

## **Methodology**

### **ICD Codes used to identify MRSA**

With effect from 2000, the National Records of Scotland has applied the rules of the International Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10), in order to determine the ICD-10 code for each death registered in Scotland.

For each death, NRS assigns a single code for the underlying cause of death and, depending upon what was written on the death certificate, may assign several other codes for other factors which contributed to the occurrence of the death. Statistics on three bases can therefore be produced:

- deaths for which MRSA was the underlying cause;
- deaths for which MRSA was a contributory factor;
- deaths for which there was any mention of MRSA.

For the purposes of producing the statistics shown in the accompanying tables, NRS identified deaths which involve MRSA separately for:

- 2000 and subsequent years, for which NRS used ICD-10 codes; and
- 1999 and earlier years, for which NRS used ICD-9 codes.

### **Identifying deaths which involved MRSA and occurred in 2000 and later years**

The selection of deaths which involved MRSA requires a search of the cause of death text entries for all deaths for any mention of Methicillin- (or Methicillin-) resistant *Staphylococcus aureus*. Detailed inspection of the text is required because the relevant ICD codes do not apply to MRSA alone, and because doctors may have used variations on the name, or made spelling errors. For example, deaths for which the following terms are mentioned are included:

- Multi-resistant *Staphylococcus aureus*;
- Multiple resistant *Staphylococcus aureus*; and
- cases that omitted the term 'aureus' but included the M, R, and S.

A finely-balanced judgment is required in some cases. For example, when 'Methicillin resistant *Streptococcal aureus*' appeared on a death certificate, it was taken as

referring to MRSA rather than to a Streptococcal infection. However, any cases of 'Methicillin sensitive Staphylococcus aureus' are excluded.

The selection of cases where the underlying cause is deemed to be an MRSA infection is not straightforward. After discussion with its medical adviser, NRS decided to count only those cases which had both a mention of MRSA and one of the following ICD-10 codes selected as the underlying cause:

- A05.0 - food-borne staphylococcal intoxication;
- A41.0 to A41.2 - septicaemia due to staphylococcus aureus / other specified staphylococcus / unspecified staphylococcus;
- A41.9 - septicaemia, unspecified;
- A49.0 - staphylococcal infection, unspecified;
- G00.3 - staphylococcal meningitis;
- J15.2 - pneumonia due to staphylococcus;
- L00 - staphylococcal scalded skin syndrome;
- M00.0 - staphylococcal arthritis and polyarthritis;
- P23.2 - congenital pneumonia due to staphylococcus;
- P36.2 - sepsis of newborn due to staphylococcus aureus.

Note: under the ICD-10 rules, certain other 'staphylococcus' codes (B95.6 to B95.8) cannot be used for the underlying cause of death.

This approach differs from that used by the Office for National Statistics (ONS) to produce figures for England & Wales. NRS's method is more consistent with the approach used to produce the figures for 1996 to 1999 because it uses the ICD-10 equivalents of the ICD-9 codes which were used to select MRSA cases for 1996 to 1999 (the ONS method includes some ICD-10 codes which are not the equivalents of those ICD-9 codes, but are ones for which it was thought that text searching might reveal mentions of MRSA).

At the same time, when it produced 'extract' files of MRSA deaths (for 2000 to 2006, inclusive), NRS also identified separately deaths for which there was mention of 'Staphylococcus' alone, or of 'Staphylococcus aureus' alone, as the numbers of those deaths were sometimes requested. Such deaths are not counted in the tables which give figures for deaths which involved MRSA (and are not identified separately in later years: NRS's database now has a special code, for 2008 onwards, which is used only if MRSA was mentioned).

## Identifying deaths which involved MRSA and occurred between 1996 and 1999

1996 is the first year for which NRS recorded the 'cause of death' text in its statistical database, and 1999 was the last year for which NRS used ICD-9 codes for the causes of death.

All deaths with a mention of one of the following ICD-9 codes were selected:

- 005.0: Staphylococcal food poisoning
- 008.4: Intestinal infections ..., other specified bacteria, [including] Staphylococcal enterocolitis
- 038.1: Staphylococcal septicaemia
- 041.1: Bacterial infections in conditions classified elsewhere and of unspecified site, Staphylococcus
- 320.3: Staphylococcal meningitis
- 482.4: Pneumonia due to Staphylococcus

These were the same ICD-9 codes as used in ONS's method, which was described in an article in 'Health Statistics Quarterly', number 21.

The selection of deaths which involved MRSA required a search of the cause of death text entries for all deaths for mentions of Methicillin- (or Methicillin-) resistant *Staphylococcus aureus*. Detailed inspection of the text was required because the relevant ICD codes do not apply to MRSA alone, and because doctors may have used variations on the name, or made spelling errors. For example, deaths for which the following terms are mentioned were included:

- Multi-resistant *Staphylococcus aureus*;
- Multiple resistant *Staphylococcus aureus*; and
- cases that omitted the term 'aureus' but included the M, R, and S.

A finely-balanced judgment was required in some cases. For example, when 'Methicillin resistant *Streptococcal aureus*' appeared on a death certificate, it was taken as referring to MRSA rather than to a *Streptococcal* infection. However, any cases of 'Methicillin sensitive *Staphylococcus aureus*' were excluded.

As a second phase, the text search was extended to cover all deaths in Scotland (Office for National Statistics (ONS) could not do the same in England & Wales because of the much larger number of deaths). This identified a few more cases, most of which had not been found in the first phase because of minor coding errors

caused by spelling mistakes etc. The automatic system for coding causes of death assigns ICD codes on the basis of text analysis, so deaths whose causes were described as (e.g.) 'staphylococcus septicaemia' or 'staphaureus septicaemia' would have been assigned to ICD-9 code 038.9 (unspecified septicaemia) rather than 038.1 (Staphylococcal septicaemia). There were also a few infant deaths where ICD-9 perinatal codes were used (e.g. 771.8).

The underlying cause of death was then taken as being MRSA if the text mentioned MRSA and one of the codes listed above had been selected as the underlying cause. This was the same method as used by ONS.

At the same time, NRS also identified separately deaths for which there was mention of 'Staphylococcus' alone, or of 'Staphylococcus aureus' alone, as the numbers of those deaths were sometimes requested. Such deaths are not counted in the tables which give figures for deaths which involved MRSA.