

Fluctuations in the statistics of deaths from particular causes

Vital Events statistics are produced from complete counts of all the events which were registered, and so are not subject to some of the kinds of errors that may affect the results of sample surveys. However, the figures for deaths from some causes may be subject to large percentage fluctuations from (say) year to year. It follows that the figure for a particular cause for any given year may provide an unreliable indicator of its usual annual number of deaths, and that the change between two years may be an unreliable indicator of any trend in deaths from that cause. This note illustrates this point using the numbers of deaths from certain causes for 2000 to 2008 (the years for which National Records of Scotland (NRS), formerly the General Register Office for Scotland (GROS), conducted the ad-hoc analysis whose results are described below). A workbook containing the charts and the underlying figures is available via a link at the foot of the page.

Deaths from particular causes for each year from 2000 to 2008

Together, [Charts 1, 2 and 3](#) show the numbers of deaths by sex in each year from 2000 to 2008 for nine of the causes of death which appear in Vital Events Reference Table 6.1. In some cases, there seems to be a general trend for the number of deaths from a cause to rise (e.g. the 'skin cancer' lines in Chart 3) or to fall (e.g. the 'ulcer' lines in Chart 1); in other cases, the figures may be remaining around broadly the same level from one year to the next. There are often year-to-year fluctuations in the numbers - for example, Chart 3 shows that there were some years in which skin cancer deaths fell, although the general trend was upwards, and Chart 1 shows some years in which the 'ulcer' lines rose, although the general trend was downwards. So the value for any given year, or for the change between one year and the next, may not be a reliable indicator of the level, or any trend in the level, of deaths from a particular cause.

Similar points apply in the case of the numbers of suicides and drug-related deaths, which are discussed later

The likely range of random year-to-year fluctuation in the number of deaths from a particular cause

If the number of deaths from a particular cause fluctuates 'randomly' from year to year, it can be represented as the outcome of a '[Poisson process](#)' (a separate page provides more about this). The underlying rate of deaths per year can be assumed to be the annual average for the period, and a rough 'likely range of values' (or a '95% confidence interval') can then be calculated as plus and minus twice the square root of the underlying rate.

For example, in the case of deaths from falls, the annual averages (over the period 2000 to 2008) are 260 for males and 400 for females, so rough likely ranges of values would be from 228 to 292 for males, and from 360 to 440 for females. Although Chart 1 shows some ups-and-downs, almost all the figures for deaths from falls are within these likely ranges, and the sole exception (299 male deaths in 2004) is only slightly above the likely upper limit.

As another example, Chart 2 shows fluctuations in deaths from asthma. The annual averages are 36 for males and 70 for females, so rough likely ranges of values would be from 24 to 48 for males, and from 53 to 87 for females, and almost all the figures for deaths from asthma are within these likely ranges (the two exceptions - 56 male deaths in 2002 and 90 female deaths in 2000) are not far above the relevant likely upper limits.

However, using the overall annual average as the underlying rate is not appropriate if there is a clear trend in the number of deaths (because a trend implies that the underlying rate is changing). Chart 1 shows general downward trends in 'ulcer' deaths: as a result, almost half the figures were outwith rough 'likely ranges' calculated from the overall averages for the nine years, because the underlying rate at the start of the period was above that overall rate, and the underlying rate at the end of the period was below that overall rate. In such cases, one can use the value of a (say) 5-year moving average centred on a given year as the underlying rate for that year, and calculate a separate likely range of values for each year. [Charts 4 and 5](#) show the results of doing this for male and female 'ulcer' deaths. The thick black lines are the actual numbers of deaths, the thick grey lines are the 5-year moving averages which indicate the downward trends (by their definition, they are not available for the first two and last two years of the period), and the dashed grey lines show the limits of the likely ranges calculated by assuming that the moving averages represent the underlying rates. The actual numbers of deaths are within, or only slightly outwith, the likely ranges - so the year to year fluctuations around the trends can be represented as the results of Poisson processes whose underlying rates are given by the moving averages.

Suicides and Drug-related deaths

Similar points apply in the case of the numbers of suicides and drug-related deaths (further information about the basis of those statistics is available from the ['Suicides'](#) section and the annual publication on [Drug-related Deaths](#)).

[Chart 6](#) shows the total number of (probable) suicides and of drug-related deaths in each year from 1996 to 2008, inclusive, together with their 5-year moving averages and rough likely ranges of values (calculated assuming that the moving averages represent the underlying rates). The lines for suicides are towards the top of the chart, and the lines for drug-related deaths are lower down.

It appears that the number of suicides has not changed greatly over the period, remaining between about 750 and roughly 900, with some year-to-year fluctuations around what seemed to be a slight downward trend between 2000 and 2005. All the fluctuations were within the likely range of values.

For drug-related deaths, the chart shows a clear upward trend throughout more-or-less the whole of the period, with some year-to-year fluctuations around the trend. In a couple of years, the actual number of drug-related deaths was slightly outwith the likely range of values that had been calculated by assuming that the underlying rate was given by the 5-year moving average - an assumption which is less likely to hold at times when the trend is for large rises (or large falls), because then the underlying rate would appear to be changing rapidly from year to year, and so the 5-year moving average may not represent well the underlying rate in a given year.

The workbook containing the charts and underlying figures is available at the following link: [Fluctuations in the number of deaths for particular causes of death](#) (Excel – 92 Kb)