Quarterly Epidemiological Commentary:
Mandatory MRSA, MSSA and *E. coli* bacteraemia, and *C. difficile* infection data (up to April-June 2017)

September 2017
About Public Health England

Public Health England exists to protect and improve the nation’s health and wellbeing, and reduce health inequalities. We do this through world-class science, knowledge and intelligence, advocacy, partnerships and the delivery of specialist public health services. We are an executive agency of the Department of Health, and are a distinct delivery organisation with operational autonomy to advise and support government, local authorities and the NHS in a professionally independent manner.

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Data included in the quarterly epidemiological commentary

This document contains quarterly, national-level epidemiological commentaries for MRSA, MSSA and *E. coli* bacteraemia and *C. difficile* infections. This includes analysis on:

- counts and rates of all cases and hospital-onset cases of MRSA, MSSA and *E. coli* bacteraemia and *C. difficile* infection.
- counts and rates of MRSA cases published by post infection review (PIR) assignment. This includes three categories – trust-assigned, clinical commissioning group (CCG)-assigned or third party-assigned cases

It also contains the following additional analysis as special feature for this publication:

- counts and rates of hospital onset and all reported MRSA, MSSA and *E. coli* bacteraemia and CDI cases by main speciality

Please note that the terminologies; ‘trust -apportioned’ and ‘not trust-apportioned’ have been updated to ‘hospital-onset’ and ‘community onset’ respectively. However, this change doesn’t constitute a change in the methodology for apportionment.

All data tables associated with this report are included in an accompanying Microsoft Excel file.

Revisions to data included are covered by a data-specific revisions and correction policy.

Further Information

This publication forms part of the range of National Statistics outputs routinely published by PHE which include monthly and annual reports on the mandatory surveillance of MRSA, MSSA and *E. coli* bacteraemia and *C. difficile* infections (CDI).

**Annual report output**

Further epidemiological analyses by financial year can be found in PHE’s annual epidemiological commentary.

**Monthly report outputs**

The following reports are produced by PHE on a monthly basis:

**MRSA bacteraemia:**
- monthly MRSA PIR-assigned counts by acute trust
- monthly MRSA PIR-assigned counts by CCG
- monthly MRSA counts by CCG

**MSSA bacteraemia:**
- monthly MSSA counts by acute trust; hospital-onset (trust-apportioned) cases only

Since April 2013, MRSA cases have been reported by PIR assignment. This is presented for historical purposes only.
- monthly MSSA counts by CCG

*E. coli* bacteraemia:
- total monthly counts of *E. coli* bacteraemia by trust
- monthly counts of *E. coli* bacteraemia by CCG

CDI:
- monthly CDI counts by acute trust in patients aged two years and over; hospital-onset (trust-apportioned) cases only
- monthly CDI counts by CCG in patients aged two years and over

Data for this report was extracted from PHE’s healthcare associated infections data capture system (HCAI DCS) on 18 July 2017.
Epidemiological analyses of 
*Staphylococcus aureus* bacteraemia data

**MRSA bacteraemia**

Since April 2013, all NHS organisations reporting cases of MRSA bacteraemia have been required to complete a post-infection review (PIR)\(^2\). Subsequent to this, all MRSA bacteraemia cases have been published by PIR assignment rather than by apportionment. In April 2014, NHS England introduced a further category of “third-party” for the PIR assignment of MRSA bacteraemia cases, acknowledging the increasingly complex nature of MRSA bacteraemia now being reported.

There has been a very significant decrease in the counts and rates of all reported MRSA bacteraemia since the mandatory surveillance of MRSA bacteraemia began in April 2007 (figures 1b, table S1a) and a similar overall decrease in counts and rates of hospital-onset cases since apportioning of MRSA bacteraemia cases began in April 2008 (figure 1a, table S1a).

There was a steep decline in the rates of all reported and hospital-onset cases between April-June 2007 (April-June 2008 for hospital-onset cases) and January-March 2014: 85% (10.2 to 1.5 cases per 100,000 population) and 79% (4.9 to 1.0 cases per 100,000 bed-days), respectively. However, since January-March 2014 the rates of all reported cases increased slightly from 1.5 to 1.6 cases per 100,000 population while hospital-onset cases decreased slightly from 1.0 to 0.9 cases per 100,000 bed-days), when compared to the most recent quarter April-June 2017.

The PIR process for all MRSA bacteraemia cases began in April 2013. Between April 2013 and March 2014, the rates of trust-assigned cases remained stable at 1.2 cases per 100,000 bed-days while rates of CCG-assigned cases decreased by 22% from 1.0 to 0.8 cases per 100,000 population.

Following the introduction of third-party assignment category in April 2014, counts and rates of CCG-assigned cases have decreased from 91 to 86 cases (0.7 to 0.6 per 100,000 population), respectively between April-June 2014 and the most recent quarter. This decrease is mostly due to the introduction of the third-party assignment category, as several cases which would be classified as CCG assigned are now classified as third-party assigned.

Over the same period (April-June 2014 to April-June 2017), counts and rates of trust-assigned cases increased from 73 to 83 cases and 0.8 to 1 case per 100,000 bed-

days, respectively. Similarly within the same period, the counts and rates of third-party assigned cases increased from 17 to 50 cases and 0.1 to 0.4 cases per 100,000 population, respectively (figure 1a, 1b, 1c and table S1b).
Figure 1a: Quarterly rates of hospital-onset/assigned MRSA bacteraemia: April-June 2008 to April-June 2017

Since April 2013, MRSA bacteraemia have been reported by PIR assignment. Hospital-onset (Trust-apportioned) MRSA bacteraemia are presented for historical purposes only.
Figure 1b: Quarterly rates of all reported MRSA bacteraemia: April-June 2007 to April-June 2017
Figure 1c: Quarterly counts of all reported MRSA bacteraemia by PIR assignment: April-June 2013 to April-June 2017
MRSA bacteraemia by main speciality: July 2016 to June 2017

Between July 2016 and June 2017 the highest rates of MRSA bacteraemia were reported from the Nephrology and General Medicine specialities with rates of all reported cases of 4.4 and 4.3 cases per 100,000 bed-days respectively. The relatively high incidence of all reported cases in these specialities is mostly due to invasive treatment procedures such as dialysis. However, incidence of hospital-onset cases in these specialities are less than half that of all reported cases indicating that most of the infections originated outside hospital.

**Figure 1d: MRSA bacteraemia by speciality: July 2016-June 2017**

MSSA bacteraemia

Since the mandatory reporting of MSSA bacteraemia began in January 2011 there has been a general trend of increasing counts and rates. The counts of MSSA bacteraemia have increased by 36% (2,199 in Q4 2011/11 to 2,996 in Q1 2017/18) and the rates have increased by 31% (16.9 cases per 100,000 population in Q4 2011/11 to 21.8 in Q1 2017/18, figure 2b, table S2a). Counts and rates of hospital-onset MSSA bacteraemia over the same period (January-March 2011 to January-March 2017) increased at a much slower pace: 11% (from 735 to 813 cases) and 4% (8.4 to 9.3 cases per 100,000 bed-days), respectively, (figure 2a, table S2a).

Rates of all reported and hospital-onset cases from earlier quarters between January-March 2011 and October-December 2013 were relatively stable, fluctuating between 16-17 cases per 100,000 population and 7-8 cases per 100,000 bed-days, respectively. However, subsequent quarters (January-March 2014 to April-June 2017) saw an increase in the rates of all reported and hospital-onset MSSA bacteraemia by
21% (18.1 to 21.8 cases per 100,000 population) and 18% (7.9 to 9.3 cases per 100,000 bed-days), respectively (figure 2a and 2b, table S2a)

While the number of all reported MSSA bacteraemia increased throughout the surveillance period (January-March 2011 to April-June 2017), the percentage of all cases that were defined as hospital-onset decreased over the same the period from 33% to 27%, indicating that over time there has been a greater increase in community-onset cases compared to hospital-onset (hospital-onset) cases.

When comparing the most recent quarter with the same period last year (April-June 2016 and April-June 2017), there was a 7% increase in the rates of all reported MSSA bacteraemia (20.4-21.8 cases per 100,000 population) while the rates of hospital-onset cases remained relatively stable (9.4-9.3 cases per 100,000 bed-days).
Figure 2a: Quarterly rates of hospital-onset MSSA bacteraemia: January-March 2011 to April-June 2017
Figure 2b: Quarterly rates of all reported MSSA bacteraemia: January-March 2011 to April-June 2017
MSSA bacteraemia by main speciality: July 2016 to June 2017

Similar to MRSA bacteraemia, most MSSA bacteraemia reported between July 2016 and June 2017 were from the Nephrology and General Medicine speciality and the rates were highest in these specialties with all reported rates of 74.4 and 54.2 cases per 100,000 bed-days, respectively. However, the incidence of hospital-onset cases in these specialities was less than a quarter of all reported cases.

Figure 2c: MSSA bacteraemia by speciality: July 2016 to June 2017
Epidemiological analyses of *Escherichia coli* bacteraemia data

The counts and rates of all reported *E. coli* bacteraemia has increased steadily at an average of 5% per year since the initiation of mandatory surveillance of *E. coli* bacteraemia in July 2011 (figure 3a), while counts and rates of hospital-onset cases has been relatively stable over the same period (figure 3b).

Counts and rates of all reported *E. coli* bacteraemia increased by 23% (8,275 to 10,182 cases) and 20% (61.7 to 74.0 cases per 100,000 population), respectively, between July-September 2011 and April-June 2017, with seasonal peaks generally reported between July and September each year (figure 3a, table S3a). While these seasonal fluctuations are present; beginning from April-June 2013, each quarter of each year has been higher than the same quarter in the preceding year, implying an overall increase over the overall time period. However, counts and rates of hospital-onset cases decreased from 1,996 to 1,976 cases and from 23.7 to 22.7 cases per 100,000 bed-days over the same period.

A similar trend is also observed when comparing the most recent quarter with the same period last year (April-June 2016 to April-June 2017). There was a 3% increase in both counts and rates of all reported cases (9,850 to 10,182 cases and 71.6 to 74.0 cases per 100,000 population) while both counts and rates of hospital-onset cases reduced slightly by 1% (1,991 to 1,976 cases and 22.9 to 22.7 cases per 100,000 bed-days) (figure 3a and 3b, table S3a).
Figure 3a: Quarterly rates of hospital-onset *E. coli* bacteraemia: April-June 2007 to April-June 2017
Figure 3b: Quarterly rates of all reported *E. coli* bacteraemia: April-June 2007 to April-June 2017

[Graph showing quarterly rates of all reported *E. coli* bacteraemia from 2011/12 to 2017/18, with rates per 100,000 population on the y-axis and financial quarters on the x-axis.]
**E. coli** bacteraemia by main speciality: July 2016 to June 2017

Most **E. coli** bacteraemia reported between July 2016 and June 2017 were from the General Medicine, Urology and Haematology specialities with all reported rates of 210.0, 153.4 and 152.3 cases per 100,000 bed-days, respectively. However, the proportion of hospital-onset cases from Haematology specialities were much greater compared to the other specialities. The incidence rates of hospital-onset cases from General Medicine and Urology were about one sixth that of all reported cases from those specialities while just over half (54%) of the case reported from Haematology specialities were hospital-onset cases.

**Figure 3c: E. coli bacteraemia by speciality: July 2016 to June 2017**
Epidemiological analyses of *Clostridium difficile* infection data

Since the initiation of CDI surveillance in April 2007, there has been an overall decrease in the counts and rates of all reported and hospital-onset cases of *C. difficile* infection (CDI). Seasonal peaks are present in January-March quarters prior to 2014/15 and the July-September quarters of 2014/15 to 2016/17 (figure 4a, 4b and table S4a), this is particularly apparent among hospital-onset cases. The bulk of this decrease occurred between April-June 2007 and January-March 2012 with a 78% and 79% reduction in both counts and rates (16,864 to 3,711 cases and 131.5 to 28.0 cases per 100,000 population, respectively), followed by an 11% and 14% reduction in the counts (3,711 to 3,299 cases) and rates (28.0 and 24.0 cases per 100,000 population) of CDI between January-March 2012 and the most recent quarter (April-June 2017) (figure 4b, table S4a).

A similar trend was observed in hospital-onset CDI counts and rates between April-June 2007 and January-March 2017: 85% (10,436 to 1,613 cases) and 84% (112.5 to 18.2 cases per 100,000 bed-days), respectively. This was then followed by a further 30% decrease in counts (1,613 to 1,132 cases) and rates (18.2 to 12.3 cases per 100,000 bed-days) of hospital-onset cases between January-March 2012 and the most recent quarter.

This shows that there has been a greater decline among hospital-onset CDI cases compared to all reported CDI cases during the surveillance period.

When the most recent quarter is compared with the same quarter last year (April-June 2016 and April-June 2017) both counts and rates of all reported CDI increased by 7% (3,070 to 3,299 cases and 22.3 to 24.0 cases per 100,000 population respectively) while both counts and rates of hospital-onset CDI cases increased by 3% (1,098 to 1,132 cases and 12.6 to 13.0 cases per 100,000 bed-days, respectively).
Figure 4a: Quarterly rates of hospital-onset CDI: April–June 2007 to April–June 2017
Figure 4b: Quarterly rates of all reported CDI: April-June 2007 to April-June 2017
CDI by main speciality: July 2016 to June 2017

Most CDI reported between July 2016 and June 2017 were from the Oncology, Haematology and General Medicine specialities with all reported rates of 73.5, 53.8 and 48.6 cases per 100,000 bed-days respectively. About half of all reported cases from these specialities were hospital-onset cases.

Figure 4c: CDI by speciality: July 2016 to June 2017
Appendix

Bed-day data

For *S. aureus* (MRSA and MSSA) bacteraemia and CDI, the average bed-day activity reported by acute trusts via KH03 returns is used to derive the bed-day denominator for acute trust incidence rates (assigned and apportioned). As of Q1 2011/12, bed-day data has been available on a quarterly basis and has been used as such for Q2 2011/12 to Q4 2015/16. This data is available at: www.england.nhs.uk/statistics/statistical-work-areas/bed-availability-and-occupancy/bed-data-overnight/

Amendments to the published figures on KH03 included the following: Q1 2016/17 bed-day data was not available at the time of writing this report; therefore, bed-day data for the same quarter of the previous year (Q1 2015/16) was used as a proxy for this quarter.

In Quarterly Epidemiological Commentaries published prior to 1 December 2015, April-June 2014 to October-December 2014 quarterly KH03 figures for one acute trust (RWD) had a percentage change of more than 20% compared with the previous quarter and the same quarter in the previous year. As a result it was replaced with the KH03 data of the same quarter in the previous year (April-June 2013 to October-December 2013).

However, PHE has reviewed its policy for processing KH03 data. All data irregularities identified are now flagged with colleagues at NHS England (data owners of the KH03 dataset). Until we receive confirmation that any identified change in the occupied overnight bed-days for an acute trust is anomalous, PHE now uses the data as published in the KH03 dataset. This affects all reports published since 1 December 2015 and incidence rates published prior that time will differ slightly as a result. In order for the KH03 data used to calculate rates included in this report to be consistent over the full time period, previously amended KH03 data for trust United Lincolnshire Hospitals (RWD) for FY 2014/2015 has been altered to reflect that published in the KH03 dataset. Please note that this could lead to slight differences in hospital-onset/assigned rates when compared with publications prior to 1 December 2015.

Missing data for acute trusts in the KH03 returns will continue to be processed as before, where the KH03 return for the same quarter from the previous year will be used as a proxy. The following acute trusts were thus affected:

- Moorfields Eye Hospital NHS Foundation Trust (RP6) 2007/08 and 2008/09 KH03 figures: Replaced with 2006/07 KH03 figure.
- Rotherham NHS Foundation Trust (RFR): 2009/10 and April-June 2010 to April-June 2011 KH03 figures: Replace with 2008/09 KH03 figure.
- Sheffield Teaching Hospitals NHS Foundation Trust (RHQ) April-June 2010 to April-June 2011 KH03 figures: Replaced with 2009/10 KH03 data
- The Princess Alexandra Hospital NHS Trust (RQW) April-June 2014 and October-December 2014 KH03 figures: Replaced with April-June 2013 to October-December 2013 KH03 figures, respectively.
- Ipswich Hospital NHS Trust (RGQ) January-March 2016 KH03 figure: Replaced with January-March 2015 figures
- West Suffolk NHS Foundation Trust (RGR) April-June 2016 to October-December 2016 KH03 figures. Replaced with April-June 2015 to October-December 2015 KH03 figures
- Gloucestershire Hospitals NHS Foundation Trust (RTE) October-December 2017 to January-March 2016 KH03 figures. Replaced with October-December 2015 to January-March 2016 KH03 figures

The KH03 data used for this report was published on 25 May 2017. This includes revisions of previously published KH03 data and so these data may differ from those used in earlier reports.

**Population data**

National incidence rates are calculated using 2007-2016 mid-year resident population estimates which are based on the 2011 census for England (2017 estimates are based on 2016 mid-year estimates). These are available at: [www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/populationestimatesforukenglandandwalesscotlandandnorthernireland](http://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/populationestimatesforukenglandandwalesscotlandandnorthernireland)

ONS population data is published as at a point in time (mid-year), however, rates for the infections covered in the mandatory surveillance are published for financial years or quarters; therefore, for a given financial year (e.g. 2014/15), the financial year population values given here take three quarters of the mid-year population estimate for the first calendar year (2014), and one quarter of the mid-year population estimate for the second calendar year (2015). Population estimates for each quarter is then derived from the financial year population value.

**Definitions**

**Apportioning and assignment of cases:**

**MRSA bacteraemia PIR-assigned cases:**

From 1 April 2013 to 30 March 2014, all MRSA bacteraemia cases reported via the HCAI Data Capture System (DCS) were assigned to either an acute trust or a CCG through the completion of a PIR. A case is deemed to be trust-assigned where the completed PIR indicates that an acute trust is the organisation best placed to ensure that any lessons learned are actioned. As of 1 April 2014, NHS England introduced a new category for the PIR assignment of MRSA bacteraemia cases: assignment to a ‘third party’ through the arbitration process. Therefore, MRSA bacteraemia with a
specimen date since 1 April 2014 are now assigned to an acute trust, a CCG or a third party through the PIR process. Further information on the PIR process can be found on the following webpage: www.england.nhs.uk/patientsafety/zero-tolerance/

**MSSA and *E. coli* bacteraemia hospital-onset (trust-apportioned) cases:**
Include patients who are (i) in-patients, day-patients, emergency assessment patients or not known; AND (ii) have had their specimen taken at an acute trust or not known; AND (iii) specimen was taken on or after day three of the admission (admission date is considered day ‘one’).

**CDI hospital-onset (trust-apportioned) cases:**
Include patients who are (i) in-patients, day-patients, emergency assessment patients or not known; AND (ii) have had their specimen taken at an acute trust or not known; AND (iii) specimen was taken on or after day four of the admission (admission date is considered day ‘one’).

Historically, report published before September 2017 have used the term ‘trust-apportioned’ to describe cases meeting the above conditions for apportionment and ‘not trust-apportioned’ for those that do not. Moving forward, these terminologies have been updated to ‘hospital-onset’ and ‘community-onset’ respectively. Please note that this is simply a change in terminology and does not constitute a change in the methodology for apportionment.

**Total reported cases:**
This is the total count of infections for each organism as of the date of extraction. Please note that for *C. difficile*, this count excludes those from patients less than two years old.

**Episode duration:**
The length of an infection episode is defined as 14 days for MRSA, MSSA and *E. coli* bacteraemia and 28 days for CDI, with the date of specimen being considered day ‘one’.

**Incidence calculations:**
**MRSA, MSSA and *E. coli* bacteraemia, and CDI population incidence (episodes per 100,000):**
This incidence is calculated using the mid-year England population and is

\[
\text{Incidence} = \frac{n \text{ episodes}}{\left( \frac{\text{mid-year population for England}}{\text{days in quarter}} \right)} \times 100,000
\]

**MRSA, MSSA and *E. coli* bacteraemia and CDI hospital-onset incidence:**
This incidence is calculated using KH03 average bed-day activity (see bed-day data above) and is calculated as follows:
\[
\text{n episodes} = \frac{\text{average KH03 beds per day} \times \text{days in quarter}}{} \times 100,000
\]
Graphs and percentage change calculation:
Please note that percentage changes in rate have been calculated using raw rate figures while those presented in the tables and commentary have been rounded to one decimal place. Similarly graphs included in this report were plotted using raw rates figures. The raw rate figures are included in the accompanying Quarterly Epidemiological Commentary's accompanying data.

Quarters:
In publications prior to March 2016, all references to quarterly data are based on calendar year definitions and NOT financial year definitions, ie:-

- Q1 2014= January-March 2014
- Q2 2014= April-June 2014
- Q3 2014= July-September 2014
- Q4 2014= October-December 2014

However, for all subsequent publications, including this one, all references to quarterly data are based on financial year definitions and NOT calendar year definitions, ie:-

- Q1 2014/15= April-June 2014
- Q2 2014/15= July-September 2014
- Q3 2014/15= October-December 2014
- Q4 2014/15= January-March 2015

Main Speciality:
This refers to the specialty under which the consultant, looking after the patient, was contracted during the period of care when the specimen was collected.