Appendix A: Statistical methodology

Death rates

This report uses three types of mortality indicators. These are age-specific death rates, crude death rates and age-standardised death rates, as described below. All rates are calculated separately for males and females and are expressed per million population. Population data are the estimated resident population at 30 June in each year, published by the Australian Bureau of Statistics[4].

Age-specific death rates

Age-specific death rates are death rates relating specifically to a certain age group. For each age group they have been calculated as the number of deaths in that age group divided by the mid-year estimated resident population for that age group, i.e.

$$r_i = d_i \ / \ p_i$$

where r_i is the age-specific death rate for age group i, d_i is the number of deaths for age group i, and p_i is the mid-year estimated resident population for age group i.

Crude death rates

The annual crude death rate is the total number of deaths in a year divided by the total mid-year estimated resident population, i.e.

$$CR = \Sigma d_i \ / \ \Sigma p_i$$

where CR is the crude death rate, d_i is the number of deaths for age group i, and p_i is the mid-year estimated resident population for age group i. The crude death rate does not reflect changes in the age structure of the population over time.

Age-standardised death rates

Age-standardisation is a method of adjustment to allow for the effect of variation in the population age structure when comparing death rates for different years or different locations (e.g. between States and Territories). This report has used the 'direct' standardisation method, which applies the age-specific death rates for a particular year to a standard population (Armitage & Berry 1987). This produces an estimate of the death rate which would have prevailed in the standard population if it had experienced the age-specific death rates in the year under study.

The standard population used is the total estimated 1991 mid-year Australian population. The usual convention of using age-specific death rates for five-year age groups, defined as 0–4, 5–9, . . ., 80–84, 85+ years, has been followed for the standardisation according to the following formula:

$$ASR = \Sigma r_i \ P_i \ / \ \Sigma P_i$$

where ASR is the age-standardised death rate, r_i is the age-specific death rate for age group i, and P_i is the standard population in age group i.

Modelling the data

The underlying annual rate of change from 1985–1996 (or 1991–1996 for the Indigenous population) has been estimated for age-specific and age-standardised death rates. An appropriate model for this type of mortality data is a Poisson regression model, with a Poisson error distribution, a log link function and the natural log of population treated as an 'offset' (Breslow & Day 1987; Brillinger 1986; Valkonen 1989).

For a particular cause of death, the model may be expressed as:

$$\log_e(D_t) = \log_e(N_t) + \text{constant} + \alpha t$$

4. The population distribution by age and sex for Australia, for each State and Territory, for the Indigenous population and for urban, rural and remote areas are available on the Internet at *http://www.aihw.gov.au*.

where t is the year of registration of death, D_t is the expected number of deaths registered in year t, N_t is the mid-year population in year t, and α is the estimated annual rate of increase or decrease in mortality. This model forms the basis for the estimate of underlying trend and the statistical tests described below. The criteria for applying it to the mortality time series data were:

- the series contained non-zero deaths for at least four years (or two years for the Indigenous population), and
- the average number of deaths across the 12 years (or six years for the Indigenous population) was at least two.

Where these criteria were met, this model was fitted separately for males and females, for each age-specific group, and for the age-standardised rates (all ages and ages 25–74 and 25–64).

Statistical tests

Two statistical tests were applied both to the age-standardised and age-specific mortality time series for males and females separately wherever the data met the above criteria for modelling. They are a 'test for trend', and a 'test for difference' to help assess whether the death rate for the most recent year is unexpected.

Test for trend

The trend is calculated from the estimated value of α from a Poisson regression model fitted to the data for all 12 years. It indicates whether death rates are generally increasing or decreasing over the period and, if so, to what extent.

Based on α, an average annual rate of change has been derived as follows:

$$\text{percentage change} = [e^{\alpha} - 1] \times 100\%$$

The annual percentage increase (or decrease) is presented in the 'Trend' column under 'Statistical tests' and can be interpreted as the average percentage change in mortality rates between consecutive years.

A blank denotes that a model has not been fitted because the data did not meet the modelling criteria.

The test of statistical significance for the annual percentage change was two-tailed. That is, there was no prior assumption that the mortality rate would be increasing or decreasing and the alternative hypothesis was that the change in mortality rate was *different* from zero. Trends which were statistically significant at the 5% and 1% levels of significance have been indicated by asterisks.

Test for difference

The test for difference refers to the difference between the observed and projected death rates for 1996 expressed as a percentage of the projected rate. The projected death rate for 1996 is estimated from a Poisson regression model fitted to the mortality time series for the period 1985 to 1995 (and 1991 to 1995 for the Indigenous population).

This field is left blank if a model was not fitted because the data did not meet the modelling criteria.

The test of statistical significance of the difference was two-tailed. That is, there was no prior assumption that the mortality rate for 1996 would be above or below the value predicted from the model fitted to previous years. Differences which were statistically significant at the 5% and 1% levels of significance have been indicated by asterisks.

Significance level

Many significance tests have been performed throughout the report and it is therefore likely that some test results reported as 'statistically significant' are the result of chance. The possibility of a chance effect should be carefully considered when making judgement about whether statistically significant trends have sufficient medical or epidemiological importance to warrant further attention.

Some of the estimates for the Northern Territory, the Australian Capital Territory, the Indigenous population and rural and remote areas are based on small numbers and may be unstable.

Appendix B: Tables available on the Internet

Data tables for the population distributions and for the less common causes of death for each State and Territory (for the period 1985–1996), for the Indigenous and non-Indigenous populations (for the period 1991–96), and for urban, rural and remote areas (for the period 1986–1996) are available on the Australian Institute of Health and Welfare World Wide Web site at *http://www.aihw.gov.au*. Users without Internet access may request the tables on disk by contacting AIHW reception on (02) 6244 1000. For each of the above populations the following mortality profiles have been included as separate tables:

- Rheumatic fever and rheumatic heart disease
- Hypertensive disease
- Other ischaemic heart disease
- Heart failure
- Atherosclerosis
- Peripheral vascular disease
- Other diseases of the circulatory system (defined in *Introduction* on page 2)
- All causes

For each cause of death the tables contain:

- numbers of deaths by year, age group and sex;
- age-specific death rates by year, age group and sex;
- crude and age-standardised death rates by year and sex, for all ages and ages 25–74
- annual rates of change (with indicators of statistical significance); and
- differences between the most recent death rate and that expected based on projections for that year (with indicators of statistical significance).

Where the number of deaths is less than 16 in any age–specific group, the total number of deaths are given by year and sex, in place of a full mortality profile. For the Australian Capital Territory, the Northern Territory, the Indigenous population and remote areas only the total number of deaths are given for the majority of the causes of death.

Tables containing population distributions at the national, State and Territory, Indigenous and urban, rural and remote levels are presented for each 10-year age group for males and females for the relevant years.

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