Public Health England

Voluntary reporting of *Staphylococcus aureus* bacteraemia in England, Wales and Northern Ireland, 2012

These analyses are based on data extracted from the Public Health England[i] (PHE) voluntary surveillance database, LabBase2[ii], on the 17th July 2013 for the period 2003-2012 in England, Wales and Northern Ireland. This report covers voluntary reports of bacteraemia due to *Staphylococcus aureus* (*S. aureus*). The analysis is limited to *S. aureus* isolated from blood cultures reported on LabBase2. The data presented here differ in some instances from data in earlier publications due to the inclusion of late reports. Hence, the number of reports for 2012 are provisional and maybe subject to change.

Rates were calculated using 2012 mid-year resident population estimates based on the 2011 census for England, Wales, and Northern Ireland.[1][2]

Geographical analyses of reports from England used Government Office regions rather than the Public Health Centre areas created in April 2013 when Public Health England was established, as the data relate to reports submitted in 2012.

The report includes analyses on the trends, age and sex distribution, geographical distribution of and the antimicrobial susceptibility data in cases of bacteraemia.

[i] In April 2013 the Health Protection Agency (HPA) was abolished and its functions transferred to Public Health England.

[ii] LabBase2 is the database that collects laboratory reports of all microorganisms isolated at nearly 400 NHS and other laboratories throughout England and Wales. The database is managed and accessed at the PHE Colindale.

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Key points

- There were 9,117 reports in 2012, comprising 8,127 from England, 619 from Wales and 371 from Northern Ireland. This represents a 4% decrease in the number of *S. aureus* laboratory reports compared with 2011 (9,492 reports). In comparison, the total number of all bacteraemia reported on LabBase2 have slightly increased from 2011 to 2012, 92,529 and 94,055, respectively.
- When the data are grouped by age and sex, the rate per 100,000 population of meticillin-resistant *S. aureus* (MRSA) was significantly higher in males than females for >64 years age group. The rate for meticillin-susceptible *S. aureus* (MSSA) bacteraemia was significantly higher in males than females across all age groups. These patterns have been described in previous years.
- The majority of MRSA tested were resistant to ciprofloxacin and erythromycin, continuing the pattern of the past five years and indeed, since the mid-1990s. The antibiotic susceptibility of MSSA has not changed since 2009; most remained susceptible to a broad range of antibiotics, including ciprofloxacin and erythromycin.
- The downward trends in *S. aureus* reports and meticillin resistance in England since 2005 is supported by data trends from the mandatory reporting system.
- Mandatory enhanced surveillance was extended to include MSSA bacteraemia on 1st January 2011.[3]

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Trends

The number of laboratories voluntarily reporting data for *S. aureus* bacteraemia has decreased from 191 in 2008 to 171 in 2012, probably due to consolidation of laboratories at NHS Trust level. The percentage of laboratories reporting drug susceptibility data remained fairly constant at 99% in 2008 and 98% in 2012.

Table 1: Laboratories reporting *S. aureus* bacteraemia, England, Wales and Northern Ireland: 2008-2012

	2008	2009	2010	2011	2012
No of *S. aureus* bacteraemia reports	**12,452**	**10,670**	**10,056**	**9,492**	**9,117**
Number of reporting laboratories	**191**	**185**	**185**	**180**	**171**
Laboratories reporting susceptibility data	**99%**	**99%**	**98%**	**98%**	**98%**

Table 2: *Staphylococcus aureus* bacteraemia laboratory reports recording meticillin susceptibility (voluntary reporting scheme): England, Wales and Northern Ireland 2003 – 2012

Year	Total *S. aureus*	Total MRSA	% MRSA	Susceptibility data not given
2003	15,930	6,041	41.5	1,372
2004	15,600	5,722	39.7	1,191
2005	15,239	5,671	39.7	968
2006	14,882	5,364	37.9	717
2007	14,103	4,202	31.2	615
2008	12,452	2,869	24.3	650
2009	10,670	1,830	19.4	1242
2010	10,056	1,373	15.7	1,327
2011	9,492	1,064	12.8	1,182
2012	9,117	1,013	12.7	1,118

From January to December 2012, 1,013 (12.7%) of the *S. aureus* from blood cultures were reported as meticillin-resistant (table 2). This represents a 4.8% decrease on the 1,064 reports of MRSA in 2011; there was a 4.0% decrease in total *S. aureus* reports reported in 2012 (9,117) compared with those in 2011 (9,492).

One concern in terms of data quality is that in 2012 the number of *S. aureus* reports where meticillin susceptibility data were not reported to LabBase2 (1,118, 12.7% all *S. aureus*) was 1.8-fold higher than the 615 reports in 2007. The reason for this increase in 'non-reporting' of susceptibility data is not clear. The largest increases in non-reporting of meticillin susceptibility or comparative antibiotics were seen in Wales, West Midlands, North East and the South West. However, there remains an underlying downward trend in the number and proportion of MRSA.

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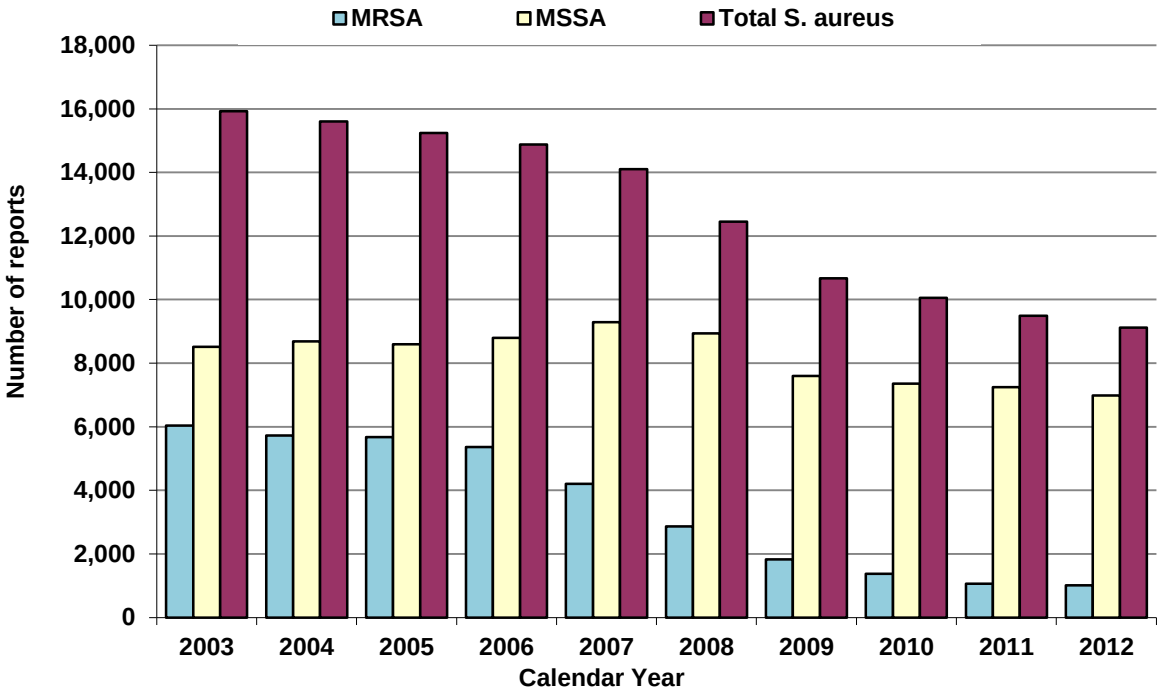
Figure 1 shows the trend in *S. aureus* bacteraemia reports and meticillin susceptibility from 2003. The downward trend in the total number of *S. aureus* and MRSA reported over time has continued in 2012: this downtrend is apparent for MRSA since 2003 and for MSSA since 2008.

Figure 1. Trend in *Staphylococcus aureus* bacteraemia laboratory reports and meticillin susceptibility (voluntary reporting scheme): England, Wales and Northern Ireland 2003-2012



Age and sex distribution

Figures 2 and 3 show the age and sex distributions as rates per 100,000 population for MRSA and MSSA bacteraemias reported voluntarily on LabBase2 for England, Wales and Northern Ireland: January to December 2012.

In both males and females alike, the highest rates (10.6 and 4.4 per 100,000 population respectively) of MRSA bacteraemia were in the over 64 years age group (figure 2). Rates of MRSA bacteraemia were significantly higher in males than females only in the 45-64 years and the over 64 years age groups ($p<0.001$).

The highest rate of MSSA bacteraemia in males was in the over 64 years age group (48.8 per 100,000 population), with a high rate also evident in the under 1 year of age group (45.6 per 100,000 population). The highest rate of MSSA bacteraemia in females was seen in the under 1 year age group (37.9 per 100,000 population) (figure 3). The rates for MSSA bacteraemia were significantly higher in males than females in all age groups ($p<0.001$ for age groups 15-44, 45-64 and >64 years; $P<0.05$ for age groups <1 and 1-14 years; see figure 3).

These overarching patterns in *S. aureus* rates are well established for both MRSA and MSSA bacteraemia, and have been described in previous years.[2]

Figure 2. Age- and sex- specific meticillin resistant *S. aureus* (MRSA) bacteraemia voluntary reporting rates per 100,000 population in 2012, England, Wales and Northern Ireland

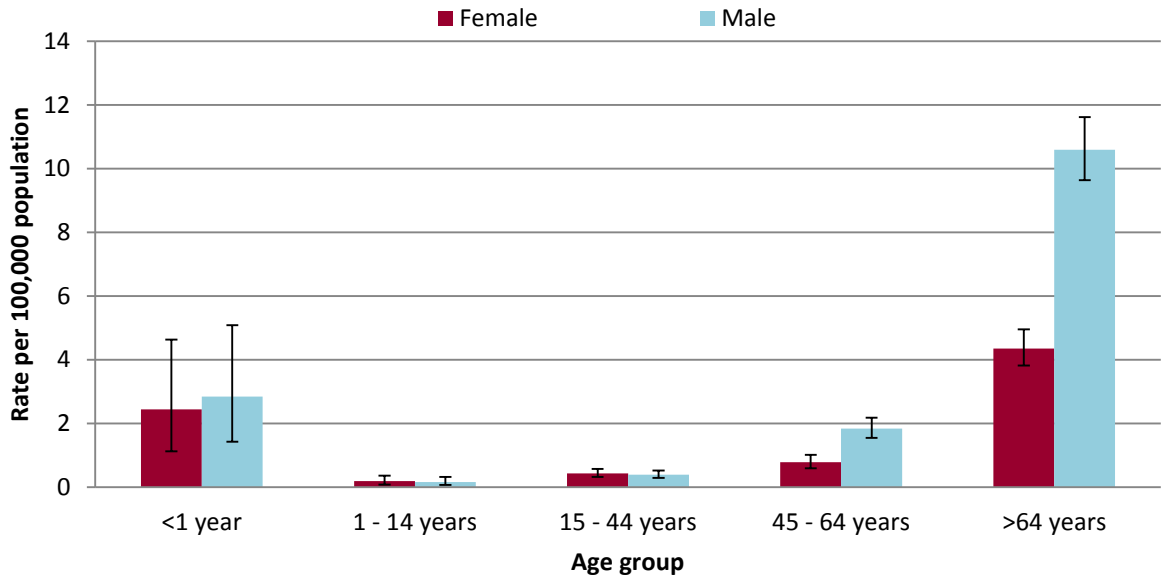


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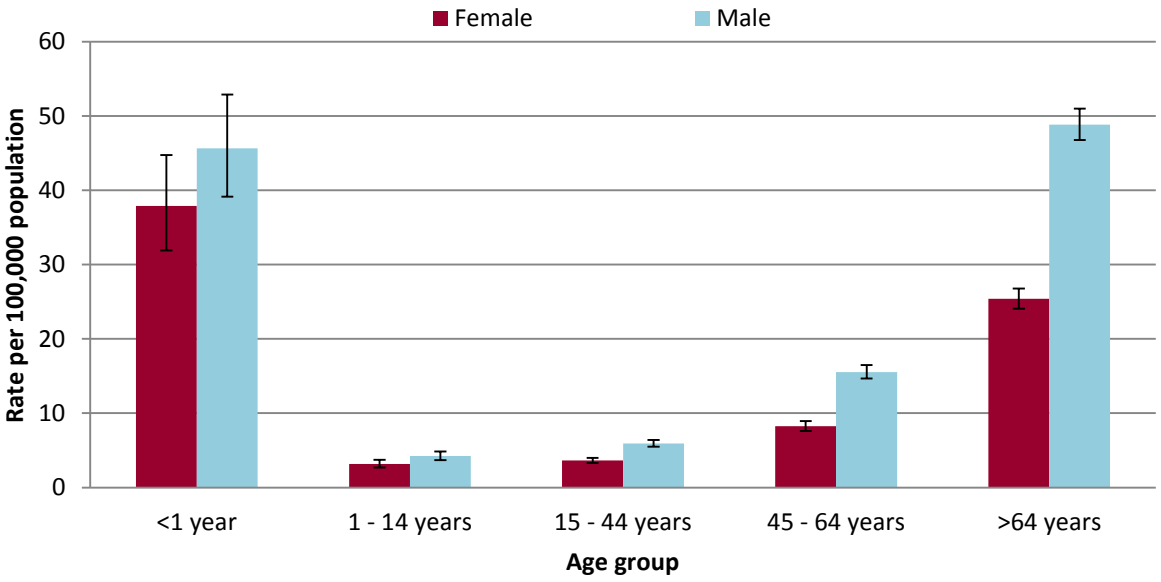
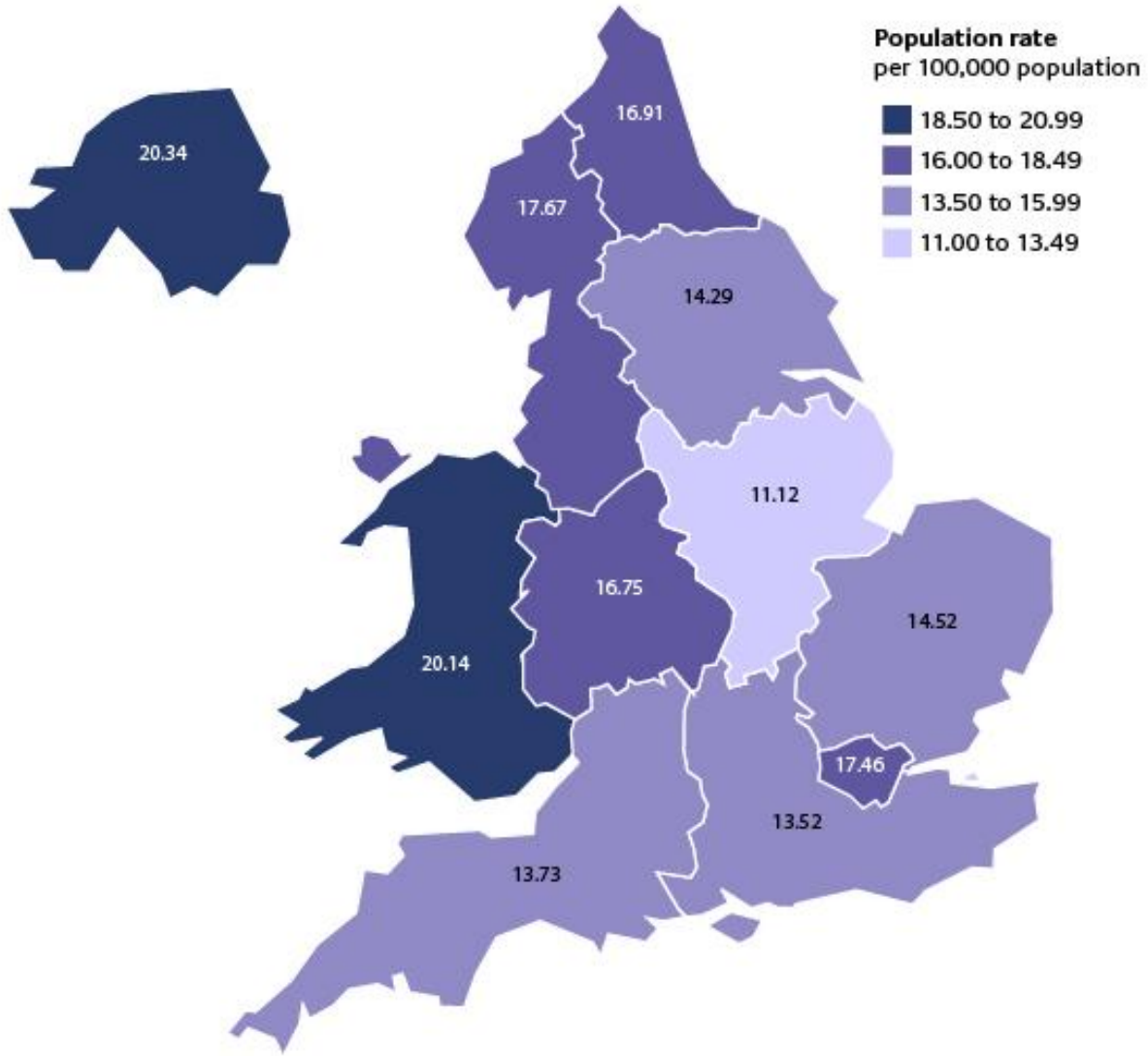
Figure 3. Age- and sex- specific meticillin sensitive *S. aureus* (MSSA) bacteraemia voluntary reporting rates per 100,000 population in 2012, England, Wales and Northern Ireland



Geographic distribution

Figure 4 shows region-specific rates of *S. aureus* bacteraemia in 2012. The overall rate of *S. aureus* bacteraemia in England, Wales and Northern Ireland was 15.6 per 100,000 population. Regions with the highest rates of infection include the North West (17.7 per 100,000) and London (17.5 per 100,000). Regions with lower incidence include the East Midlands (11.1 per 100,000). and the South East (13.5 per 100,000). Northern Ireland (20.3 per 100,000) and Wales (20.1 per 100,000) were the countries with the highest rate of infection, while England had the lowest rate (15.2 per 100,000).

Figure 4. Region-specific rates of *S. aureus* bacteraemia (95% CI): England, Wales and Northern Ireland, 2012



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Antimicrobial susceptibility

Trends in resistance to key antimicrobials for MRSA and MSSA are presented in figures 5 and 6. The percentage of non-susceptible isolates remained similar to those in 2011.

The two most common MRSA clones in the UK are the epidemic strains, EMRSA-15 and -16 which are usually resistant to ciprofloxacin and erythromycin.[4] Most voluntarily reported MRSA were resistant to these antimicrobials, suggesting that EMRSA-15 and -16 continued to account for most of the MRSA bacteraemia reported under this scheme. Analysis arising from the British Society for Antimicrobial Chemotherapy Survey (www.bsacsurv.org) shows that, between 2001 and 2007, the proportion of EMRSA-16 decreased, while the proportion of EMRSA-15 increased.[4]

A significant decrease in resistance to ciprofloxacin among MRSA isolates was observed from 2009 onwards when compared with 2008 [$p<0.001$ for 2009, 2010, 2011 and 2012; (94.9%, 91.8%, 91.2%, 87.3% and 87.1%, resistance for years 2008, 2009, 2010, 2011 and 2012, respectively)]. Similarly, a significant decrease in resistance to ciprofloxacin in MSSA isolates was observed from 2011 onwards when compared with 2008 [$p=0.03$ for 2011, $p=0.001$ for 2012; (8.7%, 7.6% and 7.1% resistance for years 2008, 2011 and 2012, respectively)]. Insofar as fluoroquinolone resistance is very stable in EMRSA-15 and -16 this may suggest some penetration by different clones.[5]

A significant decrease in resistance to erythromycin in MRSA isolates was also observed from 2009 onwards when compared with 2008 [$p=0.01$ for 2009, $p<0.001$ for 2010, 2011 and 2012; (73.7%, 70.1%, 68.0%, 60.6% and 64.0% resistance for years 2008, 2009, 2010, 2011 and 2012, respectively)]; this may reflect gene loss by EMRSA-15 and -16 or penetration by other lineages.

Laboratories are asked to send any isolates suspected to have full or intermediate glycopeptide resistance, or resistance to newer anti-staphylococcal agents (daptomycin, linezolid or tigecycline), to PHE's Antimicrobial Resistance and Healthcare Associated Infections (AMRHAI) Reference Unit, Colindale. These isolates are charactersied at the Reference Unit to explore the evolution and spread of new or emerging clones.

Reported rates of resistance to vancomycin, tigecycline, linezolid and daptomycin all remain minimal, though it is notable that AMRHAI sees small numbers of strains where mutational resistance to linezolid or daptomycin has been selected during therapy. A complicating factor is the reduction in the vancomycin breakpoint and the fact that routine disc tests fail to detect vancomycin non-susceptibility.

Resistance to mupirocin in MRSA isolates fluctuated between 7.1% and 9.1% between 2008 and 2012. However, the proportion of isolates with mupirocin susceptibility data has decreased over time and remains low at 0.7% in 2012.

A significant increase in resistance to fusidic acid in MRSA isolates was also observed from 2010 onwards when compared with 2008 [$p=0.02$ for 2010, $p< 0.0001$ for 2011, $p=0.008$ for 2012); (11.0%, 13.6%, 17.0% and 14.4% resistance for years 2008, 2010, 2011 and 2012, respectively)]. For rifampicin, a significant increase in resistance in MRSA isolates was only observed for 2008 to 2011, a significant decrease was also evident when comparing 2008

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to 2012 [p=0.001 for 2011, p=0.04 for 2012, (3.8%, 6.4% and 2.3% resistance in 2008, 2011 and 2012, respectively].

Figure 5. Reported resistance of MRSA bacteraemia isolates to antimicrobial agents (voluntary reporting scheme): England, Wales and Northern Ireland 2008-2012

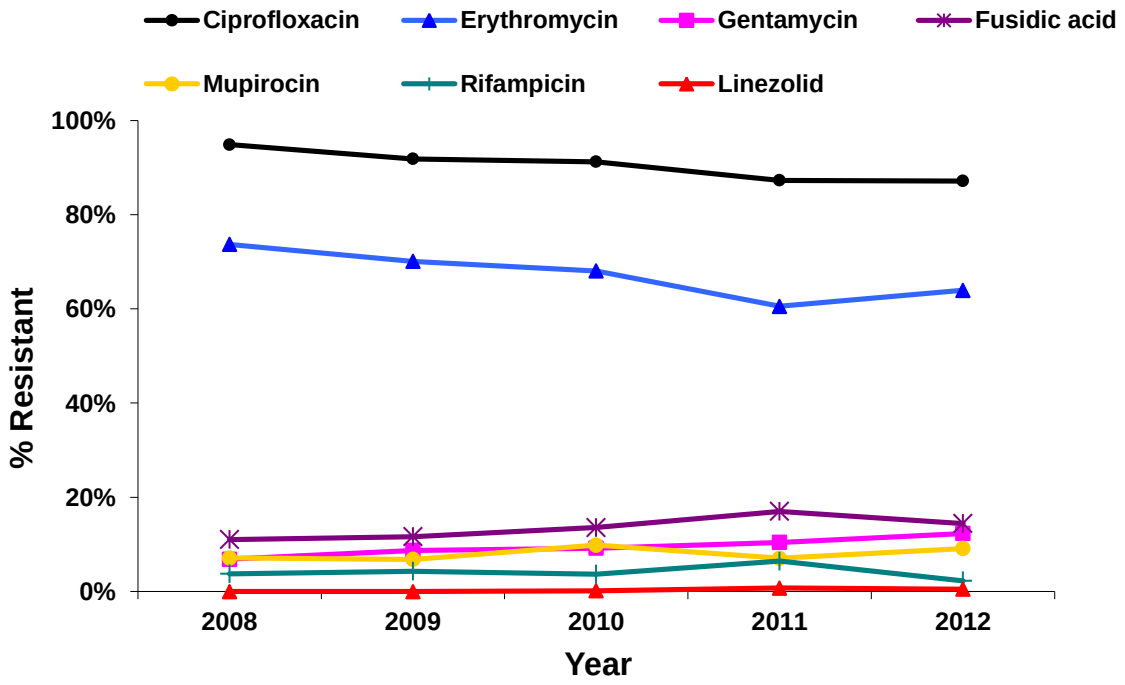
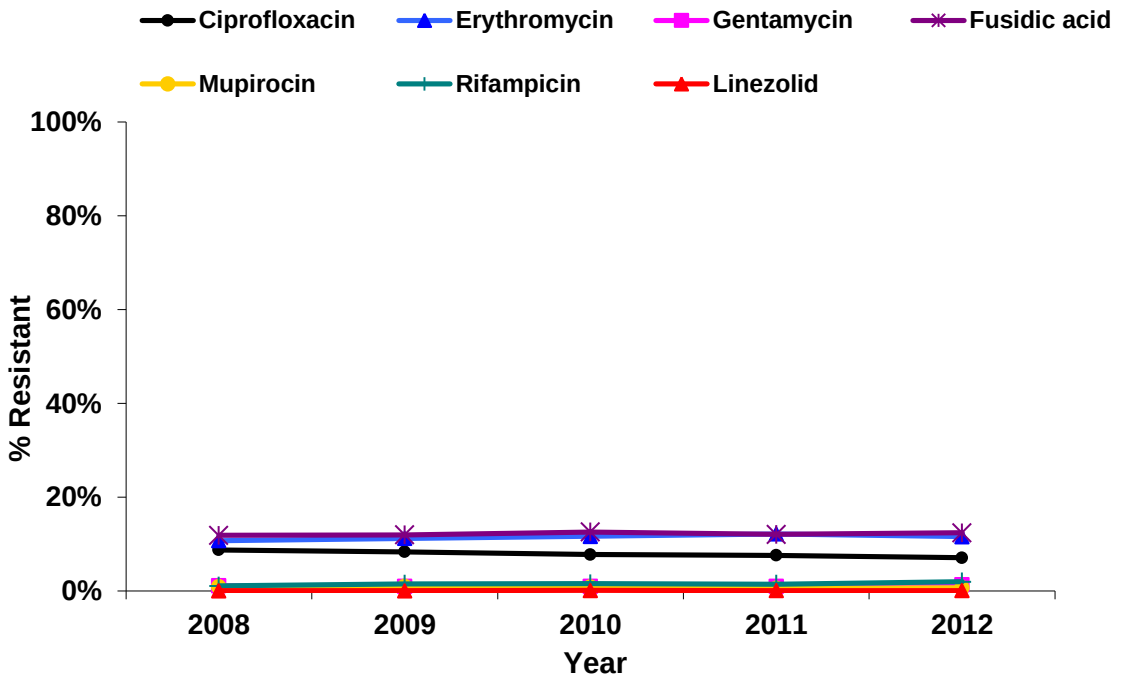


Figure 6. Reported resistance of MSSA bacteraemia isolates to antimicrobial agents (voluntary reporting scheme): England, Wales and Northern Ireland 2008-2012



Completeness of reporting through the voluntary reporting scheme

NHS acute Trusts in England are required to report all MRSA bacteraemias via a web-enabled mandatory enhanced surveillance system, which is run in parallel to the voluntary system. The total number of *S. aureus* bacteraemia is returned by each Trust as an aggregate through the Quarterly Mandatory Laboratory Returns process. From these two datasets it is possible to derive an estimate of the number of MSSA bacteraemia. Data shown here were for England only (Note: Wales and Northern Ireland do not take part in the English mandatory surveillance scheme). The number of reports in the mandatory reporting system remains consistently higher than in the voluntary system, apart from the 2012 MRSA number of reports which is marginally higher in the voluntary system. The number of *S. aureus* reports received under the voluntary system is typically 85% of the total received through mandatory surveillance, however importantly, data from both systems demonstrate the same trends over the past ten years.

Figure 7: Annual number of *Staphylococcus aureus* bacteraemia reports received via the voluntary and mandatory surveillance schemes in England, 2003-2012

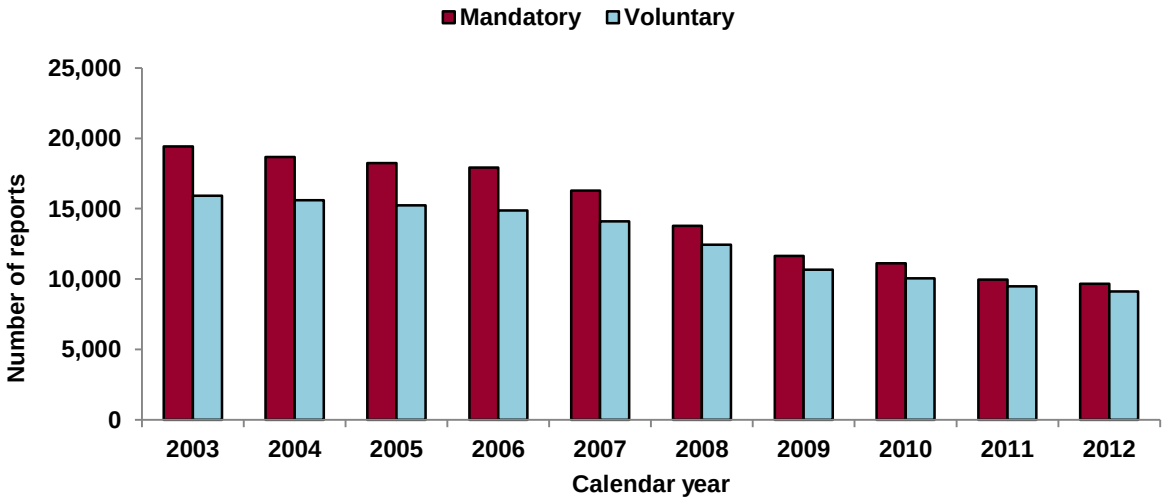


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Figure 8: Annual number of MRSA bacteraemia reports received via the voluntary and mandatory surveillance schemes in England, 2003-2012

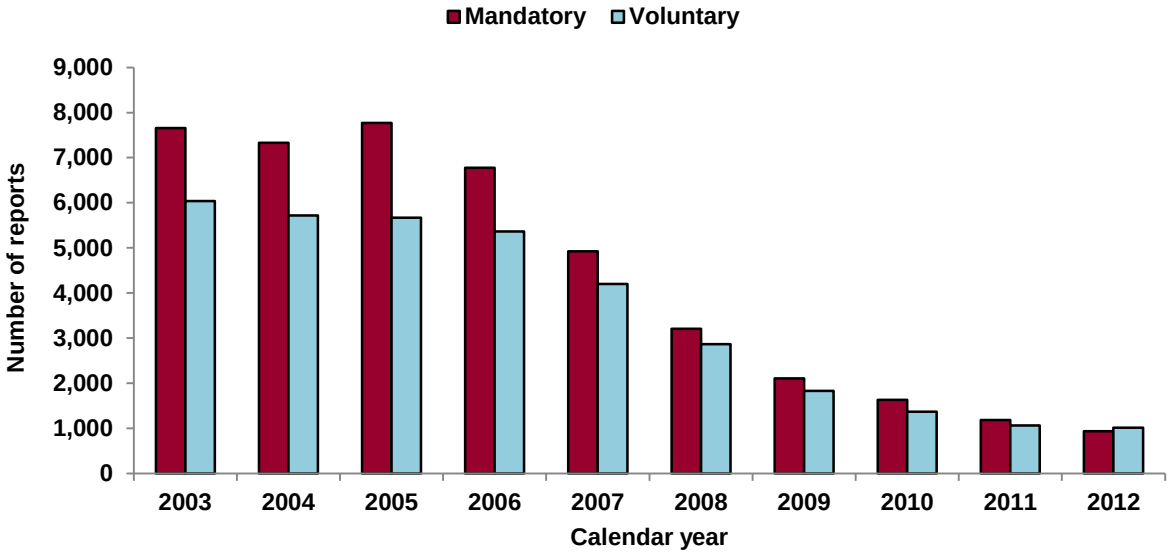
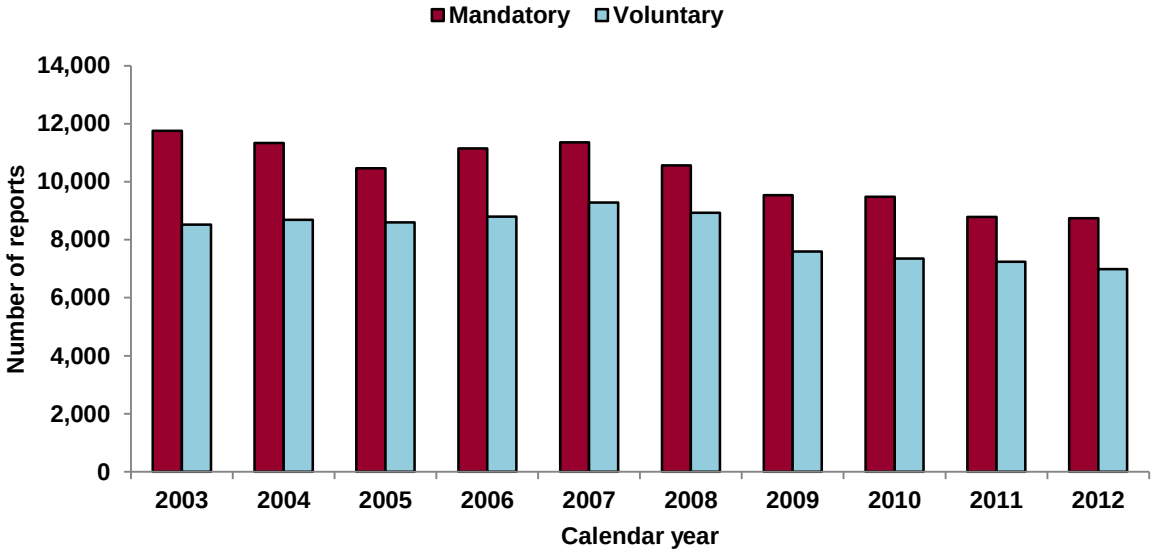


Figure 9: Annual number of MSSA bacteraemia reports received via the voluntary and mandatory surveillance schemes in England, 2003-2012



Acknowledgements

These reports would not be possible without the weekly contributions from microbiology colleagues in laboratories across England, Wales, and Northern Ireland, without whom there would be no surveillance data. The support from colleagues within Public Health England, and the Antimicrobial Resistance and Healthcare Associated Infections (ARMHAI) Reference Unit, in particular, is valued in the preparation of the report. Feedback and specific queries about this report are welcome and can be sent to: hcai.amrdivision@phe.gov.uk

Suggested citation

Data found in the *Health Protection Report* summary publication and on the online full text version can be cited as: PHE. Voluntary reporting of *Staphylococcus aureus* bacteraemia in England, Wales and Northern Ireland, 2012. *Health Protection Report* [serial online] 2013 [*date cited*]; **7**(29): HCAI

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Appendix

Table 3: Voluntary laboratory reports of *S. aureus* bacteraemia: England, Wales and Northern Ireland 2003-2012

Year	England	Wales	Northern Ireland	England, Wales & Northern Ireland
2003	14,565	771	594	15,930
2004	14,160	869	571	15,600
2005	14,047	672	520	15,239
2006	13,619	717	546	14,882
2007	12,863	686	554	14,103
2008	11,230	633	589	12,452
2009	9,604	577	489	10,670
2010	9,049	607	400	10,056
2011	8,469	644	379	9,492
2012	8,127	619	371	9,117

Table 4: Voluntary laboratory reports of MRSA bacteraemia: England, Wales and Northern Ireland 2003-2012

Year	England	Wales	Northern Ireland	England, Wales & Northern Ireland
2003	5,478	310	253	6,041
2004	5,212	274	236	5,722
2005	5,222	221	228	5,671
2006	4,912	236	216	5,364
2007	3,736	237	229	4,202
2008	2,455	207	207	2,869
2009	1,581	93	156	1,830
2010	1,186	72	115	1,373
2011	918	52	94	1,064
2012	887	52	74	1,013

Table 5: Voluntary laboratory reports of MSSA bacteraemia: England, Wales and Northern Ireland 2003-2012

Year	England	Wales	Northern Ireland	England, Wales & Northern Ireland
2003	7,841	361	315	8,517
2004	7,952	460	275	8,687
2005	7,968	349	283	8,600
2006	8,074	401	326	8,801
2007	8,594	368	324	9,286
2008	8,206	347	380	8,933
2009	7,057	221	320	7,598
2010	6,924	148	284	7,356
2011	6,790	171	285	7,246
2012	6,529	160	297	6,986

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