Annex D: Fluctuations in the numbers of drug-related deaths

D1 General information about fluctuations in death statistics is given in a separate section of the NRS website. This Annex gives some examples that are specific to statistics of drug-related deaths.

D2. The figures in Table 1 show that, in some periods (such as from 2001 to 2005, and from 2008 to 2013) there were rises and falls in the number of drug-related deaths. When there appear to be year to year fluctuations, moving annual averages are likely to provide a better guide to any long-term trend than the change between any two individual years. Figure 1 in the publication illustrates this: the dashed line, which is the 5-year moving average, "smoothes" out most of the year-to-year variation, and so should show any overall trend (or stability) better than the individual years' values (which are given by the continuous line, and sometimes appear to have quite large percentage year-to-year fluctuations). From its first value (for 1996-2000, the period centred on 1998), the 5-year moving average rose for many years, suggesting that there was a clear long-term upward trend. When the figure for 2013 was obtained, the 5-year moving average fell slightly, from 554 for 2008-2012 (the period centred on 2010) to 544 for for 2009-2013 (the period centred on 2011), because there were fewer deaths in the year which had entered the calculation (2013, with 527 deaths) than in the year which had dropped out of the calculation (2008, with 574 deaths). However, with the number of deaths rising to 614 in 2014, and further increases in subsequent years, the 5-year moving average rose again.

D3. The shaded area shows the likely range of random statistical variation around the 5-year moving average. Statistical theory suggests that, if the number of deaths can be represented as the result of a Poisson process, for which the underlying rate at which the events (deaths) occur is given by the 5-year moving average, then random year to year variation would result in only about one year in 20 having a figure outwith this range (which is a '95% confidence interval', calculated thus: the underlying rate of occurrence plus or minus 1.96 times its standard deviation; for a Poisson process, the standard deviation is the square root of the underlying rate of occurrence).

D4. Looking at Figure 1, it is clear that:

- up to (and including) 2007, the individual years' figures tended to fluctuate around a long-term upward trend, and were generally within the likely range for random statistical year to year variation about the trend;
- from 2008 (when 574 deaths were registered) to 2013 (527 deaths), there was not much overall change in the numbers: the individual years' figures tended to fluctuate from year to year, remaining between 485 (in 2010) and 584 (in 2011). The figure for 2008 appeared unusually high (being above the upper end of the likely range of random statistical variation around the 5-year moving average, which is assumed to represent the underlying rate for that time), and the figures for 2010 and 2013 appeared unusually low (both being below the lower end of the likely range of random statistical variation). The figures for the other three years in that period (2009, 2011 and 2012) were all close to the 5-year moving average value, and so were broadly in line with what appeared to be the underlying rate for that time;
- for 2014 onwards, each year's figure is much more than in the previous year. With 614 deaths in 2014, 706 in 2015, 868 in 2016, 934 in 2017, 1,187 in 2018, 1,280 in 2019 and 1,339 in 2020, the apparent long-term trend is one of rapid increases;

- the numbers for 2014 to 2018 are all within 7% of the value of the 5-year moving average that is centred on those years, and so are all broadly in line with the apparent long-term trend;
- the figure for 2019 is roughly in line with what one might expect the 5-year moving average to be, if one were to extrapolate the apparent trend suggested by its most recent four values.
- the figure for 2020 may be below the likely range of values for 2020 that one might expect on the basis of the apparent trend suggested by the 5-year moving average's most recent four values – but, if that is the case, at the time of writing, one cannot know what is the cause (e.g. an unusual level of random variation in 2020? a change in the long-term trend's annual rate of increase?);

D5. As the overall total may fluctuate from year to year, it is not surprising that there may be greater (in percentage terms) year-to-year variation in the figures for sub-groups of the population, or for areas within Scotland. For example, Table 4 shows that the number of deaths in a particular age-group can fluctuate markedly over the years (for example, the number of 15 to 24 year olds who died was 100 in 2002, 47 in 2005, 94 in 2007, 65 in 2010, 32 in 2013, 46 in 2014, 30 in 2015, 42 in 2016, 36 in 2017 and 64 in 2018). Therefore, using 5-year moving annual averages should 'smooth out' the effects of any fluctuations, and so provide a better indication of the longer-term trends. That will also apply for other analyses of the statistics: for example, the number of deaths involving some drugs may fluctuate greatly (in percentage terms) from year to year.

D6. In the case of the numbers of drug-related deaths for each NHS Board area (Table HB1), the generally small numbers involved (particularly for some areas) mean that great care should be taken when assessing any apparent trends: as 'random' year-to-year variation in the figures could produce apparently large percentage changes. This is more likely for the areas with smaller populations, but sometimes can also be seen in the figures for the more populous areas (for the purpose of this publication, 'more populous' areas have populations of at least 300,000). For example:
- Greater Glasgow & Clyde had 127 deaths in 2003, 147 in 2004, an unusually low 109 in 2005, 156 in 2006 and 147 in 2007;
- Greater Glasgow & Clyde had 183 deaths in 2011, 187 in 2012, an unusually low 138 in 2013, 189 in 2014 and 221 in 2015;
- Ayrshire & Arran had 43 deaths in 2014, 43 in 2015, an unusually high 85 in 2016, an unusually low 61 in 2017, 82 in 2018 and 108 in 2019;
- Forth Valley had 25 deaths in 2014, 31 in 2015, an unusually high 51 in 2016, an unusually low 36 in 2017, 72 in 2018 and 75 in 2019;
- Dumfries & Galloway had 22 deaths in 2017, 20 in 2018, an unusually high 35 in 2019 and 22 in 2020.

D7. This point also applies to the drug-related death rates (per 1,000 population) for various age-groups that are shown in Table HB4. Even though the figures are five-year averages, they must still be used with caution for the less populous areas. For example when the annual averages for 2007 to 2011 were calculated, just three 15-24 year old drug-related deaths in Shetland caused it to have a rate for that age-group which was double that of Scotland as a whole.

D8. Tables C1 provides figures for individual council areas. Again, because of the relatively small numbers involved, particularly for some areas, great care should be taken when using these figures. Even the numbers for the most populous areas may be subject to large percentage year-to-year fluctuations. As examples:
- Glasgow's figures from 2003 to 2008 were as follows: 93, 106, 75 (unusually low), 113, 90 (now low), 121;

- Edinburgh's from 2003 to 2010 were: 26, 17, 41 (unusually high), 30 (now low), 43, 66 (unusually high), 45, 47;
- South Lanarkshire's from 2013 to 2019 were: 34, 31, 64 (unusually high), 49, 58, 68;
- Fife's from 2017 to 2020 were: 66, 64, 81 (unusually high), 65.

D9. As the numbers of drug-related deaths for areas within councils (such as electoral wards) will be lower, and may be subject to proportionately larger year-to-year fluctuations, it is unlikely that much useful information could be obtained from looking at the figures for such small areas for a single year, or even for a few years taken together. There could also be concerns about the sensitivity of data relating to small areas, as it might be possible, in some circumstances, to infer something about identifiable individuals from such data. Therefore, one should only look at such figures for many years taken together. Even then, the smaller the areas are, the more (in percentage terms) their figures may be influenced by how NRS allocates deaths to areas, based upon the details that are collected by the registration process. Information about the basis of NRS's statistics about deaths, and examples of the fluctuations in and possible unreliability of figures for small areas, are available from the Vital Events – General Background Information and the Deaths – Background Information pages within the vital events section of the NRS website.

D10. An example of the scale of the numbers for small areas is given by an analysis for the National Forum on Drug-related Deaths, which used data for postal districts for the eight years from 2000 to 2007 (inclusive). This was done in response to a request, at a Forum meeting in September 2008, to 'identify any geographical concentrations of drug-related deaths'. Postal districts are not normally used for statistical analysis, but in this case they provided a convenient way to describe the extent to which the numbers of drug-related deaths were concentrated in certain parts of Scotland, by using a geography that would be more meaningful to Forum members than, say, the data zones or intermediate zones that were used in Scottish Neighbourhood Statistics. The database had records for 2,893 drug-related deaths (on the basis of the standard definition) in Scotland in the specified eight years (paragraph A4 of Annex A explains why there is a slight difference from the total of the published figures for those years). Of the postal districts, 'G21' had the largest number (67 - an average of 8.4 per year). Four other postal districts had totals of 50 or more drug-related deaths for that period: 'G33' (54); 'G20' (53); 'G32' (51); and 'AB24' (50). Figures were not provided for every individual postal district, because of the numbers involved. There were 25 postal districts which each had 29 or more drug-related deaths over the eight years: each of them accounted for more than 1% of the total for Scotland for that period. Taken together, these 25 postal districts accounted for about a third of all drug-related deaths in Scotland between 2000 and 2007. The remaining two-thirds of drug-related deaths in that period were deaths of residents of postal districts which had, at most, 28 such deaths over the eight years – this is areas which had, on average, at most three and a half drug-related deaths per year (many averaged fewer than one drug-related death per year). It follows that, while some postal districts have markedly more drug-related deaths than others, the problem is clearly a very widespread one, with most deaths being of people living in areas which had relatively few drug-related deaths