This inquiry found that "the most important causes of death were hypertension, non-pregnancy related infections (including AIDS), obstetric haemorrhage, pregnancy related sepsis and pre-existing maternal conditions" (South Africa, Department of Health, 2000a: 3). Research studies have supported the contribution of HIV as well as tuberculosis (Khan, *et al.,* 2001) and malaria (Granja *et al.,* 1998; Steketee *et al.,* 2001) to maternal deaths.

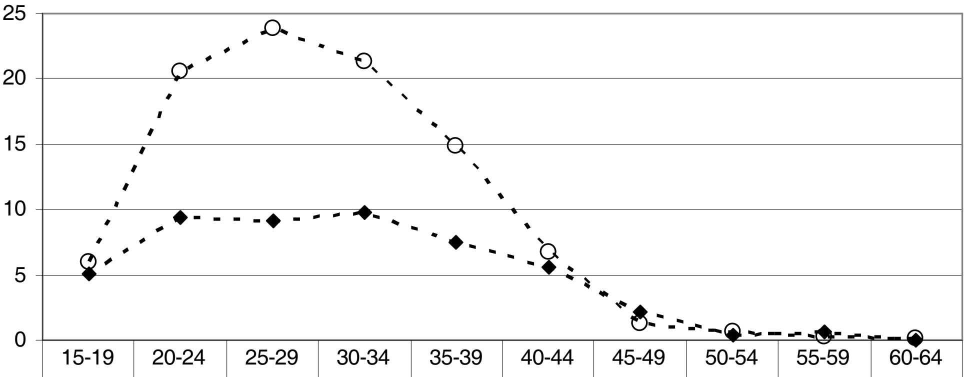
Figure 99 shows age-specific death rates from maternal conditions for females by age 1997-2004. Death rates from maternal conditions increased in every age group 20-39.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	5.1	9.3	9.1	9.8	7.5	5.6	2.2	0.4	0.6	0.0
1998	5.4	8.2	9.6	9.5	9.7	3.6	1.1	1.3	0.5	0.7
1999	4.2	10.2	12.1	10.9	7.7	4.7	1.6	0.5	0.9	1.1
2000	5.7	12.2	13.2	11.4	9.2	3.5	0.8	0.7	0.9	0.2
2001	4.2	14.5	16.7	15.4	12.7	3.6	1.2	0.5	0.0	0.0
2002	4.0	13.8	16.8	14.2	8.1	5.3	0.9	0.0	0.1	0.0
2003	4.8	15.0	17.9	17.8	11.2	3.9	0.3	0.6	0.4	0.2
2004	5.9	20.5	23.9	21.3	14.8	6.8	1.2	0.7	0.3	0.2

Figure 99. Female death rates by age per 100,000 from maternal conditions: 1997-2004

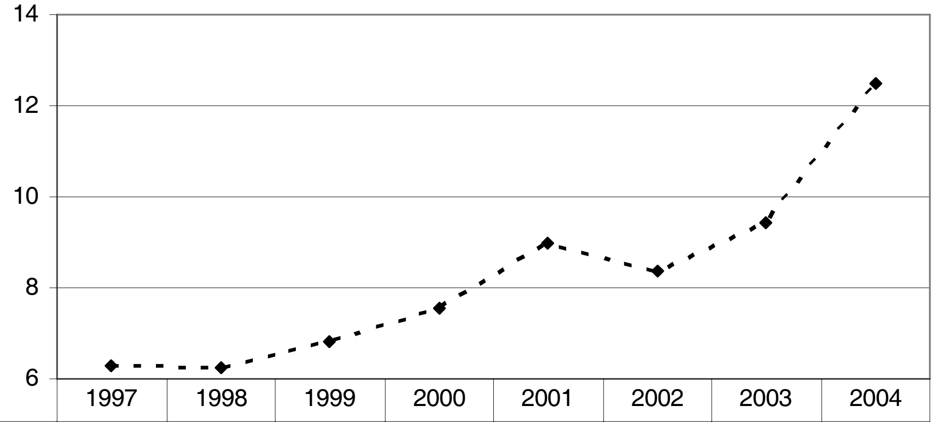
Figure 100 shows age-specific death rates from maternal conditions for females in 1997 and in 2004. The increase between 1997 and 2004 at age 20-39 is striking.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	5.1	9.3	9.1	9.8	7.5	5.6	2.2	0.4	0.6	0.0
2004	5.9	20.5	23.9	21.3	14.8	6.8	1.2	0.7	0.3	0.2

Figure 100. Female death rates by age per 100,000 from maternal conditions: 1997 and 2004

Figure 101 shows age-standardised death rates from maternal-related causes for females 1997-2004. The age-standardised rate increased 1997-2001, declined in 2002, and then increased from 2002 through 2004.



	1997	1998	1999	2000	2001	2002	2003	2004
Female	6.3	6.2	6.8	7.6	9.0	8.4	9.4	12.5

Figure 101. Female age-standardised death rates per 100,000 from maternal conditions, age 15-64: 1997-2004

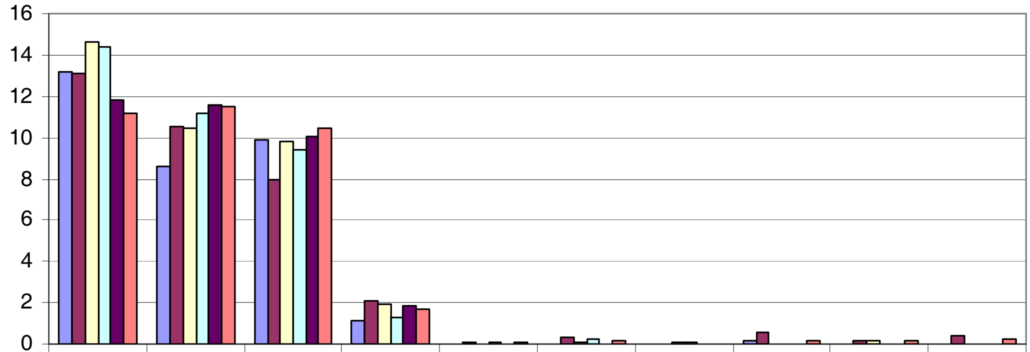
Conditions arising during the perinatal period

Conditions arising during the perinatal period can cause death to occur long after birth. These perinatal conditions refer to ICD-10 codes P05-P96.

Due to an error in coding and programming the Death Notification Data for 2003 and 2004, all persons who died in those years from conditions originating in the perinatal period were assigned an age at death of under one year of age. The total number of perinatal deaths to people of all ages increased from 52,496 in 2002 to 53,503 in 2003 to 53,341 in 2004. In 2002, 2.5% of all male deaths from conditions arising during the perinatal period occurred with an age at death of 15-64, and 2.9% of all female deaths from conditions arising during the perinatal period occurred at an age at death of 15-64. Thus, the reported ages at death from this cause for 2003 and 2004 are not plausible.

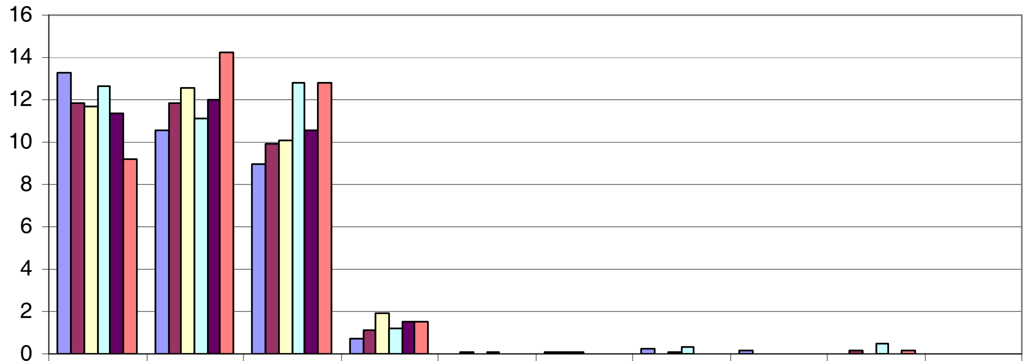
This error had not been corrected by the time this report was finalised. Thus, we only report age-specific death rates from conditions arising in the perinatal period for 1997-2002.

Figures 102 and 103 show age-specific death rates from perinatal causes by sex 1997-2002. The rates approach zero per 100,000 for people over age 35, although they are roughly constant in the 15-34 age range.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	13.2	8.6	9.9	1.1	0.0	0.0	0.0	0.1	0.0	0.0
1998	13.1	10.6	7.9	2.1	0.1	0.4	0.0	0.6	0.2	0.4
1999	14.7	10.5	9.8	1.9	0.0	0.1	0.1	0.0	0.2	0.0
2000	14.4	11.2	9.4	1.2	0.1	0.3	0.1	0.0	0.0	0.0
2001	11.8	11.6	10.1	1.9	0.0	0.0	0.0	0.0	0.0	0.0
2002	11.2	11.5	10.5	1.7	0.1	0.2	0.0	0.1	0.2	0.2

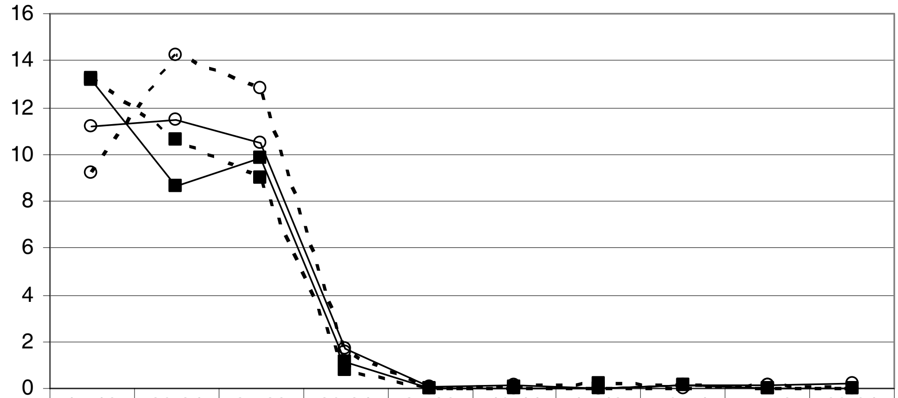
Figure 102. Male death rates by age per 100,000 from conditions originating in the perinatal period: 1997-2002



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	13.3	10.6	9.0	0.8	0.0	0.1	0.2	0.1	0.0	0.0
1998	11.9	11.9	10.0	1.1	0.1	0.1	0.0	0.0	0.2	0.0
1999	11.7	12.6	10.1	1.9	0.0	0.1	0.1	0.0	0.0	0.0
2000	12.7	11.1	12.8	1.2	0.1	0.0	0.3	0.0	0.4	0.0
2001	11.3	12.0	10.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0
2002	9.2	14.2	12.8	1.5	0.0	0.0	0.0	0.0	0.1	0.0

Figure 103. Female death rates by age per 100,000 from conditions originating in the perinatal period: 1997-2002

Figure 104 shows age-specific death rates from perinatal causes by sex in 1997 and in 2002. Below age 25, the rates fluctuated over time.

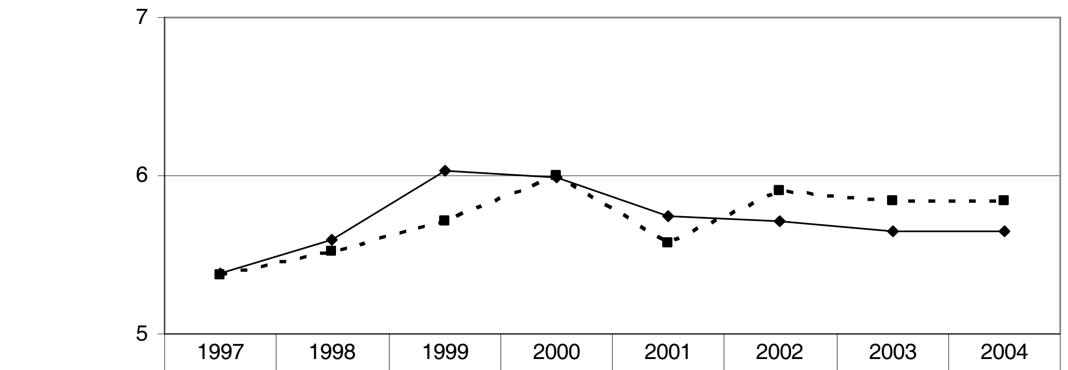


	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male 1997	13.2	8.6	9.9	1.1	0.0	0.0	0.0	0.1	0.0	0.0
Male 2002	11.2	11.5	10.5	1.7	0.1	0.2	0.0	0.1	0.2	0.2
Female 1997	13.3	10.6	9.0	0.8	0.0	0.1	0.2	0.1	0.0	0.0
Female 2002	9.2	14.2	12.8	1.5	0.0	0.0	0.0	0.0	0.1	0.0

Figure 104. Death rates by age and sex per 100,000 from conditions originating in the perinatal period: 1997 and 2002

We estimate age-standardised death rates by sex from conditions arising in the perinatal period using the age distribution by sex of deaths from this cause reported in 2002.[11] Figure 105 shows the estimated age-standardised death rates from perinatal causes by sex 1997-2004. Generally the rates increased from 1997 to 1999 or 2000 and then declined to 2004. There was no discernable trend in this cause.

[11] In 2002, deaths from conditions arising in the perinatal period to those age 15-64 had the following distribution for males: 15-19: 33.4%; 20-24: 33.7%; 25-29: 28.5%; 30-34: 3.8%; 35-39: 0.1%; 40-44: 0.1%; 45-49: 0.0%; 50-54: 0.1%; 55-59: 0.1%; 60-64: 0.1%. For females, the distribution was as follows: 15-19: 27.0%; 20-24: 36.8%; 25-29: 32.9%; 30-34: 3.1%; 35-39: 0.0%; 40-44: 0.0%; 45-49: 0.0%; 50-54: 0.0%; 55-59: 0.0%; 60-64: 0.1%. In 2003 and 2004, for males 2.5% of all deaths from conditions originating in the perinatal period were attributed to those age 15-64, and for females 2.9% of all deaths from conditions arising in the perinatal period were attributed to those age 15-64. Within the 15-64 age group for both sexes, these deaths were distributed as they were in 2002. After this, calculation of age-standardised death rates proceeded as in other cases. These calculations for 2003 and 2004 were only done for the purpose of calculating age-standardised death rates.

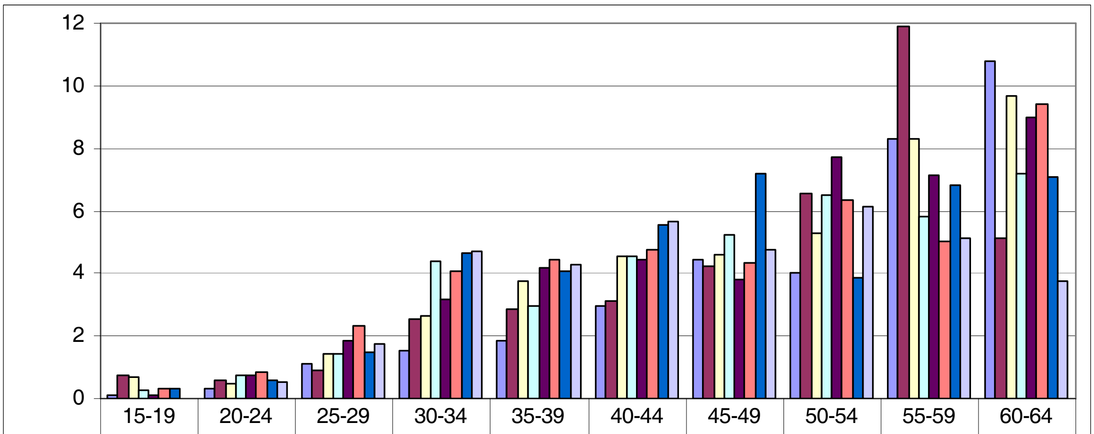


	1997	1998	1999	2000	2001	2002	2003	2004
Male	5.4	5.6	6.0	6.0	5.7	5.7	5.6	5.6
Female	5.4	5.5	5.7	6.0	5.6	5.9	5.8	5.8

Figure 105. Age-standardised death rates per 100,000 from conditions originating in the perinatal period by sex, age 15-64: 1997-2004

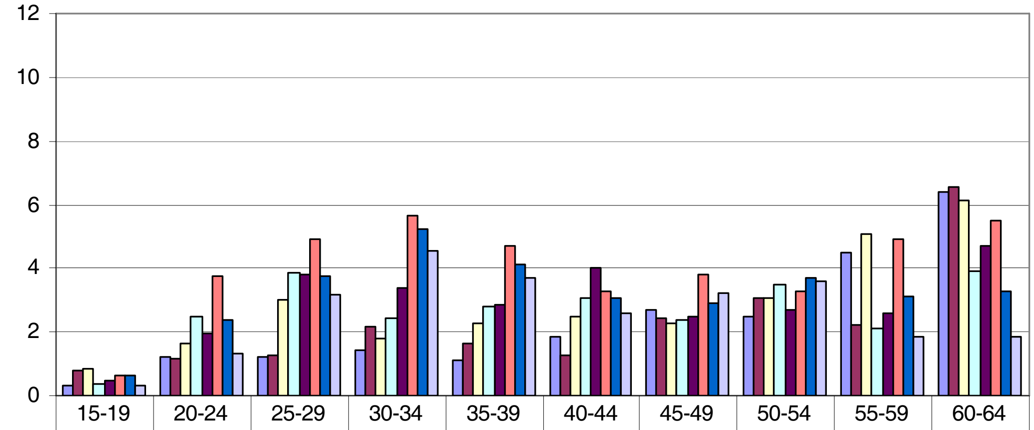
Nutritional deficiencies

One hopes that, as a country develops, deaths from nutritional deficiencies become increasingly rare. Nutritional deficiencies include specific deficiencies, such as of iodine or Vitamin A, as well as general malnutrition. These refer to ICD-10 codes D50-D53, E40-E46, E00-E02 and E50. Figures 106 and 107 show age-specific death rates from nutritional deficiencies by sex 1997-2004.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	0.1	0.3	1.1	1.5	1.8	3.0	4.5	4.0	8.3	10.8
1998	0.8	0.6	0.9	2.5	2.9	3.1	4.2	6.5	11.9	5.1
1999	0.7	0.5	1.4	2.6	3.7	4.5	4.6	5.3	8.3	9.7
2000	0.3	0.7	1.4	4.4	3.0	4.5	5.2	6.5	5.8	7.2
2001	0.1	0.7	1.8	3.2	4.2	4.4	3.8	7.7	7.1	9.0
2002	0.3	0.9	2.3	4.1	4.4	4.7	4.3	6.3	5.0	9.4
2003	0.3	0.6	1.5	4.7	4.1	5.6	7.2	3.9	6.8	7.1
2004	0.0	0.5	1.8	4.7	4.3	5.6	4.8	6.1	5.1	3.8

Figure 106. Male death rates by age per 100,000 from nutritional deficiencies: 1997-2004

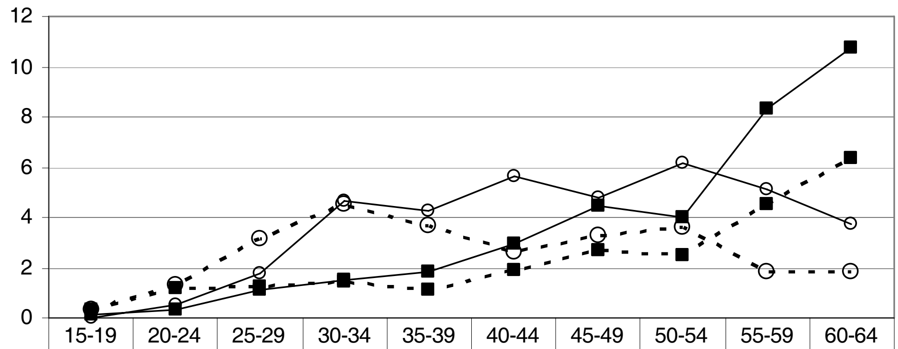


	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	0.3	1.2	1.2	1.4	1.1	1.9	2.7	2.5	4.5	6.4
1998	0.8	1.2	1.3	2.2	1.6	1.3	2.4	3.0	2.2	6.5
1999	0.8	1.7	3.0	1.8	2.3	2.5	2.3	3.1	5.1	6.2
2000	0.4	2.5	3.9	2.5	2.8	3.1	2.4	3.5	2.1	3.9
2001	0.5	1.9	3.8	3.4	2.8	4.0	2.5	2.7	2.6	4.7
2002	0.6	3.8	4.9	5.7	4.7	3.3	3.8	3.3	4.9	5.5
2003	0.6	2.4	3.8	5.2	4.1	3.1	2.9	3.7	3.1	3.3
2004	0.3	1.3	3.2	4.5	3.7	2.6	3.2	3.6	1.9	1.9

Figure 107. Female death rates by age per 100,000 from nutritional deficiencies: 1997-2004

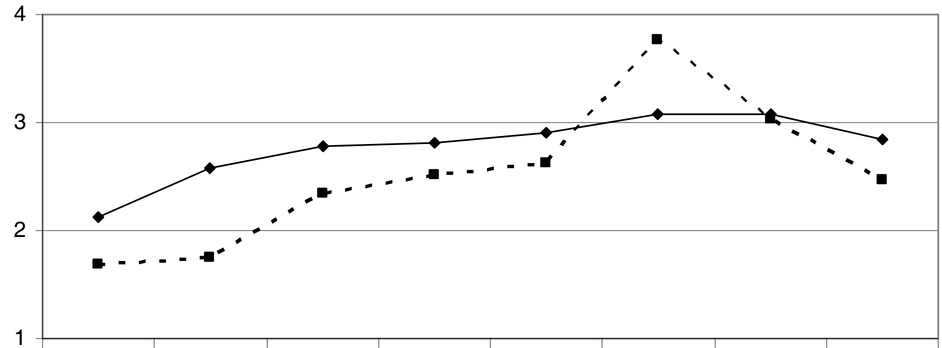
For both males in their late twenties and females in their twenties through forties, the rates rose to a peak in 2002 before declining in 2003 and 2004. Based on data on malnutrition deaths through 2001, Groenewald *et al.* (2005) identified malnutrition as a hidden cause of HIV deaths. However, the recent pattern of death rates seems to make this less likely.

Figure 108 shows age-specific death rates from nutritional deficiencies by sex in 1997 and in 2004. The pattern of change over time seems somewhat erratic. Perhaps most striking is the decline in male death rates above age 55.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male 1997	0.1	0.3	1.1	1.5	1.8	3.0	4.5	4.0	8.3	10.8
Male 2004	0.0	0.5	1.8	4.7	4.3	5.6	4.8	6.1	5.1	3.8
Female 1997	0.3	1.2	1.2	1.4	1.1	1.9	2.7	2.5	4.5	6.4
Female 2004	0.3	1.3	3.2	4.5	3.7	2.6	3.2	3.6	1.9	1.9

Figure 108. Death rates by age and sex per 100,000 from nutritional deficiencies: 1997 and 2002



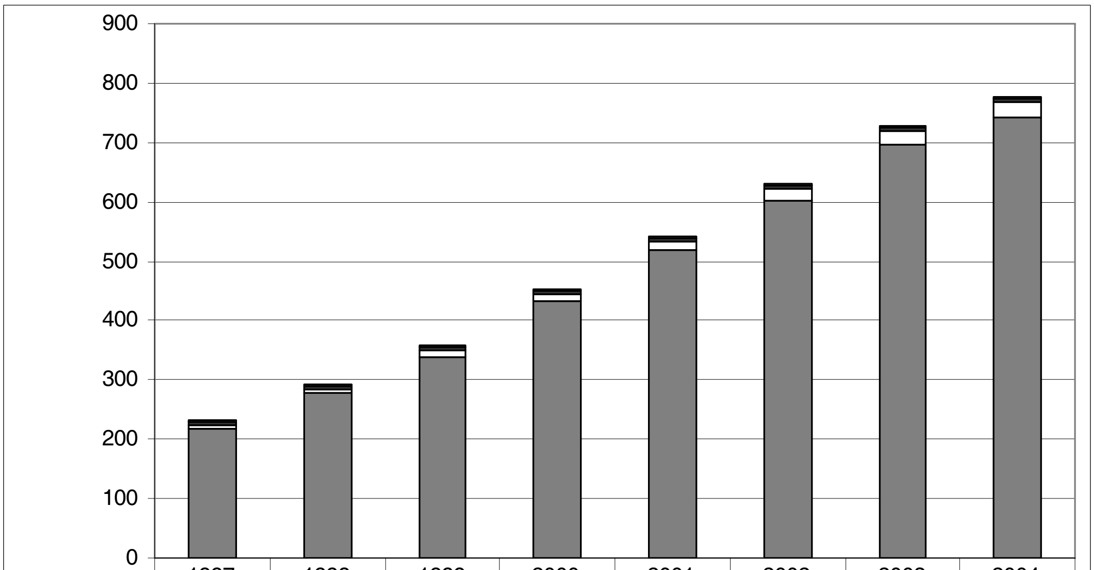
	1997	1998	1999	2000	2001	2002	2003	2004
Male	2.1	2.6	2.8	2.8	2.9	3.1	3.1	2.8
Female	1.7	1.8	2.3	2.5	2.6	3.8	3.0	2.5

Figure 109. Age-standardised death rates per 100,000 from nutritional deficiencies by sex, age 15-64: 1997-2004

Figure 109 shows age-standardised death rates from nutritional deficiencies by sex 1997-2004. Aside from a peak for females in 2002, there does not seem to be a strong trend. Deaths from each of the main causes in the nutritional deficiencies category increased from 1997 to 2002 and then declined by 2004. The major contributors to deaths from nutritional deficiencies were D53 – other nutritional anaemias (from 47 deaths in 1997 to 122 deaths in 2002 to 51 deaths in 2004), E41 – nutritional marasmus (70 deaths in 1997 to 101 deaths in 2002 to 75 deaths in 2004), and E46 – unspecified protein energy malnutrition (273 deaths in 1997 to 559 deaths in 2002 to 488 deaths in 2004). Perhaps the increase from 1997 to 2002 and the decline from 2002 to 2004 represent actual changes. In 2002, the age-adjusted rate for females exceeded that for males, although the female rate fell below the male rate by 2004. A variety of evidence shows that the degree of income inequality in South Africa has risen (Leibbrandt, Levinsohn, and McCrary, 2005; Lokshin and Popkin, 1999; Statistics South Africa, 2002), which could contribute to nutritional deficiencies.

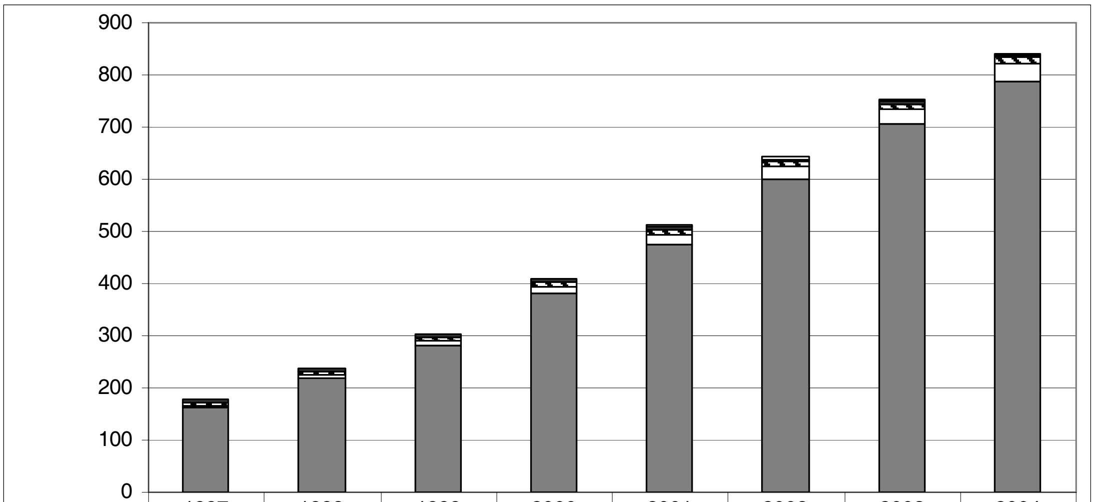
The role of the five subcategories of communicable and related diseases

Figures 110 and 111 show the values of all the subcategories of communicable and related causes of death considered: infectious diseases, parasitic diseases, maternal conditions (for females), conditions originating in the perinatal period, and nutritional deficiencies. Although infectious diseases are so dominant that the other categories are difficult to see in the figures, the data tables are interesting.



	1997	1998	1999	2000	2001	2002	2003	2004
Nutritional	2	3	3	3	3	3	3	3
Perinatal	5	6	6	6	6	6	6	6
Parasitic	4	6	10	13	17	20	22	26
Infectious	219	278	339	432	518	602	697	742

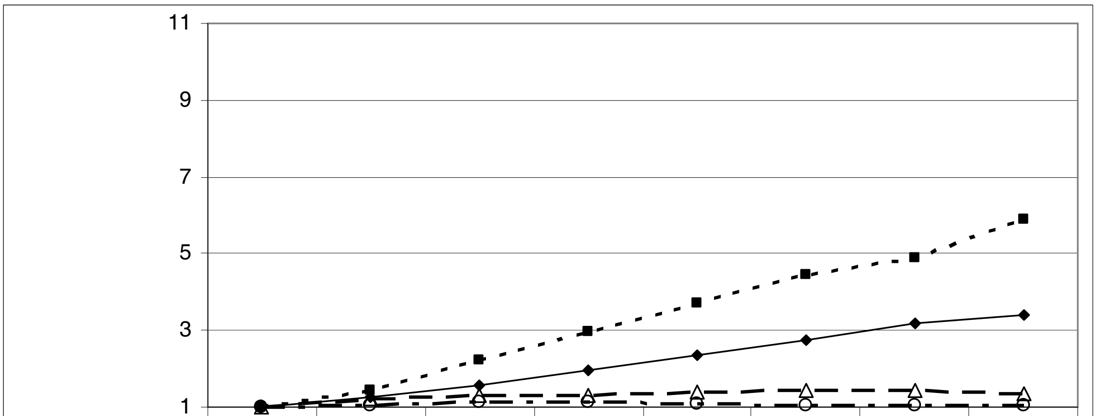
Figure 110. Components of communicable and related diseases in the male age-standardised death rate, age 15-64: 1997-2004



	1997	1998	1999	2000	2001	2002	2003	2004
Nutritional	2	2	2	3	3	4	3	2
Perinatal	5	6	6	6	6	6	6	6
Maternal	6	6	7	8	9	8	9	12
Parasitic	4	5	9	13	19	25	29	34
Infectious	162	220	281	382	476	600	706	786

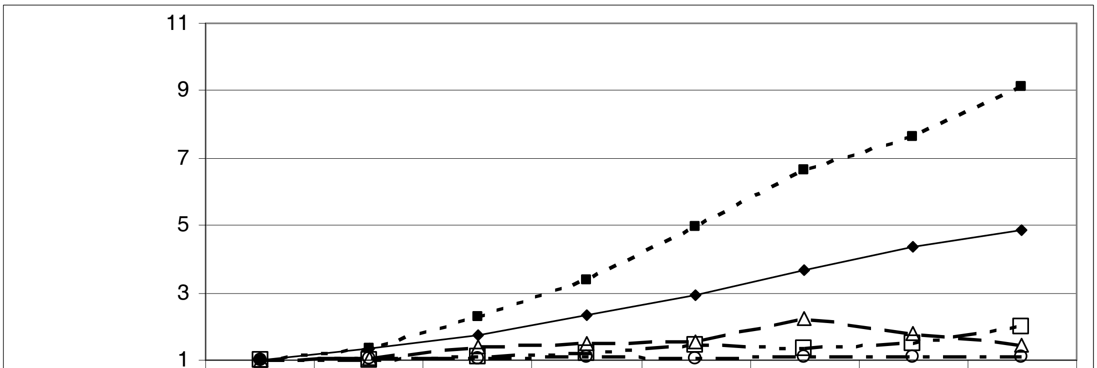
Figure 111. Components of communicable and related diseases in the female age-standardised death rate, age 15-64: 1997-2004

Figures 112 and 113 show the values of the age-standardised death rates by sex relative to the value for 1997 for the subcategories of communicable and related causes of death.



	1997	1998	1999	2000	2001	2002	2003	2004
Infectious	1.00	1.27	1.55	1.97	2.36	2.75	3.18	3.39
Parasitic	1.00	1.42	2.22	2.95	3.72	4.47	4.90	5.89
Perinatal	1.00	1.04	1.12	1.11	1.07	1.06	1.05	1.05
Nutritional	1.00	1.22	1.31	1.32	1.37	1.45	1.45	1.34

Figure 112. Male death rates from components of communicable and related diseases relative to value in 1997 (1997 Value=1.00): 1997-2004



	1997	1998	1999	2000	2001	2002	2003	2004
Infectious	1.00	1.36	1.73	2.35	2.93	3.69	4.35	4.84
Parasitic	1.00	1.35	2.27	3.36	4.97	6.65	7.64	9.12
Maternal	1.00	0.99	1.08	1.20	1.43	1.33	1.50	1.99
Perinatal	1.00	1.03	1.06	1.12	1.04	1.10	1.09	1.09
Nutritional	1.00	1.04	1.38	1.49	1.56	2.23	1.80	1.47

Figure 113. Female death rates from components of communicable and related diseases relative to value in 1997 (1997 Value=1.00): 1997-2004

The large proportionate increase in parasitic diseases in Figures 112 and 113 is primarily due to the increased death rates from parasitic opportunistic infections. The increase in the death rate from maternal conditions is a cause for concern. Although the death rate from nutritional deficiencies increased by 34% from 1997 to 2004 for males and 47% in that time period for females, it reached its peak for both sexes in 2002. Perhaps death rates from nutritional deficiencies will continue to decline.

Non-communicable diseases

In this section, we look at subcategories within non-communicable diseases. Some categories, such as stroke, cancer and diabetes, are diseases that have received a large amount of interest. Other subcategories of non-communicable diseases are examined because we suspect that a substantial portion of deaths assigned to those subcategories are in fact due to HIV.

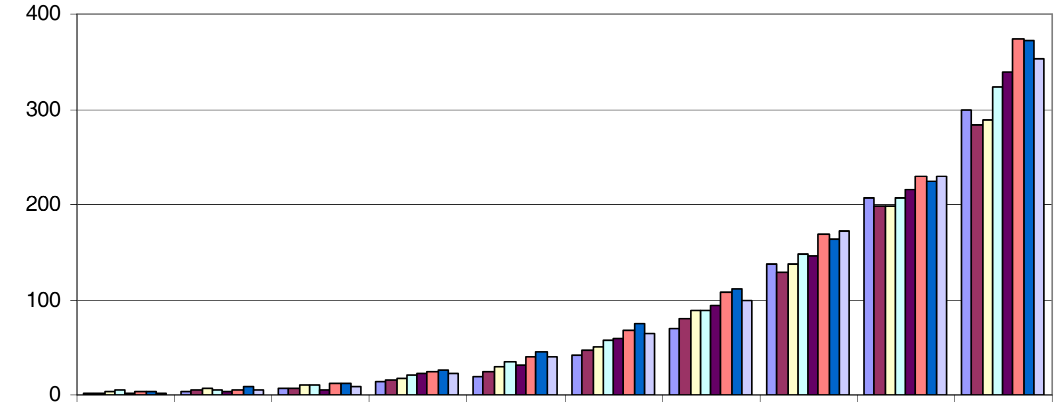
Stroke

Stroke is also called cerebro-vascular disease. It is thought to be the second greatest cause of death in the world (Murray and Lopez, 1997). There has been concern about possible increases in stroke and coronary heart disease in many developing countries, partly because of health behaviours imported from developed countries, such as smoking, and hypertension resulting from many factors, including changes in diet (Ebrahim and Smith, 2001). There is some evidence that stroke death rates in several developing countries are higher than in developed countries (Walker *et al.*, 2000).

Specifically, there has been concern in South Africa about the level of stroke deaths (Kahn and Tollman, 1999), as well as with whether stroke mortality has been increasing. There also has been concern as to whether being HIV-positive increases the chance of having a stroke. Studying young Africans in KwaZulu-Natal, Hoffman *et al.* (2000) found that although those who were HIV-positive had a higher chance of having one particular type of stroke (cryptogenic stroke), the overall chance of having a stroke was no higher for those who were HIV-positive than for those who were not HIV-positive.

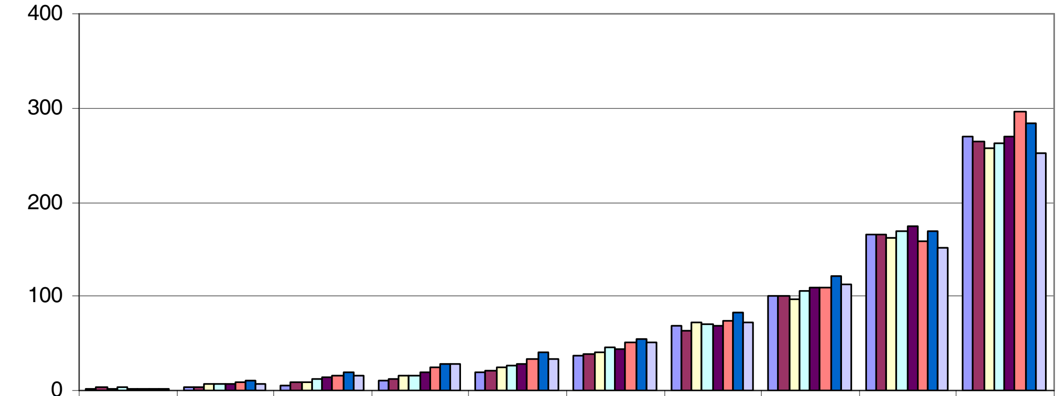
Stroke comes under the category “circulatory causes of death”. In the next section we look at all circulatory causes of death other than stroke. Strokes can be minor occurrences, or they can lead to paralysis. They can also lead to death. Stroke is covered by ICD-10 codes I60-I69.

Figures 114 and 115 show age-specific death rates by sex from stroke 1997-2004. Stroke death rates have increased for males over time in every age group above 20. They have increased for females in every age group 20-54, but they have decreased for females age 55-64.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	2.6	3.4	6.5	13.8	19.9	40.9	69.5	136.6	206.7	299.0
1998	2.5	4.7	7.8	15.0	24.5	46.1	79.4	129.1	197.5	283.6
1999	3.4	6.1	9.9	17.9	29.4	51.1	88.3	136.8	198.0	288.5
2000	4.4	5.6	9.9	20.9	34.0	57.6	87.9	147.9	207.2	323.4
2001	2.3	3.9	5.6	21.8	31.5	59.8	93.5	145.9	215.2	339.5
2002	3.6	6.0	12.3	24.5	40.8	67.5	107.1	168.3	229.0	374.8
2003	4.0	8.6	11.6	26.9	46.0	74.6	112.0	164.0	225.2	371.4
2004	2.3	4.6	9.5	22.0	39.4	65.1	99.9	171.9	229.0	353.1

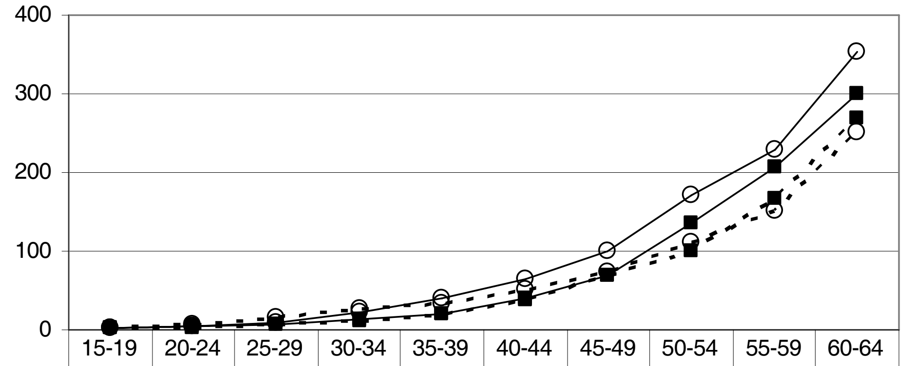
Figure 114. Male death rates by age per 100,000 from stroke: 1997-2004



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	1.3	2.9	5.6	10.8	19.4	37.6	68.6	100.9	165.9	269.0
1998	3.5	4.2	8.4	12.6	20.7	38.6	64.0	101.3	165.5	264.0
1999	2.0	7.7	9.2	15.7	24.8	40.5	72.4	96.3	161.5	256.4
2000	3.0	6.8	11.5	16.4	27.1	46.2	69.7	105.1	168.7	262.6
2001	2.3	6.9	14.1	19.2	27.5	44.7	68.8	109.5	173.6	270.4
2002	2.2	9.3	15.5	24.0	33.3	51.8	73.2	109.0	158.5	295.8
2003	2.0	10.0	18.9	28.3	40.1	54.1	82.0	122.0	169.4	284.5
2004	2.1	7.6	16.4	27.7	33.2	51.2	72.3	112.2	151.6	252.1

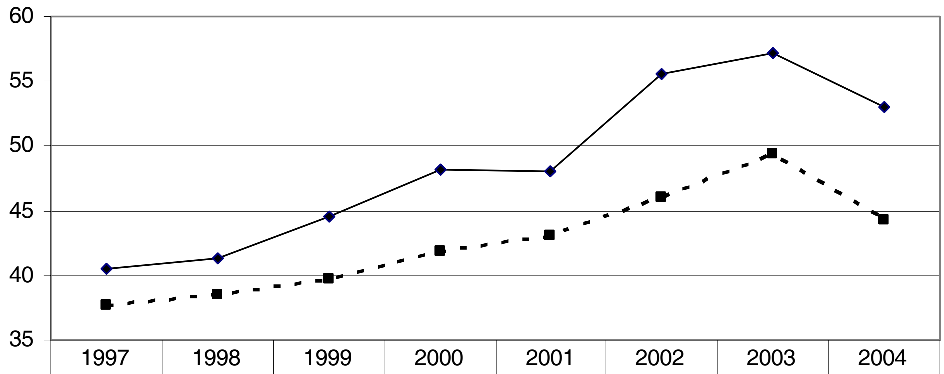
Figure 115. Female death rates by age per 100,000 from stroke: 1997-2004

Figure 116 shows age-specific death rates from stroke by sex in 1997 and in 2004. An exponential increase in the stroke death rate with age is seen for both sexes. In 1997, the male death rate at each age was equal to or higher than the female death rate. Above age 50 the male rate was much higher than the female rate. In 2004, at age 20-34 the female rate was somewhat higher than the male rate, but above age 35 the male rate was higher than the female rate, with an increasing gap with age.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male 1997	2.6	3.4	6.5	13.8	19.9	40.9	69.5	136.6	206.7	299.0
Male 2004	2.3	4.6	9.5	22.0	39.4	65.1	99.9	171.9	229.0	353.1
Female 1997	1.3	2.9	5.6	10.8	19.4	37.6	68.6	100.9	165.9	269.0
Female 2004	2.1	7.6	16.4	27.7	33.2	51.2	72.3	112.2	151.6	252.1

Figure 116. Death rates by age and sex per 100,000 from stroke: 1997 and 2004



	1997	1998	1999	2000	2001	2002	2003	2004
Male	40.5	41.3	44.6	48.2	48.1	55.5	57.2	53.0
Female	37.6	38.5	39.7	41.8	43.1	46.0	49.4	44.2

Figure 117. Age-standardised stroke death rates by sex, age 15-64: 1997-2004

Figure 117 shows age-standardised death rates from stroke by sex 1997-2004. The male rate is always higher than the female rate, and the gap has increased over time. For both sexes, the rate increased until 2003 and then declined somewhat in 2004.

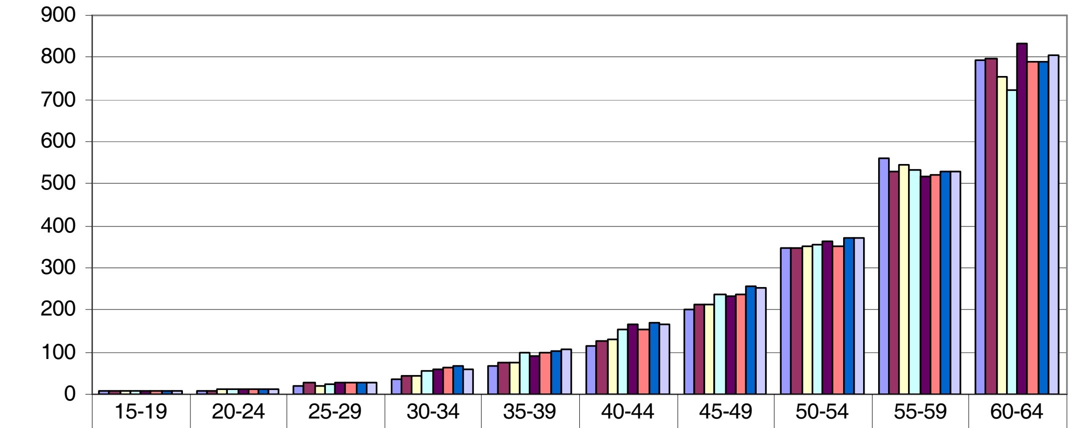
Circulatory diseases other than stroke

In the world as a whole ischaemic heart disease is the leading cause of death for adults. The World Health Organization has advised that a number of circulatory codes are “garbage codes” into which some deaths, such as those from ischaemic heart disease, are often misclassified. This is thought to be a particular problem in some developed countries, such as Japan, for which age-standardised death rates from ischaemic heart disease increased by 26% after correction (Lozano *et al.*, 2001: 11).

Reallocation schemes have been proposed for these “garbage codes” (Bradshaw *et al.,* 2003: 19; Lozano *et al.*, 2001). The Lozano *et al.* scheme is based on coefficients from a regression model, the validity of which is not known for South Africa. At this point, we feel reasonably confident about the classification into death from stroke and death from other circulatory diseases, but we do not feel confident subdividing circulatory causes of death beyond this.

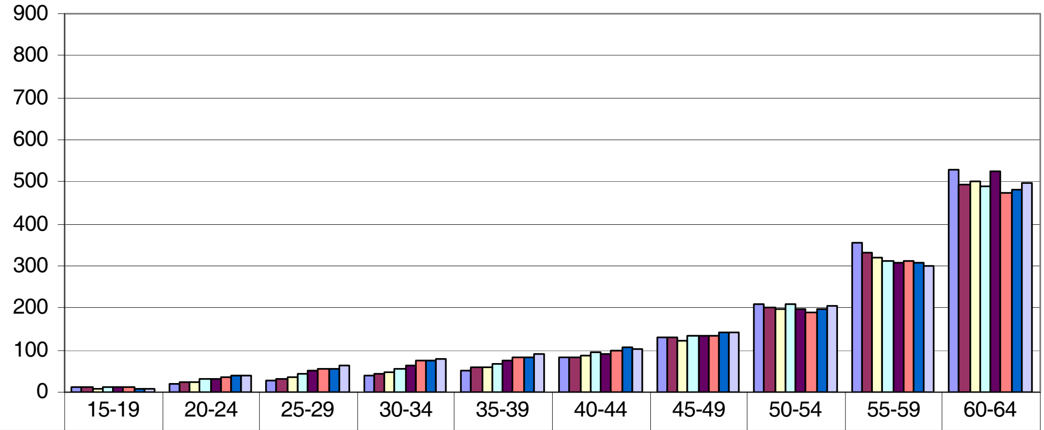
Circulatory diseases other than stroke include ischaemic heart disease, rheumatic heart disease, hypertensive heart disease, and inflammatory heart diseases, as well as other diseases. They are covered by the ICD-10 codes I01-I52, and I70-I99.

Figures 118 and 119 show age-specific death rates from circulatory diseases other than stroke by sex. The rates have increased for each age group of males 20-54. At age 55-59, the rate has declined slightly, and it has remained almost constant at age 60-64. For females, the rate has increased in every age group 20-49, but above age 50, it has declined. These declines at older ages for both sexes are a very encouraging sign.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	7.0	8.7	20.6	37.2	66.1	114.5	200.4	346.4	561.9	794.5
1998	7.8	9.7	26.5	44.8	76.8	126.9	213.6	348.9	528.5	798.2
1999	7.1	11.3	19.1	41.5	75.6	129.2	212.0	350.1	546.0	755.2
2000	6.7	11.5	24.4	55.4	97.9	152.3	237.5	354.5	531.9	722.9
2001	7.2	12.4	28.8	57.5	91.7	166.3	234.2	363.5	517.3	833.9
2002	6.6	10.7	27.4	61.8	97.1	152.6	238.4	352.1	522.9	789.4
2003	6.2	12.3	26.1	67.0	102.8	167.8	255.5	370.1	530.9	788.4
2004	7.3	13.0	29.0	61.0	105.0	167.6	252.8	372.5	530.6	803.8

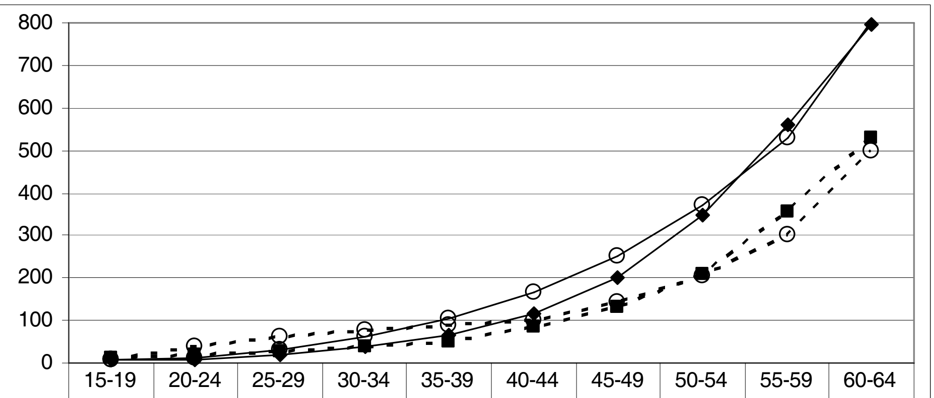
Figure 118. Male death rates by age per 100,000 from all circulatory causes except stroke: 1997-2004



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	10.6	18.4	27.7	38.7	51.9	84.3	132.2	209.4	357.2	528.0
1998	10.9	21.9	33.3	42.9	59.2	83.1	129.4	199.8	332.9	492.9
1999	9.8	22.2	35.2	47.5	58.4	86.1	120.4	198.3	320.6	500.5
2000	9.9	30.7	43.8	56.4	65.5	94.1	134.6	207.9	313.6	488.2
2001	10.1	33.5	51.5	64.0	73.3	91.9	132.7	198.7	307.0	524.7
2002	10.0	36.2	54.2	73.6	82.8	99.7	134.3	187.8	311.3	475.0
2003	8.9	37.6	55.5	75.7	82.9	105.9	141.9	195.6	306.2	479.7
2004	7.6	38.2	63.2	78.0	89.3	102.2	141.9	205.7	299.7	497.0

Figure 119. Female death rates by age per 100,000 from all circulatory causes except stroke: 1997-2004

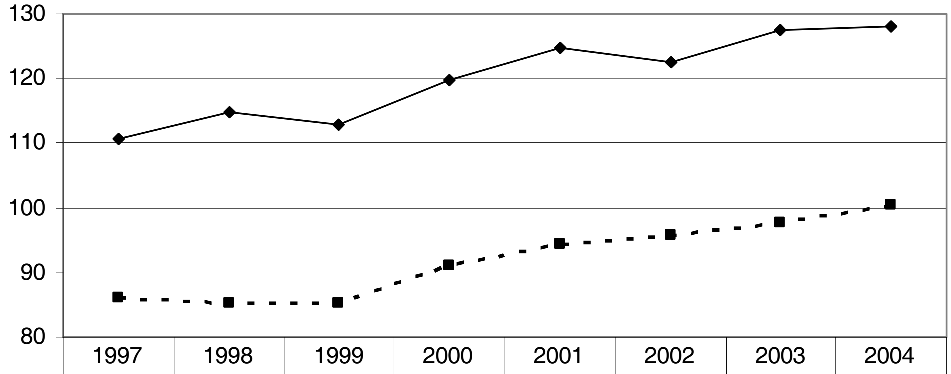
Figure 120 shows age-specific death rates from circulatory diseases other than stroke by sex in 1997 and in 2004. For both sexes in both 1997 and 2004, the rate increases with each successively older age. As for stroke, there is an almost exponential increase with age for both sexes at each date.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male 1997	7.0	8.7	20.6	37.2	66.1	114.5	200.4	346.4	561.9	794.5
Male 2004	7.3	13.0	29.0	61.0	105.0	167.6	252.8	372.5	530.6	803.8
Female 1997	10.6	18.4	27.7	38.7	51.9	84.3	132.2	209.4	357.2	528.0
Female 2004	7.6	38.2	63.2	78.0	89.3	102.2	141.9	205.7	299.7	497.0

Figure 120. Death rates by age and sex per 100,000 from all circulatory causes except stroke: 1997 and 2004

Figure 121 shows age-standardised death rates from other circulatory diseases by sex 1997-2004. The male rate is always higher than the female rate, and the gap over time is almost constant. For both sexes there has been a small increase in the rate over time.

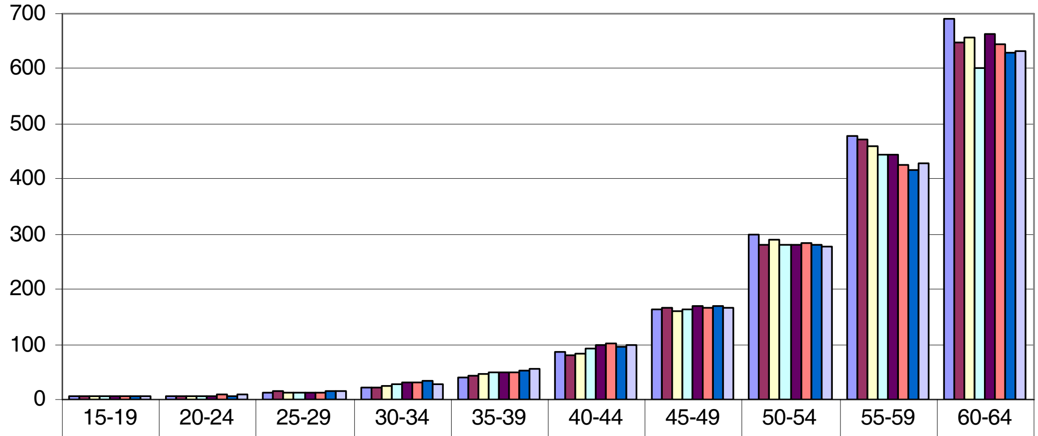


	1997	1998	1999	2000	2001	2002	2003	2004
Male	111	115	113	120	125	122	128	128
Female	86	85	85	91	94	96	98	100

Figure 121. Age-standardised death rates per 100,000 from all circulatory causes except stroke by sex, age 15-64: 1997-2004

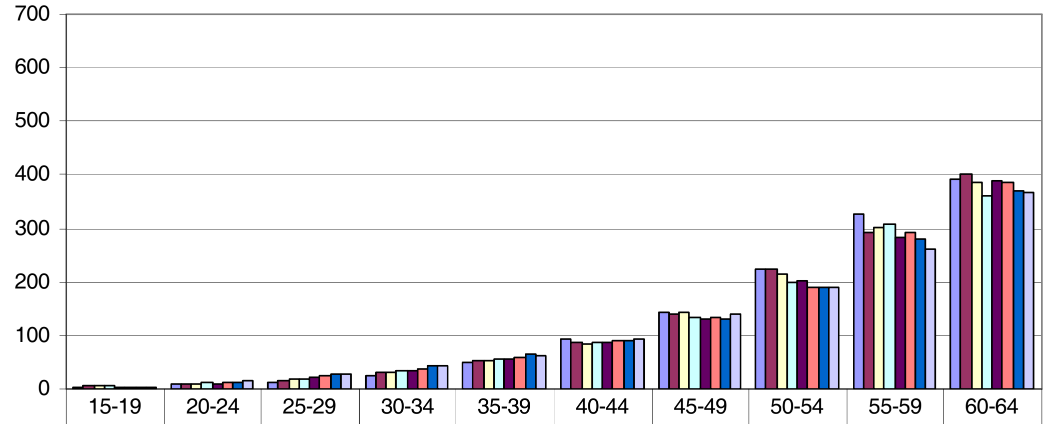
Cancer

Cancer is one of the most feared diseases in the world. Although many kinds of cancer are increasingly curable, cancer is often a fatal disease. Cancer is covered by the ICD-10 codes C00-D48.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	5.5	6.9	11.0	22.5	40.4	84.9	162.3	300.0	478.1	691.3
1998	7.1	6.6	13.9	23.1	42.3	79.0	166.0	281.7	472.0	647.5
1999	5.4	6.3	11.0	24.0	45.7	82.9	159.6	289.4	459.9	656.7
2000	6.0	7.7	13.8	29.0	50.0	92.5	162.9	279.6	444.8	600.8
2001	4.7	6.2	12.6	29.6	50.2	98.8	170.8	279.3	443.6	661.7
2002	5.4	7.8	12.7	31.9	49.9	101.7	167.9	283.2	426.8	643.4
2003	4.9	7.5	14.0	33.3	50.9	95.6	169.6	281.7	417.1	628.6
2004	6.3	8.4	16.3	28.4	54.3	99.5	167.6	278.0	430.1	632.9

Figure 122. Male Death Rates by Age per 100,000 from Cancer: 1997-2004

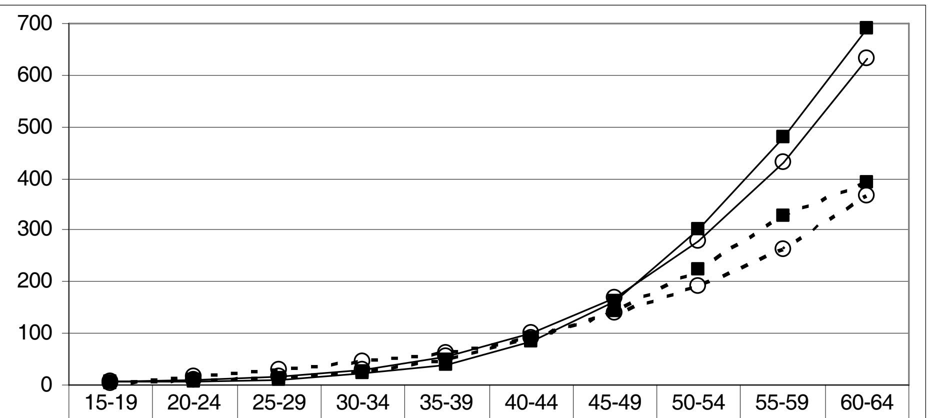


	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	4.3	8.7	13.2	25.5	49.4	91.8	143.8	224.3	326.8	393.1
1998	5.0	8.4	14.1	30.1	51.6	85.8	140.4	222.9	292.4	401.9
1999	5.2	10.4	17.7	30.9	54.4	84.6	142.7	215.5	301.9	387.0
2000	5.0	12.4	18.8	33.9	54.5	87.2	132.4	197.9	308.8	360.0
2001	4.5	10.8	22.6	35.1	55.9	87.4	129.6	201.5	283.3	387.5
2002	3.9	13.4	23.5	38.1	59.4	90.7	134.1	188.8	293.3	385.5
2003	3.7	13.7	26.8	42.4	64.4	91.3	132.0	189.2	279.3	370.6
2004	4.6	16.3	27.9	44.9	61.7	91.9	139.4	190.3	262.0	367.7

Figure 123. Female death rates by age per 100,000 from cancer: 1997-2004

Figures 122 and 123 show age-specific death rates from cancer 1997-2004. For males, below age 50 there were small increases in death rates over time, while above age 50 there were declines in death rates over time. For females, below age 40 there were small increases over time, while above age 45 there were decreases over time.

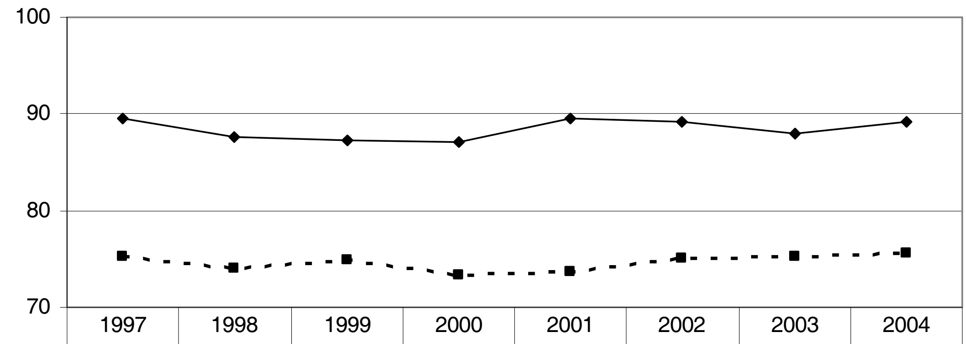
Figure 124 shows age-specific death rates from cancer by sex in 1997 and in 2004. For both sexes at each date, rates increase with age. Below age 45 the rates are about equal for the two sexes, or females have slightly higher rates; above age 50 males have much higher rates than females



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male 1997	5.5	6.9	11.0	22.5	40.4	84.9	162.3	300.0	478.1	691.3
Male 2004	6.3	8.4	16.3	28.4	54.3	99.5	167.6	278.0	430.1	632.9
Female 1997	4.3	8.7	13.2	25.5	49.4	91.8	143.8	224.3	326.8	393.1
Female 2004	4.6	16.3	27.9	44.9	61.7	91.9	139.4	190.3	262.0	367.7

Figure 124. Death rates by age and sex per 100,000 from cancer: 1997 and 2004

Figure 125 shows age-standardised death rates from cancer by sex 1997-2004. Males always have a higher rate than females, and the gap is almost constant. Over time the age-standardised rate for both sexes is virtually unchanged. In an era of concern with air pollution, smoking and other environmental hazards, it is perhaps encouraging that the age-standardised death rates from cancer are unchanged.



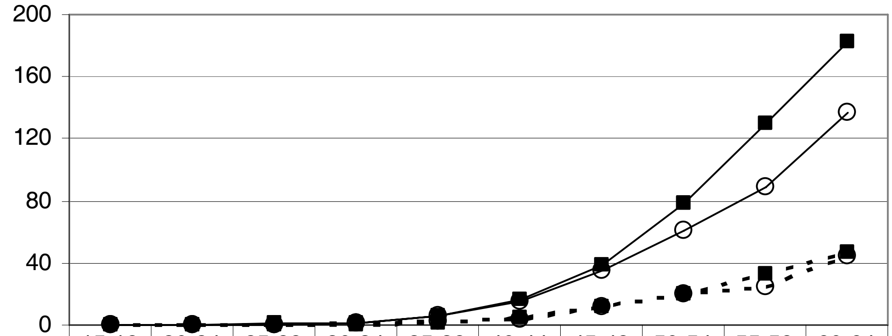
	1997	1998	1999	2000	2001	2002	2003	2004
Male	90	88	87	87	90	89	88	89
Female	75	74	75	73	74	75	75	76

Figure 125. Age-standardised death rates per 100,000 from cancer by sex, age 15-64: 1997-2004

Even though there is no noticeable change in all kinds of cancer considered together, it is worthwhile to examine whether death rates from types of cancer of particular interest have changed over time in South Africa. There has been interest in whether being HIV-positive is related to particular types of cancer. Sitas *et al.* (2000) found evidence that HIV-positive status was related to Kaposi's sarcoma, non-Hodgkin lymphoma, vulvar cancer, and cervical cancer. They did not find evidence that being HIV-positive was related to any other major form of cancer, including Hodgkin disease, multiple myelonoma and lung cancer.

We first look at lung and related cancers and then at cancer related to the reproductive system for both sexes – cancer of the breast, cervix and other parts of the female reproductive system, and cancer of the prostate, testis and other parts of the male reproductive system.

Figure 126 shows the age-specific death rates by sex from cancer of the lung, larynx and trachea (ICD-10 codes C33-C35) in 1997 and 2004. Besides the age-specific rates going down at the older ages, the age-standardised rates fell slightly – from 21 per 100,000 in 1997 to 16 per 100,000 in 2004 for males and from 6 per 100,000 in 1997 to 5 per 100,000 in 2004 for females. Even though there is reason to be concerned about the health and the mortality effects of smoking, the mortality effects as manifested in cancer of the lung, trachea or larynx do not seem to have become more serious in the recent past. After age 40, death rates for males rise rapidly, becoming more than three times as high as the female rate in 2004 – in 1997 the male rate above age 40 was more than four times as high as the female rate.

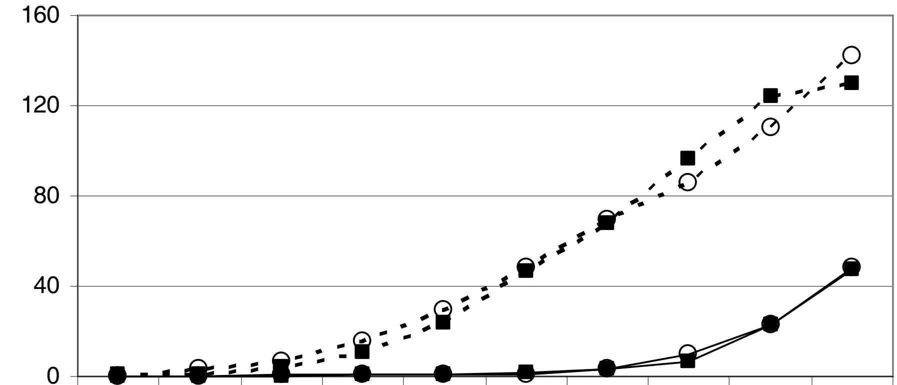


	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male 1997	0.0	0.2	0.6	1.7	6.1	16.1	38.4	78.3	130.2	182.4
Male 2004	0.2	0.2	0.5	1.1	5.4	15.6	34.7	61.1	89.2	137.4
Female 1997	0.3	0.2	0.1	0.4	1.5	4.5	11.8	20.0	32.8	47.3
Female 2004	0.0	0.4	0.6	1.4	2.1	3.8	11.1	19.5	25.0	43.9

Figure 126. Death rates by age and sex per 100,000 from cancer of the lung, trachea or larnyx: 1997 and 2004

Figure 127 shows the age-specific death rates by sex from cancer related to the reproductive system for both sexes – cancer of the breast, cervix and other parts of the female reproductive system (ICD-10 codes C50-C57) and cancer of the prostate, testis and other parts of the male reproductive system (ICD-10 codes C60-C63) in 1997 and 2004.

The rates for both sexes rise steadily with age. For females the increase is substantial after age 30, while for males, rates begin to rise rapidly after age 50. For neither sex was there much change in the rates between 1997 and 2004. Thus, despite the findings of Sitas *et al.* (2000), there has not been much change in the rates of cancer related to the female reproductive system. The age-standardised rate for females went from 28 per 100,000 in 1997 to 30 per 100,000 in 2004.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male 1997	0.2	0.3	0.2	0.4	0.6	1.5	3.4	6.6	22.7	47.7
Male 2004	0.1	0.3	0.5	0.6	1.1	1.2	2.9	9.8	22.6	48.2
Female 1997	0.4	1.0	4.4	10.3	24.0	46.5	67.9	96.5	124.1	130.2
Female 2004	0.1	3.1	6.3	15.3	29.0	48.4	69.2	85.3	110.5	142.1

Figure 127. Death rates by age and sex per 100,000 from cancer related to the reproductive system, such as breast or prostate: 1997 and 2004

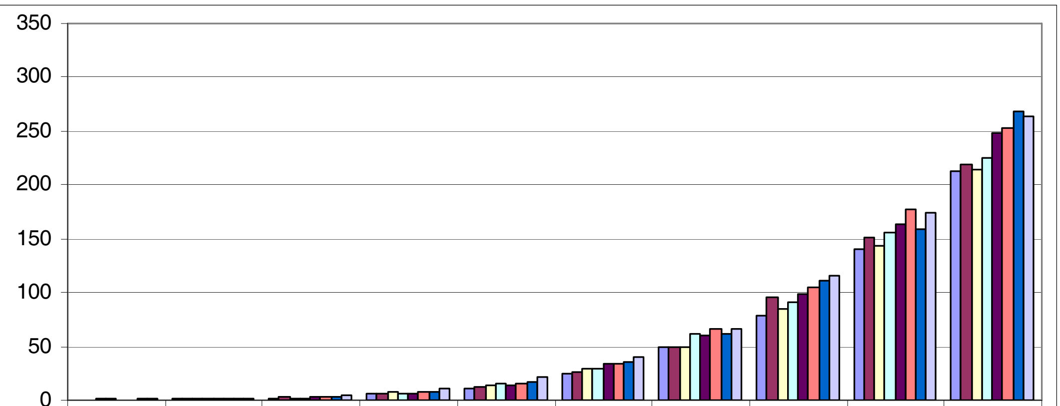
Diabetes and obesity

In the developed world and increasingly in the developing world, there is concern about the health effects of overweight and obesity. The onset of Type 2 diabetes is hastened by overweight among susceptible individuals. Some research suggests that diet and the overweight or obesity status of pregnant women could predispose their babies to obesity in later life (Yajnik, 2004). The South Africa Department of Health has had a National Programme for Control and Management of Type 2 Diabetes since 1998 (South Africa, Department of Health, 1998).

The 1998 South Africa Demographic and Health Survey found a substantial proportion of adults was overweight or obese (57% of women and 29% of men), but they also found that only 10% of men and 22% of women perceived themselves as overweight (Puoane, *et al.*, 2002: 1041-1044). It is difficult to convince people to change behaviours to address a health problem if they do not recognize that there is a health problem.

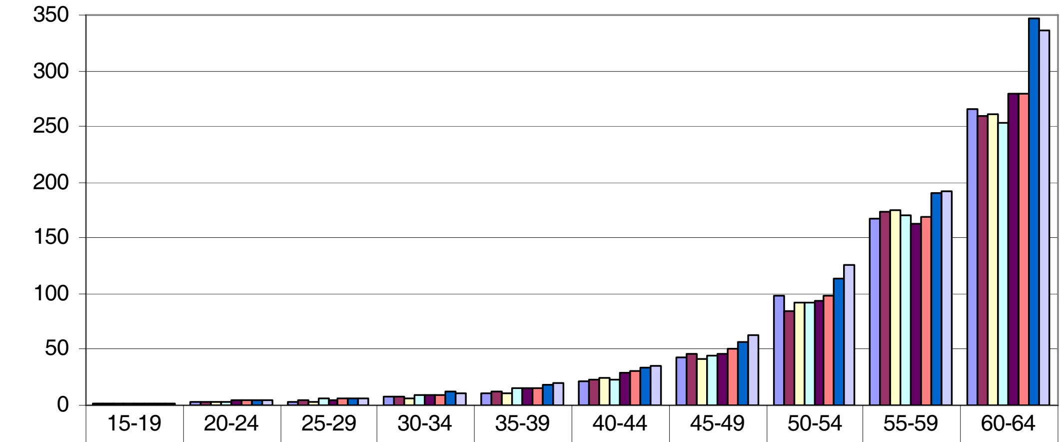
Diabetes has the potential to become a very serious problem in South Africa. It will be interesting to see the extent to which the findings of the 2004 South Africa Demographic and Health Survey regarding overweight and obesity mirror the trends seen in the mortality data.

Figures 128 and 129 show age-specific death rates from diabetes and obesity by sex 1997-2004. Diabetes and obesity as causes of death are covered by the ICD-10 codes E10-E14 and E66-E68. For males and females death rates from diabetes and obesity have increased over time in every age group above 25. In 2004, 98% of these deaths were registered as being due to diabetes.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	0.8	1.3	2.3	6.8	11.5	24.1	49.0	78.3	139.6	213.0
1998	0.5	1.1	3.1	6.2	12.3	26.6	49.4	95.9	150.7	219.4
1999	1.0	1.1	2.3	7.5	14.1	29.1	50.0	85.3	143.6	214.9
2000	1.1	1.5	2.2	6.6	15.0	29.7	62.0	91.5	155.5	225.6
2001	0.8	1.1	2.7	6.2	14.2	34.6	60.0	99.3	164.0	248.2
2002	0.6	1.2	3.0	8.1	15.4	34.6	66.7	104.6	178.0	253.1
2003	1.1	1.8	3.3	8.0	17.1	35.8	61.9	110.4	159.1	268.7
2004	0.8	1.8	4.0	10.1	21.7	39.5	66.3	115.7	173.9	263.1

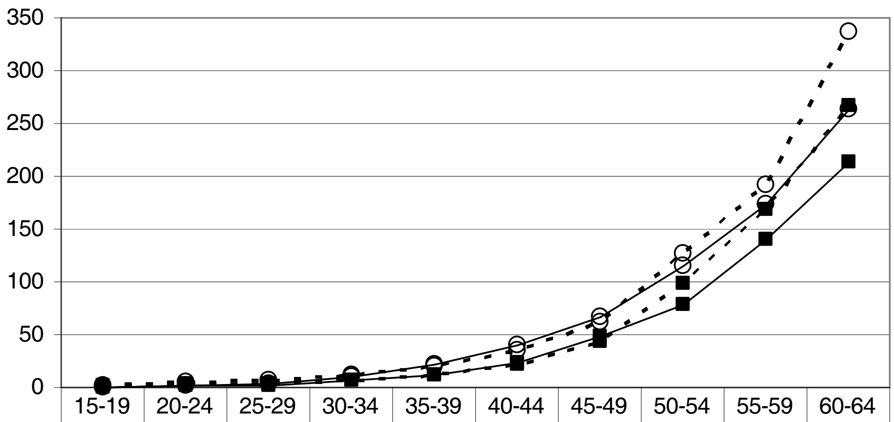
Figure 128. Male death rates by age per 100,000 from diabetes and obesity: 1997-2004



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	1.5	2.6	3.8	7.0	11.3	21.5	42.7	97.7	168.0	266.0
1998	1.4	3.1	4.8	7.9	11.9	23.2	46.0	83.8	174.2	259.8
1999	1.1	2.8	3.6	6.7	11.3	24.4	41.5	92.7	174.4	261.5
2000	2.3	2.8	5.9	8.8	15.0	23.3	44.9	91.4	169.9	253.4
2001	1.6	4.6	4.9	9.8	14.9	29.9	46.5	94.2	163.4	279.5
2002	1.5	3.8	6.6	8.9	16.0	30.4	50.3	98.3	168.6	280.1
2003	1.4	4.6	6.7	11.9	17.9	33.9	56.2	112.9	191.0	347.5
2004	1.3	5.2	6.3	10.9	19.6	35.1	62.4	125.9	192.0	335.9

Figure 129. Female death rates by age per 100,000 from diabetes and obesity: 1997-2004

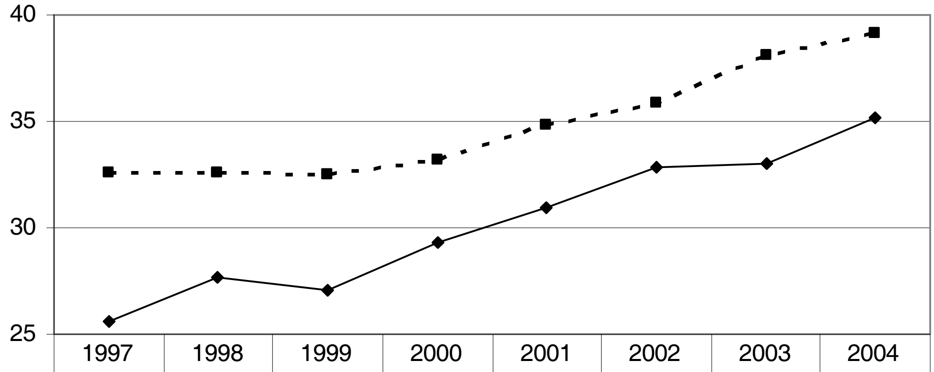
Figure 130 shows age-specific death rates from diabetes and obesity by sex in 1997 and in 2004. Below age 50 the death rates by age are similar for the two sexes, while above age 50 at each date, female death rates are higher than male death rates. Above age fifty, death rates have increased for both sexes over time.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male 1997	0.8	1.3	2.3	6.8	11.5	24.1	49.0	78.3	139.6	213.0
Male 2004	0.8	1.8	4.0	10.1	21.7	39.5	66.3	115.7	173.9	263.1
Female 1997	1.5	2.6	3.8	7.0	11.3	21.5	42.7	97.7	168.0	266.0
Female 2004	1.3	5.2	6.3	10.9	19.6	35.1	62.4	125.9	192.0	335.9

Figure 130. Death rates by age and sex per 100,000 from diabetes and obesity: 1997 and 2004

Figure 131 shows age-standardised death rates from diabetes and obesity by sex 1997-2002. Although the female rate is always higher than the male rate, the gap has narrowed considerably over time.

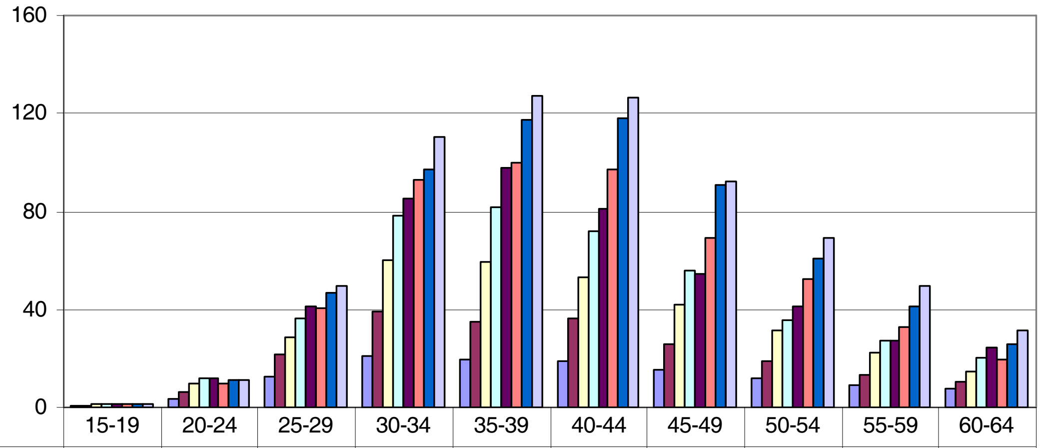


	1997	1998	1999	2000	2001	2002	2003	2004
Male	26	28	27	29	31	33	33	35
Female	33	33	32	33	35	36	38	39

Figure 131. Age-standardised death rates per 100,000 from diabetes and obesity by sex, age 15-64: 1997-2004

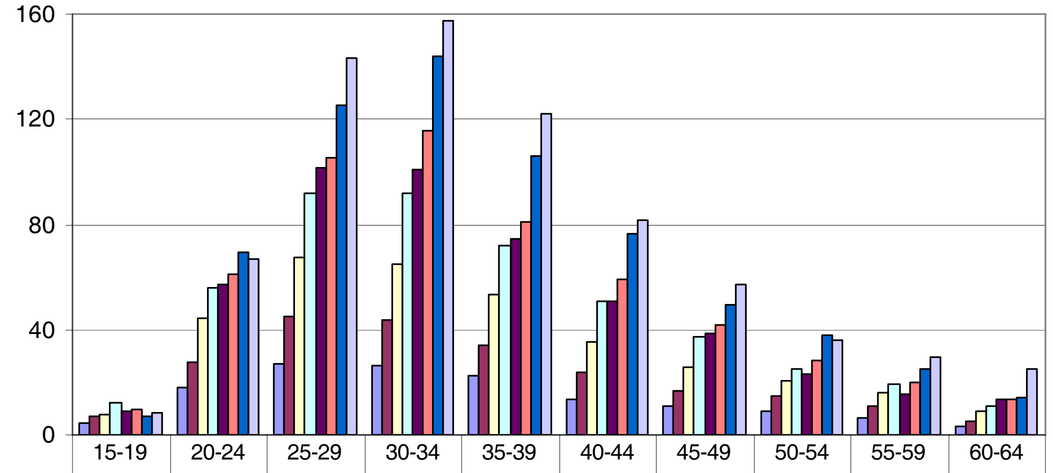
Certain disorders of the immune mechanism

Figures 132 and 133 show age-specific death rates from certain disorders of the immune mechanism (ICD-10 codes D80-D89) by sex 1997-2004. Certain disorders of the immune mechanism seems a likely candidate for misattribution of HIV deaths.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	0.5	3.6	12.2	21.3	19.5	18.6	15.1	12.0	8.9	7.9
1998	1.0	6.4	21.9	39.4	35.1	36.1	25.6	18.6	13.5	10.6
1999	1.2	9.7	28.5	59.9	59.3	53.3	41.9	31.2	22.5	14.4
2000	1.2	11.6	36.5	78.1	81.9	71.8	56.1	35.5	27.5	20.1
2001	1.2	11.9	41.5	85.0	97.8	81.2	54.7	41.2	27.2	24.3
2002	1.1	10.1	40.7	93.1	100.0	96.8	69.1	52.2	32.5	19.5
2003	1.4	11.0	46.5	97.5	117.6	118.0	91.0	60.9	41.2	26.1
2004	1.5	11.3	49.9	110.7	127.1	126.6	92.3	69.1	49.7	31.3

Figure 132. Male death rates by age per 100,000 from certain disorders of the immune mechanism: 1997-2004



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	4.3	17.7	26.9	26.5	22.3	13.5	11.1	8.9	6.3	3.4
1998	7.0	27.9	45.0	43.4	34.1	24.0	17.0	14.6	11.0	5.1
1999	7.8	44.5	67.3	64.7	53.3	35.6	25.7	20.5	15.8	9.3
2000	12.2	56.1	91.7	91.9	72.0	51.0	37.5	25.1	19.1	10.7
2001	9.3	57.4	101.7	101.0	74.6	50.5	38.5	23.4	15.2	13.6
2002	9.6	61.1	105.3	115.8	81.1	59.0	41.6	28.1	19.6	13.6
2003	7.0	69.6	125.4	144.1	105.9	76.7	49.6	38.2	25.0	13.9
2004	8.4	66.9	143.0	157.4	122.4	81.3	57.5	35.8	29.3	25.2

Figure 133. Female death rates by age per 100,000 from certain disorders of the immune mechanism: 1997-2004

Figure 134 shows age-specific death rates from certain disorders of the immune mechanism by sex in 1997 and in 2004. The age-specific death rates by sex for 2004 shown in Figure 132 look very similar to the age-specific death rates by sex for deaths registered as due to HIV shown in Figure 86.

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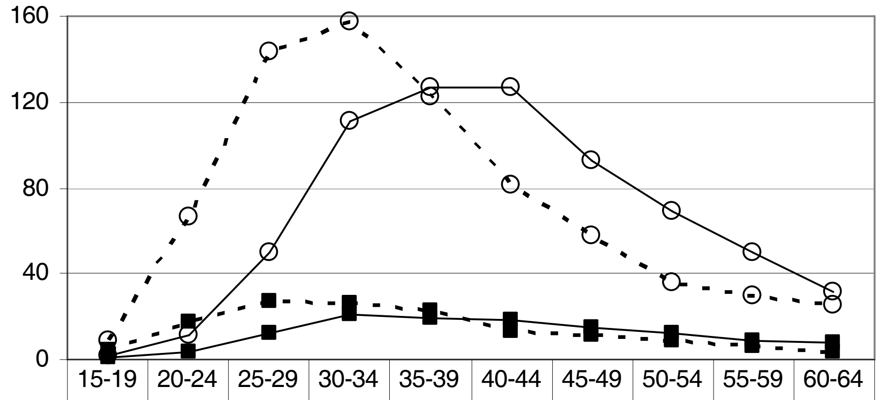
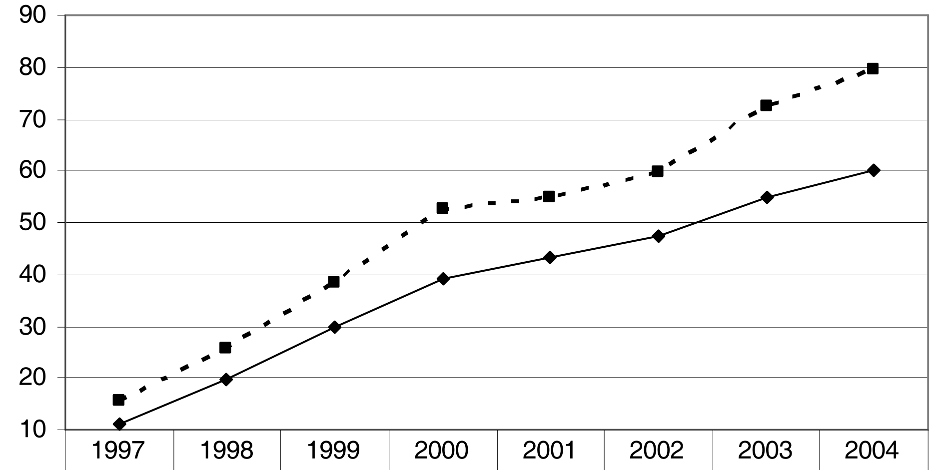


	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male 1997	0.5	3.6	12.2	21.3	19.5	18.6	15.1	12.0	8.9	7.9
Male 2004	1.5	11.3	49.9	110.7	127.1	126.6	92.3	69.1	49.7	31.3
Female 1997	4.3	17.7	26.9	26.5	22.3	13.5	11.1	8.9	6.3	3.4
Female 2004	8.4	66.9	143.0	157.4	122.4	81.3	57.5	35.8	29.3	25.2

Figure 134. Death rates by age and sex per 100,000 from certain disorders of the immune mechanism: 1997 and 2004

Figure 135 shows age-standardised death rates from certain disorders of the immune system by sex 1997-2004. The rate has risen rapidly for both sexes. The female rate is always higher than the male rate, and the gap between the rates for the two sexes has widened with time.

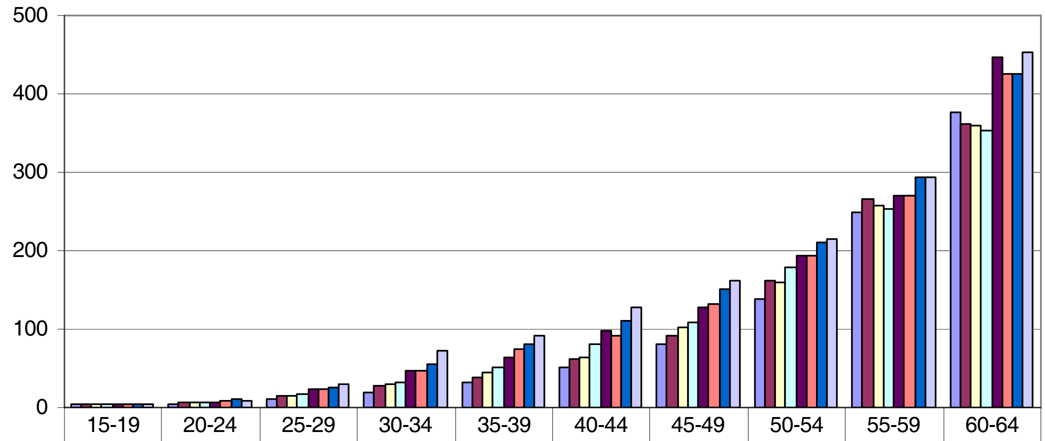


	1997	1998	1999	2000	2001	2002	2003	2004
Male	11	20	30	39	43	47	55	60
Female	16	26	39	52	55	60	72	80

Figure 135. Age-standardised death rates per 100,000 from certain disorders of the immune mechanism by sex, age 15-64: 1997-2004

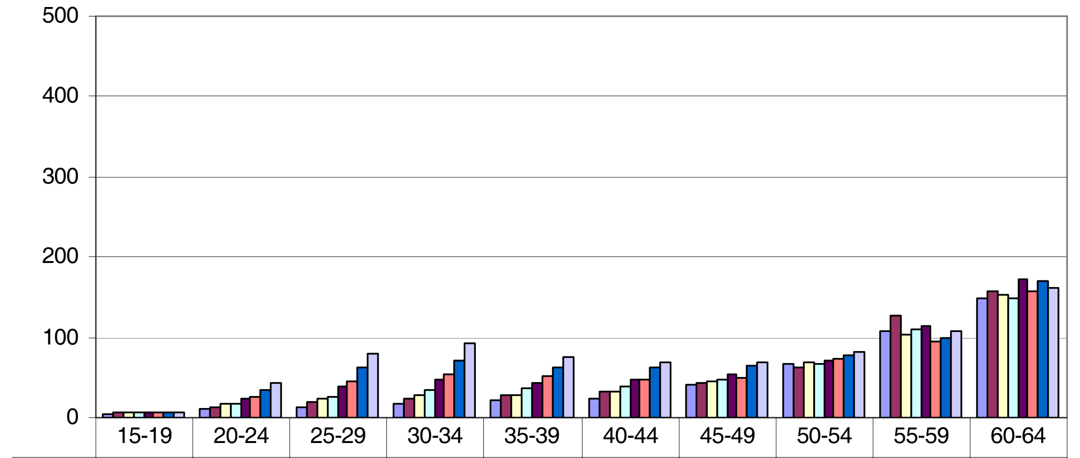
Non-communicable respiratory diseases

Figures 136 and 137 show age-specific death rates by sex for non-communicable respiratory diseases (ICD-10 codes J30-J99).



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	3.3	4.6	11.5	18.3	31.6	50.4	81.1	137.4	249.2	375.6
1998	4.1	6.3	13.8	28.6	39.2	62.7	91.7	162.8	267.0	362.0
1999	3.9	7.4	15.9	30.4	45.4	64.0	102.1	159.3	256.5	359.6
2000	5.0	6.8	16.9	32.1	50.6	79.8	108.6	177.8	253.1	352.9
2001	5.1	6.6	22.9	45.8	63.2	98.3	126.9	192.6	270.8	446.5
2002	4.5	8.5	23.4	47.1	73.5	91.1	132.4	192.9	270.8	426.5
2003	3.7	10.2	25.4	56.3	80.8	110.9	150.2	210.2	292.9	425.3
2004	4.3	9.4	30.3	71.7	91.2	127.8	160.7	214.2	293.2	453.8

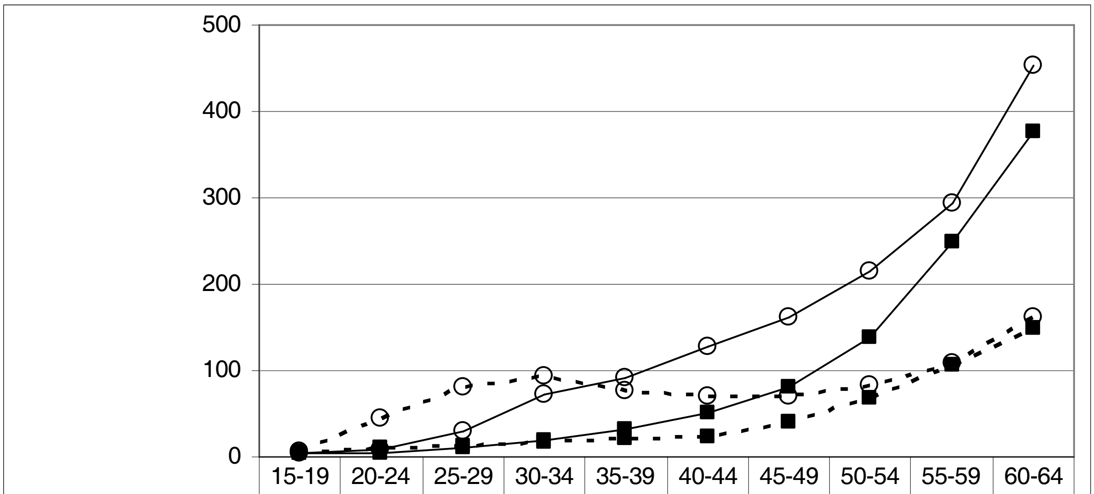
Figure 136. Male death rates by age per 100,000 from non-communicable respiratory diseases: 1997-2004



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	4.0	9.9	13.4	16.5	22.0	24.1	41.1	67.5	107.4	148.4
1998	6.6	13.2	18.4	24.2	27.9	31.6	43.1	63.5	127.5	157.6
1999	6.8	17.3	24.2	28.3	28.4	32.3	44.2	69.2	102.8	153.6
2000	5.9	18.0	25.4	33.9	35.6	38.2	47.2	67.7	110.7	149.4
2001	6.1	24.1	37.8	47.3	42.4	47.5	53.9	71.1	113.4	172.0
2002	6.3	26.9	45.7	54.3	51.5	48.3	50.5	74.1	94.6	158.3
2003	6.2	34.1	62.0	70.1	61.5	62.5	64.5	76.6	99.3	170.6
2004	6.9	43.9	80.0	92.6	75.6	69.9	69.9	82.3	108.1	162.2

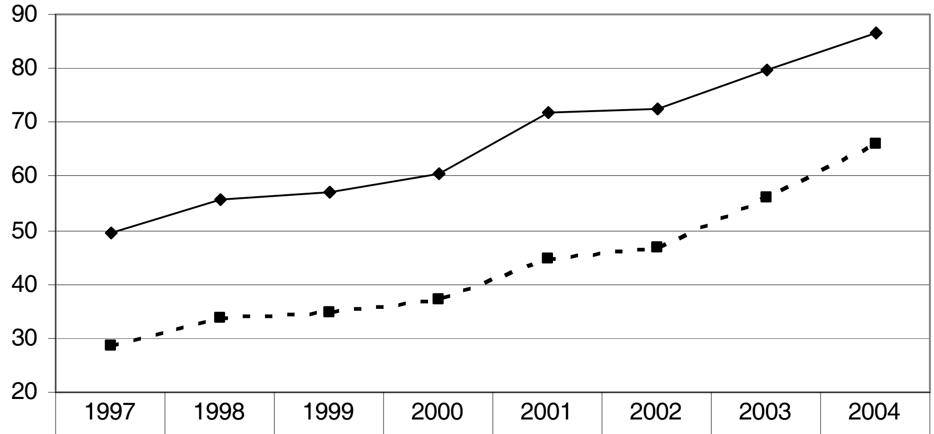
Figure 137. Female death rates by age per 100,000 from non-communicable respiratory diseases: 1997-2004

Figure 138 shows age-specific death rates by sex in 1997 and in 2004 from non-communicable respiratory diseases. In 1997, the rates for both sexes increase for each progressively older age. This is also true for males in 2004. For females in 2004, the rates are lower at age 35-49 than they are at age 25-29, but the rates are the highest above age 55.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male 1997	3.3	4.6	11.5	18.3	31.6	50.4	81.1	137.4	249.2	375.6
Male 2004	4.3	9.4	30.3	71.7	91.2	127.8	160.7	214.2	293.2	453.8
Female 1997	4.0	9.9	13.4	16.5	22.0	24.1	41.1	67.5	107.4	148.4
Female 2004	6.9	43.9	80.0	92.6	75.6	69.9	69.9	82.3	108.1	162.2

Figure 138. Death rates by age and sex per 100,000 from non-communicable respiratory diseases: 1997 and 2004



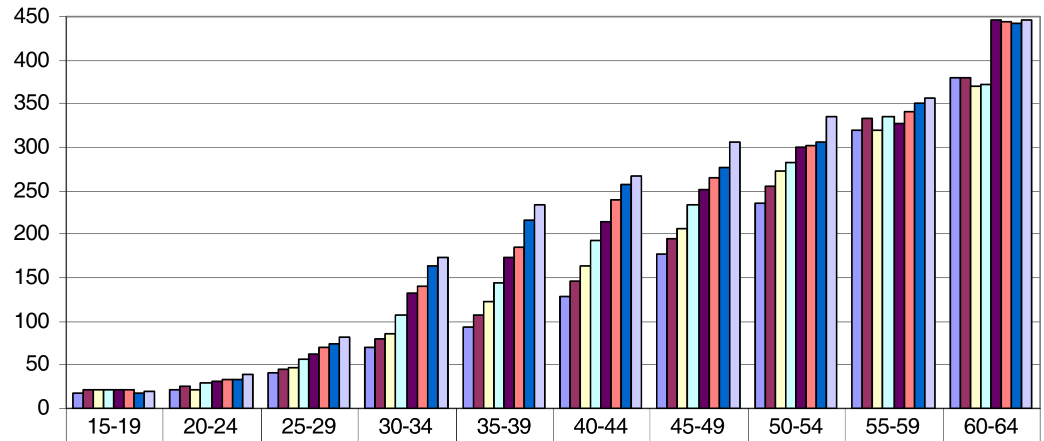
	1997	1998	1999	2000	2001	2002	2003	2004
Male	49	56	57	61	72	72	80	86
Female	29	34	35	37	45	47	56	66

Figure 139. Age-standardised death rates per 100,000 from non-communicable respiratory diseases by sex, age 15-64: 1997-2004

Figure 139 shows age-standardised death rates by sex from non-communicable respiratory diseases. The rates have increased for both sexes. The male rate is always higher than the female rate, and the gap between the rates for the two sexes has been almost constant over time.

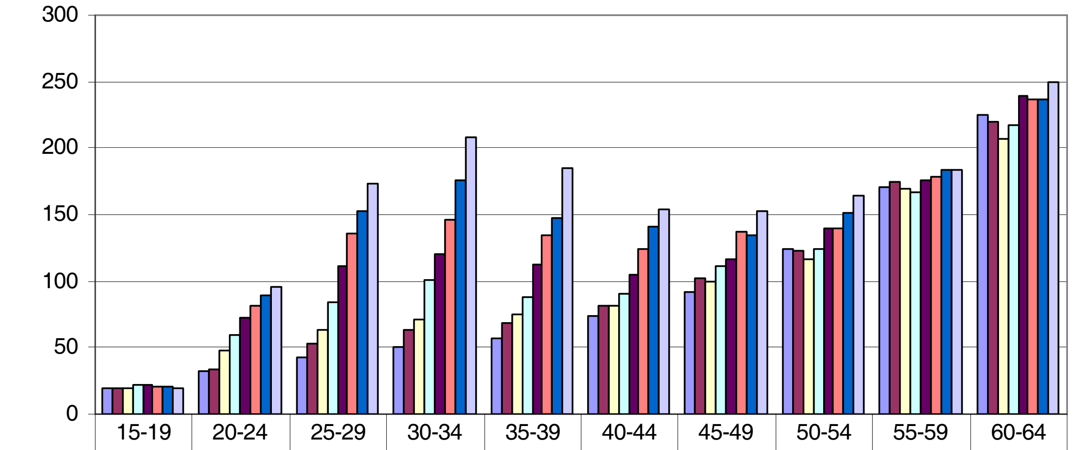
Other non-communicable diseases

Figures 140 and 141 show age-specific death rates by sex for all non-communicable diseases not already discussed, taken together.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	18.4	20.5	40.2	69.8	93.3	128.0	177.5	235.9	319.9	379.3
1998	22.1	25.2	44.9	80.0	107.1	146.7	194.0	255.7	332.3	379.4
1999	20.7	22.4	46.3	85.9	122.7	163.0	207.0	272.8	319.7	369.9
2000	20.9	30.2	55.7	107.6	144.1	193.7	233.4	281.6	334.7	372.6
2001	21.6	31.4	61.6	132.9	173.4	214.0	250.9	299.1	327.2	445.6
2002	22.3	32.6	69.6	141.2	185.9	239.4	265.9	302.2	341.0	444.9
2003	18.4	33.8	74.6	163.6	215.4	257.5	276.6	305.3	351.6	443.1
2004	20.0	38.2	81.4	172.5	233.4	267.3	306.1	334.8	356.4	445.7

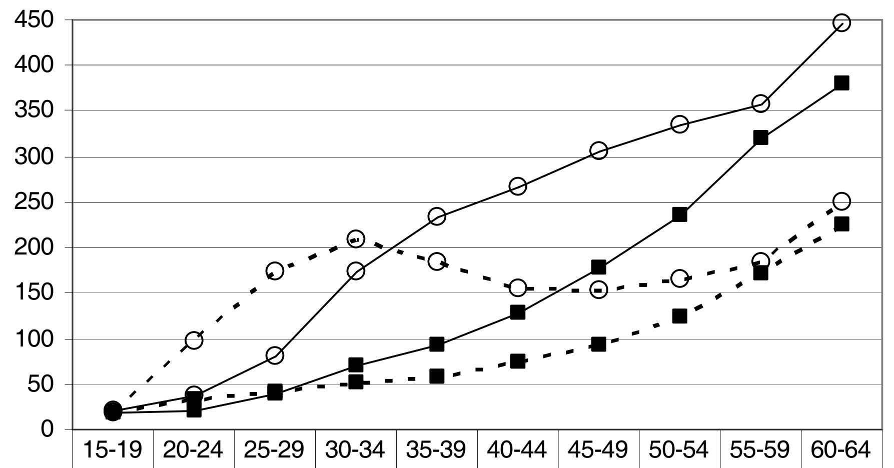
Figure 140. Male death rates by age per 100,000 from other non-communicable diseases: 1997-2004



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1997	18.8	32.5	42.0	50.9	57.5	74.2	91.9	123.9	170.4	224.5
1998	19.7	34.1	52.7	62.8	68.9	81.6	101.9	123.1	174.5	219.9
1999	19.6	47.5	62.9	70.5	74.8	81.3	99.6	116.6	169.2	206.5
2000	22.1	59.7	84.2	100.6	87.8	91.0	111.1	123.9	166.3	217.6
2001	22.3	72.2	110.7	120.0	112.8	104.8	115.9	139.9	175.8	239.7
2002	20.9	81.1	135.2	145.8	134.1	123.5	137.2	139.4	178.7	237.2
2003	21.0	88.9	152.6	176.4	146.8	140.3	134.5	150.9	183.2	236.4
2004	19.5	96.2	173.5	208.8	184.5	154.4	152.8	164.8	183.1	249.9

Figure 141. Female death rates by age per 100,000 from other non-communicable diseases: 1997-2004

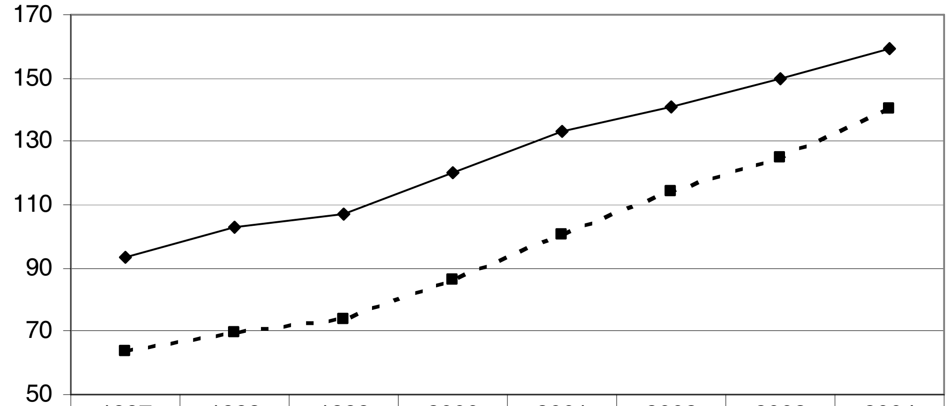
Figure 142 shows age-specific death rates by sex in 1997 and 2004 from all other non-communicable diseases. In 1997, the rates increase with each successively older age for both sexes. The male rates above age 20 in 1997 are always higher than the female rates, and the gap between the two sexes increases with age. Male rates above age 50 in 1997 and above age 35 in 2004 are higher than female rates at any age.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male 1997	18.4	20.5	40.2	69.8	93.3	128.0	177.5	235.9	319.9	379.3
Male 2004	20.0	38.2	81.4	172.5	233.4	267.3	306.1	334.8	356.4	445.7
Female 1997	18.8	32.5	42.0	50.9	57.5	74.2	91.9	123.9	170.4	224.5
Female 2004	19.5	96.2	173.5	208.8	184.5	154.4	152.8	164.8	183.1	249.9

Figure 142. Death rates by age and sex per 100,000 from other non-communicable diseases: 1997 and 2004

The age-specific pattern in 2004 for the two sexes is very different. For males in 2004, the rate increases for each successively older age. For females in 2004, the rate is lower at age 35-59 than at age 25-29. Above age 35 the male rate is higher than the female rate.



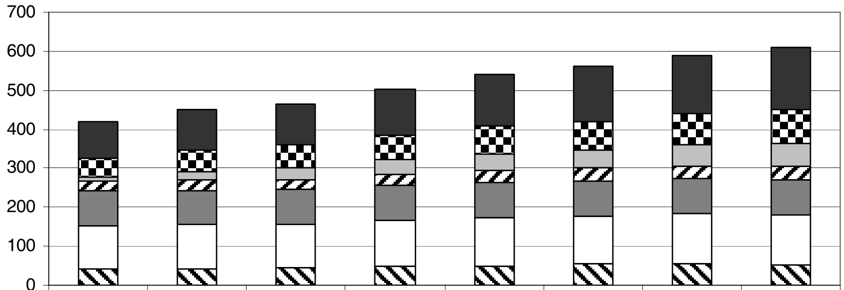
	1997	1998	1999	2000	2001	2002	2003	2004
Male	93	103	107	120	133	141	150	159
Female	64	70	74	86	101	114	125	140

Figure 143. Age-standardised death rates per 100,000 from other non-communicable diseases by sex, age 15-64: 1997-2004

Figure 143 shows the age-standardised death rates by sex from all other non-communicable diseases. The rates for both sexes increase in every year. The male rate is always higher than the female rate, but the gap between the rates for the two sexes narrows with time.

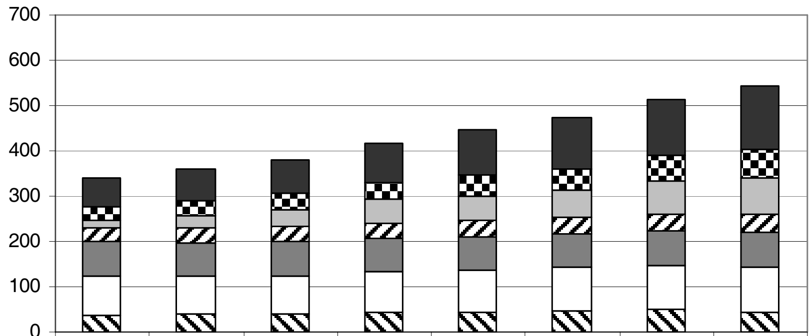
Composition of non-communicable diseases

Figures 144 and 145 show the composition of non-communicable diseases by sex in the categories discussed: stroke, other circulatory causes, cancer, diabetes and obesity, certain diseases of the immune mechanism, non-communicable respiratory diseases and all other non-communicable diseases.



	1997	1998	1999	2000	2001	2002	2003	2004
Other Non-Communicable	93	103	107	120	133	141	150	159
Non-Communicable Respiratory	49	56	57	61	72	72	80	86
Certain Immune Disorders	11	20	30	39	43	47	55	60
Diabetes and Obesity	26	28	27	29	31	33	33	35
Cancer	90	88	87	87	90	89	88	89
Circulatory Except Stroke	111	115	113	120	125	122	128	128
Stroke	41	41	45	48	48	56	57	53

Figure 144. Contribution of components of non-communicable diseases to the male age-standardised death rate, age 15-64: 1997-2004



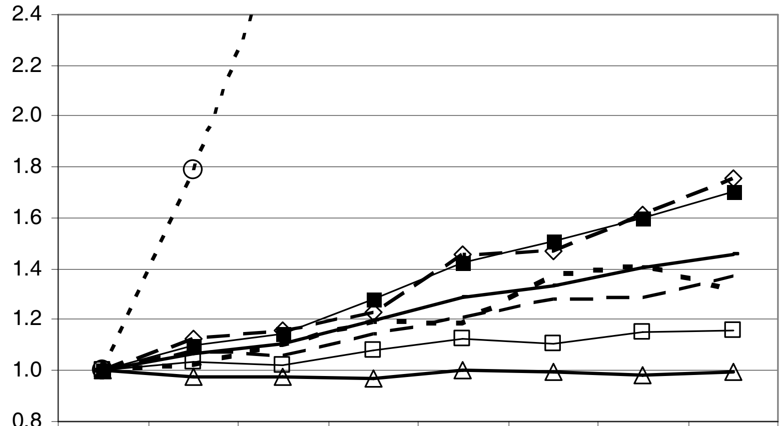
	1997	1998	1999	2000	2001	2002	2003	2004
Other Non-Communicable	64	70	74	86	101	114	123	138
Non-Communicable Respiratory	29	34	35	37	45	47	56	66
Certain Immune Disorders	16	26	39	52	55	60	72	80
Diabetes and Obesity	33	33	32	33	35	36	38	39
Cancer	75	74	75	73	74	75	75	76
Circulatory Except Stroke	86	85	85	91	94	96	98	100
Stroke	38	39	40	42	43	46	49	44

Figure 145. Contribution of components of non-communicable diseases to the female age-standardised death rate, age 15-64: 1997-2004

There was little increase over time in three of the large categories of non-communicable diseases: stroke, circulatory diseases except stroke and cancer. Between 1997 and 2004, these three groups of diseases together increased from 242 to 270 per 100,000 for males (an increase of 11.6%) and from 199 to 220 per 100,000 for females (an increase of 10.6%). In the context of large increases in many causes of death between 1997 and 2004, it is encouraging that these traditionally large sources of mortality have increased moderately. However, although the increases have been small, mortality from these diseases has not decreased, which is what one would hope to see.

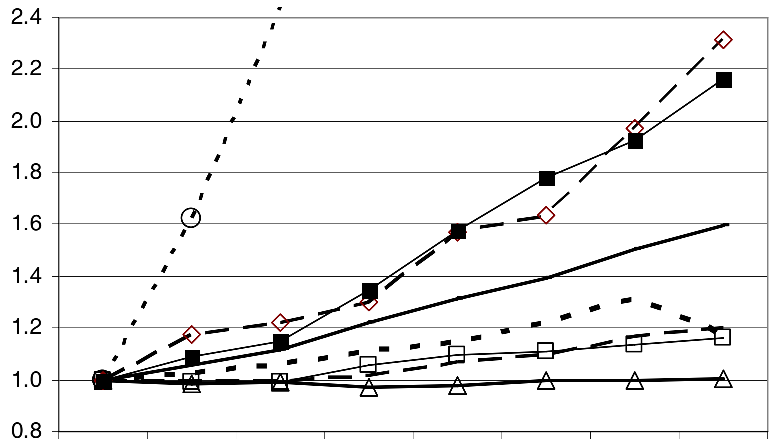
Figures 146 and 147 show for both sexes the values of all the categories of non-communicable diseases relative to their value in 1997. The vertical scale stops at 2.4, even though the values for certain immune disorders reach a value greater than 5, because if the scale went to 5.5, variation in the other non-communicable diseases could not be seen.

For both sexes, the rate of increase in certain immune disorders was far greater than that for any other subdivision of non-communicable diseases considered. After certain immune disorders, respiratory non-communicable diseases and other non-communicable diseases have the highest rates of increase.



	1997	1998	1999	2000	2001	2002	2003	2004
Stroke	1.00	1.02	1.10	1.19	1.19	1.37	1.41	1.31
Circulatory Except Stroke	1.00	1.04	1.02	1.08	1.13	1.11	1.15	1.16
Cancer	1.00	0.98	0.97	0.97	1.00	0.99	0.98	1.00
Diabetes and Obesity	1.00	1.08	1.06	1.14	1.21	1.28	1.29	1.37
Certain Immune Disorders	1.00	1.79	2.72	3.56	3.96	4.30	5.02	5.46
Non-Comm Respiratory	1.00	1.13	1.16	1.23	1.46	1.47	1.61	1.75
Other Non-Communicable	1.00	1.10	1.14	1.28	1.42	1.51	1.60	1.71
All non-Communicable	1.00	1.07	1.11	1.20	1.29	1.33	1.40	1.45

Figure 146. Male age-standardised death rates from components of non-communicable diseases relative to value for 1997 (1997 Value=1.00): 1997-2004



	1997	1998	1999	2000	2001	2002	2003	2004
Stroke	1.00	1.02	1.05	1.11	1.14	1.22	1.31	1.18
Circulatory Except Stroke	1.00	0.99	0.99	1.06	1.10	1.11	1.14	1.17
Cancer	1.00	0.98	0.99	0.97	0.98	1.00	1.00	1.01
Diabetes and Obesity	1.00	1.00	1.00	1.02	1.07	1.10	1.17	1.20
Certain Immune Disorders	1.00	1.63	2.44	3.32	3.47	3.79	4.59	5.04
Non-Comm Respiratory	1.00	1.18	1.22	1.30	1.57	1.64	1.97	2.31
Other Non-Communicable	1.00	1.09	1.15	1.35	1.58	1.78	1.93	2.17
All non-Communicable	1.00	1.06	1.12	1.22	1.31	1.39	1.51	1.60

Figure 147. Female age-standardised death rates from components of non-communicable diseases relative to value for 1997 (1997 Value=1.00): 1997-2004

Main findings on further division of natural causes of death

Communicable and related diseases

- Overall mortality from **infectious diseases** increased for both sexes. The age-standardised death rate age 15-64 was higher for males than females in every year 1997-2002 but was higher for females than males in 2003 and in 2004. Death rates from infectious diseases were higher in 2004 than in 1997 for both sexes for every age group 15-64.
- In 1997, death rates from infectious diseases were higher for females than for males below age 30 but were higher for males at ages 30-64. In 2004, death rates were higher for females below age 35 but were higher for males at age 30-64.
- The highest death rate for infectious diseases for females was 1466 per 100,000 for those age 30-34. The highest death rate for males was 1464 per 100,000 for those age 40-44.
- Death rates from **deaths registered on the death notification form as due to HIV** increased greatly between 1997 and 2004. In 2004, death rates from these deaths showed a typical pattern by age and sex of increasing to a peak and then falling rapidly with increasing age. The rate peaked at age 25-29 for females and at age 35-39 for males.
- Typically, in world experience, death rates from **tuberculosis** when it is at a high level in a population peak at young adult ages for both males and females and drop rapidly with age. In South Africa overall death rates from tuberculosis increased between 1997 and 2004.

- In every year, the age-standardised death rate age 15-64 from tuberculosis for males was higher than the rate for females, with an almost constant gap between the rates for the two sexes over time. For both sexes in every age group death rates from tuberculosis were higher in 2004 than in 1997.
- In both 1997 and 2004, death rates from tuberculosis below age 30 were higher for females than males but at age 30-64 were higher for males. After age 35 tuberculosis death rates for females fell rapidly with increasing age. After age 45 tuberculosis death rates for males fell, but more gradually than for females.
- Overall mortality from **parasitic diseases** increased for both sexes between 1997 and 2004. The age-standardised death rate age 15-64 was higher for males than females in every year 1997-2000; from 2001 to 2004 the female rate was higher in every year. Death rates from parasitic diseases were higher in 2004 than in 1997 for both sexes for every age group except for males 15-19.
- In 1997, female death rates from parasitic diseases were higher than male rates for age 15-29; above age 30 male rates were higher. In 2004, female death rates were higher below age 35; for age 35-64 male death rates were higher.
- The increase in the number of deaths from parasitic diseases between 1997 and 2004 was mainly due to the increase in 4 parasitic opportunistic infections (candidiasis, cryptococcosis, toxoplasmosis and pneumocytosis) that are especially common and likely to be fatal in persons with compromised immune systems, such as those who are HIV-positive.
- Once the four parasitic opportunistic infections are removed, **malaria** accounted for 86% of the remaining deaths from parasitic diseases in 2004. Overall mortality for both sexes from malaria increased from 1997 to 1999 and decreased in every year after 1999. The male age-standardised death rate malaria for age 15-64 was higher than the female rate, although the gap between the rates for the two sexes narrowed after 2000.
- In 1997, below age 30, the sex with the higher death rate from malaria fluctuated by age; at age 30 and above, the male rate was always higher. In 2004, the female death rate was higher than the male rate below age 30; at age 30-64 the male death rate was higher.
- The male death rate from malaria was higher in 2004 than in 1997 for those age 20-54 and 60-64; at age 15-19 and 55-59 the rate was lower in 2004 than in 1997. The female death rate was higher in 2004 than in 1997 for those age 15-49 and 55-59; at age 45-49 and 60-64 it was lower in 2004 than in 1997. In 2004, the female death rate from malaria fell steadily after age 35; the male death rate from malaria in 2004 increased through age 49, fell in the 50-59 age group and then increased to its highest level in the 60-64 age group.
- Overall mortality from **maternal conditions** increased from 1997-2001, decreased in 2002 and then increased in 2003 and 2004. Death rates from were higher in 2004 than 1997 for ages 15-44; the rate was lower in 2004 than in 1997 for age 45-49; above age 50 the rate was very low in both years. The death rate from maternal conditions more than doubled between 1997 and 2004 for those age 20-34.
- Overall mortality from **conditions originating in the perinatal period** was almost constant 1997-2004 and was almost the same for both sexes.
- Overall mortality from **nutritional deficiencies** increased from 1997 through 2002 and then declined in 2003 and 2004. In 1997, female death rates from

nutritional deficiencies were higher than male rates for those 15-29; for those age 30-64 the male rates were higher than the female rates. In 2004, female death rates were higher for those age 15-29; at age 30-64 male rates were higher.

- Male death rates from nutritional deficiencies were higher in 2004 than in 1997 for age 15-29; at age 30-64 male rates were lower in 2004 than in 1997. Female death rates were higher in 2004 than in 1997 for age 20-59; the rates were lower in 2004 than 1997 for those age 15-19 and 60-64.

Relationship to HIV

- Tuberculosis is likely to be a **cause of death to which HIV deaths are incorrectly assigned**, although what portion of tuberculosis deaths are due to HIV is not clear, partly because tuberculosis has long been endemic in South Africa, especially in the Western Cape.
- A very large portion, perhaps almost all, deaths attributed to candidiasis, cryptococcosis, toxoplasmosis and pneumocytosis are likely due to HIV.
- Malaria is also likely to be a cause of death to which HIV deaths are incorrectly assigned, although what portion of malaria deaths are due to HIV is not clear, especially in light of drug-resistant strains of malaria found in South Africa and in many other parts of the world.
- A substantial part of the increase in maternal deaths at the younger ages is likely actually due to HIV.

Non-communicable diseases

- Overall mortality from **stroke** increased for both sexes from 1997-2003 and then declined somewhat in 2004. The male age-standardised death rate age 15-64 was higher than the female rate in every year 1997-2004 and the gap between the rates for the two sexes generally widened over time.
- In 1997, the male death rate from stroke was higher than the female rate at every age. In 2004 the male death rate was higher than the female rate for age 15-19 and 35-64; the female rate was higher for age 20-34.
- For both sexes, there was almost an exponential increase with age in the death rate from stroke in both 1997 and 2004. The death rate from stroke was higher in 2004 than in 1997 for every age-sex group except for males age 15-19.
- Overall mortality from **circulatory causes other than stroke** fluctuated from 1997-2004 but generally increased over time. The male age-standardised death rate from circulatory causes other than stroke age 15-64 was higher than the female rate in every year and the gap between the rates for the two sexes remained almost constant over time.
- In both 1997 and 2004 the female death rate from circulatory causes other than stroke was higher than the male rate below age 35; at ages 35-64 the male rate was higher and was larger by an increasing margin the higher the age.
- The male death rate from circulatory causes other than stroke was higher in 2004 than in 1997 except for those 55-59. The female death rate was higher in 2004 than in 1997 for those age 20-49, and was lower for those below and above those ages. For both sexes, there was almost an exponential increase with age in the death rate from circulatory causes other than stroke in both 1997 and 2004.

- Overall mortality from **cancer** was virtually constant throughout the period 1997-2004. The male age-standardised death rate from cancer was higher than the female rate in every year 1997-2004, and the gap in the rates between the two sexes was almost constant over time.
- In 1997, the male death rate from cancer was higher than the female rate at age 15-19 and above age 45; for age 20-44 the female rate was higher. In 2004, the male death rate was higher than the female rate at age 15-19 and above age 40; for age 20-39 the female rate was higher. Above age 40 the gap between the rates for two sexes increased with age.
- The male death rate from cancer was higher in 2004 than in 1997 for age 15-49; at age 50-64 the male death rate was lower in 2004 than in 1997. The female death rate was higher in 2004 than in 1997 for age 15-39; at age 40-64 the rate was lower in 2004 than in 1997. For both males and females, there was almost an exponential increase with age in the death rate from cancer in both 1997 and 2004.
- Death rates from **cancer of the lung, trachea or larynx** were very low for both sexes below age 35 in both 1997 and 2004. The death rate from these cancers increased for females age 35-39 between 1997 and 2004. For males above age 35 and for females above age 40 death rates from cancer of the lung, trachea or larynx declined between 1997 and 2004. For males age 55-59 the rate declined by 30% and for males age 60-64 the rate declined by 25%. For both sexes, there was almost an exponential increase with age in the death rate from cancer of the lung, trachea or larnyx in both 1997 and 2004.
- Death rates by age from **cancers related to the reproductive system** for both sexes were virtually unchanged between 1997 and 2004. Below age 30 death rates from cancers related to the reproductive system were close to zero for both sexes both in 1997 and 2004. At age 20-64 female death rates from cancers related to the reproductive system were always higher than male rates, with a widening gap between the rates for the two sexes with increasing age.
- The death rate for both sexes from **cancer, stroke and other circulatory causes combined** (that is, all the sub-categories of non-communicable diseases considered so far) rose 12% between 1997 and 2004.
- Overall mortality from **diabetes and obesity** increased between 1997 and 2004 for both sexes. The female age-standardised death rate age 15-64 from diabetes and obesity was always higher than the male rate, but the gap between the sexes narrowed over time.
- Below age 20 death rates from diabetes and obesity were close to zero for both sexes both in 1997 and in 2004. Above age 30, for both sexes and every age group death rates were are higher in 2004 than in 1997.
- In both 1997 and 2004 female death rates from diabetes and obesity were higher than male rates for those age 20-34 and 45-64; for those age 35-44 male rates were higher. For both sexes, there was almost an exponential increase with age in the death rate in both 1997 and 2004.
- Overall mortality from **certain disorders of the immune mechanism** increased in every year 1997-2004 for both sexes. The female age-standardised death rate age 15-64 was always higher than the male rate, and the gap between the rates for the two sexes increased over time.
- The death rate from certain disorders of the immune mechanism increased for both sexes at every age between 1997 and 2004. The pattern of death

rates from this category by age and sex in 2004 looks very much like that for death rates from deaths registered as caused by HIV.

- Overall mortality from **non-communicable respiratory diseases** increased in every year 1997-2004 for both sexes. The male age-standardised death rate was always higher than the female rate and the gap between the rates for the two sexes remained almost constant over time. The death rate from non-communicable respiratory diseases was higher in 2004 than in 1997 for both sexes for every age 15-64.
- In both 1997 and 2004, the female death rate from non-communicable respiratory diseases was higher than the male rate below age 35; at age 35-64 the male rate was higher in both years. In 2004, the female rate at age 30-34 from non-communicable respiratory diseases was higher than the female rate at ages 35-54. The male rates increased with each successively older age group in both 1997 and 2004. The female rates increased with each successively older age group in 1997.
- Overall mortality from **other non-communicable diseases** increased for both sexes in each year 1997-2004. Male age-standardised death rates were always higher than female rates. But the gap between the rates for the two sexes narrowed over time.
- In 1997 the female death rate from other non-communicable diseases was higher than the male rate below age 30; in 2004 the female death rate from other non-communicable diseases was higher below age 35. In 2004, the female rate at age 30-34 was higher than the female rate at ages 35-59. The male rates increased with each successively older age group in both 1997 and 2004. The female rates increased with each successively older age group in 1997.
- It is likely that a large part, or almost all, of the **deaths** attributed to certain disorders of the immune system are **misattributed** and are actually due to HIV. The same is the case for some deaths attributed to non-communicable respiratory diseases. However it is not clear how large a portion of the latter are actually due to HIV in the light of the almost exponential increase in male death rates from this cause with age.
- It is also likely that some deaths attributed to other non-communicable diseases are actually misattributed and are due to HIV. However, again it is not clear how large a portion of these deaths are actually due to HIV, given the continued increase in male death rates from this cause with age.

Comments

In this section, besides discussing some major subdivisions of the communicable and related diseases and non-communicable diseases cause of death categories, we also discussed some causes of death that seemed likely candidates for being hidden HIV deaths. Many of our thoughts agree with the causes that Groenewald *et al.* (2005) highlighted, although we did not examine exactly the same sub-categories that they did.

First let us consider communicable and related causes of death in this regard. **Tuberculosis** is certainly a good candidate for misattribution of cause of death, partly because of the general agreement that HIV and tuberculosis each increase the chances of death from the other and decrease the time to death from the other.

However, as we pointed out, further thought would be helpful in considering the relation between HIV and tuberculosis.

The evidence seems quite good that **parasitic opportunistic infections** are a place where HIV deaths are often misclassified. Despite the evidence of the relation between HIV and **malaria**, the change between 1997 and 2004 in the age pattern of malaria death rates by sex as well as evidence of increased occurrence of resistant strains of malaria that are more likely to be fatal than in the past, whether or not HIV is present, suggests the value of work to disentangle what part of increased malaria mortality is related to HIV and what part is not. It also seems likely that a substantial part of the increase in **maternal mortality** at the younger ages is related to HIV, although more work in this area could also be helpful. Although Groenewald *et al.* (2005) saw substantial evidence of HIV deaths being hidden in deaths from **nutritional deficiencies**, it seems to us that although it is possible, it is not as clear as they suggest.

Next let us consider non-communicable causes of death in relation to HIV. **Certain disorders of the immune system** is very likely to be a category that includes many deaths due to HIV. It also seems possible that **non-communicable respiratory diseases** include some HIV deaths, although it is likely that death rates from that cause are also increasing for other reasons, especially among males. **Other non-communicable diseases** (as a category) could also include HIV deaths. This area also could benefit from further work.

An important remaining question is: how should one determine the proportion of deaths from these causes that are actually due to HIV? Clarification of how this was done by Groenewald *et al.* (2005) would be helpful, and the thoughts of others could also contribute to resolving this issue.

The age pattern of increased mortality from many causes that include persistent elevated male mortality at the older ages also appears for tuberculosis, malaria, non-communicable respiratory diseases and other non-communicable diseases. This age pattern is not apparent in death rates from deaths reported as due to HIV on the death notification forms. This makes us wonder whether there are sources of systematic substantial mortality increases other than HIV, perhaps related to some of the issues that Gwatkin (1980) raised. It seems that investigation of this would be worthwhile.

We noted earlier that at the younger ages female death rates from both communicable and related diseases and non-communicable diseases were higher than male rates even in 1997. The examination of more detailed categories of natural causes reveals that this held true for most detailed natural causes, including tuberculosis, nutritional deficiencies, and circulatory diseases other than stroke.

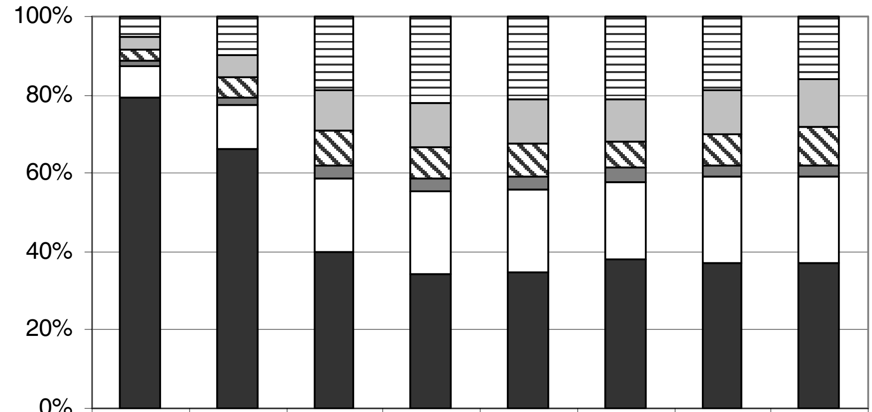
FURTHER DIVISION OF UNNATURAL CAUSES OF DEATH

In this section we look at a further division of unnatural causes of death. With cooperation from the Department of Transport and from the South African Police Service, we have some specific information on deaths from transport and on deaths from homicide. We use this information to say more about transport deaths, homicide deaths and other kinds of death. We also look to some extent at other divisions of causes of unnatural deaths.

Subdivision of unnatural deaths using death notification data

It is useful to know the death rates from unnatural causes as a whole by age and sex and how they have changed over time. It would also be useful for analysis and policy planning to know the level of death rates and how they have changed over time from particular causes such as transport, use of firearms, and use of knives, as well as homicides. However, detail about the nature of unnatural deaths is almost completely lacking in 1997 and 1998, and is incomplete in 1999 and later years.

Figure 148 shows the distribution of selected causes of unnatural deaths for all those age 15-64 for every year 1997 through 2004. The ”unspecified event unknown intent” category means that it was an unnatural death, but nothing else is known about the death. This is ICD-10 code Y34. This undetermined category constituted more than two-thirds of all unnatural deaths in 1997 and 1998, and about 40% of all unnatural deaths in 1999-2004.



	1997	1998	1999	2000	2001	2002	2003	2004
Firearms	5	10	19	22	21	21	19	16
Knife	3	5	10	11	11	11	11	12
Transport	3	5	9	8	9	7	8	10
Poisoning	2	2	3	3	3	4	3	3
Other Specified Cause	8	11	19	21	21	20	22	22
Y34 Unspecified Event Undetermined Intent	79	66	40	34	35	38	37	37

Figure 148. Percentage distribution of selected causes of unnatural deaths, age 15-64: 1997-2004

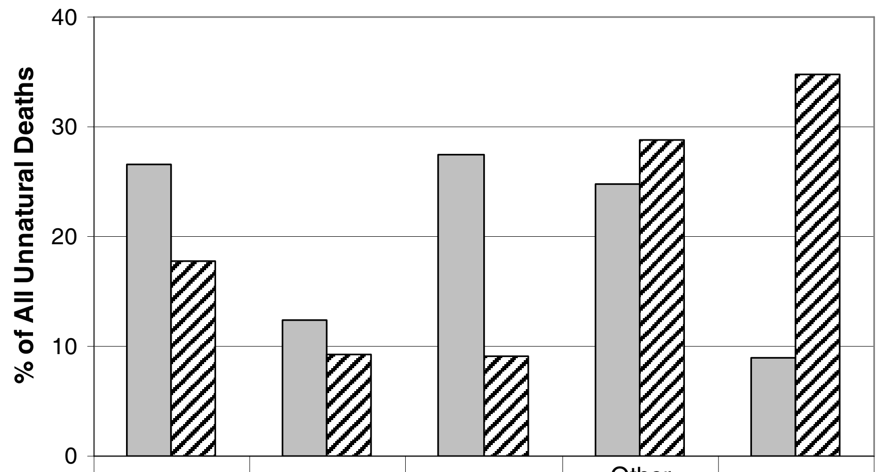
One reason for this large percentage of undetermined cause is the *Wet op Geregtelike Doodsondersoeke* (Judicial Death Inquest Act #58) of 1959. This law states that determination of intent (assault by others, intentional self-harm, or accident) is the prerogative of the court. Court proceedings can take a long time, and the death notification form is usually filled out long before any court proceedings have been completed. Thus, intent is rarely recorded on the death notification form. This means that a classification of unnatural deaths into the traditional categories of homicide, suicide, and accident is not possible from death notification data. Very often the circumstances of death (transport, firearm, knife, etc.) is also not recorded, although the Judicial Death Inquest Act does not prohibit the recording of that kind of information.

Other sources of data on unnatural cause deaths

Departments that collect data pertinent to various kinds of unnatural deaths, such as the Department of Transport and the South African Police Service (SAPS), are possible sources of detailed data on unnatural deaths. Data from both the Department of Transport and the SAPS are used later in this section.

In 1999, the National Injury Mortuary Surveillance System (NIMSS) was established in order to improve knowledge about unnatural deaths. Mortuaries participate voluntarily in this system. In 2004, participating mortuaries were in six provinces and the data covered about 40% of all unnatural deaths. The participating mortuaries are predominantly located in urban areas (NIMSS, 2005: 2).

Participating mortuaries fill out a special form for each unnatural death, which includes information about the circumstances of the death (firearm, sharp, burn, etc.) and the apparent manner intent of death (homicide, suicide, accident, natural, undetermined). The NIMSS form is not a legal document, so filling out the apparent manner of death does not violate the Judicial Death Inquest Act. Thus, the NIMSS data can show the distribution of unnatural deaths among homicide, suicide, and accidents, with only a small percentage of unnatural deaths left with undetermined intent. They also can give information on the proportion of unnatural deaths due to causes such as firearms, sharps, drowning and burns.



	Firearms	Knife	Transport	Other Specified	Undetermined
NIMSS	27	12	27	25	9
Death Registration	18	9	9	29	35

Figure 149. Percentage distribution of all unnatural deaths from NIMSS data and from death registration data, 2001

Figure 149 shows the percentage distribution of all unnatural deaths for 2001 based on (1) the distribution of unnatural deaths in the NIMSS data (NIMSS, 2002) and (2) the distribution of unnatural deaths in the death registration data. There are both similarities and differences in the distributions based on the two data sources. In both sources a higher percentage of deaths is attributed to firearms than to knives. The percentage due to transport is much higher in the NIMSS than in the death registration data, while a much higher proportion in the death registration data than in the NIMSS data are of undetermined cause. Even if the percentage distributions are compared with undetermined unnatural deaths excluded, the percentage due to firearms is still somewhat higher in the NIMSS data, and the percentage due to transport is still much higher. This difference in the distribution of types of unnatural deaths could be due to the heavy urban representation in the NIMSS data. Firearms could be more likely used in urban than in non-urban areas, and transport deaths are almost certainly more likely in urban than in non-urban areas. Some other possible implications of the urban setting of most NIMSS-participating mortuaries are discussed in Altbeker (2005).

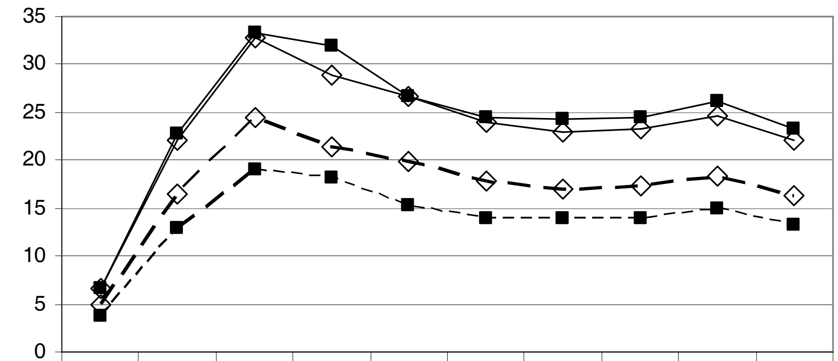
We are not using the NIMSS data further in this report because at least 60% of all unnatural deaths are not included and, more importantly, the mainly urban location of the participating mortuaries raises questions about the generalisability of the NIMSS results.

Transport and non-transport deaths

The Department of Transport provided data on the number of transport deaths by age for 2001 and 2003. These data are also presented separately according to whether the victim was a pedestrian or not.

To obtain transport deaths by age and sex, the sex ratio by age from reported transport deaths in the death notification data was applied to the transport deaths by age from the Department of Transport.

Figure 150 shows death rates for both sexes combined for pedestrian and non-pedestrian transport deaths in 2001 and 2003. Transport death rates for non-pedestrians are higher than for pedestrians at every age. For people age 15-64, in 2001 36% of all transport deaths were to pedestrians, while in 2003 43% of all transport deaths were to pedestrians.

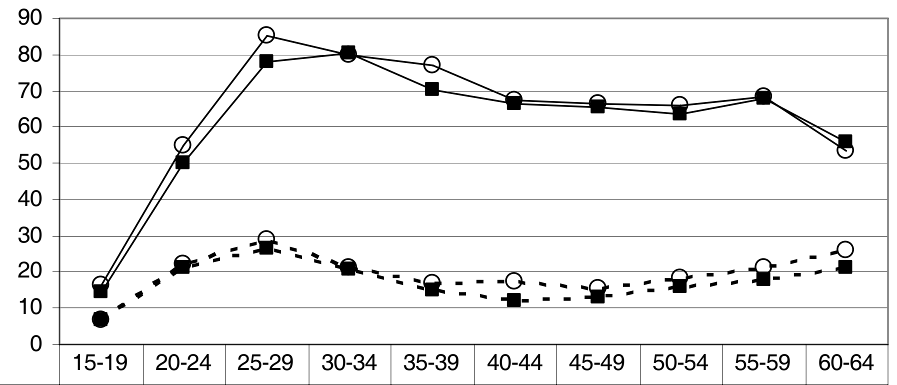


	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Pedestrian 2001	3.8	13.0	19.0	18.3	15.2	14.0	13.9	13.9	15.0	13.3
Pedestrian 2003	4.9	16.4	24.4	21.5	19.8	17.8	17.0	17.4	18.3	16.4
Non-Pedestrian 2001	6.6	22.7	33.2	32.0	26.7	24.5	24.4	24.4	26.2	23.2
Non-Pedestrian 2003	6.6	22.1	32.8	28.9	26.6	23.9	22.9	23.4	24.6	22.0

Figure 150. Death rates by age per 100,000 from transport: Pedestrians and non-pedestrians, both sexes combined, based on Transport Department data: 2001 and 2003

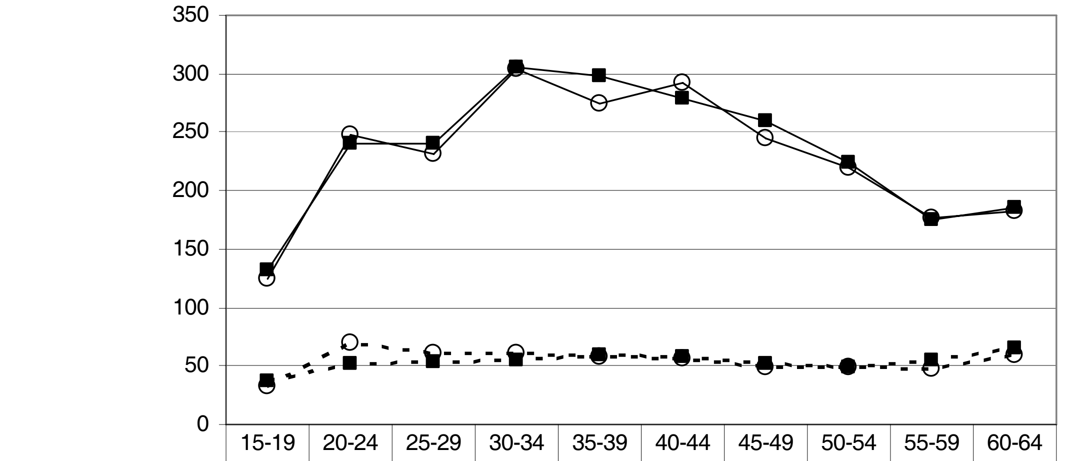
For both pedestrians and non-pedestrians, death rates increase to age 25-29 and then decline somewhat, with a secondary peak at age 55-59. Death rates to non-pedestrians were virtually the same in 2001 and 2003, while death rates for pedestrians at every age increased between 2001 and 2003.

Figure 151 shows the death rates from transport causes by age and sex in 2001 and 2003, based on the data from the Department of Transport. For both sexes, there was very little change by age between 2001 and 2003. At every age, the transport death rate is higher for males than females. For both sexes, the rate increases to its highest value at age 25-29. The rate then declines somewhat before rising at older ages. For males, it rises to age 55-59 and then declines for age 60-64. For females, the rate increases after the forties.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male 2001	14.4	50.2	78.0	80.2	70.1	66.3	65.5	63.5	67.9	55.7
Male 2003	16.1	54.8	85.2	79.8	77.1	67.5	66.7	65.8	68.4	53.4
Female 2001	6.5	21.1	26.3	20.7	14.8	12.3	13.0	15.7	17.9	20.9
Female 2003	6.7	22.1	28.7	21.1	16.9	17.5	15.5	18.4	21.1	26.0

Figure 151. Death rates by age and sex from transport per 100,000 based on Transport Department data: 2001 and 2003



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male 2001	132	240	240	305	298	279	259	224	175	185
Male 2003	124	247	232	304	275	292	245	220	176	183
Female 2001	37	53	53	55	59	58	52	48	55	65
Female 2003	32	70	60	61	58	56	49	49	48	59

Figure 152. Death rates by age and sex per 100,000 from unnatural causes other than transport: 2001 and 2003

Figure 152 shows death rates by sex in 2001 and 2003 from unnatural causes other than transport. The rates changed little for either sex between 2001 and 2003. Figure 152 looks much like Figure 30, which showed death rates by sex from all unnatural causes.

Homicide and non-homicide deaths

Homicide is a major problem in South Africa. It is generally agreed that South Africa has the second highest homicide rate in the world, exceeded only by Colombia. However, there is evidence that homicide has declined in South Africa.

Figure 153 shows the number of homicides recorded by the SAPS by financial year (South African Police Service, 2006). The number of homicide deaths has declined over time, especially since the late 1990s.

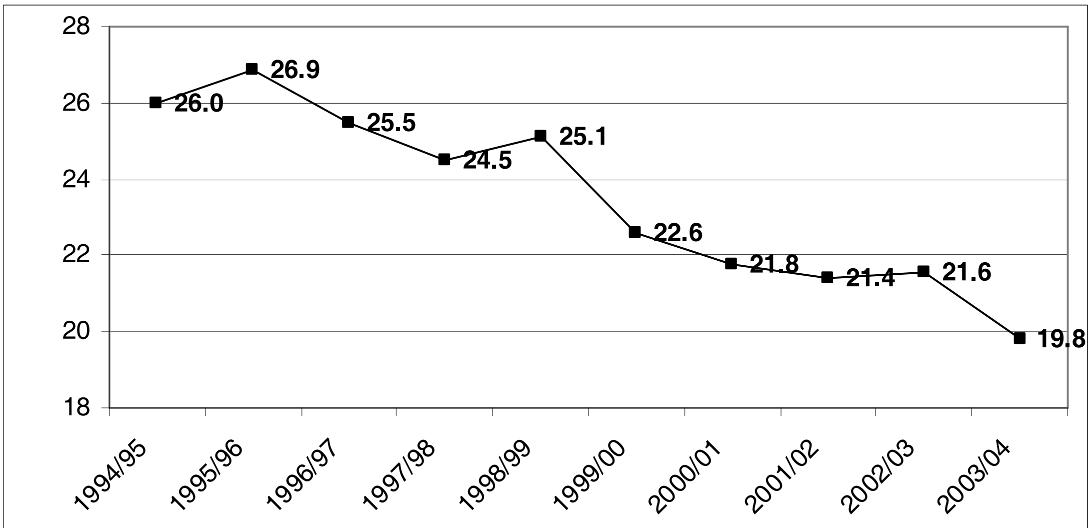
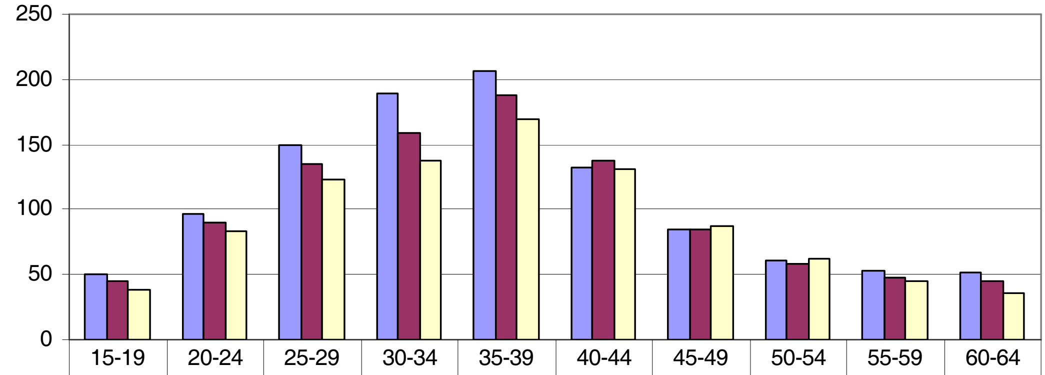


Figure 153. Number of homicide deaths in thousands according to the South African Police Service by financial year: 1994/95-2003/04

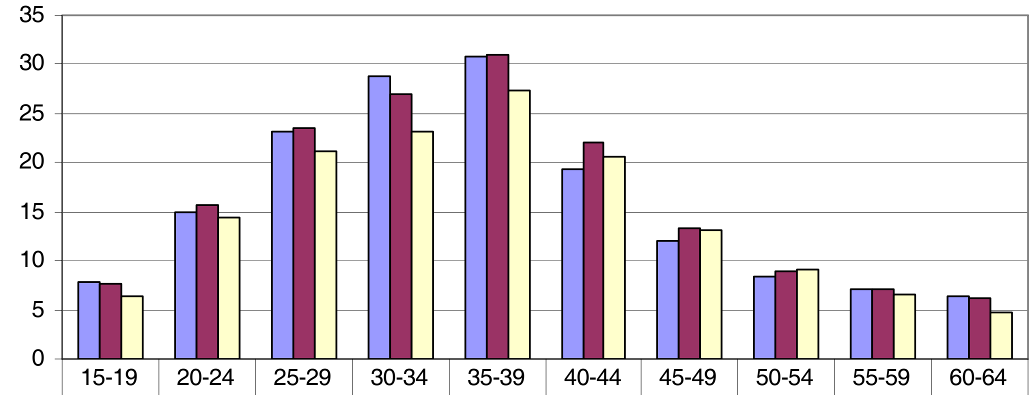
SAPS provided data on the number of homicide deaths by age for 2002, 2003 and 2004. The breakdown by sex (but not also by age) was given for each year.[12]

Figures 154 and 155 show the death rates from homicide by sex in 2002-2004, based on SAPS data. Note the difference in the vertical scale for the two sexes. For males below age 40, homicide rates declined each year. For females below age 40, homicide rates were lower in 2004 than in 2003.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
2002	50.3	96.6	149.1	188.7	206.7	132.8	84.2	60.9	53.2	52.0
2003	45.1	90.6	135.1	158.9	187.8	137.3	85.2	58.3	47.4	44.6
2004	37.9	83.9	122.4	137.4	169.4	131.2	86.9	61.5	45.6	35.4

Figure 154. Male death rates by age per 100,000 from homicide based on SAPS data: 2002-2004



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
2002	7.8	15.0	23.2	28.8	30.8	19.3	11.9	8.5	7.1	6.5
2003	7.7	15.7	23.6	27.0	30.9	22.0	13.3	8.9	7.0	6.1
2004	6.3	14.3	21.2	23.2	27.4	20.6	13.1	9.2	6.6	4.8

Figure 155. Female death rates by age per 100,000 from homicide based on SAPS data: 2002-2004

Table 7 shows the age-standardised death rates age 15-64 from homicide for both sexes 2002-2004. Even though we have homicide death rates for only three

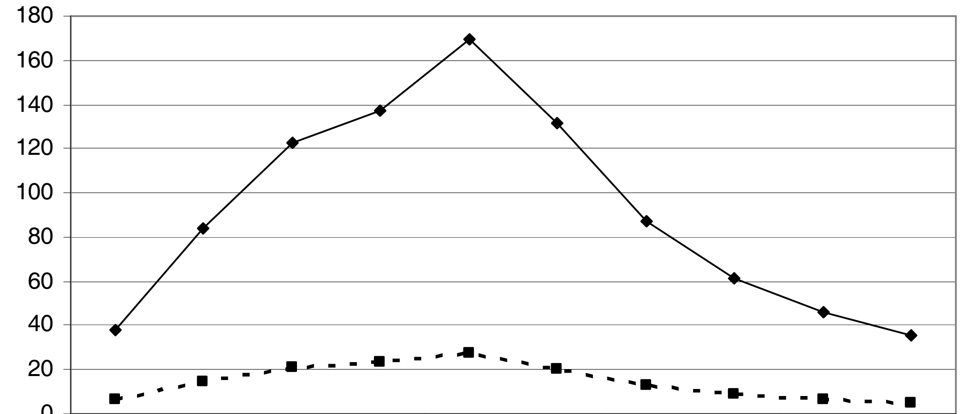
[12] There was a substantial number of homicide deaths with age unknown. These deaths were distributed proportionately to those homicide deaths with age known. The age groups in which the homicide data were provided were somewhat unconventional, being 11-15, 16-20, etc. The deaths were redistributed into conventional five-year age groups, using Statistics South Africa estimates of the number of people by sex by single year of age in the given year.

years, 2002-2004, it is interesting that overall homicide death rates declined in that period for males and were lower in 2004 than in 2002 or 2003 for both sexes.

Table 7. Age-standardised death rates age 15-64 from homicide: 2002-2004

	2002	2003	2004
Male	115.2	105.6	96.4
Female	17.2	17.5	15.7

Figure 156 shows homicide rates by age and sex in 2004. In Figures 154 and 155 the shape of the age pattern of homicide death rates looks very similar for the two sexes. Figure 156 makes clear that the male homicide death rates are much higher than the female homicide death rates. In 2004, the age-standardised homicide death rate age 15-64 for males was 96 per 100,000 and for females was 16 per 100,000.



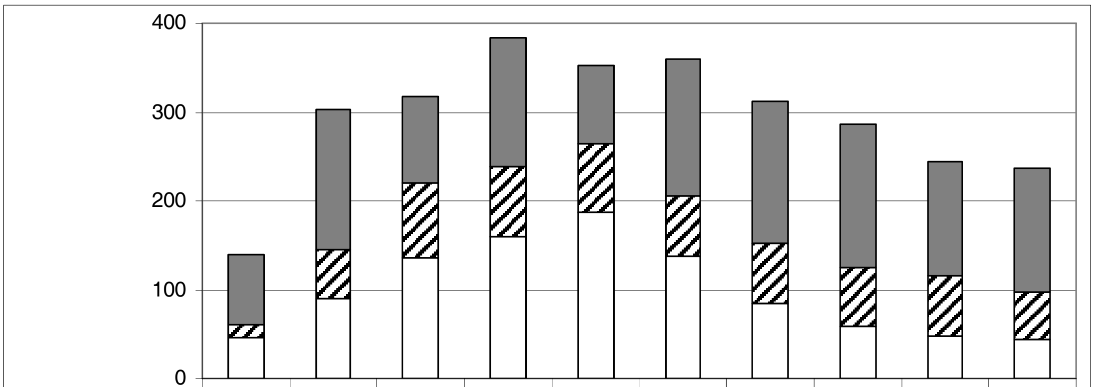
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Male	37.9	83.9	122.4	137.4	169.4	131.2	86.9	61.5	45.6	35.4
Female	6.3	14.3	21.2	23.2	27.4	20.6	13.1	9.2	6.6	4.8

Figure 156. Homicide death rates by age and sex per 100,000 based on SAPS data: 2004

Subdivision into transport, homicide and other unnatural causes

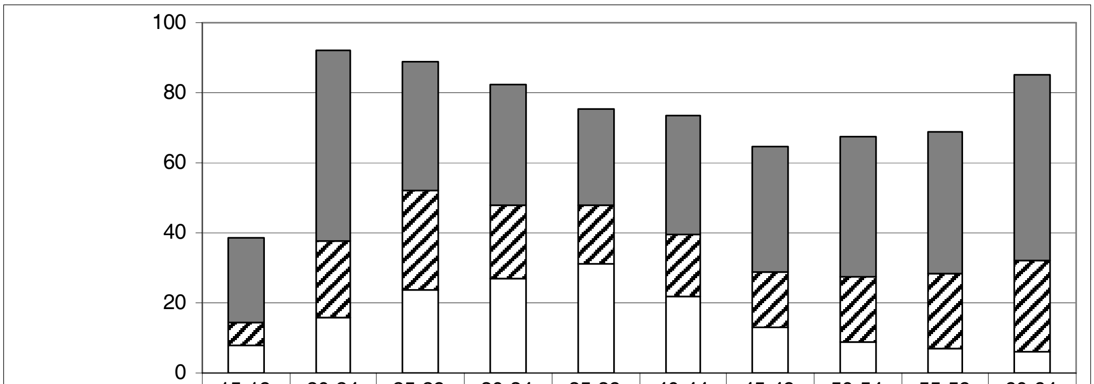
Using the information about all unnatural deaths, homicide deaths and transport deaths by age and sex for 2003, we can look at a decomposition of unnatural deaths. Other unnatural deaths (not from transport or homicide) include non-transport accidents and suicide. Other information suggests that in South Africa suicide death rates are low.

Figure 157 shows the decomposition of unnatural deaths for males, and Figure 156 shows the decomposition of unnatural deaths for females. For males the age pattern of death rates from all unnatural causes looks similar to that for homicide death rates. For females this is less true, as death rates from other unnatural causes for females rise very rapidly from the 15-19 to the 20-24 age group.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Other Unnatural	79	157	97	145	87	155	159	162	129	138
Transport	16	55	85	80	77	68	67	66	68	53
Homicide	45	91	135	159	188	137	85	58	47	45

Figure 157. Male death rates by age per 100,000 from homicide, transport and other unnatural causes: 2003



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Other Unnatural	24	54	37	34	27	34	36	40	41	53
Transport	7	22	29	21	17	18	16	18	21	26
Homicide	8	16	24	27	31	22	13	9	7	6

Figure 158. Female death rates by age per 100,000 from homicide, transport or other unnatural causes: 2003

Figures 159 and 160 show the percentage distribution of the three types of unnatural deaths. These figures make it clear that the three kinds of unnatural deaths considered here play very different roles for the two sexes and different age groups. For males, homicide accounted for a majority of all unnatural deaths for those 35-39, and accounted for the plurality of deaths for those 25-44. Other unnatural causes accounted for a majority of unnatural deaths for males 15-24 and 45-49. Homicide did not account for a plurality of all unnatural deaths for females at any age. Other unnatural causes accounted for a plurality of unnatural deaths for females at every age and accounted for a majority of female unnatural deaths at ages 15-24 and 45-64.

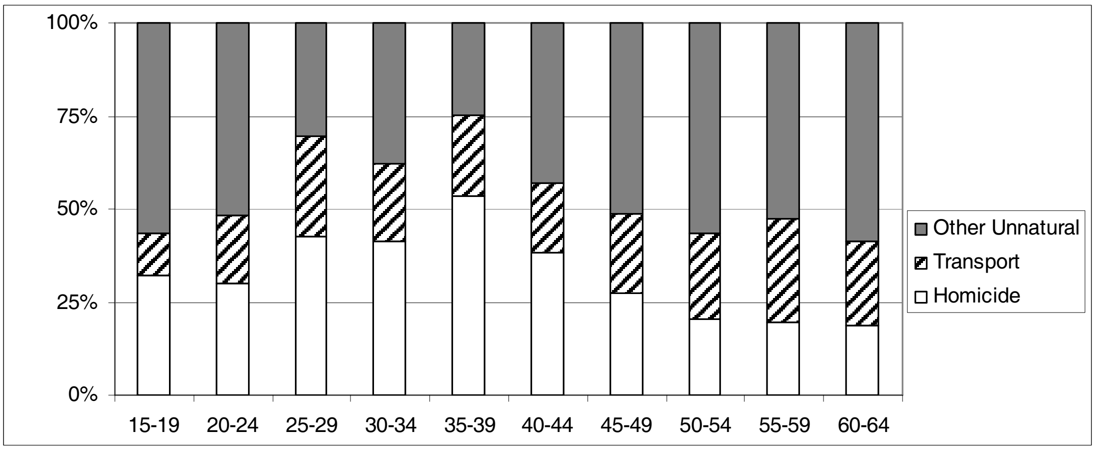


Figure 159. Percentage distribution of all male unnatural deaths into homicide, transport and other unnatural causes: 2003

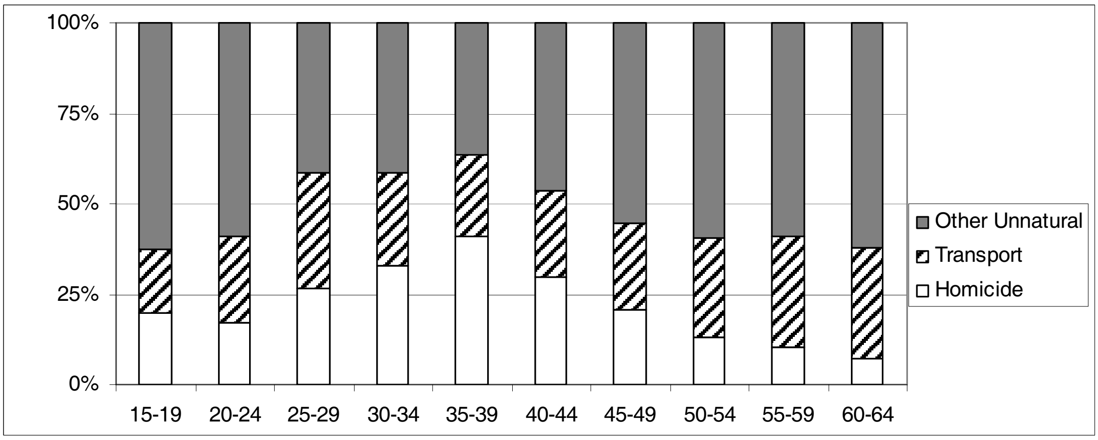


Figure 160. Percentage distribution of all female unnatural deaths into homicide, transport and other unnatural causes: 2003

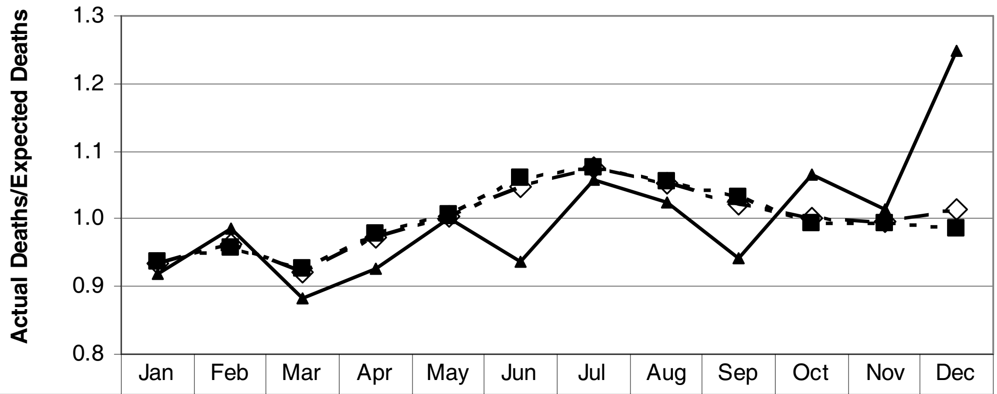
Seasonality of unnatural deaths

Figure 161 looks at the seasonality of all deaths, all natural deaths and all unnatural deaths in 2004. In this figure and similar figures, the actual number of deaths reported from a particular cause is divided by the number of deaths that would be expected to occur in a given month, if the same number of deaths occurred on every day of the year.

If the value is 1.00, then the actual number of deaths from a given cause is the same as would be expected. If the value is greater than 1.00, there were more deaths from the given cause than expected, and if the value is less than 1.00, there were fewer deaths in the given month than expected. Thus, the differing number of days in various months is taken into account.

We see in Figure 161 that the seasonality of all deaths and of all natural deaths in 2002 was virtually identical. This is not surprising, since in 2004, 89% of all deaths to people age 15-64 were from natural causes.

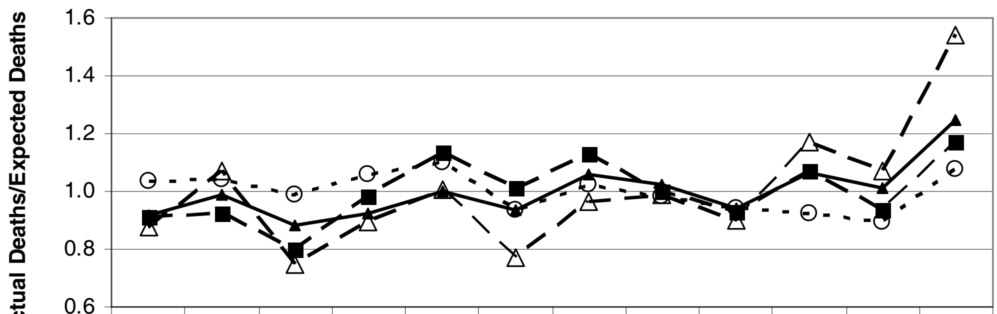
The seasonality of unnatural deaths in 2004 was somewhat different. The most striking aspect of the seasonality of unnatural deaths is the extent to which they disproportionately occur in December. In 2004, there were 25% more deaths from unnatural causes in December than would have been expected. The most obvious explanation is that unnatural deaths tend to occur when people are on holiday.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
All	0.93	0.96	0.92	0.97	1.00	1.05	1.07	1.05	1.02	1.00	0.99	1.02
Natural	0.94	0.96	0.93	0.98	1.01	1.06	1.08	1.06	1.03	0.99	0.99	0.99
Unnatural	0.92	0.99	0.88	0.93	1.00	0.94	1.06	1.02	0.94	1.06	1.01	1.25

Figure 161. Seasonality of all deaths, natural cause deaths and unnatural cause deaths, age 15-64: 2004

Figures 162 and 163 show the seasonality of particular kinds of unnatural deaths. With 37% of all unnatural deaths to those age 15-64 coded as "unnatural cause but undetermined cause unknown intent" we use caution in looking at the seasonality of those unnatural deaths for which more detail was specified. In both figures the seasonality of all unnatural deaths is shown for comparison.



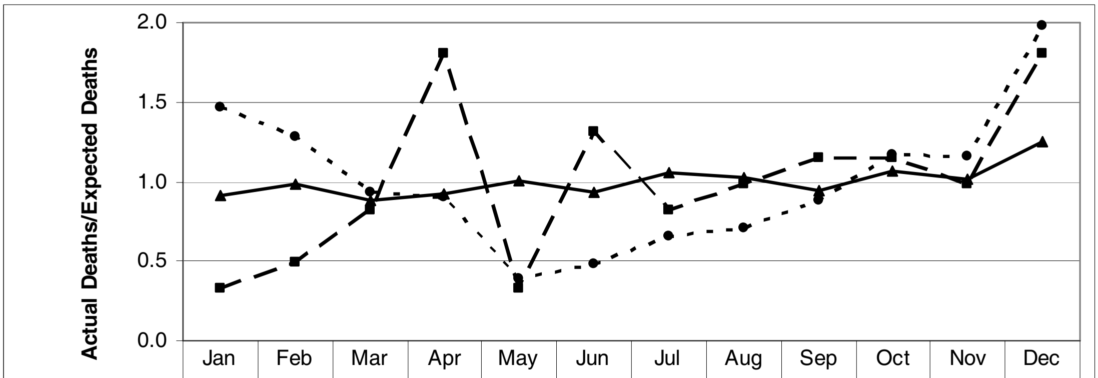
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Unnatural	0.92	0.99	0.88	0.93	1.00	0.94	1.06	1.02	0.94	1.06	1.01	1.25
Firearms	1.04	1.04	0.99	1.06	1.10	0.94	1.02	0.98	0.94	0.92	0.90	1.08
Knife	0.88	1.07	0.75	0.89	1.01	0.77	0.96	0.99	0.90	1.17	1.07	1.54
Transport	0.91	0.92	0.80	0.99	1.13	1.01	1.13	1.00	0.93	1.07	0.94	1.17

Figure 162. Seasonality of all unnatural cause deaths, and firearm, knife and transport deaths, age 15-64: 2004

In Figure 162 seasonality of reported deaths from use of knives[13] and use of firearms is shown as well as seasonality of transport deaths. All of these detailed

[13] What is referred to here as death due to knives is referred to in the Cause of Death data as death due to sharps.

causes of death in Figure 162 show a disproportionate number of deaths in December, with 54% more deaths from use of knives in December than would be expected. There are also 17% more transport deaths in December than expected.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Unnatural	0.92	0.99	0.88	0.93	1.00	0.94	1.06	1.02	0.94	1.06	1.01	1.25
Drowning	1.46	1.29	0.93	0.90	0.39	0.48	0.66	0.71	0.88	1.17	1.16	1.98
Falls	0.33	0.49	0.82	1.81	0.33	1.32	0.82	0.99	1.15	1.15	0.99	1.81

Figure 163. Seasonality of all unnatural cause deaths, drowning deaths and deaths from falls, age 15-64: 2004

In Figure 163, seasonality of deaths from drowning and from falls is shown. Drowning deaths disproportionately occurred in December and January. Deaths from falls were especially likely to occur in April and in December. Vacation time carries an elevated risk of death from a variety of unnatural causes.

Main findings on further division of unnatural causes of death

- Although deaths from unnatural causes were reported well by 1997, in 1997 and 1998 such a large proportion of unnatural deaths include no further information that deaths from unnatural causes cannot be subdivided for those years. Even in 1999-2004, about 40% of all unnatural deaths included no further information, which limits the usability of detail on such deaths.
- According to information on **transport deaths** from the Department of Transport, overall transport death rates, and pedestrian and non-pedestrian transport death rates, for both sexes, peak in the early twenties and then fall gradually with age. Non-pedestrian transport death rates are higher than pedestrian death rates at every age.
- In 2001, 36% of all transport deaths to those age 15-64 occurred to pedestrians; in 2003 this figure rose to 43%.
- Male **non-transport unnatural cause** death rates are higher than those for females. The rates for both sexes look similar to the death rates from all unnatural causes.
- According to the SAPS, the number of **homicide deaths** has decreased since 1994, especially since the late 1990s. For both sexes homicide death rates rise with increasing age to the thirties and then decline with increasing age. Male homicide death rates are much higher at every age than female homicide death rates. In 2004, the age-standardised homicide death rate per 100,000 for age 15-64 was 96 for males and 16 for females.

- In 2004, among **homicide, transport and other unnatural causes**, homicides accounted for a plurality of male unnatural deaths age 25-44 and for a majority of unnatural deaths for males age 35-39. Other unnatural causes accounted for a plurality of unnatural deaths for males at all other ages. For females other unnatural causes accounted for a plurality of unnatural deaths at all ages. Other unnatural causes account for an especially large proportion of unnatural deaths for both sexes below age 25 and above age 40.
- **Unnatural deaths** are especially common **in December**, with 25% more unnatural deaths in that month than would be expected from an even distribution of unnatural deaths over every day of the year. Deaths from virtually every detailed unnatural cause occurred disproportionately in December – 54% more knife deaths than would be expected, 17% more transport deaths, 98% more drowning deaths and 81% more deaths from falls.

Comments

It is striking what a large role homicide plays in unnatural mortality of males, although declines in male homicide rates since 2002 are encouraging. The high incidence of unnatural deaths from several causes, including drowning, transport, and knives, justifies increasing attention to prevention of accidents and policing to prevent homicides in December.

Detailed information on deaths from homicide and transport deaths are very useful. The data we have already obtained show the potential of their use for mortality analysis. Hopefully even greater cooperation between Statistics South Africa, SAPS, the Department of Transport and the Department of Health as the convenor of the Comprehensive Health Task Team will lead to more sharing of mortality data in the future.

The Judicial Death Inquest Act has been interpreted as barring those that fill out the death notification forms from indicating the manner of death (intent). However, the law does not bar recording the circumstances of the injury (firearm, sharp, burn, etc.). It would be useful if the SAPS personnel who fill out the death notification form indicated the circumstances of the death (firearm, transport, burn, etc.) on a larger proportion of cases.

If a “best opinion about apparent manner of death” item were placed on the death notification form, without legal weight (as on the NIMSS form), it would allow calculation of unnatural death rates by apparent intent (homicide, suicide, accidents) from death registration data.

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The Judicial Death Inquest Act was passed in 1959. Perhaps it would be timely for the provisions of the act to be reconsidered.

COMPARISON OF MORTALITY IN SOUTH AFRICA AND RUSSIA: 1997-2002

South Africa and Russia are interesting countries to compare. According to the World Bank classification, they are both lower middle income countries (gross national income per capita $826-$3,255). As shown in Table 8, they have virtually the same gross national income per capita. Purchasing power parity gross national income per capita adjusts for the cost of goods in a given country. That measure indicates that South Africans are on average somewhat better off than Russians. By contrast, in 2003 France had a gross national income per capita of $24,730 and a purchasing power parity gross national income per capita of $27,640 (World Bank, 2006).

Table 8. Indicators of per capita income and income distribution in South Africa and Russia

	Gross National Income (GNI) per capita	Parity Purchasing Power (PPP) GNI per capita	% with < $2 per Day	% of Income or Consumption to Poorest 20% of Population	Percentage Unemployed Among those Age 15-24
South Africa Year	$2,750 2003	$10,130 2003	34.1% 2000	3.5% 2000	44.2% 2000
Russia Year	$2,610 2003	$8,950 2003	7.5% 2002	8.2% 2003	24.7% 2000

However, South Africa has a considerably more unequal income distribution than Russia. Thirty-four per cent of South Africans in 2000 lived on less than $2 per day, while this was true of only 8% of Russians in 2002. Income concentration is considerably greater in South Africa than Russia, with 4% of income or consumption by the poorest 20% of the population in South Africa, while 7% of income or consumption is by the poorest 20% of the population in Russia. Among young adults, 44% are unemployed in South Africa and 25% in Russia.

Both countries are well known for having high unnatural cause mortality and high overall mortality by international standards. Many similar factors have been cited as causes for the high levels of unnatural cause mortality in the two countries, including social disorganization after large political changes accompanied by a sharp decline in social control.

The timing of major social and political changes was similar in the two countries. In South Africa, in 1985, influx control regulations, which had previously severely restricted residence of Africans in South African cities, were repealed (Kok and Gelderblom, 1994: 9). In 1991, apartheid laws were voided, and in 1994, a new South African state was formed. In Russia, in 1986, with Gorbachev becoming head of the Soviet Union, many earlier restrictions on activities were relaxed or eliminated. In 1991, the Soviet Union dissolved, and Russia became a separate country (Bunce, 1993; Tarschys, 1993).

In the 1980s and 1990s, throughout the world income inequality within countries tended to increase (Goesling, 2001). Increased income inequality became even more pronounced in societies in a process of political and social transition (Cornia and Court, 2001: 8-11). In both South Africa and Russia a substantial portion of the population experienced real declines in their standard of living (Leibbrandt, Levinsohn, and McCrary, 2005; Lokshin and Popkin, 1999; Statistics South Africa,

2002) and for others improvements occurred much more slowly than had been hoped for or expected (Brainerd and Cutler, 2005; Gavrilova *et al*., 2000).

This decline in social control in both countries was accompanied by a much higher level of violent death, which was facilitated by the greater availability of weapons, including firearms. Considerable violence accompanied the political struggle in South Africa. After 1994, deaths from political violence declined rapidly in South Africa, except in Kwazulu-Natal, where substantial political violence continued until 1999 (Keegan, 2005: 18-19). With new social and political arrangements after 1991, individual freedoms increased, but crime and other deviant behaviour also increased. Firearm license applications increased from 135,000 in 1985 to 257,000 in 1993 (Keegan, 2005: 30). These licence applications declined after 1994 to 162,000 in 2004 (Gould *et al.* 2004: 197). Homicide rates peaked in South Africa in 1994-1995 and have declined since (Moller, 2005: 265). In South Africa the number of licensed firearms increased from 2.5 million in 1986 to 3.5 million in 1996 to 3.7 million in 2004 (Keegan, 2005: 27), and there is a widespread perception that illegal firearms have steadily been entering South Africa from countries in the region that are in conflict (Meek, 2000). According to police records, firearms were used in 42% of murders in 1994 and in 49% of murders in 2000 in South Africa (Gun Free South Africa, 2002).

In Russia, homicides increased after the mid-1980s, decreased in the late 1990s and then increased again (Cheryakov*, et al*., 2002). Despite strict gun control laws, increased involvement of organized crime in violence and increased availability of illegal firearms have been concerns in Russia (Kvashis and Babaev, 2001). In the Soviet period to legally own a knife with a blade over a certain length, one needed a permit permitting ownership of a "deadly weapon." In both countries, what would have been a non-lethal assault or a brawl could turn into homicide with the presence of a firearm.

For Russia, a major factor in high natural cause and unnatural cause mortality has been alcohol consumption (Brainerd and Cutler, 2005; Pridemore, 2004; Shkolnikov, Mesle and Vallin, 1996: 167-171; Walberg *et al*., 1998). The stress associated with social disorganization, along with economic problems and increased income inequality, have also been cited as causes of high unnatural cause mortality (Brainerd and Cutler, 2005; Chen, Wittgenstein, and McKeon, 1996; Walberg *et al.,* 1998).

Alcohol was also heavily involved in mortality in Russia in the Soviet period, and the anti-alcohol policies that Gorbachev instituted led to a temporary decline in male mortality. However, these policies, which mainly restricted the supply of alcohol, were curtailed because of widespread unpopularity in the late 1980s and were politically untenable in the post-Soviet period (Shkolnikov, Mesle and Vallin, 1996; Tarschys, 1993).

The role of alcohol in unnatural cause mortality in South Africa has also been highlighted (Duflou, Lamont and Knobel, 1988; Lerer, 1992; Pluddemann *et al*., 2004). Social disorganization after large political changes has also been cited as a cause of increases in unnatural cause mortality in South Africa (Shaw, 2001, 2002).

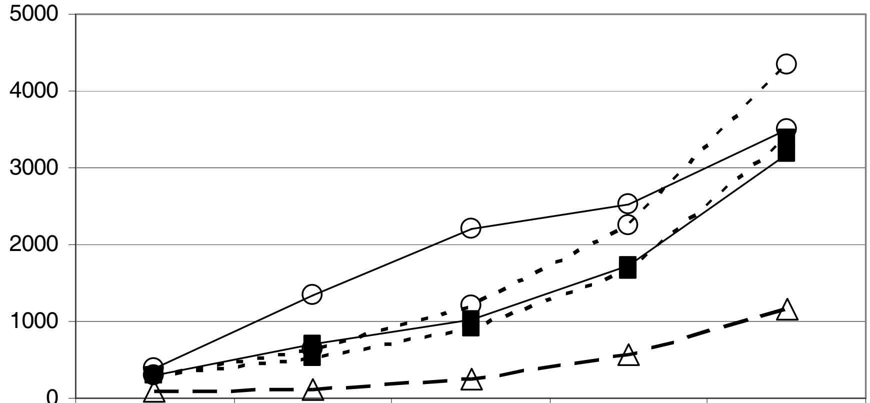
The data on death rates overall and by cause for Russia and France are from the online WHO Mortality Database (World Health Organization, 2006).[14] That source has data for Russia through 2002. We compare death rates in South Africa and Russia for 1997 and 2002. The WHO Mortality Database presents data for

[14] Unnatural causes of death are called external causes of death in the ICD-10 codes.

those age 15-64 in ten year age groups. Those age groups are therefore used in this section.

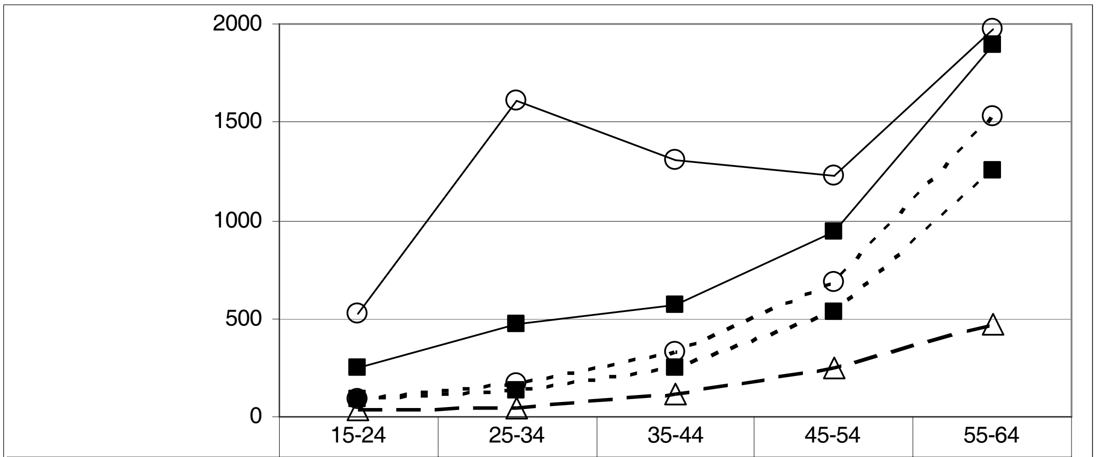
Overall death rates compared

Before turning to unnatural cause mortality, we look briefly at all cause mortality by sex in South Africa and Russia. Between 1997 and 2002, in each country, death rates at a given age tended to progressively decrease or increase over time. In order to present changes in death rates over time in an economical manner, Figures 164 and 165 show age-specific death rates for males and females respectively for South Africa and Russia in 1997 and in 2002. Data for France in 2000 are shown as a comparison.



	15-24	25-34	35-44	45-54	55-64
South Africa 1997	306	711	1016	1721	3192
Russia 1997	286	523	908	1658	3382
South Africa 2002	378	1337	2196	2523	3510
Russia 2002	289	635	1194	2246	4341
France 2000	85	120	243	569	1156

Figure 164. Male death rates by age per 100,000 from all causes in South Africa and Russia: 1997 and 2002



	15-24	25-34	35-44	45-54	55-64
South Africa 1997	246	468	567	943	1891
Russia 1997	88	134	248	532	1250
South Africa 2002	529	1606	1308	1229	1970
Russia 2002	90	171	328	681	1525
France 2000	32	46	112	245	472

Figure 165. Female death rates by age per 100,000 from all causes in South Africa and Russia: 1997 and 2002

In Figure 164, in both South Africa and Russia, male death rates in every age group increased between 1997 and 2002. Below age 45, in both 1997 and 2002, male death rates were higher in South Africa than in Russia, while above age 55, they were higher in Russia. Below age 45, the increase in male death rates in Russia was smaller between 1997 and 2002 (a 31% increase for those age 35-44) than in South Africa (an 88% increase for those age 35-44). However, for those age 55-64, the increase between these dates in Russia (28%) was greater than for South Africa (10%).

As shown in Figure 165, the pattern of change in death rates for females is different than for males. All of the groups by sex and country, except for females in South Africa, show the typical pattern of gradual increases in death rates with increasing age through age 44, with the death rates increasing at an accelerating pace through age 64. For South Africa, in 2002, the death rate for women age 25-44 was higher than for women age 45-54.

Unnatural deaths compared

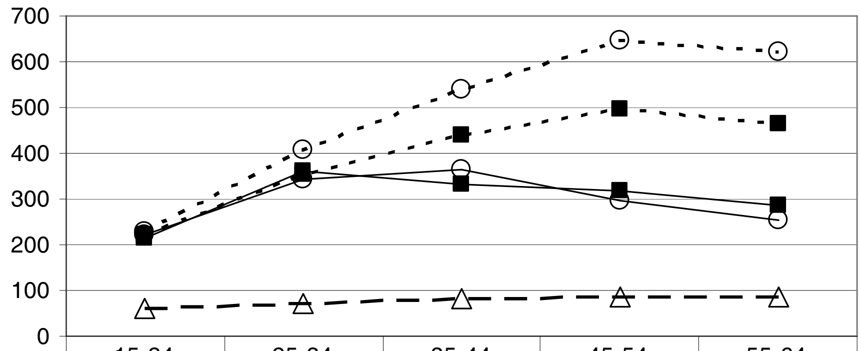
Unnatural cause death rates in both South Africa and Russia for both sexes were high. For males unnatural cause death rates ranged from a low of 3.5 times the rate for France for those age 55-64 in 2002 in South Africa, to a high of 5.1 times the rate in France for those age 25-34 in 1997 in South Africa. For Russian males, the multiple of the rate ranged from a low of 3.6 times the French value for those age 15-24 in 1997, to 7.4 times the French value for those age 55-64 in 2002. For females in South Africa, the multiple ranged from a low of 2.2 times the French value for those age 55-64 in 2002, to 4.9 times the French value for those age 25-34 in 2002. For Russian females, there was a low of 3.0 times the French value for those age 15-24 in 1997 to a high of 4.9 times the French value for those age 25-34 in 2002.

We now make the same comparisons for unnatural cause death. For males (Figure 166), in 1997, the South African unnatural cause death rates by age increased from the 15-24 age group to the 25-34 age group and then declined with each older age group. In 2002, the rates increased through the 35-44 age group. Also, for South African males unnatural cause death rates declined for the 25-34, 45-54, and 55-64 age groups between 1997 and 2002. These declines varied by age, ranging from 4% (age 25-34) to 11% (age 55-64). There was a 3% increase for those age 15-24 and a 10% increase for those age 35-44.

For Russian males, there is a different pattern. In both 1997 and 2002, unnatural cause death rates by age increased for every age group 15-54 and then declined slightly in the 55-64 age group. Also, Russian male unnatural cause death rates increased for every age group between 1997 and 2002. These increases were substantial in the older age groups, with an increase of 34% for those age 55-64.

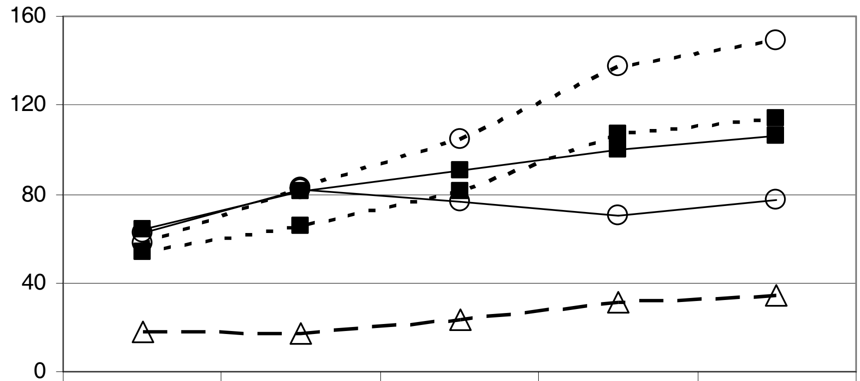
For females (Figure 167), in 1997 in South Africa, unnatural cause death rates increased gradually with age. In 2002, for South African females, unnatural cause death rates increased from the 15-24 age group to the 25-34 age group and then declined to a fairly constant level at older ages. For South African females below age 34, there were small increases in the unnatural cause death rates between 1997 and 2002, but there were substantial declines between 1997 and 2002 above age 35, with decreases ranging from 16% (age 35-44) to 30% (age 45-54).

For Russian females in both 1997 and 2002, unnatural cause death rates increased with age. Also, as for Russian males, unnatural cause death rates increased between 1997 and 2002 in every age group, with a low percentage increase of 6% (age 15-24) to a high of 31% (age 55-64). Since Russian male unnatural cause death rates are so much higher than those for females, an increase of 34% in the male rate at age 55-64 resulted in a rise in the unnatural cause death rate of 156 per 100,000, while an increase of 31% in the female rate at age 55-64 resulted in a rise in the unnatural cause death rate of only 35 per 100,000.



	15-24	25-34	35-44	45-54	55-64
South Africa 1997	214	360	331	318	287
Russia 1997	221	355	440	497	464
South Africa 2002	221	345	364	297	255
Russia 2002	230	407	539	648	621
France 2000	62	71	82	85	84

Figure 166. Male death rates by age per 100,000 from unnatural causes in South Africa and Russia: 1997 and 2002



	15-24	25-34	35-44	45-54	55-64
South Africa 1997	64	81	90	100	106
Russia 1997	54	66	81	107	114
South Africa 2002	63	82	76	70	78
Russia 2002	58	83	105	137	149
France 2000	18	17	24	31	35

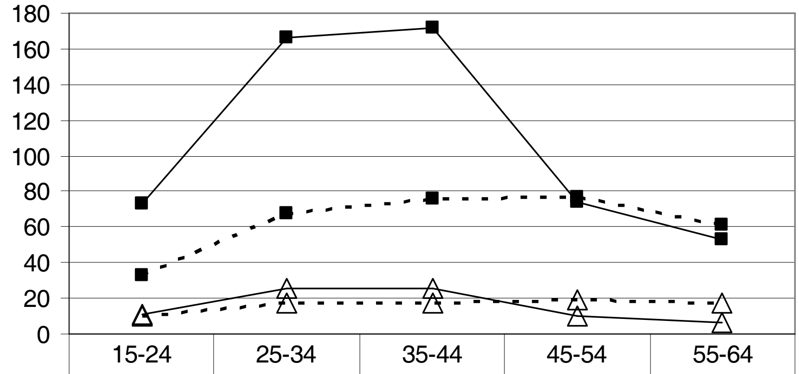
Figure 167. Female death rates by age per 100,000 from unnatural causes in South Africa and Russia: 1997 and 2002

Homicide and transport deaths compared

With the available data for South Africa and Russia, we can compare age-specific death rates from homicide for 2002, and from transport for 2001.

Figure 168 shows homicide rates by age and sex in South Africa and Russia in 2002.[15] The female rates in the two countries are almost the same. Above age 45 the female rates are somewhat higher in Russia, but at age 25-44 the female rates are some higher in South Africa. The male homicide death rates are much higher in South Africa than in Russia at age 15-44. Above age 45 the male rates are slightly higher in Russia than in South Africa.

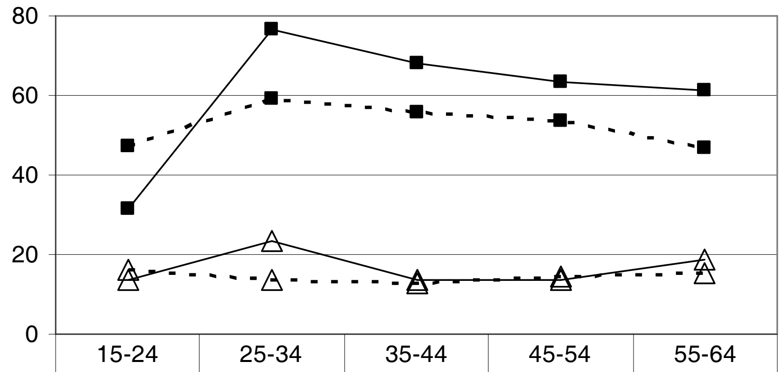
[15] The death rates used for Russia are for deaths from “assault”.



	15-24	25-34	35-44	45-54	55-64
Russian Males	33	68	76	77	61
Russian Females	10	17	18	19	17
South African Males	73	167	172	74	53
South African Females	11	26	25	10	7

Figure 168. Homicide death rates by age and sex per 100,000 for South Africa and Russia: 2002

Figure 169 shows death rates by age and sex from transport deaths for 2001 for South Africa and Russia. The female death rates from transport for South Africa and Russia were about the same, although the South African rates for 25-34 were somewhat higher than for Russian females 25-34. The transport death rates for Russian males varied little by age. The South African male rates were more variable. At age 15-24 the Russian rates were higher than the South African rates; above age 25 the South African rates were higher than the Russian rates.



	15-24	25-34	35-44	45-54	55-64
Russian Males	47	59	56	54	47
Russian Females	16	14	13	14	15
South African Males	32	77	68	63	61
South African Females	14	23	14	14	19

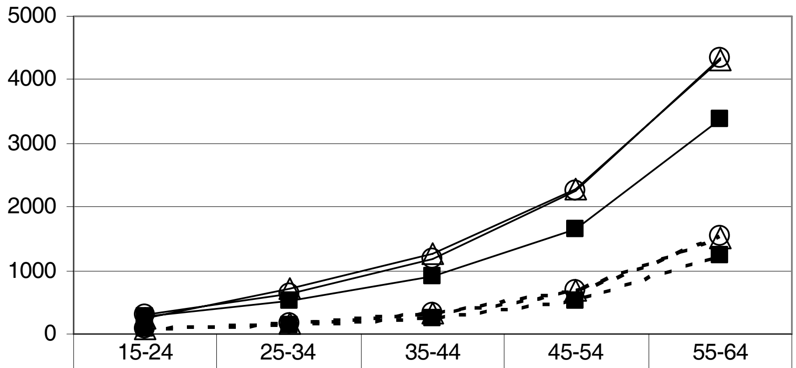
Figure 169. Transport death rates age and sex per 100,000 for South Africa and Russia: 2001

The effect of change in unnatural cause mortality on all cause mortality in South Africa and Russia

We have seen that while the rate of unnatural cause mortality in South Africa declined for both sexes between 1997 and 2002, in Russia it increased for both sexes. What is the influence of the change in unnatural cause mortality on all cause mortality for both sexes in each country?

Figures 170 and 171 show actual all cause mortality rates by sex for each country in both 1997 and 2002. They also show what all cause mortality rates would have been in 2002 if all cause mortality had increased at the same rate as natural cause mortality. Another way to look at this is, what would all cause mortality have been in 2002 if unnatural cause mortality had increased as rapidly as natural cause mortality?

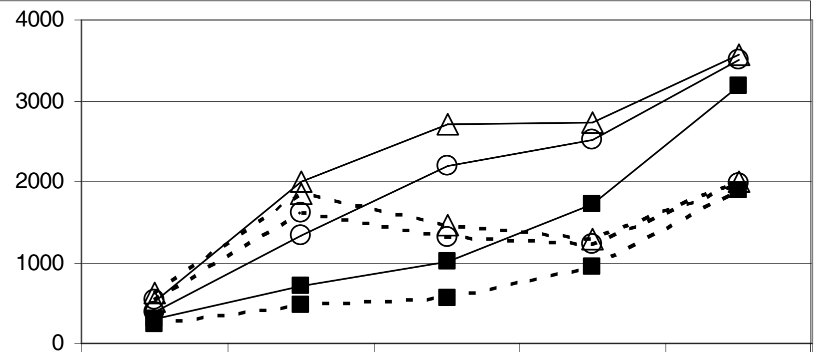
Looking at Figure 170, we see that for both males and females the actual age-specific death rates in 2002 were virtually identical to the 2002 hypothetical death rates in Russia. This is because both natural cause mortality and unnatural cause mortality in Russia increased between 1997 and 2002, and they increased at virtually the same rate. Thus, whatever problems exacerbated natural cause mortality in Russia, the same or different factors exacerbated unnatural cause mortality to the same extent.



	15-24	25-34	35-44	45-54	55-64
Male Actual 1997	286	523	908	1658	3382
Male Actual 2002	289	635	1194	2246	4341
Male Hypothetical 2002	261	710	1269	2282	4313
Female Actual 1997	88	134	248	532	1250
Female Actual 2002	90	171	328	681	1525
Female Hypothetical 2002	84	173	333	681	1514

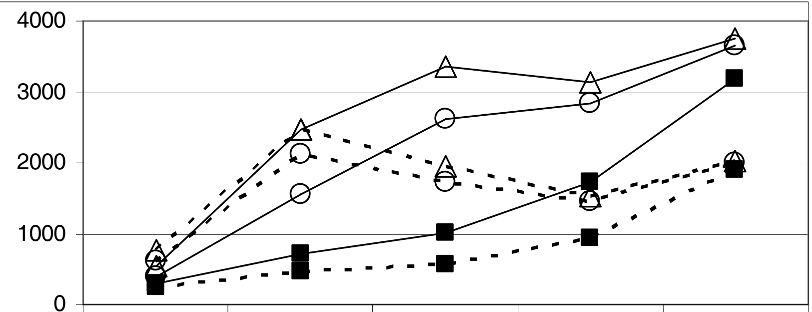
Figure 170. Russian actual all cause death rates by age and sex per 100,000 in 1997 and 2002 and hypothetical 2002 death rates if all cause death rates increased at the same rate as natural cause death rates between 1997 and 2002

Figure 171 shows the situation for South Africa. For females at all ages, the decline or slower increase in unnatural cause than natural mortality slightly moderated the increase in all cause mortality. If all cause mortality had risen at the same rate as natural cause mortality then the overall death rate for females age 25-34 would have been 15% higher. For males, the slower rate of increase in unnatural cause than natural cause mortality and the decline in unnatural cause mortality above age 45 inhibited the increase in all cause mortality between 1997 and 2002. If unnatural cause mortality for South African males had increased at the same rate as natural cause mortality, then for males 25-34 all cause mortality age would have been 50% higher in 2002 than it actually was, while for males age 35-44 it would have been 24% higher.



	15-24	25-34	35-44	45-54	55-64
Male Actual 1997	306	711	1016	1721	3192
Male Actual 2002	378	1337	2196	2523	3510
Male Hypothetical 2002	526	2010	2716	2730	3577
Female Actual 1997	246	468	567	943	1891
Female Actual 2002	529	1606	1308	1229	1970
Female Hypothetical 2002	630	1844	1465	1296	2005

Figure 171. South African actual all cause death rates by age and sex per 100,000 in 1997 and 2002 and hypothetical 2002 death rates if all cause death rates increased at the same rate as death rates by natural causes between 1997 and 2002



	15-24	25-34	35-44	45-54	55-64
Male Actual 1997	306	711	1016	1721	3192
Male Actual 2004	383	1561	2623	2848	3643
Male Hypothetical 2004	545	2466	3365	3133	3744
Female Actual 1997	246	468	567	943	1891
Female Actual 2004	626	2118	1726	1447	1999
Female Hypothetical 2004	758	2458	1961	1541	2037

Figure 172. South African actual all cause death rates by age and sex per 100,000 in 1997 and 2004 and hypothetical 2004 death rates if all cause death rates increased at the same rate as death rates by natural causes between 1997 and 2004

Although we can only make a comparison with Russia through 2002, for South Africa, we can ask what the exercise shown in Figure 171 would look like if we compared 1997 and 2004. This comparison is shown in Figure 172.

If all cause mortality had risen 1997-2004 at the same rate as natural cause mortality in the same time period, the overall death rate for females age 25-34 would have been 16% higher, and for males age 25-34, 58% higher.

Main findings from the comparison of mortality in South Africa and Russia

- South Africa and Russia have similar gross national income per capita, although South Africa has a more unequal income distribution. Both countries experienced political liberalization in the mid-1980s and dramatic political change in the early 1990s.
- Both countries have very high all cause mortality and unnatural mortality by world standards. Male and female all cause mortality is higher in South Africa than in Russia, especially between age 25 and 55. Male and female unnatural cause mortality is higher in Russia than in South Africa, especially above age 25 for males and above age 45 (35 in 2002) for females.
- In Russia, natural cause mortality and unnatural cause mortality increased by age for both sexes between 1997 and 2002 at almost the same rate. In South Africa, for both sexes, unnatural cause mortality increased at a much lower rate than natural cause mortality.
- In South Africa if unnatural cause mortality had increased at the same rate as natural cause mortality between 1997 and 2002, then the female all cause death rate age 25-34 would have been 15% higher than it actually was, the male all cause death rate at age 25-34 would have been 50% higher, and the male death rate at age 35-44 would have been 24% higher.
- In South Africa if unnatural cause mortality had increased at the same rate as natural cause mortality between 1997 and 2004, then the female all cause death rate age 25-34 would have been 16% higher than it actually was, the male all cause death rate at age 25-34 would have been 58% higher, and the male death rate at age 35-44 would have been 28% higher.
- Although high overall and unnatural cause mortality are a cause for concern for South Africa, South Africa is not the only country with such problems, and the trend in unnatural mortality is much worse in Russia.

Comments

Comparing South Africa with Russia points out that there are countries with both higher unnatural cause death rates and less desirable trends in unnatural cause mortality than South Africa. However, greater increases in natural cause mortality in South Africa than in Russia have resulted in worse overall mortality trends for both South African men and women than Russian men and women below age 55. It is striking how much the slower increase or decline in unnatural cause death rates than natural cause death rates has slowed the increase in overall South African death rates, especially for men. Nonetheless, although South Africa has a more desirable trend in unnatural mortality than Russia, the higher homicide and transport death rates for males age 25-44 in South Africa than in Russia are a cause for concern.

MORTALITY SCENARIOS

We now examine three different mortality scenarios. In each scenario we vary one aspect of the mortality situation in 2004, 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 2004 level.[16]

The first scenario is what mortality conditions would look like in 2004 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.

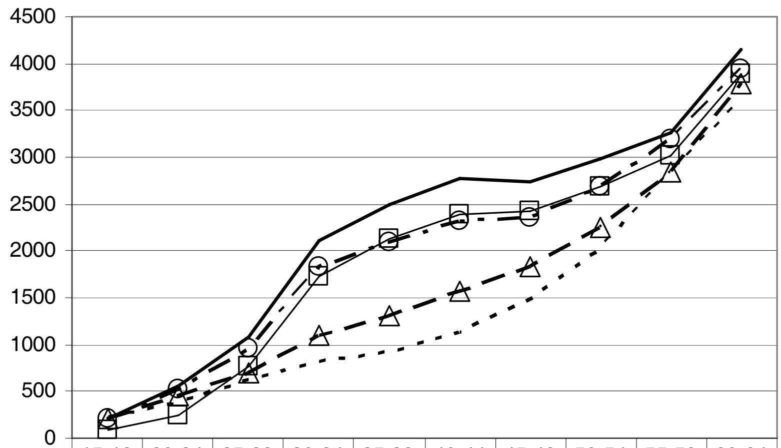
In the second scenario, we leave unnatural cause death rates and non-communicable cause death rates unchanged, but we examine the impact on mortality if communicable and related death rates in 2004 had the values by age and sex that they had in 1997.

In the third scenario, we calculate what mortality would have looked like in 2004 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 173 and 174 show the actual death rates by age in 1997 and 2004. They also show what the death rates in 2004 would have been under each of the three scenarios.

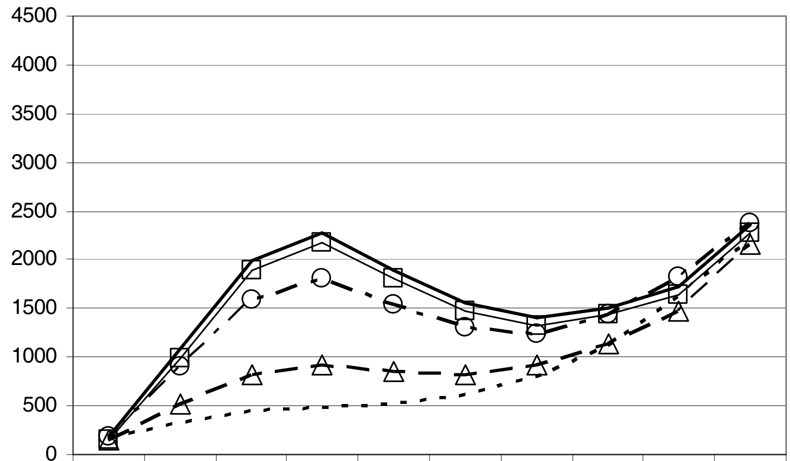
For both males and females returning to the communicable disease death rates of 1997 (Scenario 2) would have had the greatest effect on lowering death rates by age. For males, eliminating all unnatural deaths (Scenario 1) and returning death rates from non-communicable diseases to their 1997 values (Scenario 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 2004.

[16] 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.



	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
No Unnatural Deaths	81	245	759	1726	2120	2394	2421	2682	3018	3886
Communicable 1997 Values	214	454	697	1095	1302	1562	1837	2256	2847	3779
Non-Communicable 1997 Values	212	516	964	1825	2099	2327	2354	2679	3185	3939
Actual 2004	216	555	1081	2118	2498	2765	2744	2979	3270	4146
Actual 1997	235	381	625	817	916	1136	1486	2016	2838	3614

Figure 173. Male death rates by age per 100,000 according to three scenarios: 2004

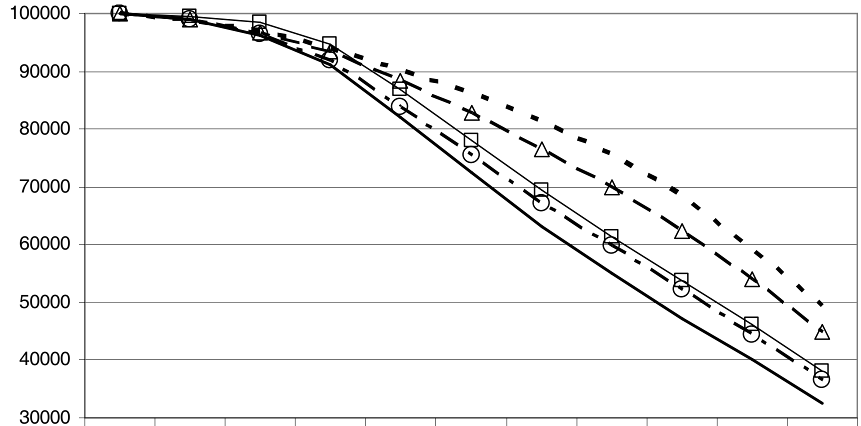


	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
No Unnatural Deaths	148	992	1895	2178	1805	1473	1329	1434	1641	2274
Communicable 1997 Values	156	525	822	915	855	822	925	1140	1480	2161
Non-Communicable 1997 Values	181	901	1597	1811	1533	1312	1244	1442	1829	2375
Actual 2004	187	1085	1985	2267	1890	1548	1400	1506	1717	2360
Actual 1997	165	331	452	489	526	615	800	1116	1626	2201

Figure 174. Female death rates by age per 100,000 according to three scenarios: 2004

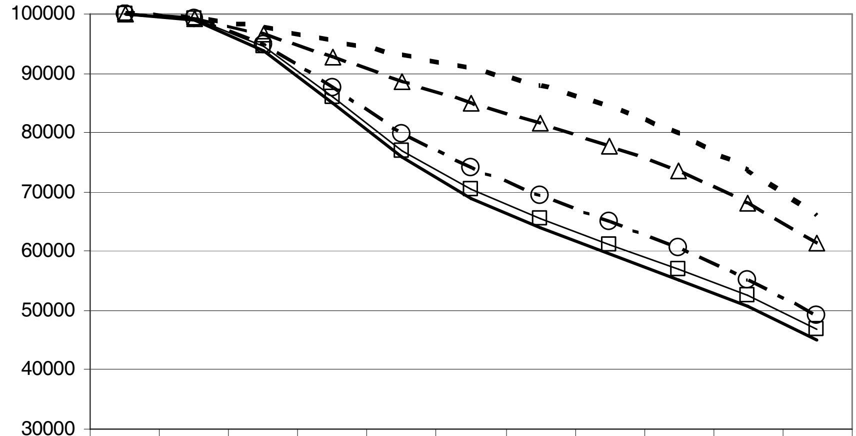
Figures 175 and 176 show under the three scenarios and for the actual situations in 1997 and 2004 the number of survivors to given ages out of 100,000 on their 15th birthday. Below age 35, for males Scenario 1 (eliminating unnatural deaths) gives the best survival of all the alternatives considered. 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	100000	99598	98384	94718	86883	78138	69313	61402	53685	46151	37979
Comm 1997 Values	100000	98934	96714	93401	88423	82846	76618	69889	62427	54130	44786
Non-Comm 1997 Values	100000	98946	96423	91887	83870	75507	67204	59732	52233	44529	36545
2004 Actual	100000	98924	96218	91152	81984	72347	62991	54904	47293	40145	32604
1997 Actual	100000	98830	96967	93981	90220	86179	81420	75589	68336	59282	49458

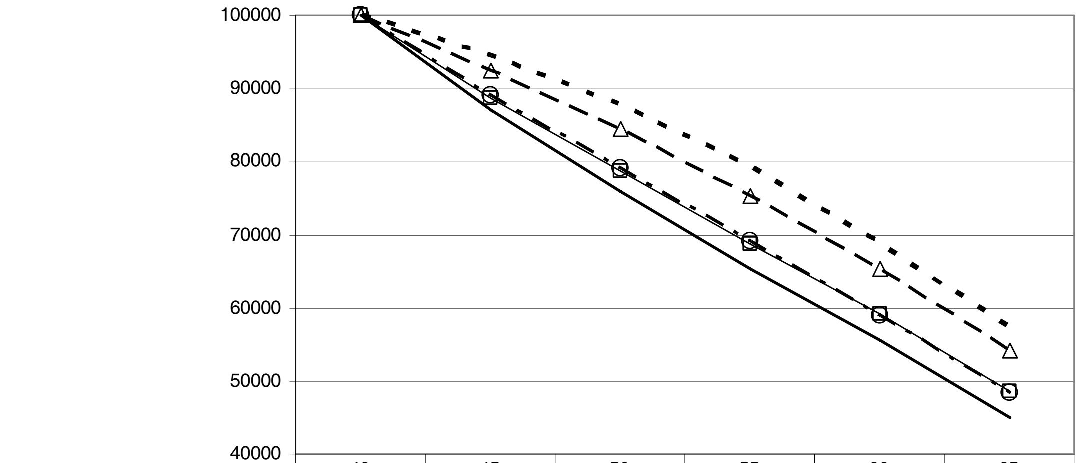
Figure 175. Male survivors to given ages out of 100,000 on their 15th birthday, according to three scenarios: 2004



	15	20	25	30	35	40	45	50	55	60	65
No Unnatural Deaths	100000	99262	94458	85915	77044	70390	65391	61187	56952	52463	46819
Comm 1997 Values	100000	99222	96652	92758	88610	84899	81478	77793	73481	68238	61243
Non-Comm 1997 Values	100000	99099	94731	87456	79880	73982	69284	65103	60574	55277	49082
2004 Actual	100000	99070	93836	84963	75848	69002	63861	59542	55221	50676	45028
1997 Actual	100000	99176	97546	95368	93064	90647	87901	84453	79869	73630	65951

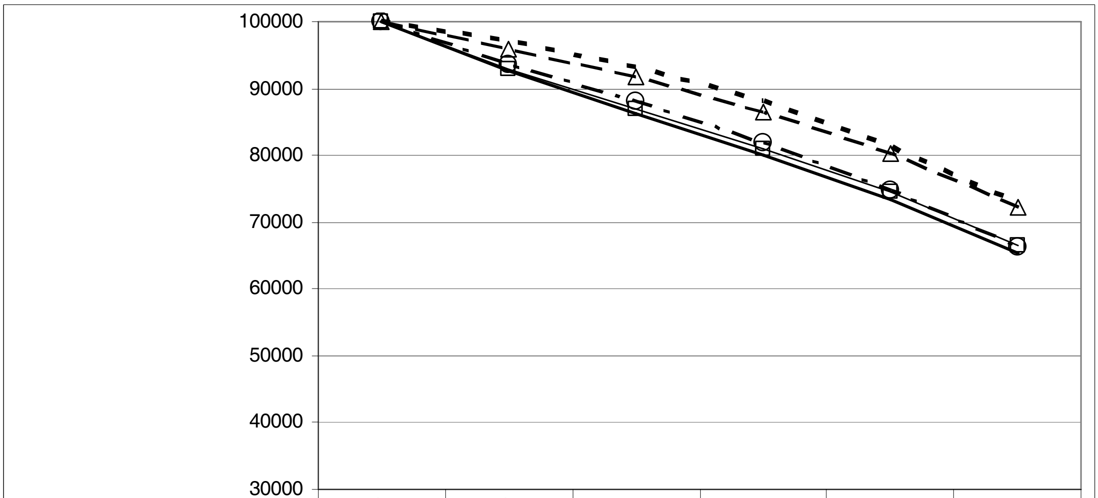
Figure 176. Female survivors to given ages out of 100,000 on their 15th birthday, according to three scenarios: 2004

By looking at Figures 175 and 176 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	88706	78581	68705	59064	48605
Comm 1997 Values	100000	92483	84360	75353	65339	54060
Non-Comm 1997 Values	100000	89003	79108	69176	58973	48399
2004 Actual	100000	87068	75890	65370	55489	45066
1997 Actual	100000	94477	87711	79295	68790	57390

Figure 177. Male survivors to given ages out of 100,000 on their 40th birthday, according to three scenarios: 2004



	40	45	50	55	60	65
No Unnatural Deaths	100000	92898	86925	80909	74531	66513
Comm 1997 Values	100000	95971	91630	86551	80376	72136
Non-Comm 1997 Values	100000	93650	87999	81876	74717	66343
2004 Actual	100000	92549	86291	80028	73441	65257
1997 Actual	100000	96971	93166	88109	81227	72755

Figure 178. Female survivors to given ages out of 100,000 on their 40th birthday, according to three scenarios: 2004

Figures 177 and 178 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 2004. 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 1997-2004 than in male mortality.

Figures 177 and 178 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 177 is the1997 actual mortality situation, in which 57.4% of those alive at age 40 were still alive at age 65. In Figure 178 the worst survival scenario for females was the actual 2004 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 9 shows the difference these three scenarios make for survival from the 15th birthday to the 65th birthday and for survival in the 15-40 and 40-65 age segments.

Table 9. Percentage surviving between given ages and change in percentage surviving according to three scenarios compared with actual mortality: 2004

	% Surviving 15-65	Increase in % Surviving 15-65 Compared to Actual 2004	% Surviving 15-40	Increase in % Surviving 15-40 Compared to Actual 2004	% Surviving 40-65	Increase in % Surviving 40-65 Compared to Actual 2004
Male						
No unnatural deaths	38	5	78	6	49	4
1997 communica-ble & related death rates	45	12	83	11	54	9
1997 non-communica-ble death rates	37	4	76	4	48	3
Actual 2004	33		72		45	
Female						
No unnatural seaths	47	2	70	1	67	2
1997 communica-ble & related death rates	62	17	85	16	72	7
1997 non-communica-ble death rates	49	4	74	5	66	1
Actual 2004	45		69		65	

Table 9 shows that for both sexes for the entire 15-65 age range as well as for the two 25-year age segments, returning to the 1997 level of communicable and relate diseases would have had the largest effect on survival. For males, eliminating unnatural deaths and returning to the 1997 level of non-communicable disease mortality would have had similar effects. For females, eliminating unnatural deaths would have had little effect, and returning to the 1997 level of non-communicable disease mortality would have influenced survival only in the younger age segment, since for much of the older age group, non-communicable disease mortality declined between 1997 and 2004.

Table 10 shows the effects of the three scenarios on the number of years lived age between the 15th and the 65th birthday. Then it shows the increase in the percentage surviving to the 65th birthday over the actual 2004 situation and the increase in the number of years lived age 15-65 compared to what was implied by the actual 2004 mortality situation. This is also shown for the 15-40 and the 40-65 age segments.

Table 10. Years lived for in given age groups and increase in years lived according to three scenarios compared with actual mortality: 2004

	Years Lived 15-65	Increase in Years Lived 15-65 Compared to Actual 2004	Years Lived 15-40	Increase in Years Lived 15-40 Compared to Actual 2004	Years Lived 40-65	Increase in Years Lived 40-65 Compared to Actual 2004
Male						
No unnatural Deaths	37.9	2.1	23.4	0.7	18.5	0.7
1997 Communicable & related death rates	39.8	4.2	23.4	0.7	19.7	1.9
1997 Non-communicable death rates	36.9	1.3	22.9	0.2	18.5	0.7
Actual 2004	35.6		22.7		17.8	
Female						
No unnatural Deaths	36.8	0.6	22.1	0.3	20.9	0.2
1997 communicable & related death rates	42.2	6.0	23.5	1.6	22.0	1.3
1997 Non-communicable death rates	38.0	1.8	22.4	0.5	21.1	0.4
Actual 2004	36.2		21.9		20.7	

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 10 is helpful in putting the impact of mortality change 1997-2004 in perspective. As in Table 9, Scenario 2 – returning to the 1997 mortality situation for communicable and related diseases – would have the largest impact on survival. However, for males 15-40, eliminating unnatural deaths and returning to the 1997 communicable and related diseases situation would have essentially 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.

Main findings from three mortality scenarios

We considered three mortality scenarios as ways of hypothetically altering the 2004 mortality situation. In Scenario 1, all unnatural mortality is eliminated. In Scenario 2, death rates from communicable and related diseases are returned to their 1997 level, and in Scenario 3, death rates from non-communicable diseases are returned to their 1997 level. Comparisons are also made with the actual mortality situation in 1997 and in 2004.

- The 1997 actual mortality situation provided the best mortality outcome in most cases, but there were some exceptions. First we consider effects on death rates by age and sex. For males age 15-19, the actual 1997 death rates were higher than in any of the scenarios. This is because the actual male death rate 15-19 declined between 1997 and 2004. For males 20-24 the first scenario with no unnatural deaths resulted in the lowest death rates. For females 15-19 the no unnatural deaths scenario yielded the lowest death rate, and the second lowest was Scenario 2, returning to 1997 communicable and related mortality. At age 60-64, Scenario 2, returning to 1997 communicable and related mortality, yielded the lowest death rate because at the older ages, female death rates from non-communicable diseases declined between 1997 and 2004.
- For males, eliminating unnatural deaths and returning to the 1997 non-communicable disease situation had virtually the same effects on mortality.
- Considering survival from age 15 to 65, 15 to 40 or 40 to 65, for both sexes the 1997 actual situation yielded the best survival, followed by returning to the 1997 communicable and related disease level.

Comments

It is not surprising that returning to the 1997 communicable and related mortality situation makes the most difference for females. It is interesting that eliminating unnatural deaths and returning to the 1997 non-communicable disease mortality situation have about the same impact on males.

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. Issues relating to causes of death also present interesting questions for other sub-Saharan African countries.

It would have been desirable to make some detailed comparisons between the results we obtained for South Africa and those for other sub-Saharan African countries like the comparisons we made between South Africa and Russia. The best source of international data by age, sex, year of death and cause of death is the WHO Mortality Database (World Health Organization, 2006), which was the source of data for Russia and France used in the comparisons in the earlier section. The only sub-Saharan African country listed in the WHO Mortality Database with complete coverage of deaths is Mauritius, and the most recent year for which data from Mauritius are available is 2000. Thus, unfortunately at this time it is not possible to make meaningful detailed comparisons with other sub-Saharan African countries.

However we hope that the patterns found and the explanations offered will be helpful not just for understanding South Africa but will contribute to the understanding of sub-Saharan Africa more generally.

We now summarise some of our main findings and observations about mortality in South Africa in a series of tables. For some sex-age groups and some causes of death the increase in death rates between 1997 and 2004 has been truly astounding.

Table 11 indicates for females and Table 12 for males the age groups for which the death rate between 1997 and 2004 increased by more than 2.5 times.[17] This large increase in death rates has occurred for several causes of death for both males and females. It is concentrated in ages 20-44 and especially for communicable diseases. It also occurs for some non-communicable diseases that exhibit an age pattern of mortality similar to HIV and that likely include a high proportion of deaths that are due to HIV.

[17] Values are not shown for conditions originating in the perinatal period in most of the tables in this section, since we only have reliable data by age for that cause of death 1997-2002. Data are shown for conditions originating in the perinatal period in Table 15, which compares male and female death rates in 1997. None of the tables for males includes mortality from maternal conditions.

Table 11. Causes of death and age groups for which the 2004 female death rate was more than 2.5 times the 1997 value

	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
All causes		X	X	X	X	X				
Natural causes		X	X	X	X	X				
Unnatural causes										
Communicable and related		X	X	X	X	X	X	X		
Non-communicable		X	X	X	X					
Infectious		X	X	X	X	X	X	X		
Stated HIV				X	X	X				
Tuberculosis		X	X	X	X	X	X			
Parasitic		X	X	X	X	X	X	X	X	X
Parasitic opportunistic infections	X	X	X	X	X	X	X	X	X	X
Malaria		X		X						
Maternal conditions			X							
Nutritional deficiencies			X	X	X					
Stroke		X	X	X						
Circulatory except stroke										
Cancer										
Lung cancer			X	X						
Cancer reprod. system		X								
Diabetes and obesity										
Disorders immune mechanism		X	X	X	X	X	X	X	X	X
Non-communicable respiratory		X	X	X	X	X				
Other non-communicable		X	X	X	X					

Table 12. Causes of death and age groups for which the 2004 male death rate was more than 2.5 times the 1997 value

	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
All causes				X	X					
Natural causes			X	X	X	X				
Unnatural causes										
Communicable and related		X	X	X	X	X	X	X		
Non-communicable				X						
Infectious		X	X	X	X	X	X	X		
Stated HIV					X	X				
Tuberculosis		X	X	X	X	X	X			
Parasitic		X	X	X	X	X	X	X	X	X
Parasitic opportunistic infections	X	X	X	X	X	X	X	X	X	X
Malaria										
Nutritional deficiencies				X						
Stroke										
Circulatory except stroke										
Cancer										
Lung cancer										
Cancer reproductive system										
Diabetes and obesity										
Disorders immune mechanism	X	X	X	X	X	X	X	X	X	X
Non-communicable respiratory			X	X	X	X				
Other non-communicable					X					

One of the most distinctive aspects of recent mortality experience in South Africa has been the rapid rise in female death rates, especially at the young adult ages. This is believed to be primarily due to increases in mortality from HIV. For both females and males death rates by age from stated HIV rise to a peak and then decline fairly rapidly with age. The peak for males occurs about five years later than for females.

The search for hidden HIV deaths under other stated causes of death has often begun with looking for such a peaked pattern. Table 13 indicates for males and for females for 2004 and for 1997 whether death rates by age fell from a peak and if so what the peak age group was. By a “peak” we mean a five-year age group that has a higher death rate from the stated cause than does the next older age group. Some causes of death exhibit two or even three peak age groups with a lower rate in the next older age group. When this occurs, the age of the first peak is indicated.

Table 13. Whether death rates from natural causes declined from a peak and age of peak value: 2004 and 1997

	2004				1997			
	Male		Female		Male		Female	
	Peak	Age of Peak	Peak	Age of Peak	Peak	Age of Peak	Peak	Age of Peak
All causes	X	40-44	X	30-34				
Natural causes			X	30-34				
Communicable and related	X	40-44	X	30-34			X	25-29
Non-communicable			X	30-34				
Infectious	X	40-44	X	30-34			X	25-29
Stated HIV	X	35-39	X	30-34	X	35-39	X	25-29
Tuberculosis	X	40-44	X	30-34	X	55-59	X	30-34
Parasitic	X	35-39	X	30-34	X	40-44	X	25-29
Parasitic opp. infections	X	35-39	X	30-34	X	30-34	X	25-29
Malaria	X	45-49	X	30-34	X	45-49	X	25-29
Maternal conditions	n.a.		X	25-29	n.a.		X	30-34
Nutritional deficiencies	X	30-34	X	30-34	X	45-49	X	30-34
Stroke								
Circulatory except stroke								
Cancer								
Lung cancer							X	15-19
Cancer reprod. system								
Diabetes and obesity								
Disorders imm. mechanism	X	35-39	X	30-34	X	30-34	X	25-29
Non-commun. respiratory			X	30-34				
Other non-communicable			X	30-34				
n.a. = not applicable								

We think that when there is no peak age, it is unlikely that hidden HIV is playing a substantial role in the given cause of death. Both males and females in 2004 show a peak for death from all causes combined. However, since males do not show a peak for natural causes, this male peak for all causes of death is completely due to a strong peak from unnatural causes of death, which are high at young adult ages.

For females both in 2004 and 1997 and for males in 2004 all of the communicable and related causes of death examined in detail had a peak age. This is also true for males in 1997 except for communicable and related causes in total. Thus, peaking by age for these kinds of causes of death is not a recent phenomenon in South Africa.

Most of the non-communicable diseases do not exhibit a peak age. Certain disorders of the immune mechanism shows a peak for both sexes in both years. As we noted, we think that almost all of the death sin that category are actually due to HIV. Non-communicable respiratory diseases and other non-communicable diseases show a peak only for females in 2004. We think that although HIV could play a role in those causes of death, it is likely that something else was leading to mortality from those causes, especially for males.

Table 14 shows more information for the causes of death for which there was a male peak in 2004. As noted, for HIV, death rates fall off rapidly after the peak age. In Table 14, for each cause of death for which there is a male peak in 2004, the age of the peak is indicated along with the value of the death rate at the peak age. The value of the male death rate for that cause 15 years after the peak age is shown (Column 3). Then, the value 15 years after the peak age divided by the value at the peak age is shown (Column 4). If there is a rapid fall in the death rate after the peak age, we think it is more likely that the given cause of death is hiding actual HIV deaths.

Table 14. For causes of death for which males in 2004 had a peak value, the value at the peak age, 15 years later and 15 years later relative to the value at the peak age

	(1) Peak Age	(2) Value at Peak Age	(3) Value After 15 Years	(4)=(3)/(2) (Value After 15Yrs)/ (Value at Peak)
Stated HIV	35-39	132.4	65.4	0.49
Parasitic opp. infections	35-39	49.5	20.9	0.42
Disorders immune mechanism	35-39	127.1	69.1	0.54
All causes	40-44	2765	3270	1.18
Communicable and related	40-44	1522	973	0.64
Infectious	40-44	1464	948	0.65
Tuberculosis	40-44	685.6	464.7	0.68
Parasitic	35-39	54.9	27.1	0.49
Malaria	45-49	6.4	6.3	0.98
Nutritional deficiencies	30-34	4.7	4.8	1.02

For HIV, for parasitic opportunistic infections and for certain disorders of the immune mechanism, the values in Column 4 of Table 14 are low, indicating a rapid fall in the death rates by age after the peak age. The values for the other causes of death with a peak are higher, suggesting that even though HIV could play a role, something else is likely causing the persistent high death rates at older ages.

Higher female than male death rates at younger ages have also sometimes been taken as indicative of HIV. However, even in 1997 females had a higher chance of dying from natural causes from their 15th birthday to their 40th birthday than males. Only the much higher mortality from unnatural causes of males than females in 1997 allowed females to overall have better survival conditions than males in the15-39 age segment.

It is interesting to note for which causes of death young females had higher death rates than males in 1997. This is indicated in Table 15 for ages 15-19, 20-24 and 25-29. We see in Table 15 that young females had higher death rates than young males in 1997 from almost every cause of death examined in detail. For some or all groups 15-24 the female death rate was not higher for all causes, unnatural causes, malaria, stroke, cancer and lung cancer. More examination of what was happening in mortality conditions of young adults in 1997 to reverse the typical sex differential in mortality would be warranted.

Table 15. Causes of death for which the female death rate was higher than the male death rate at young ages: 1997

	15-19	20-24	25-29
All causes			
Natural causes	X	X	X
Unnatural causes			
Communicable and related	X	X	X
Non-communicable	X	X	X
Infectious	X	X	X
Stated HIV	X	X	X
Tuberculosis	X	X	X
Parasitic	X	X	X
Parasitic opportunistic infections	X	X	X
Malaria			X
Perinatal period	X	X	X
Nutritional deficiencies	X	X	X
Stroke			
Circulatory except stroke	X	X	X
Cancer		X	X
Lung cancer	X		X
Cancer reproductive system	X	X	X
Diabetes and obesity	X	X	X
Disorders immune mechanism	X	X	X
Non-communicable respiratory	X	X	X
Other non-communicable	X	X	X

It is also worthwhile gathering together what we have found about improving mortality conditions among those 15-19 and those age 55-64. Table 16 indicates for males and females 15-19 for which causes of death the death rate was lower in 2004 than in 1997 and for which causes of death the death rate had risen between 1997 and 2004 by a modest amount – less than 20%. Similar information is shown in Table 17 for males 55-64 and in Table 18 for females 55-64.

We see in Table 16 that for 5 of the 20 specific causes or groups of causes considered for young males, as well as for all causes, the death rate was lower in 2004 than in 1997 and in an additional 8 of them it was less than 20% greater. Of the 21 specific causes or groups of causes considered for young females, for 6 of them the death rate fell between 1997 and 2004 and for an additional six, as well as for all causes, it was less than 20% higher than the 1997 rate. While death rates from all causes declined for males, for females they increased, but only by 13%. A variety of causes of death contributed to this favourable mortality trend. Something was generally lowering or limiting the risks of death from some causes for young people in South Africa. This is also worth further examination.

Table 16. Causes of death for which the 2004 death rate was less than the 1997 value or less than 20% greater than the 1997 value: Males and females 15-19

	Male 15-19		Female 15-19	
	2004<1997	**2004<1.2*1997**	**2004<1997**	**2004<1.2*1997**
All causes	X			X
Natural causes		X		
Unnatural causes	X		X	
Communicable and related		X		
Non-communicable		X		X
Infectious				
Stated HIV		X	X	
Tuberculosis				
Parasitic				
Parasitic opp. infections				
Malaria	X			X
Maternal conditions	n.a.	n.a.		X
Nutritional deficiencies	X			X
Stroke	X			
Circulatory except stroke		X	X	
Cancer		X		X
Lung cancer			X	
Cancer reproductive system	X		X	
Diabetes and obesity		X	X	
Disorders immune mechanism				
Non-communicable respiratory				
Other non-communicable		X		X

We see in Table 17 that for both of the older age groups of males, death rates from all causes increased between 1997 and 2004 by less than 20% (15% for each age group). Of the 20 causes of death or groups of causes death considered in addition to mortality from all causes, seven showed a fall in the death rate between 1997 and 2004 for males 55-59 and four showed a fall for the 60-64 age group. For males 55-59, an additional five causes increased by less than 20% between 1997 and 2004, and for males 60-64, an additional seven causes increased by less than 20%.

Table 17. Causes of death for which the 2004 death rate was less than the 1997 value or less than 20% greater than the 1997 value: Males 55-59 and 60-64

	Male 55-59		Male 60-64	
	2004<1997	2004<1.2*1997	2004<1997	2004<1.2*1997
All causes		X		X
Natural causes		X		X
Unnatural causes	X		X	
Communicable and related				
Non-communicable		X		X
Infectious				
Stated HIV				
Tuberculosis				
Parasitic				
Parasitic opp. infections				
Malaria	X			
Nutritional deficiencies	X		X	
Stroke		X		X
Circulatory except stroke	X			X
Cancer	X		X	
Lung cancer	X		X	
Cancer reproductive system	X			X
Diabetes and obesity				
Disorders immune mechanism				
Non-communicable respiratory		X		
Other non-communicable		X		X

Table 18 shows similar information for females. As with males, the all cause death rate for females in each age group increased by less than 20% between 1997 and 2004 (5% for those 44-59 and 7% for those 60-64). Of the 21 causes of death or groups of causes considered, nine showed lower death rates for females 55-59 in 2004 than in 1997. For a further five causes death rates were less than 20% higher than their 1997 values. For females 60-64, seven causes showed lower death rates in 2004 than in 1997 and and four showed rates that were less than 20% higher.

With increases in the proportion of the population at older ages, and with older persons often taking on increasing responsibilities for the care of relatives, this favourable trend in the mortality of older persons is very welcome. It also deserves further study.

Another positive aspect of the mortality situation in South Africa is the surprisingly small increase in mortality for females in the 40-64 age segment. Despite deterioration in the survival of females in their twenties and thirties, the slight worsening in the survival chances of females who survive to their 40^{th} birthday is somewhat surprising and deserves further study.

The worst survival is that of males age 40-64 both in 1997 and in 2004. Further examination of their situation is warranted. It would be important to understand what contributes to their high mortality in addition to any effects of HIV.

Table 18. Causes of death for which the 2004 death rate was less than the 1997 value or less than 20% greater than the 1997 value: Females 55-59 and 60-64

	Female 55-59		Female 60-64	
	2004<1997	**2004<1.2*1997**	**2004<1997**	**2004<1.2*1997**
All causes		X		X
Natural causes		X		X
Unnatural causes	X		X	
Communicable and related				
Non-communicable	X		X	
Infectious				
Stated HIV				
Tuberculosis				
Parasitic				
Parasitic opp. infections				
Malaria		X		
Maternal conditions	X			
Nutritional deficiencies	X		X	
Stroke	X		X	
Circulatory except stroke	X		X	
Cancer	X		X	
Lung cancer	X		X	
Cancer reproductive system	X			X
Diabetes and obesity		X		
Disorders immune mechanism				
Non-communicable respiratory		X		X
Other non-communicable		X		X

It is hoped that setting out in some detail the mortality situation by cause of death in South Africa will help researchers and policy-makers. Also, the possibilities for research of scientific and policy value using the South African Death Notification data 1997-2004 have barely been scratched by the research presented in this report. We hope that the potential in these data will motivate others to use them.

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APPENDIX A. COMPLETENESS OF DEATH REGISTRATION AND MULTIPLIERS TO ADJUST FOR INCOMPLETENESS OF DEATH REGISTRATION AND TO REDISTRIBUTE NATURAL ILL-DEFINED DEATHS

One commonly used method of estimating completeness of death registration is through a version of the Growth-Balance method (Bennett and Horiuchi, 1981, 1984; Hill, 1987; Preston and Coale, 1982). These methods are useful when another approach is not feasible. However, for South Africa, these methods yield very high estimates of completeness of death registration, including implausibly high estimates for children.

For 2003, using the Preston and Hill (1980) method, Statistics South Africa (2006:4) estimated that the overall completeness of death registration was approximately 90 percent for males and 87 percent for females and that the completeness estimates for 2004 were 87 percent and 82 percent respectively. We estimated overall completeness of death registration for 2003 of 82 percent for males and 86 percent for females; for 2004 we estimated overall completeness of 78 percent for males and 83 percent for females Some of the reasons why these estimates may be implausible could relate to the assumptions of a stable population closed to migration for South African population and that death recording in the register does not vary with age. Using a variant of the Growth-Balance method, Dorrington *et al*. (2001:53) estimated completeness of registration of deaths age 15 and older at 94 percent for 2000; we estimated completeness of registration for those age 15 and older for 2000 of 85 percent for males and 87 percent for females.

We used a more direct approach. We estimated completeness of registration as follows. For each five-year age group, sex and year of death, the number of deaths reported on Death Registration Forms provided the numerator. The denominator was obtained from the estimated actual number of deaths to the given sex and age group in the given year of death.

In estimating the percent of deaths registered, there has been a high degree of awareness of the incompleteness of the available data. Statistics South Africa decided not to estimate or publish model life tables for South Africa because of awareness of issues of error. The estimated actual number of deaths by age, sex and year was obtained using the Statistics South Africa mid-year population estimates based on the UN East Asian mortality pattern in Spectrum (UNAIDS, 2005). The Spectrum program with inputs such as the adjusted antenatal clinic survey results was judged as a good way to take account of international experience, while modeling estimates for South Africa based on South African empirical data. To obtain the HIV positive population in South Africa for their 2006 release, the United Nations used the same pattern.

We divided the numerator by the denominator to estimate the proportion of deaths to the given sex and age group in the given year of death that were registered. This method leads to higher estimates of mortality that those based on completeness estimates from the Growth-Balance methods.

There are strengths and weaknesses of both the growth-balance methods and of the approach we used. Some growth balance methods assume that the population is stable and some do not. All of the growth balance methods assume that the population is closed to migration and that the completeness of registration of deaths does not differ by age for a given sex in a given year. Our approach uses modelling assumptions in the Spectrum program, and although it does not assume that the population is closed to migration, only documented migration is taken into account, which probably ignores a large portion of international migration. However, an advantage of our approach is that it does not assume that the completeness of registration of deaths is the same at all ages for a given sex in a given year.

Appendix Table A1 shows the estimated true number of deaths for the period 1997-2004.

Appendix Table A2 shows the estimated percent of deaths that were registered. The estimates of completeness of registration of deaths for those 15-64 tend to decrease slightly over time. It is probable that among adults, HIV deaths are registered less completely than non-HIV deaths.

Appendix Table A3 indicates the multipliers (weights that should be applied to the reported deaths from death registration to take into account the completeness of registration).

The multiplier in Appendix Table A3 for a given sex and age group in a given year is the reciprocal of the estimated completeness of registration. Thus, in 2002 for males age 40-44, it is estimated that 78.0% of all deaths were registered. This the multiplier for males age 40-44 in 2002 is 1/.780=1.282 When the estimated completeness of registration (Appendix Table A2) was greater than 100%, the multiplier for the given group (Appendix Table A3) is 1.000 – we do not scale down the reported number of deaths.

As stated earlier in the report, analysis of mortality for those 0-14 and 65+ is problematic. Using the multipliers in Appendix A3 would give better estimates than if the unadjusted data on deaths are used to estimate mortality rates for these age groups.

It is worth noting that in Appendix Table A3 within the 15-64 age group, for females in 2004 the largest multipliers are for those age 20-34. Also the multipliers for this age group increased from 1997 through 2004. This means that we estimate that the deaths to females in this high mortality age range are more numerous both absolutely and relatively than if we had used the same multiplier for every age. Thus, the female death rates, such as those shown in Figure 6 (all cause death rates by age and sex), would have been lower for age 20-34 than we estimate and the increase in female death rates in these ages would have been less 1997-2004 than we estimate if we had used a growth balance method to estimate completeness of registration of deaths.

We only estimate one multiplier for a given age and sex in a given year. If we knew *a priori* which deaths were due to HIV and which deaths were not, then it could be possible to develop different multipliers (scale factors) to correct for incompleteness of reporting of HIV deaths and non-HIV deaths. However, which deaths are actually HIV deaths and which deaths are actually non-HIV deaths, is precisely what we do not know, and thus one multiplier for a given age and sex in a given year was regarded as the best approach at this time.

As discussed in the main text, a substantial proportion of natural cause deaths are coded as natural ill-defined deaths – ICD-10 Codes R00-R99. This means that the death had a natural cause, but nothing else was recorded about the death. The proportion of natural cause deaths that were natural ill-defined deaths by age, sex and year of death is shown in Appendix Table A4.

Appendix Table A5 shows the weights (multipliers to apply to natural cause deaths by age, sex and year of death to adjust both for incompleteness of death registration and to redistribute natural ill-defined deaths among all categories of natural cause deaths). The multipliers in Table A5 are used when classifications within natural causes are examined. When the multipliers in Appendix Table A5 are used as weights, the weights in Appendix Table A3 are used for unnatural cause deaths, and a weight of 0 (zero) is applied to natural ill-defined deaths (ICD Codes R00-R99). This approach redistributes natural ill-defined deaths proportionately to the distribution of other natural deaths within the given category of sex, age group and year of death.

Appendix Table A1. Estimated actual number of deaths (in thousand) for South Africa: 1997-2004

Male	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
0-14	53.08	55.01	55.96	55.97	56.11	57.56	59.16	60.95
0-4	45.73	47.69	48.52	48.26	47.9	48.5	49.03	49.6
5-9	4.03	4.10	4.29	4.59	5.10	5.89	6.88	7.93
10-14	3.32	3.22	3.15	3.12	3.11	3.17	3.25	3.42
15-19	5.18	5.31	5.33	5.44	5.38	5.31	5.24	5.24
20-24	7.53	8.35	9.09	10.25	11.16	11.90	12.64	13.05
25-29	8.58	10.83	13.13	16.32	18.89	20.72	22.43	23.36
30-34	10.16	12.96	16.05	20.67	25.55	30.29	35.65	39.33
35-39	11.72	14.58	17.56	21.56	25.23	28.22	31.62	33.96
40-44	12.28	14.78	17.48	21.13	24.74	27.97	31.46	33.39
45-49	13.00	14.62	16.38	18.85	21.35	23.77	26.52	28.25
50-54	14.11	15.20	16.37	17.92	19.57	21.24	23.06	24.28
55-59	15.35	15.86	16.43	17.15	17.94	18.93	20.08	21.13
60-64	16.42	16.86	17.31	17.80	18.26	18.82	19.39	19.88
65+	50.22	51.26	52.38	53.56	54.86	56.29	57.86	62.98
Total	217.63	235.62	253.47	276.62	289.99	321.02	345.11	365.8
15-64	114.33	129.35	145.13	167.09	188.07	202.17	228.09	241.87
Female								
0-14	41.85	44.34	45.88	46.46	47.01	48.31	49.79	51.49
0-4	37.56	39.96	41.28	41.5	41.47	41.97	42.4	42.87
5-9	2.44	2.57	2.84	3.19	3.75	4.52	5.50	6.56
10-14	1.85	1.81	1.76	1.77	1.79	1.82	1.89	2.06
15-19	3.54	3.87	4.10	4.55	4.63	4.62	4.36	4.31
20-24	7.12	9.09	11.33	14.68	17.79	21.24	23.67	25.15
25-29	7.96	11.04	14.91	20.63	26.3	32.58	37.65	41.53
30-34	7.16	9.24	12.01	16.62	21.76	28.72	35.65	41.90
35-39	7.04	8.55	10.44	13.32	16.07	19.63	23.02	26.65
40-44	6.91	7.93	9.22	11.15	13.07	15.57	17.88	19.91
45-49	7.40	7.97	8.70	9.82	11.01	12.63	14.21	15.68
50-54	8.53	8.90	9.35	9.98	10.58	11.41	12.22	13.08
55-59	10.12	10.34	10.60	10.98	11.38	11.91	12.45	12.98
60-64	11.71	12.00	12.31	12.63	12.94	13.29	13.63	13.97
65+	57.64	58.90	60.27	61.73	63.25	64.98	66.84	69.97
Total	176.98	192.17	209.12	232.55	255.79	284.89	311.37	336.62
15-64	77.49	88.93	102.97	124.36	145.53	171.60	194.74	215.16

Appendix Table A2. Estimated percentage of deaths registered (completeness of registration): 1997-2004

Male	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
0-14	40.6	45.4	43.3	44.4	45.7	51.4	53.6	56.9
0-4	40.0	45.1	42.7	43.8	45.5	52.2	55.0	59.4
5-9	42.3	43.3	44.0	43.4	41.2	40.5	40.1	39.5
10-14	46.4	52.4	52.3	54.5	55.9	58.2	61.1	61.5
15-19	72.9	77.2	81.6	78.5	82.8	88.5	91.8	87.8
20-24	108.3	105.1	94.8	85.8	79.7	80.0	81.1	78.1
25-29	127.0	120.3	105.4	91.5	88.6	89.2	88.6	83.4
30-34	116.0	110.5	101.1	88.5	81.2	78.0	76.4	71.1
35-39	101.6	99.6	93.2	85.2	82.9	84.3	82.9	81.7
40-44	95.4	93.8	86.6	80.3	77.3	76.1	78.0	78.0
45-49	93.6	96.6	90.9	84.5	83.1	80.3	82.5	80.4
50-54	79.7	85.2	84.3	84.5	85.6	86.7	88.6	85.6
55-59	82.0	87.4	85.2	80.5	80.5	80.7	85.0	84.0
60-64	67.9	73.5	73.0	79.3	82.0	85.2	89.1	84.1
65+	94.4	101.0	96.4	96.0	99.2	98.6	102.2	89.9
Total	80.1	84.3	80.7	78.4	78.5	79.5	81.7	78.0
15-64	92.2	94.3	89.5	84.2	82.3	82.2	83.1	80.2
Female								
0-14	44.5	49.4	47.2	47.5	48.7	54.2	56.2	59.8
0-4	43.2	48.1	45.7	46.2	47.6	54.2	57.0	61.3
5-9	51.3	55.8	52.9	49.7	45.3	42.8	39.7	42.1
10-14	64.1	70.7	73.9	74.4	80.7	80.8	86.1	84.7
15-19	69.5	74.5	80.5	75.0	83.3	91.3	103.2	105.2
20-24	75.4	74.9	72.1	65.6	60.1	57.5	59.1	58.7
25-29	91.6	87.6	83.1	74.2	71.6	70.0	68.6	65.0
30-34	98.9	103.6	100.5	93.3	84.3	80.0	77.9	71.7
35-39	96.2	103.1	102.0	100.2	96.9	97.3	97.3	92.5
40-44	91.6	99.0	95.7	97.2	96.9	97.8	101.7	101.1
45-49	85.4	95.4	97.2	96.2	98.1	98.9	100.8	101.8
50-54	72.9	80.7	82.5	90.3	94.9	97.3	104.5	105.8
55-59	78.1	85.5	81.5	80.1	79.7	83.3	87.6	91.2
60-64	79.2	83.1	81.4	88.5	92.7	94.8	96.9	94.4
65+	93.3	103.7	100.7	104.9	109.1	109.8	113.8	101.8
Total	77.7	84.4	82.5	83.1	83.6	84.3	86.3	82.6
15-64	83.9	89.0	87.6	85.6	83.7	83.1	84.2	81.8

Appendix Table A3. Weights (multipliers) to apply to deaths by age, sex and year of death to adjust for completeness of death registration: 1997-2004

Male	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
0-4	2.501	2.218	2.343	2.281	2.197	1.914	1.818	1.684
5-9	2.366	2.310	2.275	2.307	2.425	2.468	2.494	2.532
10-14	2.153	1.908	1.910	1.836	1.789	1.719	1.637	1.626
15-19	1.373	1.295	1.225	1.273	1.208	1.129	1.089	1.139
20-24	1.000	1.000	1.055	1.166	1.255	1.251	1.233	1.280
25-29	1.000	1.000	1.000	1.093	1.129	1.121	1.129	1.199
30-34	1.000	1.000	1.000	1.130	1.231	1.282	1.309	1.406
35-39	1.000	1.004	1.073	1.173	1.207	1.186	1.206	1.224
40-44	1.048	1.066	1.155	1.246	1.293	1.314	1.282	1.282
45-49	1.069	1.036	1.100	1.183	1.203	1.245	1.212	1.244
50-54	1.254	1.174	1.186	1.184	1.168	1.153	1.129	1.168
55-59	1.219	1.144	1.174	1.242	1.243	1.239	1.176	1.190
60-64	1.474	1.361	1.370	1.261	1.219	1.174	1.122	1.189
65+	1.059	0.990	1.037	1.041	1.008	1.015	1.015	1.015
Female								
0-4	2.317	2.081	2.187	2.166	2.102	1.844	1.754	1.631
5-9	1.950	1.792	1.891	2.013	2.206	2.336	2.519	2.375
10-14	1.561	1.414	1.353	1.345	1.240	1.237	1.161	1.181
15-19	1.439	1.342	1.243	1.334	1.201	1.095	1.000	1.000
20-24	1.326	1.336	1.387	1.524	1.664	1.738	1.692	1.704
25-29	1.091	1.142	1.203	1.347	1.396	1.428	1.458	1.538
30-34	1.011	1.000	1.000	1.071	1.186	1.249	1.284	1.395
35-39	1.040	1.000	1.000	1.000	1.032	1.028	1.028	1.081
40-44	1.091	1.010	1.045	1.029	1.032	1.023	1.000	1.000
45-49	1.172	1.048	1.029	1.040	1.019	1.011	1.000	1.000
50-54	1.372	1.240	1.212	1.108	1.054	1.028	1.000	1.000
55-59	1.280	1.169	1.227	1.249	1.255	1.201	1.142	1.096
60-64	1.263	1.203	1.229	1.130	1.079	1.055	1.032	1.059
65+	1.072	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Appendix Table A4. Proportion of natural cause deaths that were natural ill-defined deaths – ICD-10 Codes R00-R99: 1997-2004

Male	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
0-4	0.1185	0.1298	0.0842	0.0743	0.0578	0.0884	0.0609	0.0426
5-9	0.0489	0.0589	0.0570	0.0579	0.0507	0.0486	0.1458	0.1860
10-14	0.0838	0.1002	0.0901	0.0969	0.0858	0.0904	0.1882	0.1524
15-19	0.1502	0.2126	0.1604	0.1552	0.1447	0.1352	0.1532	0.1676
20-24	0.1780	0.2074	0.1636	0.1424	0.1261	0.1213	0.1419	0.1350
25-29	0.1654	0.1721	0.1383	0.1270	0.1312	0.1201	0.1223	0.1274
30-34	0.1512	0.1606	0.1297	0.1295	0.1267	0.1274	0.1294	0.1270
35-39	0.1556	0.1607	0.1427	0.1303	0.1287	0.1304	0.1291	0.1273
40-44	0.1566	0.1681	0.1284	0.1248	0.1300	0.1275	0.1327	0.1290
45-49	0.1529	0.1595	0.1354	0.1257	0.1328	0.1258	0.1325	0.1336
50-54	0.1489	0.1445	0.1278	0.1303	0.1285	0.1304	0.1280	0.1269
55-59	0.1411	0.1455	0.1228	0.1204	0.1228	0.1172	0.1247	0.1250
60-64	0.1357	0.1479	0.1243	0.1161	0.1209	0.1251	0.1268	0.1211
65+	0.1798	0.1830	0.1640	0.1594	0.1601	0.1607	0.1609	0.1527
Female								
0-4	0.1175	0.1301	0.0819	0.0745	0.0605	0.0784	0.0619	0.0466
5-9	0.0550	0.0570	0.0542	0.0503	0.0497	0.0525	0.1538	0.2021
10-14	0.0875	0.1037	0.0907	0.0979	0.0889	0.0962	0.1458	0.1574
15-19	0.1251	0.1494	0.1379	0.1282	0.1361	0.1322	0.1409	0.1408
20-24	0.1508	0.1642	0.1306	0.1359	0.1338	0.1302	0.1345	0.1346
25-29	0.1430	0.1580	0.1369	0.1366	0.1405	0.1352	0.1363	0.1356
30-34	0.1489	0.1544	0.1381	0.1340	0.1446	0.1375	0.1418	0.1368
35-39	0.1525	0.1506	0.1332	0.1298	0.1390	0.1323	0.1343	0.1416
40-44	0.1575	0.1428	0.1337	0.1293	0.1330	0.1327	0.1409	0.1376
45-49	0.1396	0.1497	0.1242	0.1246	0.1260	0.1303	0.1325	0.1355
50-54	0.1311	0.1373	0.1108	0.1165	0.1203	0.1202	0.1260	0.1217
55-59	0.1391	0.1346	0.1078	0.1120	0.1059	0.1136	0.1197	0.1165
60-64	0.1449	0.1382	0.1197	0.1197	0.1239	0.1246	0.1252	0.1197
65+	0.2147	0.2160	0.1963	0.1985	0.1971	0.1957	0.1903	0.1823

Appendix Table A 5. Weights (multipliers) to apply to natural cause deaths by age, sex and year of death to adjust for completeness of death registration and to redistribute natural ill-defined deaths: 1997-2004

(Apply weights from Appendix Table A 3 to unnatural cause deaths and apply weight of 0 to natural ill-defined deaths ICD-10 Codes R00-R99)

Male	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
0-4	2.837	2.549	2.559	2.464	2.332	2.099	1.936	1.758
5-9	2.488	2.454	2.412	2.448	2.555	2.594	2.919	3.110
10-14	2.350	2.120	2.099	2.033	1.957	1.890	2.016	1.918
15-19	1.615	1.645	1.459	1.507	1.412	1.306	1.286	1.368
20-24	1.216	1.262	1.261	1.359	1.437	1.423	1.437	1.480
25-29	1.198	1.208	1.160	1.252	1.300	1.274	1.286	1.374
30-34	1.178	1.191	1.149	1.298	1.410	1.469	1.503	1.611
35-39	1.184	1.197	1.252	1.349	1.385	1.364	1.385	1.403
40-44	1.243	1.281	1.325	1.423	1.486	1.506	1.478	1.472
45-49	1.262	1.232	1.272	1.353	1.387	1.425	1.397	1.436
50-54	1.474	1.372	1.360	1.361	1.340	1.326	1.294	1.338
55-59	1.419	1.339	1.338	1.412	1.417	1.403	1.344	1.360
60-64	1.705	1.597	1.564	1.426	1.387	1.342	1.285	1.353
65+	1.291	1.211	1.240	1.239	1.200	1.209	1.209	1.198
Female								
0-4	2.626	2.392	2.383	2.341	2.237	2.001	1.870	1.711
5-9	2.064	1.900	1.999	2.119	2.321	2.465	2.977	2.977
10-14	1.711	1.578	1.488	1.491	1.361	1.369	1.360	1.401
15-19	1.645	1.578	1.442	1.530	1.390	1.262	1.164	1.164
20-24	1.561	1.599	1.595	1.763	1.922	1.998	1.955	1.968
25-29	1.274	1.357	1.393	1.560	1.624	1.651	1.688	1.780
30-34	1.188	1.183	1.160	1.237	1.386	1.448	1.496	1.616
35-39	1.227	1.177	1.154	1.147	1.199	1.184	1.187	1.259
40-44	1.295	1.178	1.206	1.182	1.190	1.179	1.164	1.160
45-49	1.362	1.232	1.175	1.188	1.166	1.163	1.153	1.157
50-54	1.579	1.437	1.363	1.254	1.198	1.169	1.144	1.139
55-59	1.486	1.351	1.375	1.406	1.404	1.355	1.297	1.241
60-64	1.477	1.396	1.396	1.283	1.231	1.205	1.180	1.203
65+	1.364	1.276	1.244	1.248	1.245	1.243	1.235	1.223

APPENDIX B. SOUTH AFRICAN DEATH REGISTRATION FORMS

G.P.-S. 017-0150 BI-20

REPUBLIC OF SOUTH AFRICA

ABRIDGED DEATH CERTIFICATE

(Issued in terms of Act No. 51 of 1992)

Certified a true extract from the death register of:

Identity number [ ][ ][ ][ ][ ][ ] [ ][ ][ ][ ] [ ][ ] [ ]

Surname ....

Forenames in full ....

....

Date of birth: Year [ ] Month [ ] Day [ ]

GEKANSELLEER
CANCELLED

Gender ....

Marital state ....

Date of death: Year [ ] Month [ ] Day [ ]

Place of death ....

Cause of death ....

....

(Official date stamp)

....
Director-General: Home Affairs

Appendix Figure B 1. Abridged death registration form, 1992

No. 0043372

G.P.-S. 017-0188

BI-18

REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF HOME AFFAIRS

FULL DEATH CERTIFICATE

(Issued in terms of Act 51 of 1992)

Certified a true extract from the death register of:

1. Identity Number ☐☐☐☐☐☐ ☐☐☐☐ ☐☐ ☐
2. Surname ....
3. Forenames in full ....
4. Date of birth: Year ☐☐☐☐ Month ☐☐ Day ☐☐ 5. Gender ....
6. Occupation .... 7. Marital status ....
8. Country of birth ....
9. Nature of pension ....
10. Residential address ....

GEKANSELLEER
CANCELLED

PARTICULARS OF DEATH

11. Date of death: Year ☐☐☐☐ Month ☐☐ Day ☐☐
12. Place of death ....
13. Cause of death ....
14. Duration of disease or last illness ....
15. Name of medical practitioner ....
16. Intended place of burial ....

INFORMANT

17. Capacity ....
18. Signed by ....

(Official date stamp)

....
Director-General: Home Affairs

Appendix Figure B 2. Full Death Registration Form, 1992

REPUBLIC OF SOUTH AFRICA
DEPARTMENT OF HOME AFFAIRS

BI - 1663

NOTIFICATION / REGISTER OF DEATH / STILL BIRTH

in terms of the Births and Deaths Registration Act, 1992 (Act No. 51 of 1992)

Space for Bar Code

** Must be completed in black ink (please tick ✓ where applicable)*
** Please refer to instructions*

SERIAL No: A0 1857265

FILE No: DATE:

A PARTICULARS OF DECEASED INDIVIDUAL ☐ / STILLBORN CHILD ☐

Identity number of deceased ☐☐☐☐☐☐ ☐☐☐☐ ☐☐☐ ☐
Date of death Y Y Y Y M M D D
Date of birth Y Y Y Y M M D D
Surname
Age at last birthday ☐☐☐ years
Maiden Name (If female)
Sex
Forenames
If death occurred within 24 hours after birth
No. of hours alive

MARITAL STATUS OF DECEASED Single ☐ Civil Marriage ☐ Living as married ☐ Widowed ☐
Religious Law Marriage ☐ Divorced ☐ Customary Marriage ☐

PLACE OF BIRTH (municipal district or country if abroad) ____
PLACE OF DEATH (City / Town / Village) ____
PLACE OF REGISTRATION OF DEATH ____
CITIZENSHIP OF DECEASED ____

Left thumb print of deceased

B PARTICULARS OF INFORMANT

Identity number
Initials and Surname
Relationship to deceased Parent ☐ Spouse ☐ Child ☐ Other kin ☐ Other (specify) ☐
Postal address ....
Postal Code Dialling Code
Was the next of kin of the deceased a smoker* during the past five years? Yes ☐ No ☐ Refuse to answer ☐ Telephone No.
Date .... Signature ....

Left thumb print of informant

CANCELLED

C PARTICULARS OF FUNERAL UNDERTAKER

Initials and Surname
Designation No.
Place of burial / cremation ____
Date .... Signature ....

Office Stamp of Funeral Undertaker

D CERTIFICATE BY ATTENDING MEDICAL PRACTITIONER / PROFESSIONAL NURSE

I, the undersigned, hereby certify that the deceased named in Section A, to the best of my knowledge and belief, died solely and exclusively due to NATURAL CAUSES specified in Section G ☐

I, the undersigned, am not in the position to certify that the deceased died exclusively due to natural causes ☐

....
INITIALS AND SURNAME SIGNATURE

Postal Address
Postal Code
SAMDC / SANC Reg. No.
Date signed Y Y Y Y M M D D

CERTIFICATE BY DISTRICT SURGEON / FORENSIC PATHOLOGIST

I, the undersigned, hereby certify that a medicolegal post-mortem examination has been conducted on the body of the person whose particulars are given in Section A and that the body is no longer required for the purpose of the Inquest Act, 1959 (Act No. 58 of 1959) and that the cause of death is: Unnatural ☐ Under investigation ☐
Natural (Cause of Death as indicated in Section G) ☐

Postal Address
Postal Code

Initials and Surname
Place of post-mortem .... Date Y Y Y Y M M D D
Mortuary Reference ....
Signature .... Date signed Y Y Y Y M M D D
SAMDC Reg. No.

E FOR OFFICIAL USE ONLY

Registration of death approved and burial order issued
Initials and Surname of Registrar
Address
Force No. / Designation No.
Persal No.
Date .... Signature ....

Office Stamp ▷

* Someone who smokes tobacco on most days

PARAGON 225639 (H)

Appendix Figure B 3. Death registration form introduced in 1998

NOTIFICATION / REGISTER OF DEATH / STILL BIRTH

BI - 1663
Page 2

INFORMATION FOR MEDICAL AND HEALTH USE ONLY
(After completion *seal* to ensure confidentiality)

Space for Bar Code

SERIAL No: A 01857265

FILE No: DATE:

CANCELLED

F DEMOGRAPHIC DETAILS

Initials and Surname of deceased

Identity Number

Place of death 1. Hospital: (Inpatient ☐ ER/ Outpatient ☐ DOA ☐) 2. Nursing Home ☐ 3. **Home** ☐ 4. **Other (Specify)** ☐ ....

FACILITY NAME (If not institution, give street and number) ....

Usual residential address of deceased # .... Suburb

Town / Village

Name of Plot, Farm, etc. .... Census Enumerator Area

Street name and number .... Magist. Dist. ....

Deceased's Education (Specify ✓ only highest class completed/achieved) Postal Code

None	Gr1	Gr2	Gr3	Gr4	Gr5	Gr6	Gr7	Gr8 Form 1	Gr9 Form 2	Gr10 Form 3 NTC1	Gr11 Form 4 NTC2	Gr12 Form 5 NTC3	Univ Tech	CODE

Province ....

Country ....

USUAL OCCUPATION OF DECEASED (give type of work done during most of working life. Do not use retired) ....

TYPE OF BUSINESS / INDUSTRY (e.g. **Mining, Farming**) **refer to** instructions ....

Was the deceased a smoker* five years ago? (✓) : Yes ☐ No ☐ Do not know ☐ **Not applicable (minor)** ☐

G MEDICAL CERTIFICATE OF CAUSE OF DEATH

FOR OFFICE USE ONLY
ICD-10

Approximate interval between onset and Death (Days/Months/Years)

PART 1. Enter the disease, injuries or complications that caused the death. Do not enter the mode of dying, such as cardiac or respiratory arrest, shock, or heart failure. List only one cause on each line.

IMMEDIATE CAUSE (Final disease or condition resulting in death) a. ________ Due to (or as a consequence of)

Sequentially list conditions, if any, leading to immediate cause. Enter UNDERLYING CAUSE last (Disease or injury that initiated events resulting in death)

b. ________ Due to (or as a consequence of)

c. ________ Due to (or as a consequence of)

d. ________ Due to (or as a consequence of)

PART 2. Other significant conditions contributing to death but not resulting in the underlying cause given in Part 1. ________

If a **female**, was she pregnant 42 days prior to death? (✓) : Yes ☐ No ☐

If **stillborn**, please write mass in grams

Do you consider the deceased to be: African ☐ White ☐ Indian ☐ Coloured ☐ Other ☐ (Specify) ________

Method of ascertainment of cause of death:

1. Autopsy ☐
2. Opinion of attending medical practitioner ☐
3. Opinion of **attending medical practitioner on duty** ☐
4. Opinion of registered professional nurse ☐
5. Interview of family member ☐
6. Other ☐ (Specify) ________

Where someone lived on most days

* Someone who smokes tobacco on most days

Appendix Figure B 3 (Continued)

APPENDIX C. LIFE TABLE VALUES: 1997-2004

Appendix Table C 1. Life Table l_x Values by Sex, l_{15}=100000: 1997-2004

Male	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
15	100000	100000	100000	100000	100000	100000	100000	100000
20	98830	98818	98812	98788	98816	98838	98915	98924
25	96967	96822	96754	96490	96364	96267	96271	96218
30	93981	93478	93370	92667	92111	91676	91379	91152
35	90220	88985	88385	86578	85059	83814	82645	81984
40	86179	84206	82759	79902	77506	75518	73499	72347
45	81420	78800	76671	72979	69855	67227	64505	62991
50	75589	72616	70106	65994	62551	59633	56573	54904
55	68336	65328	62742	58601	55139	52134	48981	47293
60	59282	56603	54274	50567	47497	44726	41773	40145
65	49458	47294	45403	42328	38658	36370	33923	32604
Female								
15	100000	100000	100000	100000	100000	100000	100000	100000
20	99176	99122	99078	98976	98975	98992	99069	99070
25	97546	97062	96530	95718	95435	94778	94113	93836
30	95368	94244	92950	90996	89631	87721	86053	84963
35	93064	91239	89292	86243	83838	80650	77869	75848
40	90647	88332	85905	82199	79178	75209	71727	69002
45	87901	85373	82673	78572	75194	70791	66862	63861
50	84453	81856	79056	74808	71316	66759	62680	59542
55	79869	77358	74623	70455	67057	62566	58374	55221
60	73630	71322	68792	64899	61769	57557	53627	50676
65	65951	63952	61732	58263	54918	51164	47644	45028

Appendix Table C 2. Life Table $_5m_x$ Values by Sex: 1997-2004

Male	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
15-19	0.002353	0.002378	0.002390	0.002439	0.002383	0.002339	0.002181	0.002164
20-24	0.003807	0.004080	0.004210	0.004708	0.005025	0.005270	0.005419	0.005546
25-29	0.006255	0.007029	0.007119	0.008083	0.009026	0.009772	0.010428	0.010814
30-34	0.008168	0.009850	0.010970	0.013590	0.015920	0.017920	0.020074	0.021181
35-39	0.009162	0.011037	0.013150	0.016038	0.018586	0.020826	0.023429	0.024978
40-44	0.011359	0.013266	0.015274	0.018115	0.020766	0.023232	0.026071	0.027651
45-49	0.014855	0.016336	0.017892	0.020105	0.022065	0.023947	0.026202	0.027439
50-54	0.020158	0.021133	0.022173	0.023734	0.025193	0.026838	0.028773	0.029789
55-59	0.028376	0.028625	0.028946	0.029438	0.029782	0.030591	0.031769	0.032701
60-64	0.036137	0.035840	0.035599	0.035475	0.041037	0.041219	0.041483	0.041463
Female								
15-19	0.001654	0.001763	0.001852	0.002058	0.002060	0.002026	0.001871	0.001868
20-24	0.003315	0.004200	0.005212	0.006695	0.007283	0.008700	0.010261	0.010853
25-29	0.004516	0.005892	0.007557	0.010114	0.012545	0.015467	0.017894	0.019851
30-34	0.004891	0.006480	0.008029	0.010728	0.013360	0.016798	0.019972	0.022673
35-39	0.005262	0.006477	0.007734	0.009603	0.011433	0.013964	0.016421	0.018905
40-44	0.006152	0.006813	0.007667	0.009025	0.010324	0.012104	0.014042	0.015479
45-49	0.008004	0.008413	0.008947	0.009815	0.010588	0.011727	0.012914	0.013997
50-54	0.011159	0.011301	0.011537	0.011987	0.012311	0.012969	0.014229	0.015063
55-59	0.016257	0.016238	0.016265	0.016420	0.016420	0.016677	0.016953	0.017168
60-64	0.022007	0.021793	0.021634	0.021550	0.023483	0.023523	0.023632	0.023603

Appendix Table C 3. Life Table $_5q_x$ Values by Sex: 1997-2004

Male	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
15	0.011695	0.011822	0.011880	0.012121	0.011844	0.011625	0.010848	0.010764
20	0.018853	0.020193	0.020829	0.023265	0.024813	0.026006	0.026735	0.027351
25	0.030793	0.034538	0.034973	0.039614	0.044136	0.047696	0.050817	0.052646
30	0.040022	0.048067	0.053386	0.065717	0.076555	0.085756	0.095573	0.100581
35	0.044785	0.053705	0.063657	0.077100	0.088804	0.098976	0.110663	0.117548
40	0.055227	0.064202	0.073560	0.086649	0.098708	0.109786	0.122379	0.129317
45	0.071617	0.078477	0.085630	0.095712	0.104559	0.112971	0.122958	0.128389
50	0.095954	0.100361	0.105041	0.112024	0.118501	0.125753	0.134209	0.138620
55	0.132483	0.133566	0.134965	0.137101	0.138591	0.142087	0.147159	0.151148
60	0.165716	0.164462	0.163447	0.162927	0.186094	0.186840	0.187925	0.187843
Female								
15	0.008238	0.008777	0.009215	0.010237	0.010248	0.010081	0.009313	0.009296
20	0.016438	0.020781	0.025723	0.032925	0.035764	0.042572	0.050020	0.052831
25	0.022326	0.029033	0.037085	0.049323	0.060815	0.074458	0.085639	0.094561
30	0.024160	0.031886	0.039356	0.052237	0.064641	0.080603	0.095112	0.107286
35	0.025968	0.031867	0.037936	0.046890	0.055576	0.067463	0.078866	0.090257
40	0.030293	0.033494	0.037614	0.044128	0.050322	0.058740	0.067827	0.074509
45	0.039235	0.041197	0.043759	0.047899	0.051575	0.056964	0.062551	0.067619
50	0.054279	0.054955	0.056066	0.058192	0.059717	0.062809	0.068699	0.072580
55	0.078109	0.078020	0.078146	0.078863	0.078862	0.080048	0.081319	0.082309
60	0.104296	0.103335	0.102619	0.102242	0.110905	0.111081	0.111567	0.111441

Appendix Table C 4. Life Table $_5L_x$ Values by Sex: 1997-2004 (l_{15}=100000)

Male	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
15-19	497076	497045	497030	496970	497039	497094	497288	497309
20-24	489494	489101	488914	488194	487948	487762	487965	487854
25-29	477371	475752	475310	472892	471186	469857	469123	468426
30-34	460503	456159	454389	448112	442924	438723	435060	432842
35-39	440998	432978	427861	416200	406412	398330	390362	385829
40-44	418998	407515	398576	382203	368402	356864	345010	338347
45-49	392522	378540	366943	347432	331016	317150	302695	294739
50-54	359812	344860	332120	311487	294225	279416	263885	255493
55-59	319046	304827	292540	272919	256589	242150	226884	218596
60-64	271852	259740	249193	232237	215388	202739	189239	181873
Female								
15-19	497941	497806	497696	497441	497438	497480	497672	497676
20-24	491806	490462	489021	486735	486026	484424	482955	482267
25-29	482286	478267	473700	466785	462667	456246	450417	446999
30-34	471081	463710	455605	443099	433673	420927	409805	402027
35-39	459279	448928	437991	421105	407540	389648	373991	362124
40-44	446372	434263	421445	401927	385930	365001	346475	332157
45-49	430885	418073	404322	383450	366274	343875	323856	308508
50-54	410803	398035	384197	363159	345932	323311	302635	286909
55-59	383747	371700	358538	338385	322064	300308	280003	264742
60-64	348953	338186	326310	307906	291717	271803	253178	239260