Fluctuations in and possible unreliability of death statistics for individual local authority areas for individual weeks

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 total number of deaths registered in a single week for one part of Scotland (such as a local authority area) may be subject to large percentage fluctuations, due to both natural variation and factors (such as public holidays) which affect the arrangements for registering deaths. It follows that the figure for a particular local authority for any given week may be an unreliable indicator of the area's usual weekly number of deaths, and that the change over a few weeks may be an unreliable indicator of any trend in the number of events in that local authority area. This note illustrates these points using the numbers of deaths registered, week by week, in each local authority in 2009 (the year for which the General Register Office for Scotland (GROS) conducted the analysis whose results are described below). These figures are on the normal basis for GROS statistics of deaths by local authority area - see the section on 'Geographical basis of Vital Events statistics'. The workbook containing the table is available via a link at the foot of the page.

The table has two parts:

- the upper half shows the number of deaths registered, week by week, for each local authority in 2009, together with (in the final column) the overall average number of deaths per week (for weeks 5 to 48, to avoid any problems that might be caused if there were unusual values in the weeks at the start or the end of the year). A note below explains why there are so few registrations shown for 'week 1'.
- the lower half identifies cases where the figure for a local authority increased between one week and the next by more than both the specified 'threshold' amounts - i.e., (as the spreadsheet is initially set up) the magnitude of the rise must be greater than 10 deaths and it must represent an increase of more than 20%. This means that the table will not highlight large percentage rises that are based on small numbers (e.g. it will not identify a 'doubling' from 2 to 4 deaths) nor any changes that represent only a small percentage increase. (This part of the table also covers only weeks 5 to 48.)

For example, the upper part of the table shows that Edinburgh's numbers of deaths registered from week 5 to week 9 were as follows: 71, 78, 78, 81 and 102 - so, if one looked only at those weeks, one might think that Edinburgh normally had around 70-80 deaths per week, and that there had been an alarming increase in mortality in week 9. The lower part of the table shows that the increase in Edinburgh's deaths registered in week 9 was 21, so it was above the threshold of 10 (and a rise from 81 to 102 is also above the other threshold of 20%)

Similarly, Edinburgh's numbers of deaths registered from week 12 to week 16 were as follows: 75, 62, 69, 71, 90 - so, looking only at those weeks, the normal level for Edinburgh would appear to be about 60-70 deaths per week, with an alarming increase in week 16. The lower part of the table identifies this as another increase which is greater than both the specified thresholds. As it happens, the final column shows that, overall, Edinburgh had an average of 78 deaths registered per week in

2009 (considering only weeks 5 to 48) - so, in this case, the large rise follows four weeks in which below-average numbers of deaths (75, 62, 69, 71) were registered. The 90 deaths registered in week 16 represented 12 more than the overall average level of 78 per week - but the 62 registered in week 13 represented 16 fewer than the overall average, so the low number is arguably the more unusual.

In total, the lower part of the table identifies five weeks (9, 16, 29, 40 and 43) in which there was an increase in Edinburgh's number of deaths that was greater than both the specified thresholds. However, in many cases, the number of deaths can be represented reasonably well by the results of a Poisson process (a separate page provides more information about this). Assuming, for simplicity, that the underlying rate of occurrence is given by the average number of deaths per week, 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 assumed underlying rate. In the case of Edinburgh, with an average of 78 deaths per week (in weeks 5 to 48), the rough likely range of values (or '95% confidence interval') would be from about 60 to around 96. The numbers of deaths registered in weeks 5 to 48 of 2009 were consistent with this: only week 9 had a figure (102) which is outwith that range. Therefore, four of the five cases of 'large' increases in Edinburgh's registered number of deaths are simply the result of fluctuations which are within the rough likely range of values, with a rise from a below-average number in one week to an above average number in the next week (from 71 in week 15 to 90 in week 16; from 65 in week 28 to 82 in week 29; from 66 in week 39 to 87 in week 40; and from 68 in week 42 to 87 in week 43).

Similarly, Glasgow had an average of 123 deaths per week (in weeks 5 to 48). Assuming that its number of deaths per week can be represented by the results of a Poisson process, its rough likely range of values would be between about 101 and 145 deaths per week. Glasgow's actual numbers of deaths registered in weeks 5 to 48 were broadly consistent with this. The only figures outwith the likely range were 151 in week 5, 146 and 147 in weeks 8 and 9, 100 in week 21, 96 in week 26, 99 in week 34 and 99 in week 39: in all cases, the number of deaths was at most 5% outwith the calculated likely range of values'. Glasgow had four 'large' week-to-week increases in deaths: in three cases, the cause was a rise from a number which was below the likely range to one within the likely range (from 100 in week 21 to 126 in week 22; from 96 in week 26 to 137 in week 27; from 99 in week 39 to 131 in week 40), and the remaining case was an increase which was within the likely range (from 107 in week 14 to 131 in week 15) - so, in no case was an apparently alarming increase in deaths due to mortality increasing to exceptionally high level.

The figures for other local authorities could be analysed in a similar way.

A note on how the registration weeks are defined is included in the 'Date of registration is basis of Vital Events statistics' section. In the case of 2009, the Vital Events statistical database's code for 'week 1' applies to only a small number of events - those which were registered on Thursday 1, Friday 2 or Saturday 3 January 2009. However, when GROS produces statistics of the number of registrations for 'week 1' of 2009, it adds in registrations from the incomplete 'week 53' of 2008 (Sunday 28 to Wednesday 31 December 2008), so the figures for 'week 1' of 2009 cover the period from Sunday 28 December 2008 to Saturday 3 January 2009, inclusive.

The analysis looks only at the increases in weeks 5 to 48 because of the effect of the public holidays at Christmas and New Year on the figures for the weeks at the start and end of each year. The figures for some other weeks will also be affected by public holidays (e.g. those at Easter) and local holidays, this and the fact that deaths do not occur ‘at random’ (e.g. a bad car crash may cause several deaths), could mean that the actual fluctuations in the figures for any given local authority are a little greater than would be expected from a Poisson process.

The workbook containing the table is available at the following link:
Fluctuations in weekly numbers of deaths by Council area (Excel 94 Kb)