Methodology

This document provides information on the identification of deaths which are due to hypothermia, or to which hypothermia contributed, and notes on the possible year-to-year fluctuations in the figures.

How deaths involving hypothermia are identified

The International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10), which National Records of Scotland (NRS) uses to code the causes of deaths, has a number of different categories which are relevant to hypothermia.

The deaths which are counted, for the purpose of these statistics, as involving hypothermia are the ones for which the ICD-10 codes for the causes of the death include one (or more) of the following:

- T68 - hypothermia associated with low environmental temperature
- R68.0 - hypothermia not associated with low environmental temperature
- T88.5 - other complications of anesthesia and ‘hypothermia’ was mentioned somewhere in the cause of death
- P80 - hypothermia of newborn
- X31 - exposure to excessive natural cold

Two of these codes (T88.5 and P80) are used for very few, if any, deaths in any given year. Although codes T68 and X31 may appear similar, they serve different purposes in the ICD: T68 is used to record that a person's injuries included hypothermia (and other ICD-10 codes would be used if the person also had other types of injury); X31 is used to record that exposure to excessive natural cold caused, or contributed to, a person's injuries and/or medical problems (e.g. the failure of an organ). The two codes may well be recorded together, but (if so) the death will only be counted once in these statistics.

These figures cover all the deaths for which the death certificate mentioned ‘hypothermia’, plus all the deaths for which one (or more) of the specified codes was used and the death certificate mentioned something other than ‘hypothermia’ (generally ‘exposure’ or perhaps a related term, such as ‘frostbite’). They include cases where people died outside, perhaps caught by the weather while hillwalking or failing to get home after drinking.

Hypothermia was the underlying cause of fewer than half of the deaths for which it was mentioned on the death certificate. Most deaths involving hypothermia were

ones to which it had contributed, but for which there was another underlying cause, such as a mental and behavioural disorder due to the use of psychoactive substances (e.g. chronic alcoholism), heart disease, a stroke, pneumonia, alcoholic liver disease or a fall.

NRS is sometimes told why a person died of hypothermia. ‘Exposure to excessive cold’ (ICD-10 code X31) was the underlying cause of (on average) 27 deaths per year in the period from 2000 to 2012, inclusive. In some of these cases, the information available to NRS (from the death certificate or another source) indicates that the death was caused by being outside in the cold - for example, the cause of death may include the words ‘exposure (outdoors)’ or the place of death may have been described as (e.g.) a field or a wood. There are also cases where the place of death appears to be a private address, and the death is said to be due to (e.g.) ‘inadequate heating’ or ‘self-neglect’. ‘Alcohol intoxication’ is referred to in several cases. However, often, all NRS is told is that hypothermia was the underlying cause of death and that the person died in a hospital - in such cases, NRS does not know whether the death was due to being, say, in a cold home or being outside in freezing conditions.

Year-to-year fluctuations in the figures

Over the period from 2000 to 2012, about 80 deaths per year (on average) involved hypothermia. For any cause with such a level of deaths, one would expect that ‘random’ year to year variation could lead to quite large percentage fluctuations in the figures for Scotland as a whole, and there could be even larger (in percentage terms) fluctuations for the smaller Health Board and Council areas, as their numbers may be very small. More information about this is given below, in the Technical Note.

The fact that there could be large (in percentage terms) ‘random’ year-to-year fluctuations means that the difference between the figures for two years must be very large (in percentage terms) for one to be confident that there is a real difference in their mortality rates. For example, in the three years from 2000 to 2002, inclusive, there were (on average) 104 deaths per year involving hypothermia. The corresponding figure for 2009 to 2011, inclusive, was an average of 70 deaths per year. With such numbers, the drop of about 33% would be regarded as a statistically significant change, and the further fall to ‘only’ 48 deaths in the next year (2012) appears to confirm the downward trend in the number of deaths involving hypothermia . However, had the fall been ‘only’ 20-25% (and had the figure for 2012 been around 80, say), it could have been within the range of possible fluctuations (see the Technical Note), and hence not significant statistically. Therefore, one should not make too much of the number in any one year, or of the change between any two years.

Technical note

As explained within the Deaths - Background Information - Fluctuations section on this website there may be large percentage fluctuations in the numbers of deaths from particular causes.

For some of the causes of death for which the numbers fluctuate from year to year, one can look at:

a) 5-year moving annual averages, as they should provide a better indication of the overall long-term trend than the figures for the individual years; and

b) the likely range of values around the moving annual average. The likely range of statistical variability in the figures is estimated by assuming that the numbers represent the outcome of a Poisson process, with the underlying rate of occurrence in each year being the same as the value of the 5-year moving annual average which is centred on that year. 'Upper' and 'lower' boundaries of an approximate '95% confidence interval' around the moving annual average are calculated by adding/subtracting twice the standard deviation. (For a Poisson distribution, the mean and the variance are the same, so the standard deviation is simply the square root of the moving average).

However, in the case of hypothermia:

i. one cannot assume that the underlying rate of death in a given year is the same as the value of the 5-year moving average which is centred on that year: because the death rate could be much higher in particularly harsh winters, and much lower when the weather is relatively mild. Therefore, the year-to-year variation in the number of deaths involving hypothermia could be much more than the ‘random' fluctuations that one would expect from statistics that represent the outcome of a Poisson process.

ii. even if the assumption were correct, with (since 2000) an average of around 80 deaths per year involving hypothermia, the approximate ‘95% confidence interval’ would be from 62 to 98, which would represent a range of plus or minus some 20-25%. This indicates that ‘random’ fluctuations could produce very large year-to-year percentage changes.

In the case of the change between 2000-2002 and 2009-2011 (see above) the annual averages for the two periods are 104 and 70, respectively, so their difference is 34. The variance of the difference between two independent variables is the sum of their variances, so the variance of the difference is 174 (104+70), and its standard deviation is 13.2 (the square root of 174). The difference of 34 between the averages for 2000-2002 and 2009-2011 is over 2½ times its standard deviation, so it follows that this drop of about 33% appears definitely to be statistically significant at the conventional 5% level (assuming that the numbers represent the outcome of a Poisson process). However, as indicated earlier, a change of 20-25% could be within the expected range of fluctuations. Therefore, users of these statistics are reminded that the figures can fluctuate considerably (in percentage terms) from one year to the next - so one should not make too much of the number in any one year, or of the change between any two years.