Report:

Deaths involving MRSA: England and Wales, 2008

Jane Carter
Office for National Statistics

Key findings

- The number of death certificates in England and Wales mentioning MRSA (meticillin-resistant *Staphylococcus aureus*) infection fell by 23 per cent between 2007 and 2008 to 1,230
- The number of death certificates in England and Wales mentioning *Staphylococcus aureus* (including those not specified as resistant) was 1,500 in 2008, a decrease of 27 per cent compared with 2007
- Between 2007 and 2008, age-standardised death rates for deaths involving MRSA decreased by 31 per cent among males and by 13 per cent among females, to 18 and 10 per million population respectively
- Rates of deaths involving MRSA in the period 2004 to 2008 were highest in older age groups. In the 85 and over group, there were 659 and 326 deaths per million population for males and females respectively. This compares with figures for the under 45 age group of 1 death per million population for both males and females
- Between 2004 and 2008, MRSA was involved in 3 per 1,000 deaths in England and Wales

This report presents the latest figures from the Office for National Statistics (ONS) database of deaths where meticillin-resistant *Staphylococcus aureus* (MRSA) was mentioned as a contributory factor. It includes provisional figures for 2008 (based on provisional deaths registrations for 2008) and updated rates for 2007 (based on mid-year population estimates for 2007). Figures for 2004 to 2007 are provided for comparison purposes. Provisional mortality rates for 2008 have been calculated using the population projections for 2008,¹ as population estimates are not yet available. Final figures and rates will be provided in the next annual report.

Changes to this report

Reports on deaths involving MRSA which were published in 2008 included breakdowns by individual communal establishment.^{2,3} Following feedback from users of the statistics and comparison with other sources of data, it became apparent that the figures produced at this detailed level are not of sufficient quality for routine publication as National Statistics (Background note 6). Consequently, alternative methods for the production of local-level figures on deaths involving MRSA are being investigated, and comparable figures for the 2004–08 are not included in this report.

Results

Number of deaths where *Staphylococcus aureus* or MRSA contributed to the death or was the underlying cause of death

The number of death certificates in England and Wales mentioning *Staphylococcus aureus* (*S. aureus*) infection (including those specifying meticillin resistance (MRSA)) increased each year from 2004 to 2006 from 1,599 to 2,150 (Table 1). However, in 2007 the number of certificates mentioning *S. aureus* decreased slightly to 2,052, and then decreased again, by 27 per cent, to 1,500 in 2008.

- The number of death certificates mentioning MRSA increased from 1,138 in 2004 to 1,652 in 2006. It then decreased slightly to 1,593 in 2007, and fell further to 1,230 in 2008
- The number of death certificates mentioning *S. aureus* without specifying meticillin resistance remained fairly stable between 2004 and 2007, and then decreased in 2008 (Figure 1)

In 2004, 71 per cent of deaths mentioning *S. aureus* specified meticillin resistance. By 2008 this had risen to 82 per cent.

Figure 1

Number of death certificates mentioning *Staphylococcus aureus* by meticillin resistance, 2004–08¹

England and Wales

¹ Figures for deaths registered in 2008 are provisional.

Underlying cause of death

The proportion of mentions of *S. aureus* or MRSA that were selected as the underlying cause of death stayed stable between 2004 and 2007, at around one in three, and then fell to one in five in 2008 (Table 1).

Mortality rates for all deaths mentioning *Staphylococcus aureus* or MRSA:

Sex

Throughout the period 2004 to 2008, age-standardised rates for deaths involving *S. aureus* and MRSA were higher for males than for females.

The rates for deaths involving MRSA in males decreased by 6 per cent from 19 per million population in 2004 to 18 in 2008. In females the rate increased by 15 per cent from 9 per million population to 10, over the same period (Table 2).

The rates for deaths involving *S. aureus* in males decreased 17 per cent from 27 per million population in 2004 to 22 in 2008. In females the rate decreased by 6 per cent from 14 per million population to 13, over the same period.

Between 2007 and 2008, the age-standardised rates for MRSA among males decreased by 31 per cent, with the rate among females decreasing by 13 per cent to 18 and 10 per million population respectively. This represents the first decrease among males in England and Wales since

2004 and the third consecutive year that the rate for females has fallen during this period (Figure 2).

Age

Most of the deaths involving *S. aureus* or MRSA are in the older age groups. For the combined period 2004–08, age-specific mortality rates for deaths involving MRSA in the 85 and over age group were 659 and 326 deaths per million population, for males and females respectively. In the under 45 age group there was 1 death per million population, for both males and females (Table 3).

Place of death

Death certificates rarely specify the place where an infection was acquired. However, the place of death is recorded. Between 2004 and 2008, deaths involving *S. aureus* and MRSA accounted for less than 1 per cent respectively of all deaths in England and Wales (Table 4). Among deaths that occurred in NHS hospitals and NHS nursing homes, deaths involving *S. aureus* accounted for 0.6 per cent and 0.5 per cent of the totals in these institutions respectively. Deaths involving MRSA accounted for 0.4 per cent of all deaths in NHS hospitals and in NHS nursing homes.

The majority of deaths occur in hospital (56 per cent of all deaths between 2004 and 2008 occurred in NHS hospitals). We would therefore expect the majority of *S. aureus* and MRSA deaths to also occur in hospital. Many of these deaths in hospital will have been to patients who were admitted because they were already seriously ill with another

Table 1

Number of death certificates with *Staphylococcus aureus* and MRSA mentioned and as the underlying cause, 2004–08¹

	2004	2005	2006	2007	2008
England and Wales²					
Mentions					
All <i>Staphylococcus aureus</i>	1,599	2,099	2,150	2,052	1,500
MRSA	1,138	1,649	1,652	1,593	1,230
Percentage of <i>S. aureus</i> mentions that were MRSA	71	79	77	78	82
Underlying cause					
All <i>Staphylococcus aureus</i>	547	642	707	630	305
MRSA	357	465	519	460	228
Percentage of mentions selected as underlying cause					
All <i>Staphylococcus aureus</i>	34	31	33	31	20
MRSA	31	28	31	29	19
England					
Mentions					
All <i>Staphylococcus aureus</i>	1,514	1,960	2,025	1,941	1,395
MRSA	1,069	1,536	1,556	1,517	1,137
Percentage of <i>S. aureus</i> mentions that were MRSA	71	78	77	78	82
Underlying cause					
All <i>Staphylococcus aureus</i>	516	596	653	596	273
MRSA	334	432	480	439	200
Percentage of mentions selected as underlying cause					
All <i>Staphylococcus aureus</i>	34	30	32	31	20
MRSA	31	28	31	29	18
Wales					
Mentions					
All <i>Staphylococcus aureus</i>	84	134	119	103	101
MRSA	68	109	95	73	90
Percentage of <i>S. aureus</i> mentions that were MRSA	81	81	80	71	89
Underlying cause					
All <i>Staphylococcus aureus</i>	31	46	52	30	31
MRSA	23	33	39	20	27
Percentage of mentions selected as underlying cause					
All <i>Staphylococcus aureus</i>	37	34	44	29	31
MRSA	34	30	41	27	30

1 Figures for deaths registered in 2008 are provisional.

2 England and Wales data include non-residents who died in England and Wales. Data for England and Wales separately exclude deaths of non-residents.

Figure 2

Age-standardised mortality rates for *Staphylococcus aureus* and MRSA, 2004–08¹

1 Mortality rates for 2008 have been calculated using provisional death registrations figures for 2008 and population projections for 2008 as estimates are not yet available. These rates are therefore provisional.

Table 2

Age-standardised mortality rates for *Staphylococcus aureus* and MRSA by sex, 2004–08¹

	Rates per million population				
	2004	2005	2006	2007	2008 ¹
England and Wales²					
All <i>Staphylococcus aureus</i> , Males	26.9	32.6	35.7	33.8	22.4
All <i>Staphylococcus aureus</i> , Females	14.1	19.4	18.0	16.7	13.3
MRSA, Males	19.4	25.8	26.8	26.3	18.2
MRSA, Females	9.0	14.4	13.2	11.8	10.3
England					
All <i>Staphylococcus aureus</i> , Males	27.1	32.4	35.6	33.9	22.0
All <i>Staphylococcus aureus</i> , Females	14.2	19.3	18.1	16.8	13.3
MRSA, Males	19.4	25.6	26.8	26.6	17.8
MRSA, Females	8.9	14.3	13.2	11.9	10.2
Wales					
All <i>Staphylococcus aureus</i> , Males	23.7	34.6	33.8	30.5	26.2
All <i>Staphylococcus aureus</i> , Females	11.6	19.0	16.0	12.6	13.2
MRSA, Males	19.4	28.2	25.9	21.4	23.8
MRSA, Females	9.1	15.4	12.4	8.0	11.5

1 Mortality rates for 2008 have been calculated using provisional death registrations figures for 2008 and population projections for 2008 as estimates are not yet available. These rates are therefore provisional.

2 England and Wales data include non-residents who died in England and Wales. Data for England and Wales separately exclude deaths of non-residents.

condition. In England and Wales over the period 2004–08, 89 per cent of deaths that mentioned *S. aureus* and 87 per cent of deaths that mentioned MRSA occurred in NHS hospitals.

Methods

All deaths are coded by the Office for National Statistics (ONS) according to the Tenth Revision of the International Classification of Diseases (ICD–10) supplied by the World Health Organisation. Since 1993 ONS has stored the text of death certificates on a database, along with all the ICD coding relating to causes identified on the death certificate. ONS uses a combination of ICD–10 codes and this text to identify death certificates on which MRSA infection was mentioned.

Table 3

Age-specific mortality rates for *Staphylococcus aureus* and MRSA by sex, 2004–08¹

Age group	Rates per million population			
	Males		Females	
	All <i>S. aureus</i>	MRSA	All <i>S. aureus</i>	MRSA
England and Wales²				
Under 45	2.7	1.1	2.1	0.8
45–54	11.4	8.3	7.7	5.3
55–64	31.7	22.3	16.5	10.8
65–74	95.1	73.8	52.2	37.6
75–84	318.4	257.3	160.9	126.4
85 and over	776.0	658.9	397.7	325.6
England				
Under 45	2.6	1.1	2.1	0.8
45–54	11.5	8.5	7.8	5.2
55–64	31.0	21.7	16.4	10.6
65–74	94.1	72.6	52.5	37.6
75–84	316.7	255.2	160.6	126.1
85 and over	790.2	672.7	399.7	327.3
Wales				
Under 45	2.1	1.0	1.2	0.5
45–54	8.4	6.3	5.1	5.1
55–64	39.3	29.7	16.5	13.4
65–74	108.3	91.5	46.0	34.8
75–84	344.7	290.3	158.2	126.9
85 and over	539.0	429.2	362.9	293.8

1 Mortality rates for 2008 have been calculated using provisional death registrations figures for 2008 and population projections for 2008 as estimates are not yet available. These rates are therefore provisional.

2 England and Wales data include non-residents who died in England and Wales. Data for England and Wales separately exclude deaths of non-residents.

Identification of deaths involving *Staphylococcus aureus* and MRSA

The ICD–10 codes used to select deaths in order to then search manually were the same as used in previous analyses. They are identified in Boxes One and Two.² Initially all deaths were extracted that had a code which specifically related to *Staphylococcus* or *S. aureus* mentioned on the death certificate. The text of these death certificates was then searched manually to identify *S. aureus* and MRSA. The codes used to identify these deaths are given in Box One.

In addition, all deaths which had non-specific codes (that is, one which could include a *Staphylococcal* or an *S. aureus* infection but could also include other infections) mentioned anywhere on the death certificate were extracted. They were then searched manually to identify both *S. aureus* and MRSA. The codes used to identify these deaths are given in Box Two.

Deaths with an underlying cause of *S. aureus* were identified by selecting those deaths with a mention of *S. aureus* that also had as the underlying cause one of the causes of death listed in Box One or Box Two. The same procedure was followed for the identification of those deaths with MRSA as the underlying cause. As in previous MRSA reports² where MRSA was mentioned on the death certificate, the code A41.9 (septicaemia, unspecified) was taken to indicate that MRSA was also the underlying cause of death. This is because this code is sometimes selected as the underlying cause of death when MRSA septicaemia is mentioned on the death certificate.

Background notes

1. The number of deaths due to MRSA is difficult to estimate. Trends in mortality are normally monitored using the underlying cause of death (the disease which initiated the train of events leading directly to death). However MRSA, and other healthcare associated infections, are not often the underlying cause of death. Those who die with

Table 4

Number of deaths mentioning *Staphylococcus aureus* and MRSA by place of death, compared to all causes of death, 2004–08^{1,2}

	All cause number of deaths	S. aureus			MRSA		
		Number of S. aureus deaths	Percentage of all S. aureus deaths	S.aureus as a percentage of all deaths in the establishment	Number of MRSA deaths	Percentage of all MRSA deaths	MRSA as a percentage of all deaths in the establishment
England and Wales ¹							
Own home	483,226	150	1.6	0.03	122	1.7	0.03
NHS hospital	1,423,228	8,378	89.1	0.59	6,333	87.2	0.44
Non-NHS hospital	11,099	30	0.3	0.27	25	0.3	0.23
Hospice	121,799	56	0.6	0.05	55	0.8	0.05
NHS nursing home	11,950	61	0.6	0.51	44	0.6	0.37
Non-NHS nursing home	226,462	382	4.1	0.17	371	5.1	0.16
Private residential home	136,882	157	1.7	0.11	149	2.1	0.11
Local Authority residential home	32,901	31	0.3	0.09	31	0.4	0.09
Other places	95,437	155	1.6	0.16	132	1.8	0.14
Total	2,542,984	9,400	100.0	0.37	7,262	100.0	0.29
England							
Own home	451,697	139	1.6	0.03	111	1.6	0.02
NHS hospital	1,323,584	7,861	89.0	0.59	5,933	87.1	0.45
Non-NHS hospital	10,337	29	0.3	0.28	24	0.4	0.23
Hospice	117,398	56	0.6	0.05	55	0.8	0.05
NHS nursing home	11,843	60	0.7	0.51	43	0.6	0.36
Non-NHS nursing home	213,990	370	4.2	0.17	359	5.3	0.17
Private residential home	130,966	154	1.7	0.12	146	2.1	0.11
Local Authority residential home	31,221	31	0.4	0.10	31	0.5	0.10
Other places	86,168	135	1.5	0.16	113	1.7	0.13
Total	2,377,204	8,835	100.0	0.37	6,815	100.0	0.29
Wales							
Own home	31,438	11	2.0	0.03	11	2.5	0.03
NHS hospital	95,960	494	91.3	0.51	389	89.4	0.41
Non-NHS hospital	261	—	—	—	—	—	—
Hospice	4,249	—	—	—	—	—	—
NHS nursing home	103	1	0.2	0.97	1	0.2	0.97
Non-NHS nursing home	12,274	12	2.2	0.10	12	2.8	0.10
Private residential home	5,870	3	0.6	0.05	3	0.7	0.05
Local Authority residential home	1,677	—	—	—	—	—	—
Other places	7,944	20	3.7	0.25	19	4.4	0.24
Total	159,776	541	100.0	0.34	435	100.0	0.27

1 Figures for deaths registered in 2008 are provisional.

2 England and Wales data include non-residents who died in England and Wales. Data for England and Wales separately exclude deaths of non-residents.

MRSA are usually patients who were already very ill and it is their existing illness, rather than MRSA, which is often designated as the underlying cause of death. There is therefore an interest in the number of deaths where MRSA contributed to the death – only conditions which contribute directly to the death should be recorded on the death certificate. Results presented in this report identify deaths where the underlying cause was MRSA and also where MRSA was not the underlying cause but was a contributory factor in the death.

2. MRSA was first isolated in 1961, the same year that the antibiotic meticillin was first used. MRSA remained at low levels in the UK until 1992.⁴ Since then, the number of invasive infections caused by MRSA increased each year until 2006.² Those who die with MRSA are often already very ill and vulnerable to infection. The HPA carry out a mandatory reporting scheme for all cases of MRSA. Results are published annually on the HPA website.⁵ A 2003 Department of Health report addressed actions that should be taken to reduce levels of healthcare associated infections.⁶ Updated guidance on death certification, with specific reference to healthcare associated infections, was issued to doctors in May 2005.⁷ This was followed by a message from the Chief Medical Officer to all doctors reminding them of their responsibilities with respect to death certification and drawing their attention to the guidance.⁸

3. Since 1986 ONS has used the internationally recommended death certificate for neonatal deaths. This means that these deaths cannot be assigned an underlying cause of death.⁹ However, as the data were based on all mentions of *S. aureus* and MRSA, neonates have been included. Neonatal deaths were extracted in the same way as described above for postneonatal deaths.

4. Provisional figures for 2008 death registrations were published on 21 May 2009. Deaths involving MRSA for 2008 have therefore been marked as provisional to allow further quality assurance before the release of final figures in the next annual report. The quality of the provisional figures is comparable with final death registration figures released in previous years.

5. Mortality rates are presented as deaths per million population, directly age-standardised to the European standard population.

6. Investigation into relevant data quality issues has revealed that the quality of the available data on place of death is not sufficient for figures, at this detailed level to be routinely published as National Statistics. The place where a death occurred is recorded in death registration and cannot always be reliably translated into a specific, known healthcare organisation or site. The registrar of births and deaths is required by law to record the name and address of the place where the death occurred, and this information is provided by a qualified informant (usually a relative of the deceased). If a death is referred to the coroner and an inquest takes place, the place of death comes directly from the coroner via 'Form 99'. In practice, the information provided by informants is of variable quality. There is no way for the registrar to know, and nowhere in the current registration system for registrars to record, the NHS or other organisation that was responsible for the patient's care. For example, different parts of one hospital site may report to different NHS Trusts. There is also no direct relationship between the textual information recorded by the registrar and any recognised list or classification of healthcare units and sites, such as the NHS Organisation Codes.

Box one

ICD-10 codes specifically relating to *Staphylococcus* infection

Code	Text
A05.0	Food borne staphylococcal intoxication
A41.0–A41.2	Septicaemia due to <i>staphylococcus aureus</i> /other specified staphylococcus/unspecified staphylococcus
A49.0	Staphylococcal infection, unspecified
B95.6–B95.8	<i>Staphylococcus aureus</i> /other staphylococcus/unspecified staphylococcus as the cause of diseases classified to other chapters
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 <i>staphylococcus aureus</i>

Box two

ICD-10 codes related to infection, but not specifically *Staphylococcus*

Code	Text
A04.8	Other specified bacterial intestinal infections
A38	Scarlet fever
A48.3	Toxic shock syndrome
G06.1	Intraspinal abscess and granuloma
G04.2	Bacterial meningoencephalitis and meningomyelitis, not elsewhere classified
I30.1	Infective pericarditis
I38	Endocarditis, valve unspecified
J03.8	Acute tonsillitis due to other specified organisms
J86	Pyothorax
K12.2	Cellulitis and abscess of mouth
K14.0	Glossitis
L03	Cellulitis
L08.9	Local infection of skin and subcutaneous tissue, unspecified
M60.0	Infective myositis
M86	Osteomyelitis
M46.2	Osteomyelitis of vertebra
M71.1	Other infective bursitis
N39.0	Urinary tract infection, site not specified
T80.2	Infections following infusion, transfusion and therapeutic injection
T81.4	Infection following a procedure, not elsewhere classified
T82.6	Infection and inflammatory reaction due to cardiac valve prosthesis
T82.7	Infection and inflammatory reaction due to other cardiac and vascular devices, implants and grafts
T83.5	Infection and inflammatory reaction due to prosthetic device, implant and graft in urinary system
T83.6	Infection and inflammatory reaction due to prosthetic device, implant and graft in genital tract
T84.5	Infection and inflammatory reaction due to internal joint prosthesis
T84.6	Infection and inflammatory reaction due to internal fixation device [any site]
T84.7	Infection and inflammatory reaction due to other internal orthopaedic prosthetic devices, implants and grafts
T85.7	Infection and inflammatory reaction due to other internal prosthetic devices, implants and grafts
T87.4	Infection of amputation stump
T88.0	Infection following immunization

Glossary

- Staphylococcus aureus* (*S. aureus*):** This is a common germ that lives completely harmlessly on the skin and in the nose of about one third of people. It is more common on skin that is broken, for example, by a cut or sore. People who have *S. aureus* on, or in, their bodies but who are unharmed by it are described as **colonised**. *S. aureus* can cause problems when it gets the opportunity to enter the body. This is more likely to happen in people who are already unwell.
- Meticillin-resistant *Staphylococcus aureus* (MRSA):** This is a variety of *S. aureus* that is resistant to meticillin, and some of the other antibiotics that are usually used to treat *S. aureus*. This sometimes makes it more difficult to treat MRSA infections.
- Age-standardised rate:** Directly age-standardised rates make allowances for differences in the age structure of the population, over time and between sexes. The age-standardised rate for a particular disease is that which would have occurred if the observed age-specific rates for the disease had applied in a given standard population. In this report we have used the European standard population. This is a hypothetical population standard, which is the same for both males and females allowing standardised rates to be compared for each sex, and between males and females.

References

- Government Actuary's Department Population Projections, accessed 4 August 2009, available at: www.gad.gov.uk/Demography%20Data/Population/index.aspx
- Office for National Statistics (2008) 'Report: Deaths involving MRSA: England and Wales, 2003–07', *Health Statistics Quarterly* 39, 56–62. Available on the Office for National Statistics website at: www.statistics.gov.uk/statbase/Product.asp?vlnk=6725
- Office for National Statistics (2008) 'Report: Deaths involving MRSA and *Clostridium difficile*, by communal establishment: England and Wales, 2001–06', *Health Statistics Quarterly* 38, 74–84. Available on the Office for National Statistics website at: www.statistics.gov.uk/statbase/Product.asp?vlnk=6725
- Livermore D (2000) 'Antibiotic resistance in staphylococci', *International Journal of Antimicrobial Agents* 16 Suppl 1, S3–S10.
- Health Protection Agency (2008) *Mandatory Surveillance of Healthcare Associated Infection Report 2008*, accessed 6 July 2009 available at: www.hpa.org.uk/web/HPAweb&HPAwebStandard/HPAweb_C/1216193832294
- Department of Health (2003) *Winning Ways: Working together to reduce Healthcare Associated Infection in England. Report from the Chief Medical Officer*, Department of Health: London.
- Office for National Statistics. *Guidance for doctors certifying cause of death in England and Wales, from the Office for National Statistics Death Certification Advisory Group*. Published on the General Register Office website, April 2005, accessed 6 July 2009, available at: www.gro.gov.uk/medcert
- Department of Health (2005) *CMO Update, Issue 42, Summer 2005*, Department of Health: London.
- Office for National Statistics (2005) *Mortality Statistics: Childhood Infant and Perinatal*, Series DH3 no. 36. Available on the Office for National Statistics website at: www.statistics.gov.uk/statbase/Product.asp?vlnk=6305