UK Health Security Agency

Quarterly epidemiological commentary

Mandatory Gram-negative bacteraemia, MRSA, MSSA and *C. difficile* infections (data up to July to September 2021)

27 January 2022

Contents

Data included in this quarterly epidemiological commentary

This document contains quarterly, national-level epidemiological commentaries for Meticillin-resistant *Staphylococcus aureus* (MRSA), Meticillin-sensitive *Staphylococcus aureus* (MSSA), *Escherichia coli* (*E. coli*), *Klebsiella* spp. and *Pseudomonas aeruginosa* (*P. aeruginosa*) bacteraemia and *Clostridioides difficile* infection (CDI). This includes analyses on counts and incidence rates of all cases and hospital-onset (previously referred to as trust-apportioned) cases of MRSA, MSSA, *E. coli*, *Klebsiella* spp. and *P. aeruginosa* bacteraemia and CDI.

All data tables associated with this report are included in an OpenDocument spreadsheet. Revisions to data included are covered by a data-specific revisions and correction policy.

Citation to UK Health Security Agency (UKHSA), healthcare associated infections (HCAI) and antimicrobial resistance (AMR) division is required.

Citation: UK Health Security Agency. Quarterly epidemiology commentary: mandatory MRSA, MSSA and Gram-negative bacteraemia and *C. difficile* infection in England (up to July to September 2021) London: UK Health Security Agency, January 2022.

COVID-19 and this data

The coronavirus (COVID-19) pandemic has had an effect on the number of infection cases of both bacteraemia (particularly due to *E. coli*) and CDI. In general, counts of all reported cases during the financial year 2020 to 2021 were lower than would be expected, while counts of hospital-onset *Klebsiella* and *P. aeruginosa* cases increased exceeding previous counts observed in this setting. Analysis of voluntary laboratory surveillance data also showed a reduction in the total number of cases of other bloodstream infections during this period, so the phenomenon was not limited to the species covered by the mandatory surveillance.

As the voluntary surveillance shows similar trends to the mandatory surveillance scheme, it would appear that the low counts were not a specific ascertainment problem in the mandatory programme.

In response to the pandemic, elective procedures in hospitals were initially cancelled or delayed, although some activity resumed between COVID-19 waves. As a result, the beds occupied overnight; the denominator used for hospital-onset infection rates, was much lower than would otherwise be expected over these periods. In some instances, increasing

rates of hospital-onset infection have been observed, despite a decrease in the counts of infections.

Further information

This publication forms part of the range of National Statistics outputs routinely published by UKHSA which include monthly and annual reports on the mandatory surveillance of MRSA, MSSA and *E. coli*, *Klebsiella* spp. and *P. aeruginosa* bacteraemia and CDI.

Annual report output

Further epidemiological analyses by financial year can be found in UKHSA's annual epidemiological commentary.

Monthly report outputs

The following reports are produced by UKHSA on a monthly basis.

MRSA bacteraemia

Counts of all reported, hospital-onset cases, community-onset cases, healthcare associated and community associated MRSA bacteraemia by organisation.

MSSA bacteraemia

Counts of all reported, hospital-onset cases, community-onset cases, healthcare associated and community associated MSSA bacteraemia by organisation.

E. coli bacteraemia

Counts of all reported, hospital-onset cases, community-onset cases, healthcare associated and community associated *E. coli* bacteraemia by organisation.

Klebsiella spp. bacteraemia

Counts of all reported, hospital-onset cases, community-onset cases, healthcare associated and community associated *Klebsiella* spp. bacteraemia by organisation.

P. aeruginosa bacteraemia

Counts of all reported, hospital-onset cases, community-onset cases, healthcare associated and community associated *P. aeruginosa* bacteraemia by organisation.

CDI

Counts of all reported, hospital-onset cases, community-onset cases, healthcare associated and community associated CDI by organisation.

Data for this report was extracted from UKHSA's HCAI data capture system (DCS) on 3 November 2021.

Epidemiological analyses of Gram-negative bacteraemia data

E. coli bacteraemia

The incidence rate of all reported *E. coli* bacteraemia has increased each year since the initiation of the mandatory surveillance of *E. coli* bacteraemia in July 2011 until start of the COVID-19 pandemic (January to March 2020 figure 1a). This increase was primarily driven by community-onset cases (Table S1a).

The number and incidence rates of total reported and community-onset cases declined after the pandemic but still remains higher than observed at the start of *E. coli* surveillance. In contrast, the incidence rate of hospital-onset cases remained relatively stable during the same period, although a sharp reduction was observed in the previous quarter (April to June 2021 Figure 1b) .

Between July to September 2011 and July to September 2021, the count and the incidence rate of all reported cases of *E. coli* bacteraemia increased by 22.2% from 8,275 cases to 10,115 and from 61.8 to 71.2 cases per 100,000 population, respectively. Similarly, over the same period, the count of community-onset cases increased by 31.9% from 6,279 to 8,282, while the incidence rate increased by 24.2% from 46.9 to 58.3 cases per 100,000 population. Over the same period, the count of hospital-onset cases decreased by 8.2% from 1,996 to 1,833. This corresponded to a decrease in the incidence rate of hospital-onset cases by 5.1% from 23.6 per 100,000 bed-days to 22.4.

When comparing the most recent quarter (July to September 2021) to the same period in the previous year (July to September 2020) there was a 1.3% decrease in the count and rate of all reported cases from 10,245 to 10,115 and from 72.1 to 71.2 per 100,000 population. Community-onset *E. coli* bacteraemia cases decreased by 3.6% from 8,591 to 8,282, with the community-onset incidence rate decreasing by the same percentage (3.6% from 60.4 per 100,000 population to 58.3 Figure 1a and 1b, Table S1).

In July to September 2021, the hospital-onset *E. coli* bacteraemia cases increased by 10.8% from 1,654 to 1,833 compared to July to September 2020. However, incidence rate decreased by 5% from 23.5 to 22.4 per 100,000 bed-days compared to the same period. It is important that these figures are interpreted with caution.

In the period since January to March 2020, the total count of hospital-onset *E. coli* bacteraemia cases have been lower than what was observed in the pre-pandemic period, this was most obvious in April to June 2020. During this period the rate of hospital-onset cases stayed approximately the same, suggesting the rate of declines in both overnight bed-days (hospital activity) and hospital-onset cases was similar. In July to September

2021, the number of hospital-onset cases has increased while the incidence rate of these cases is slightly less compared to the same period in the previous year. The decline in incident rates but not counts of cases is due to a steady return of the typical number of overnight bed-days in July to September 2021 compared to the unusually low levels in July to September 2020.

Comparing the most recent quarter with July to September 2019, which is a more typical period prior to the COVID-19 pandemic, shows a 14.4% decrease in total cases and the rate from 11,822 to 10,115 and from 83.3 to 71.2 cases per 100,000 population. Community-onset cases decreased 15.5% from 9,796 to 8,282 while the rate declined 15.6% from 69 to 58.3 cases per 100,000 population. Finally, hospital-onset cases decreased by 9.5% compared over the same period from 2,026 to 1,833, while the hospital-onset rate fell by 4.8% from 23.5 to 22.4 cases per 100,000 bed-days (Figure 1a and 1b).

There is evidence of seasonality in the incidence of all-reported *E. coli* bacteraemia cases, with the highest rates observed between July to September of each year, although, care is required in interpreting data for financial year 2020 to 2021 and 2021 to 2022 due to the reduction in cases and hospital activity.

Figure 1a: Quarterly rates of all reported *E. coli* bacteraemia: July to September 2011, to July to September 2021

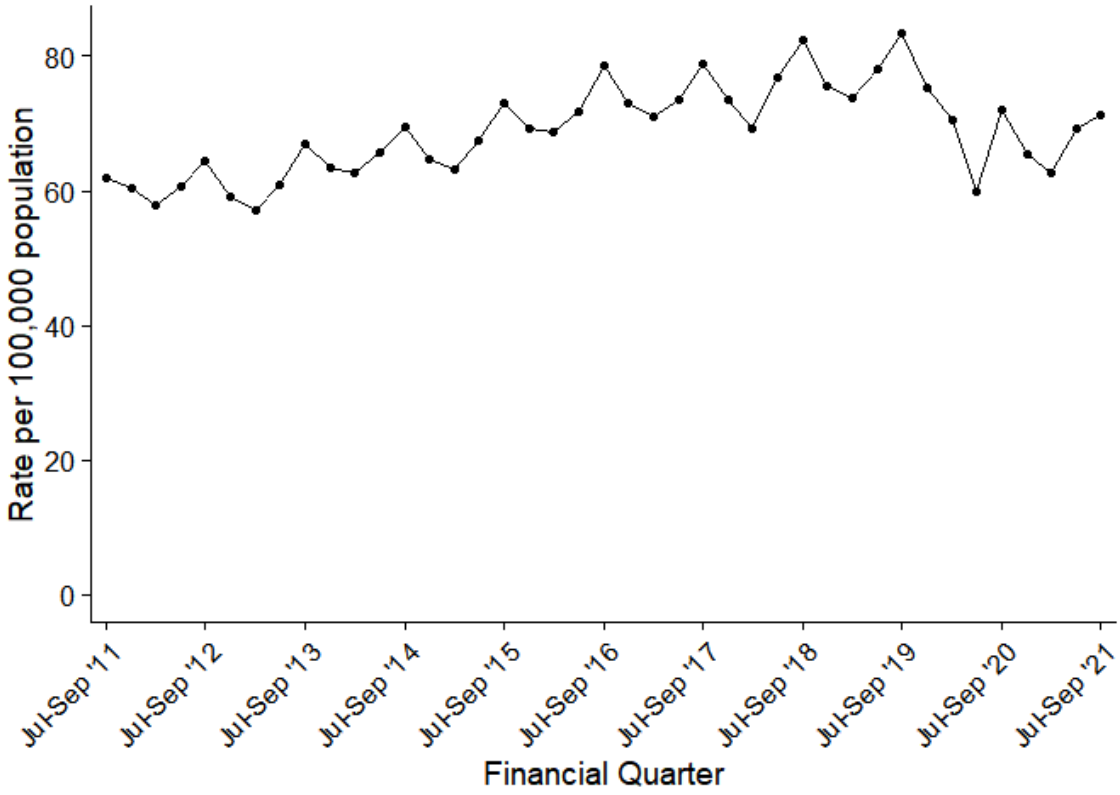
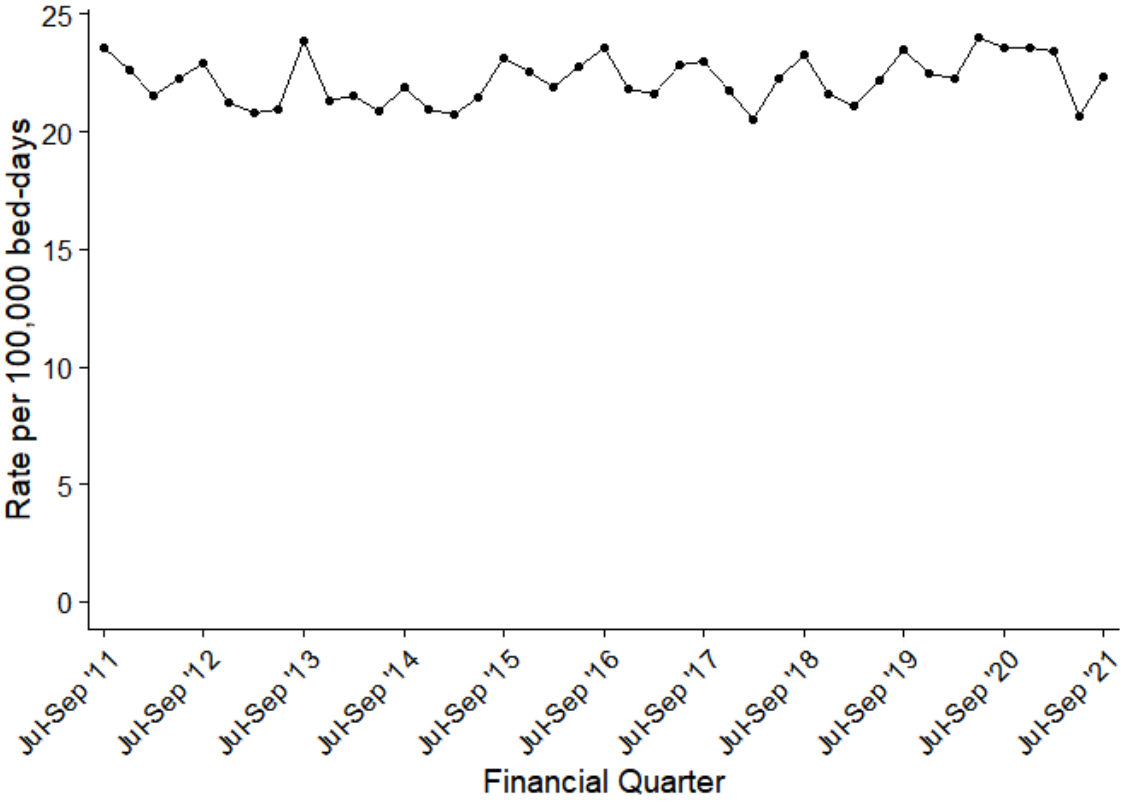


Figure 1b: Quarterly rates of hospital-onset *E. coli* bacteraemia: July to September 2011, to July to September 2021



From April 2020, the HCAI DCS has included questions relating to prior trust exposure to the same acute trust reporting Gram-negative bacteraemia cases. These additional mandatory items were developed to assist the UK governments ambition to reduce healthcare-associated Gram-negative BSI and CDI from a 2019 baseline to threshold levels. This supports the intention to reduce Gram-negative BSI by 25% by March 2022, and by 50% by March 2024.

Cases since April 2020 have also been categorised as:

- Healthcare-Onset
- Healthcare Associated (HOHA)
- Community-Onset
- Healthcare Associated (COHA) or Community-Onset

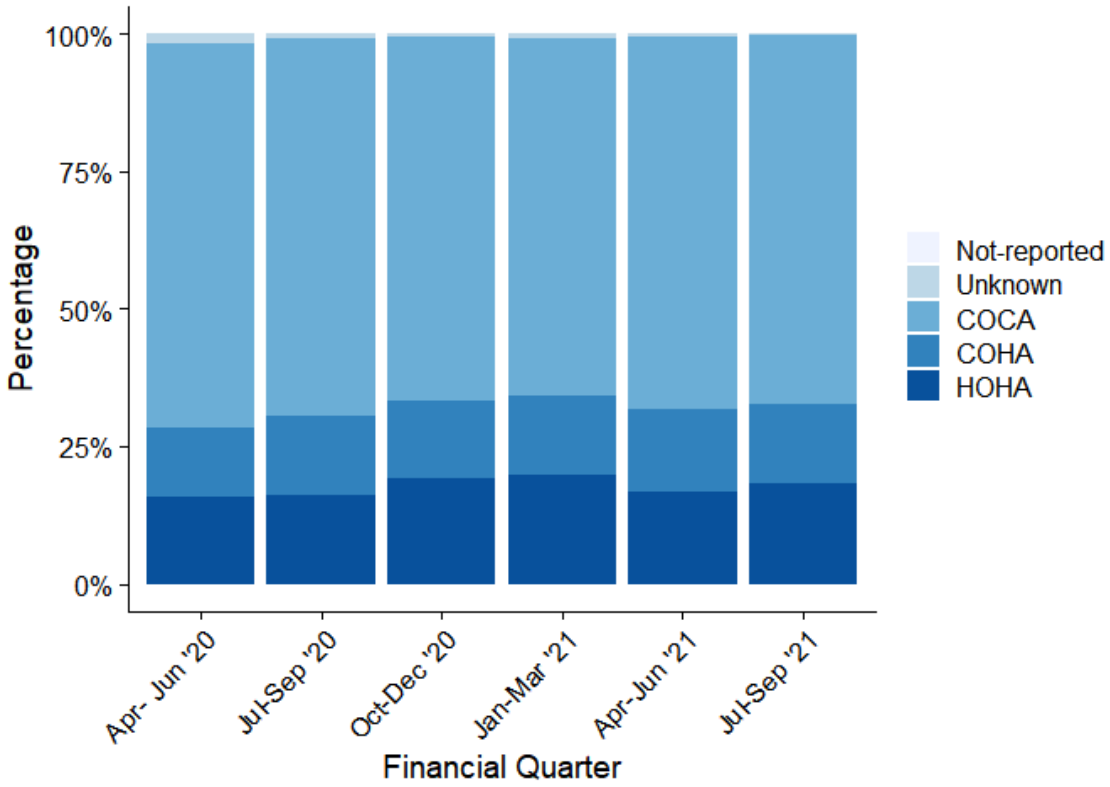
- Community Associated (COCA).

Cases where data on the most recent discharge were recorded as 'Don't know' are assigned as 'Unknown', and those with missing information as ''Not reported'.

COCA cases accounted for the majority of reported *E. coli* bacteraemia, between April to June 2020 and July to September 2021. While there have been some fluctuations, the proportion has remained fairly consistent at around 67% of all cases. During the same time period, the proportion of HOHA and COHA cases increased from 15.9% to 18.1% and 12.5% to 14.4% all *E. coli* bacteraemia cases respectively. While COCA cases have decreased from 69.9% to 67.1%. (Figure 1c, Table S1a).

Although the proportions remained broadly stable, when comparing the number of HOHA cases from the current quarter to the same quarter in 2020, HOHA cases increased by 10.8%. COHA and COCA cases, on the other hand, decreased by 1.6% and 3.4%, respectively.
It is worth noting that the period being compared (July to September 2020) includes the first lockdown, which resulted in reductions to hospital admissions during this period. Therefore, 2020 total counts were much lower than would otherwise be expected over these periods. Hence, this increase should be viewed with caution.

Figure 1c: Count of *E. coli* bacteraemia cases by prior trust exposure: April to June 2020, to July to September 2021



Klebsiella spp. bacteraemia

Between April to June 2017 and July to September 2021, there was a 29.6% increase in the count of all reported *Klebsiella* spp. bacteraemia cases from 2,348 to 3,044 and a 26.5% increase in the incidence rate from 16.9 to 21.4 cases per 100,000 population (Figure 2a).

The count of community-onset cases also increased by 19.7% from 1,678 to 2,009 cases, while the incidence rate increased by 16.8% from 12.1 to 14.1 cases per 100,000 population, respectively. Over the same period, the count of hospital-onset cases increased by 54.5% from 670 to 1,035 cases, while the rate increased by 62.9% from 7.8 to 12.6 cases per 100,000 bed-days (Figure 2b). Counts and rates of hospital-onset *Klebsiella* spp. increased between July to September 2020 and January to March 2021.

Since the pandemic, both counts and rates hospital-onset cases increased to levels not reported since the start of mandatory surveillance of *Klebsiella* spp. Incidence rate of hospital-onset cases peaked at 15.5 cases per 100,000 bed-days in the quarter January to March 2021.The specific drivers of this increase are still being investigated, but we do know these trends coincided with increased incidence of COVID-19, Sloot and others. 2021 (1). Data for the most recent quarter has shown an increase in total cases and incidence rate, the highest count (3,044 cases) and rate (21.4 cases per 100,000 bed days) seen since surveillance began.

The counts and incidence rate of hospital-onset case increased by 26.1% and 8% respectively when compared with the same quarter in the previous year (July to September 2020), and 15.3% and 21.3% respectively when compared to the same period in 2019 previous year (July to September 2019). As a result, a comparison to the same period in 2019 (July to September 2019), which is a more typical year prior to the pandemic, shows a 2% increase in the count of all reported cases from 2,984 to 3,044, with a corresponding increase in rate of 1.8% from 21 to 21.4 per 100,000 population. Community-onset *Klebsiella* spp. cases had little change (2,086 to 2,009), with rates decreasing from 14.7 to 14.1 per 100,000 population. Hospital-onset *Klebsiella* spp. cases increased by 15.3% from 898 to 1,035 corresponding to a sharp increase in incidence of 21.3% from 10.4 to 12.6 per 100,000 bed-days (Table S2).

During July to September 2021, 70.1% (2,133 divided by 3,044) of all reported *Klebsiella* spp. bacteraemia were caused by *Klebsiella pneumoniae*, an increase from 69.1% in the same quarter in the previous year (July to September 2020). Over the same period, the percentage of cases caused by *Klebsiella oxytoca* was 18.1% (550 divided by 3,044) in July to September 2021 from 19.6% in the same quarter in the previous year (July to September 2020).

During the period where there were observed increases in the counts and rates of hospital-onset *Klebsiella* spp., the increase was generally proportional among all species as they all followed broadly the same trend. The exception to this was *K. oxytoca*, which increased

within hospital-onset cases around the start of the pandemic and broadly maintained a similar rate throughout the period (2.0 to 2.1 per 100,000 bed days).
There is evidence of seasonality in the incidence trends of all-reported *Klebsiella* spp. bacteraemia cases, with the highest rates normally observed in July to September of each year, although it is important to evaluate financial year 2020 to 2021 and 2021 to 2022 with caution.

Figure 2a: Quarterly rates of all reported *Klebsiella* spp. bacteraemia by species: April to June 2017, to July to September 2021

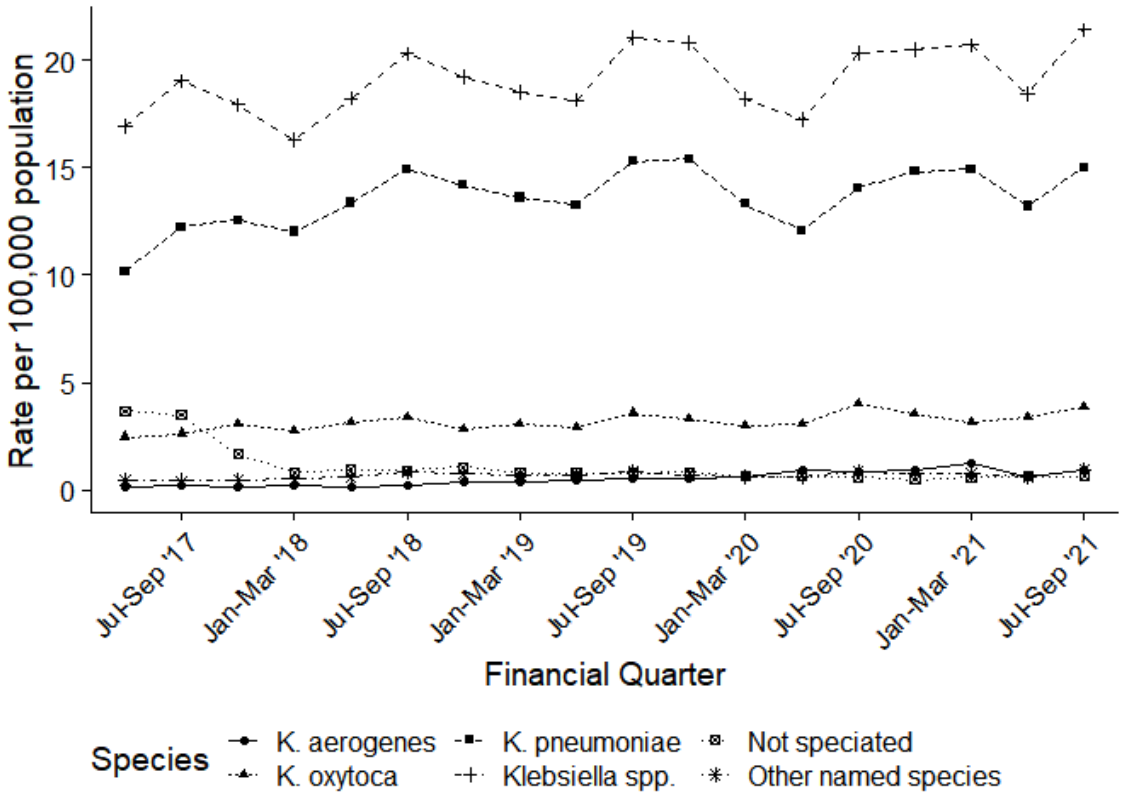
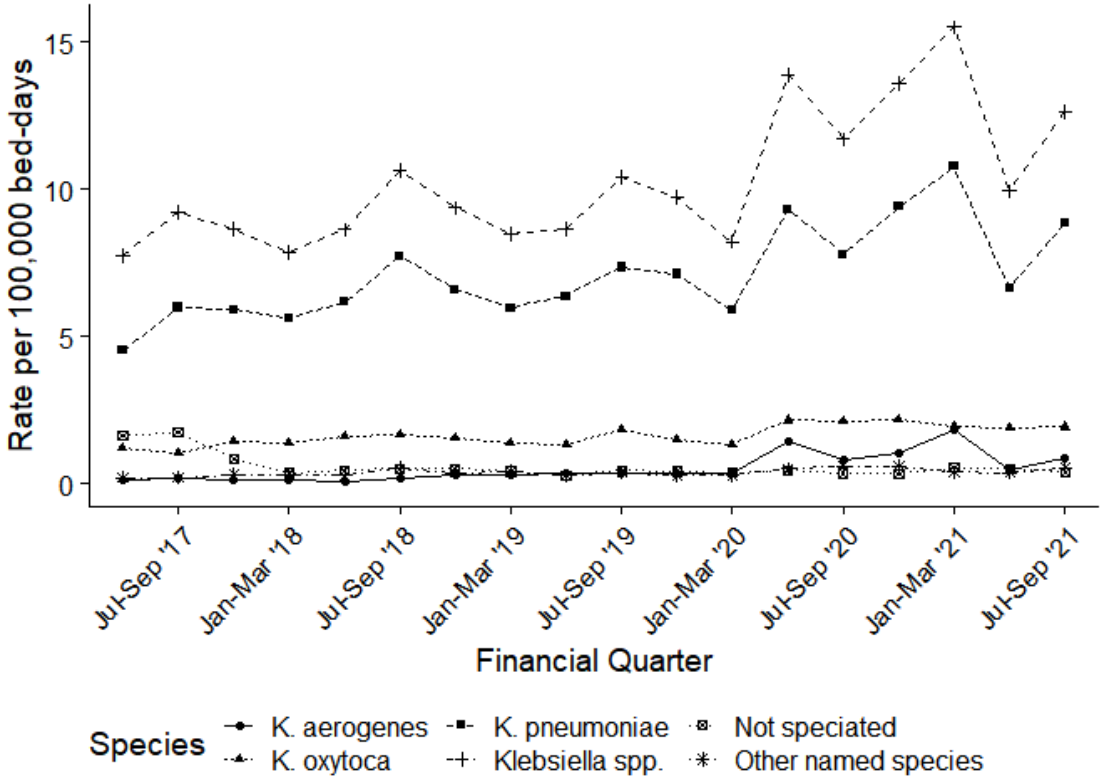


Figure 2b: Quarterly rates of hospital-onset *Klebsiella* spp. bacteraemia: April to June 2017, to July to September 2021

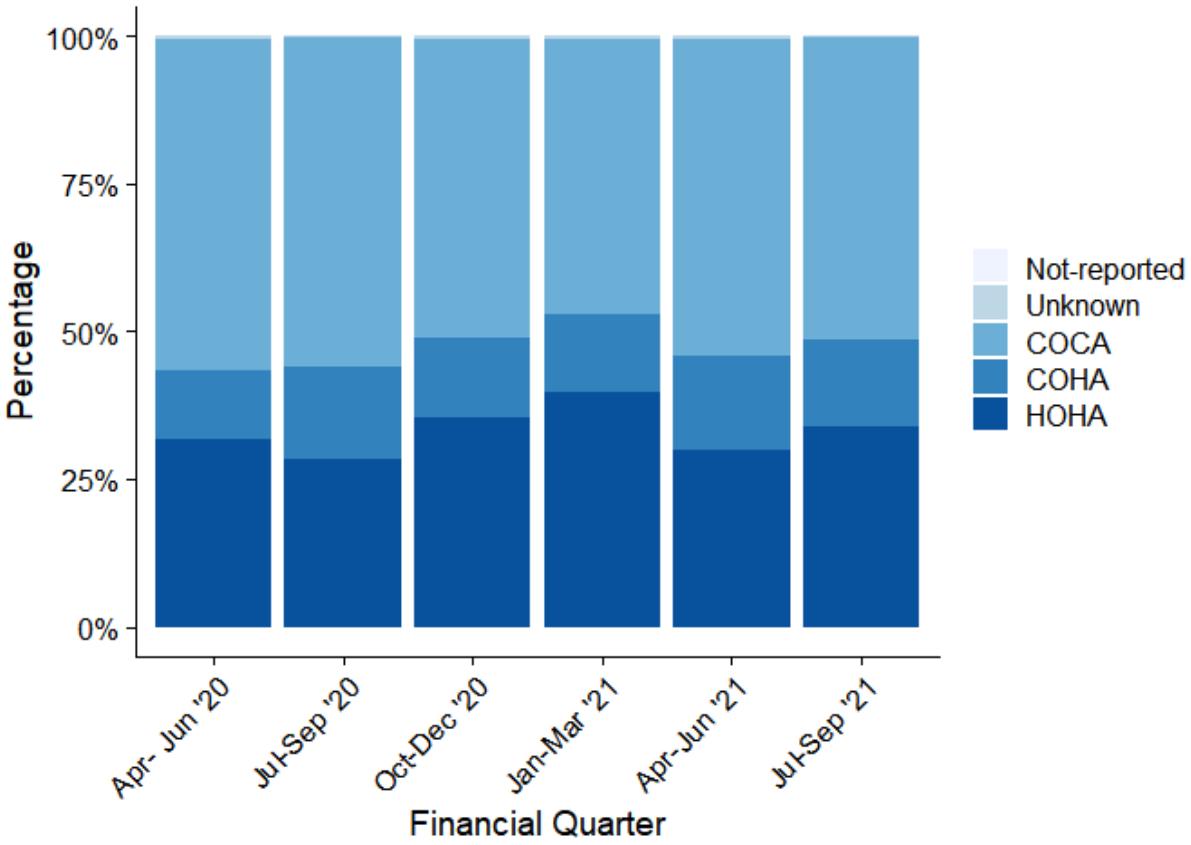


Similar to *E. coli* bacteraemia, between April to June 2020 and July to September 2021, COCA cases account for the majority of *Klebsiella* spp. bacteraemia.

HOHA cases peaked at 39.6% in January to March 2021 alongside a decline in COCA cases to 46.4%. The increase in HOHA cases coincided with the second lockdown and has been investigated by Sloot and others. 2021(1). Their research found that it corresponded with an increase in patients with co or secondary COVID-19 infections. Overall, the percentage of COCA cases has remained broadly stable at around half of all cases.

When comparing to the same quarter in 2020, HOHA cases increased from 28.4% to 34% of all cases. There was a slight decline in the percentage of COHA cases which dropped from 15.5% to 14.7% of all *Klebsiella* spp. bacteraemia cases. While the number of COCA cases have decreased from 56.3% to 51.1% of all reported cases. (Figure 2c, Table S2a).

Figure 2c: Count of *Klebsiella* spp. bacteraemia cases by prior trust exposure: April to June 2020, to July to September 2021



Pseudomonas aeruginosa bacteraemia

Between April to June 2017 and July to September 2021, there was a 25.2% increase in the count of all reported *P. aeruginosa* bacteraemia cases from 1,012 to 1,267 and a 22.1% increase in the incidence rate from 7.3 to 8.9 cases per 100,000 population (Figure 3a). The count and the incidence rate of community-onset cases increased by 20.8% from 638 to 771 cases and by 17.9% from 4.6 to 5.4 cases per 100,000 population respectively. Over the same period, the count and the incidence rate of hospital-onset cases increased by 32.6% from 374 to 496 cases and by 39.9% from 4.3 to 6.1 cases per 100,000 bed-days respectively (Figure 3b).

Similar to *Klebsiella* spp. cases, an increase in counts and rates of hospital-onset *P. aeruginosa* was also observed during the second wave of the pandemic. The counts and rates of hospital-onset *P. aeruginosa* increased between July to September 2020 and January to March 2021. During this period, both the counts and rates of hospital-onset cases increased to levels not seen since the initiation of mandatory surveillance of *P. aeruginosa* bacteraemia. This peaked at 7.0 cases per 100,000 bed-days in January to March 2021. The reasons for this increase has been investigated by Sloot and others, 2021 (1). They discovered that the increase coincided with a rise in the percentage of hospital-onset bacteraemia cases who were also positive for COVID-19. When comparing similar quarters, since the beginning of the surveillance, data for the most recent quarter has the highest total and hospital-onset count, with corresponding incidence rates. Whereas, counts and rates of community-onset cases are at the average expected figures.

When compared with the same period in the previous year (July to September 2020), care should be taken as it is a comparison with a quarter largely affected by the COVID-19 pandemic. A comparison to the same period in 2019 (July to September 2019), which was a more typical year before the pandemic, shows a 5.8% increase in count of all reported cases from 1,197 to 1,267 and a 5.6% increase in the rate from 8.4 to 8.9 cases per 100,000 population. Counts of hospital-onset *P. aeruginosa* case increased 23.4% from 402 to 496, which corresponds to an increase in the incidence rate of 29.9% from 4.7 to 6.1 per 100,000 bed-days. Counts of community-onset *P. aeruginosa* cases decreased from 795 to 771, with a corresponding decline in the community-onset incidence rate of 3.2% from 5.6 to 5.4 per 100,000 population (Figure 3a, 3b and Table S3).

There is evidence of seasonality in the incidence of all-reported *P. aeruginosa* bacteraemia cases, with the highest rates normally observed in July to September of each year.

Figure 3a: Quarterly rates of all reported *P. aeruginosa* bacteraemia: April to June 2017, to July to September 2021

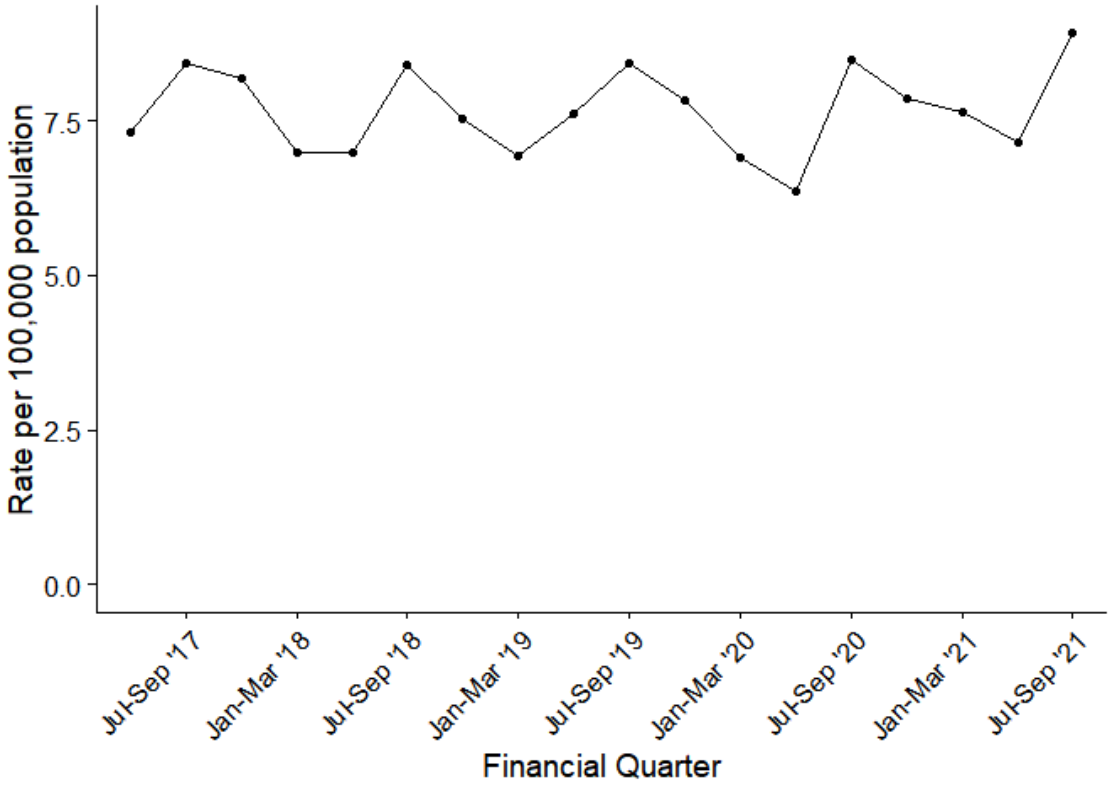
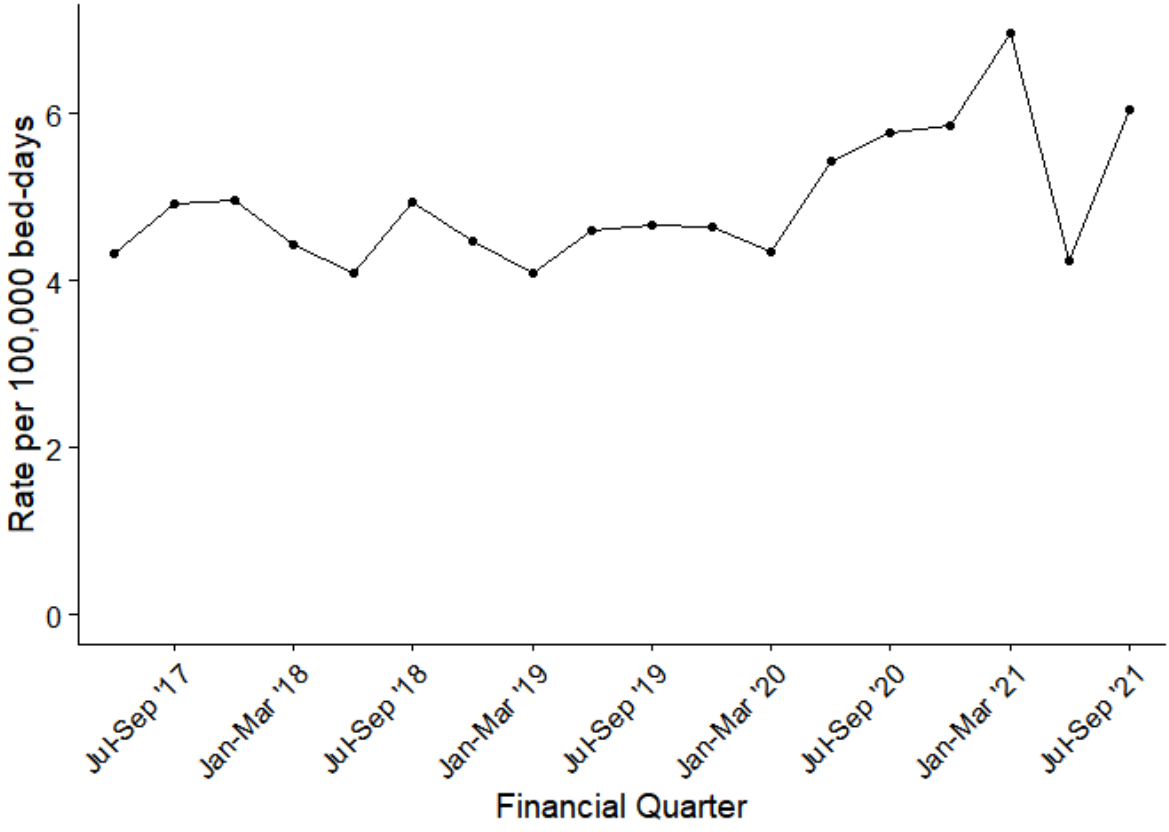


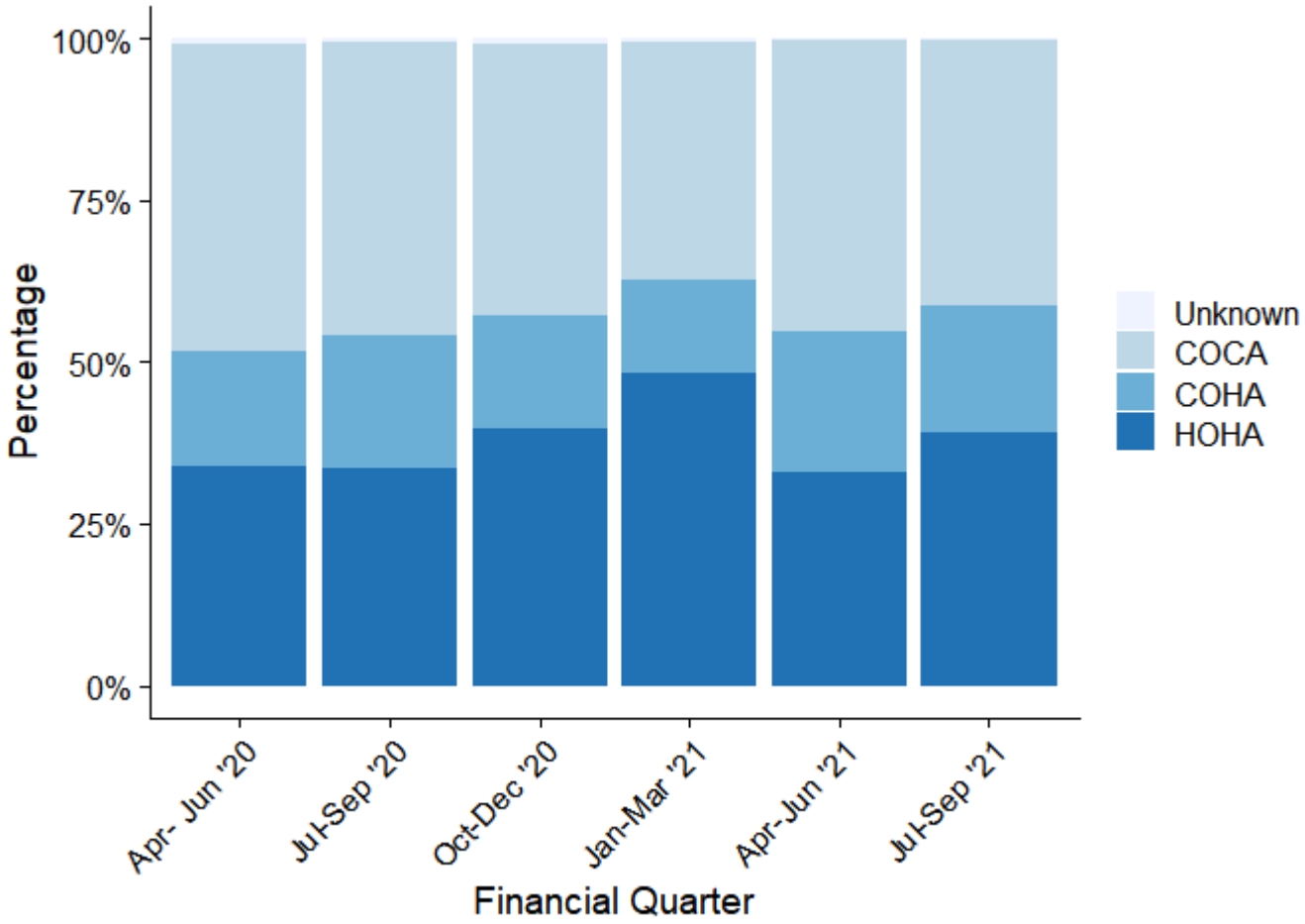
Figure 3b: Quarterly rates of hospital-onset *P. aeruginosa* bacteraemia: April to June 2017, to July to September 2021



Between April to June 2020 and July to September 2021 approximately half of all reported cases were COCA. HOHA cases surpassed COCA cases for the first time since April 2020, when the second wave of the pandemic (January to March 2021) peaked.

The percentage of HOHA cases increased from 33.9% in April 2020 to 48.2%, bringing the percentage of HOHA cases to a similar percentage of COCA cases observed in April 2020 (47.5%). Over the same period, there was a corresponding decrease in COCA cases from 47.5% to 36.8%. Comparing to the same quarter in 2020 (July to September 2020), HOHA cases increased from 33.9% to 39.1% of all *P. aeruginosa* bacteraemia cases. The percentage of COHA cases declined slightly from 20.2% to 19.6%. COCA cases have decreased from 45.6% to 41%. (Figure 3c Table S3a).

Figure 3c: Count of *P. aeruginosa* bacteraemia cases by prior trust exposure: April to June 2020, to July to September 2021



Epidemiological analyses of *Staphylococcus aureus* bacteraemia data

MRSA bacteraemia

There has been a considerable decrease in the incidence rate of all reported MRSA bacteraemia since the enhanced mandatory surveillance of MRSA bacteraemia began in April 2007 (Figures 4a, Table S4a). The incidence rate of all reported cases fell by 85% from 10.2 cases per 100,000 population in April to June 2007 to 1.5 cases per 100,000 in January to March 2014. The rate has fluctuated between 0.6 and 1.8 since then and is currently at 1.2 cases per 100,000 population in July to September 2021.

A similar trend was observed with the incidence rate of hospital-onset cases (Figures 4b, Table S4a). There was a steep decrease of 79% from 4.9 cases per 100,000 bed-days in April to June 2008 to 1 case per 100,000 bed-days in January to March 2014. Subsequently, between January to March 2014 and July to September 2021, the rate has decreased to 0.9 cases per 100,000 bed-days. Within this period there have been fluctuations of hospital-onset cases overtime.

Similar to *Klebsiella* spp. and *P. aeruginosa,* the count and rate of hospital-onset peaked at 1.5 cases per 100,000 bed-days in January and March 2021 (Figure 4b). This was the highest rate seen for hospital-onset MRSA bacteraemia since July to September 2011. The reasons for this increase are still being investigated. it coincided with a rise in the percentage of hospital-onset bacteraemia cases who were also positive for COVID-19.

A comparison to the same period in 2019 (July to September 2019), which was a more typical year before the pandemic, shows a 14% decrease in total counts from 200 to 172 in July to September 2021, and a similar decline in the incidence rate of 14.2% from 1.4 to 1.2 cases per 100,000 population. Community-onset MRSA bacteraemia cases decreased by 23.8% from 134 to 102, while the rate decreased 24% from 0.9 to 0.7 cases per 100,000 population (Table 4a). During the same quarter in 2019, the count of hospital-onset MRSA bacteraemia cases increased from 66 to 70. (Figure 4a and 4b).

Figure 4a: Quarterly rates of all reported MRSA bacteraemia: April to June 2007, to July to September 2021

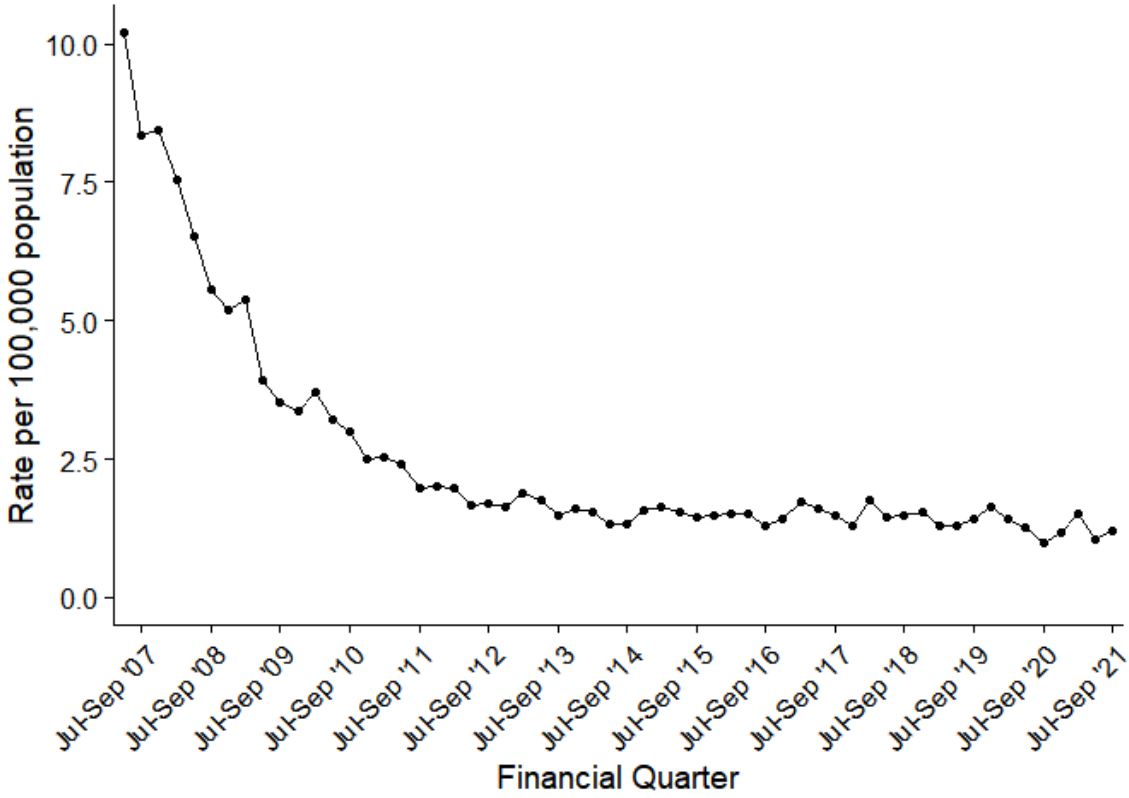
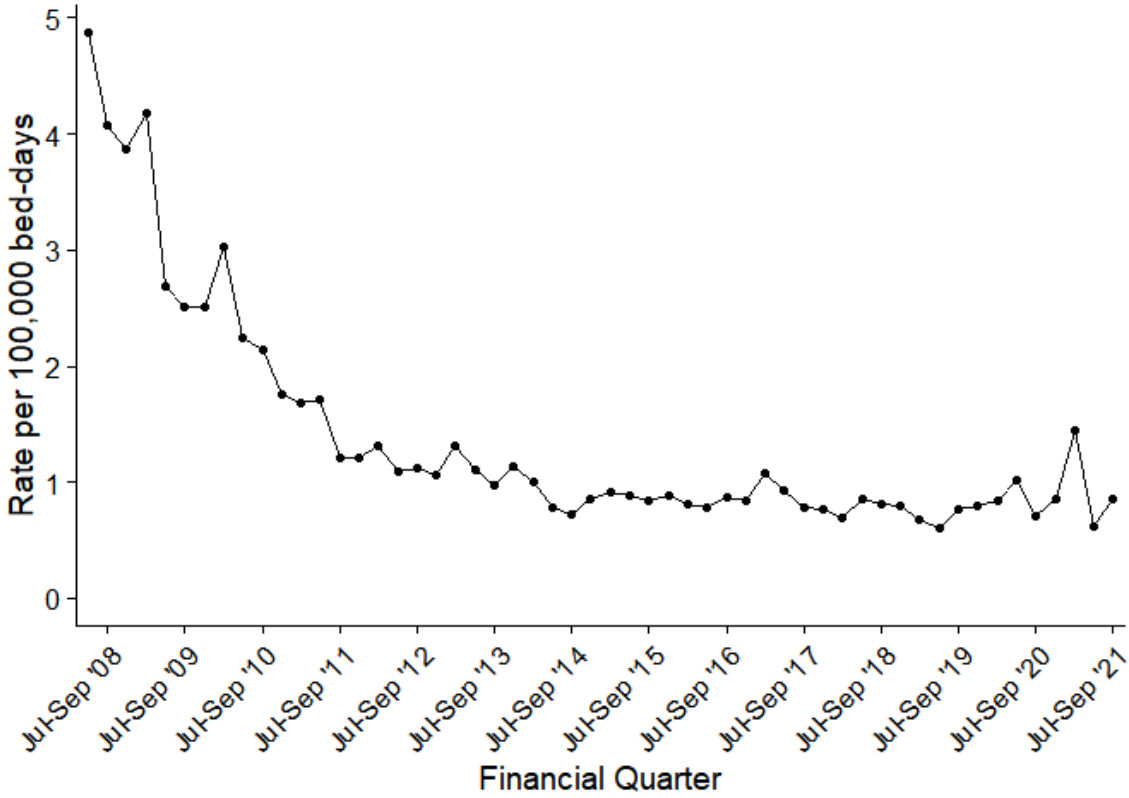


Figure 4b: Quarterly rates of hospital-onset MRSA bacteraemia: April to June 2008, to July to September 2021



MSSA bacteraemia

Since the mandatory reporting of MSSA bacteraemia began in January 2011 there has been a general trend of increasing counts and incidence rates of cases. The count of all reported cases of MSSA bacteraemia increased by 37.2% from 2,199 to 3,016 between January to March 2011 and July to September 2021. This was accompanied by a 26.3% increase in incidence rate from 16.8 to 21.2 per 100,000 population (Figure 5a, Table S5).

These increases are primarily driven by increases in community-onset cases. Between January 2011 and July to September 2021, the count and the incidence rate of community-onset cases increased by 41.5% and 30.4% respectively from 1,464 to 2,072 cases and from 11.2 to 14.6 cases per 100,000 population. Over the same period, the count of hospital-onset cases increased by 28.4% from 735 to 944 cases, while the hospital-onset incidence rate increased 38.2% from 8.3 to 11.5 cases per 100,000 bed-days (Figure 5a and 5b, Table S5a). Since the beginning of the COVID-19 pandemic there has generally been lower numbers of all reported MSSA cases.

Furthermore, since July to September 2020, there has been an increase in hospital-onset cases. The overall reduction is, in part, a result of reduced hospital admissions. This has caused a large increase in the rate of hospital-onset cases over a relatively short time since overnight bed-days is used as a denominator for rate calculations. This culminated in a peak during January to March 2021 of 13.4 cases per 100,000 bed-days and 998 cases, which was the highest MSSA hospital-onset rate and count, that has been observed since the inception of MSSA surveillance. This pattern is comparable to that observed in both *Klebsiella* spp. and *P. aeruginosa.* Furthermore, MSSA hospital-onset cases in July to September 2021 are at their highest since the beginning of surveillance when compared to similar quarters, with a similarly high incident rate seen during the pandemic, in the same period in 2020.

A comparison to the same period in 2019 (July to September 2019), which is a more typical year prior to the pandemic, shows a 4.7% decrease in the counts of all reported cases from 3,166 to 3,016 and a 4.9% decrease in the rate from 22.3 to 21.2 cases per 100,000 population. Hospital-onset MSSA bacteraemia cases have increase by 11.3% from 848 to 944, this corresponds to an increase in the incidence rate increase of 17.2% from 9.8 to 11.5 per 100,000 bed-days. Community-onset MSSA bacteraemia cases decreased by 10.6% from 2,318 to 2,072, while the rates decreased by 10.8% from 16.3 to 14.6 per 100,000 population.

Figure 5a: Quarterly rates of all reported MSSA bacteraemia: January to April 2011, to July to September 2021

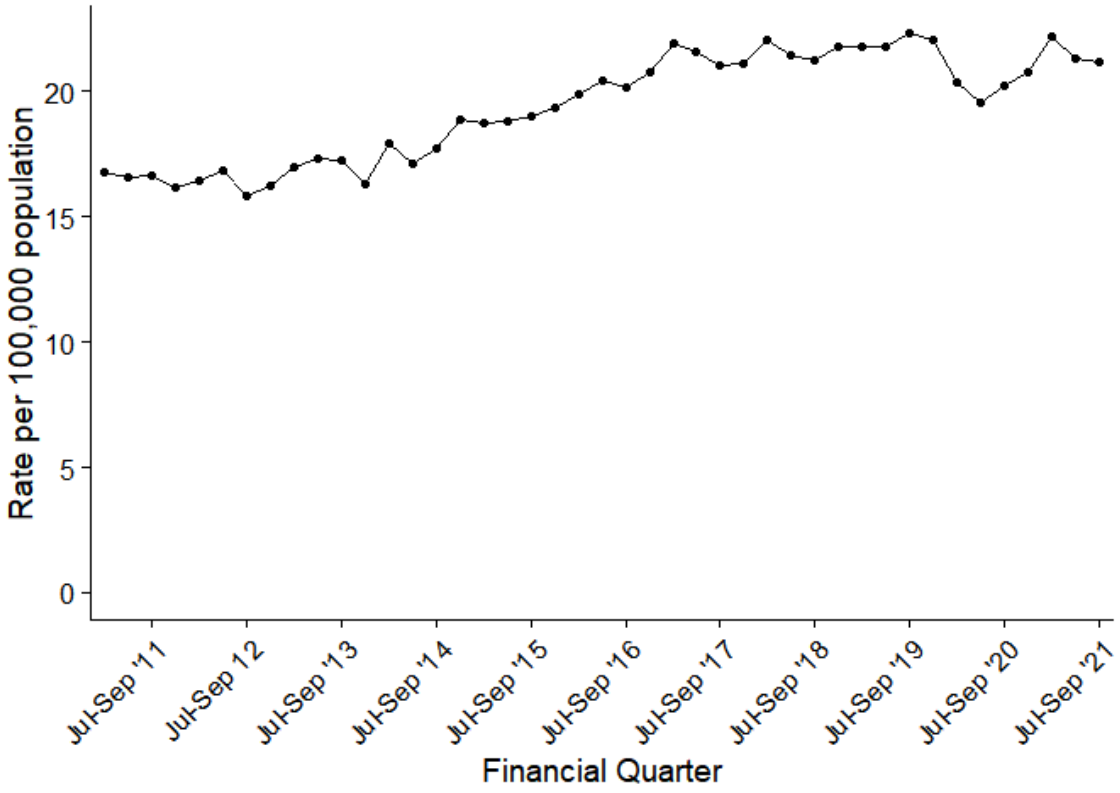
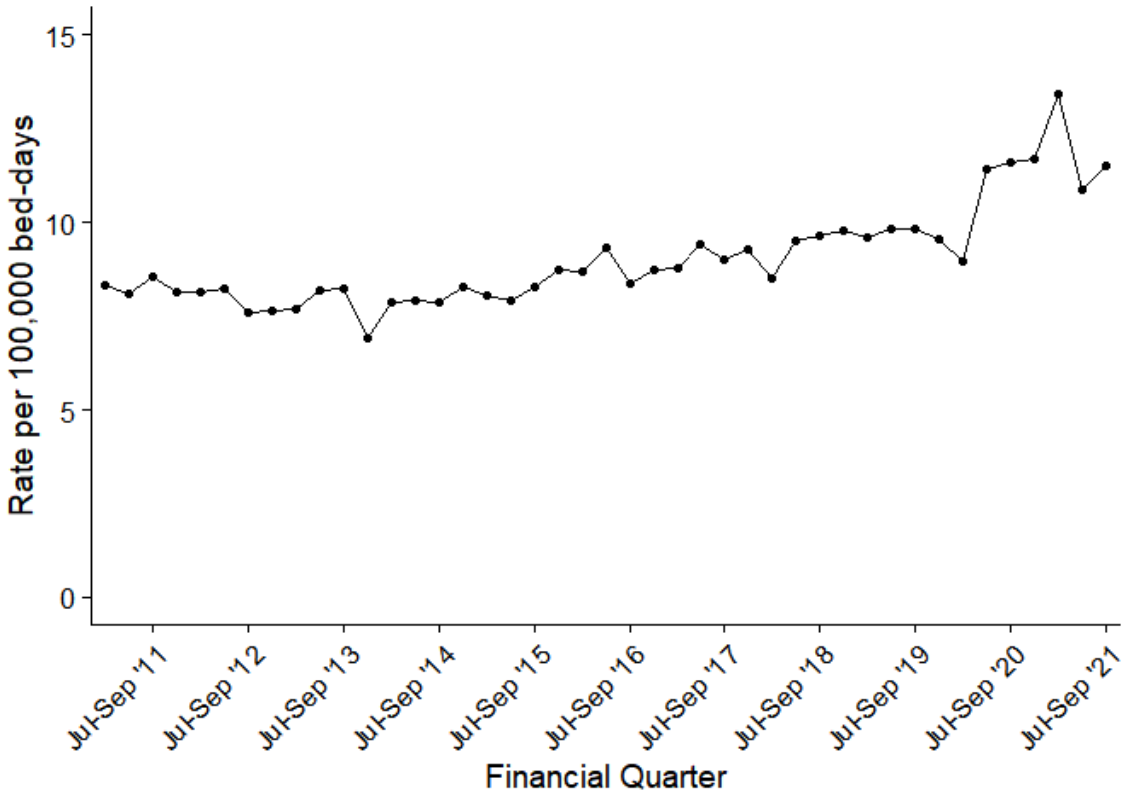


Figure 5b: Quarterly rates of hospital-onset MSSA bacteraemia: January to April 2011, to July to September 2021


15
10
5
0
Rate per 100,000 bed-days
Jul-Sep '11
Jul-Sep '12
Jul-Sep '13
Jul-Sep '14
Jul-Sep '15
Jul-Sep '16
Jul-Sep '17
Jul-Sep '18
Jul-Sep '19
Jul-Sep '20
Jul-Sep '21
Financial Quarter

Epidemiological analyses of *Clostridioides difficile* infection data

Since the initiation of *C. difficile* (CDI) surveillance in April 2007, there has been an overall decrease in the count and incidence rate of both all-reported and hospital-onset cases of CDI (Figure 6a, 6b and Table S6).

A large part of the decrease in the incidence rate occurred between April to June 2007 and January to March 2012, with a 78% decrease in all-reported cases of CDI from 16,864 to 3,711 cases and an associated 79% reduction in incidence rate from 131.6 cases per 100,000 population to 27.9. Subsequently, between January to March 2012 and July to September 2021, the count of all-reported cases increased by 7% from 3,711 to 3,969 cases, with the incidence rate remaining the same for both quarters at 27.9 cases per 100,000 population.

There were similar, but greater, reduction among hospital-onset CDI cases with an 85% reduction in count of cases between April to June 2007 and January to March 2012 from 10,436 to 1,613 cases and a 84% reduction in the incidence rate from 112.1 to 18.1 per 100,000 bed-days. This was followed by a further 13.3% decrease in the count of cases from 1,613 to 1,398 cases and a decrease of 5.6% in the incidence rate from 18.1 cases per 100,000 bed-days to 17.1 between January to March 2012 and July to September 2021.

Comparing the most recent quarter (July to September 2021) to the same period in the pre-pandemic period (July to September 2019) shows a 9.1% increase in the count of all reported cases and 8.9% increase in incidence rate from 3,639 to 3,969 and 25.6 to 27.9 cases per 100,000 population, respectively. Hospital-onset CDI cases increased by 15.4% from 1,211 to 1,398 which corresponds to an incidence rate increase of 21.5% from 14 cases per 100,000 bed-days to 17.1. Community-onset CDI cases increased by 5.9% from 2,428 to 2,571 while the rate increased from 17.1 to 18.1 per 100,000 population (Figure 6a and 6b).

Figure 6a: Quarterly rates of all reported *C. difficile*: April to June 2007, to July to September 2021

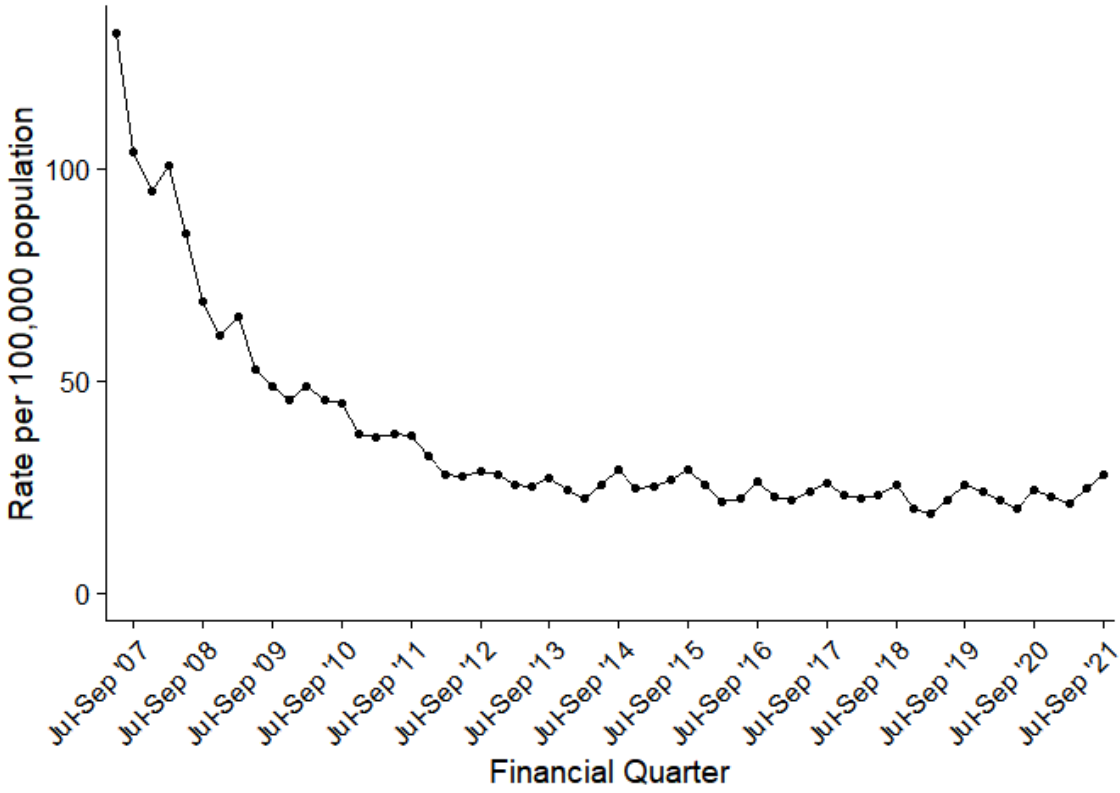
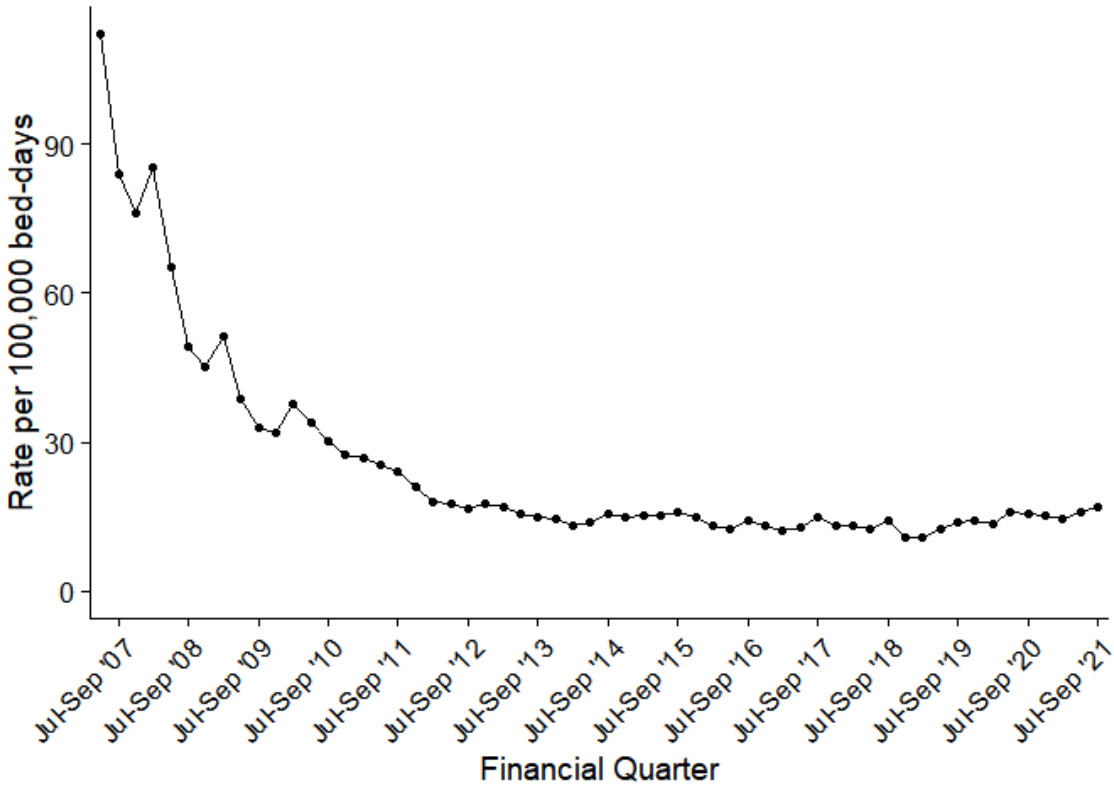


Figure 6b: Quarterly rates of hospital-onset *C. difficile*: April to June 2007, to July to September 2021



From April 2017, the HCAI DCS has included questions relating to prior trust exposure to the same acute trust reporting the CDI case. These additional, mandatory, items help align English CDI surveillance with definitions used by the European Centre for Disease Prevention and Control (ECDC) and Centres for Disease Control and Prevention (CDC) in the USA.

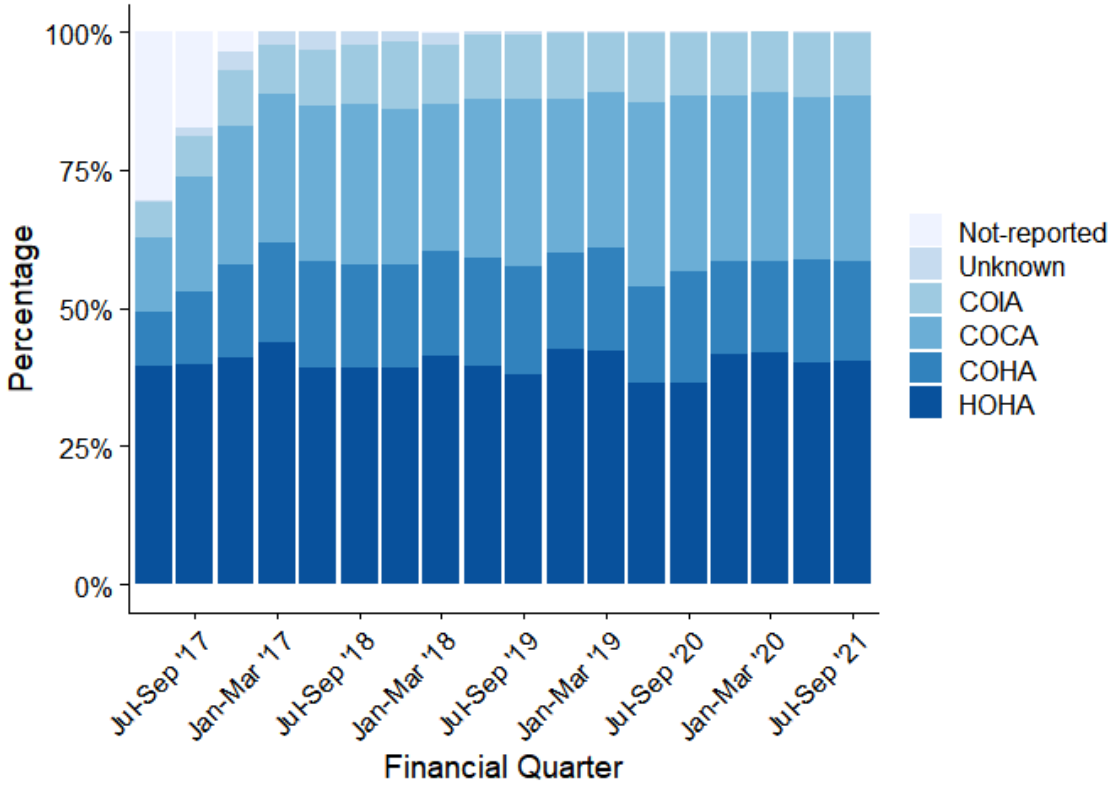
Cases are now categorised as:

- Healthcare-Onset
- Healthcare Associated (HOHA)
- Community-Onset, Healthcare Associated (COHA)
- Community-Onset
- Indeterminate Association (COIA) Community-Onset
- Community Associated (COCA).

Cases where prior admission details were recorded as ‘Don’t know’, are assigned as ‘Unknown’ and those with missing information as ‘’Not-reported’.

Between April to June 2017 and July to September 2021 the largest proportion of cases were HOHA. While there have been some fluctuations, the proportion has remained broadly stable at around 40% of all cases. Over the same period, COCA cases increased from 28% to 29.9% of all CDI. COHA cases have decreased from 19.1% to 18.2% of all CDI. COIA cases have increased from 10.2% to 11.4% of all CDI. Much of the increase observed is likely due to improved data quality as shown by the sharp decline of cases with missing data (Figure 7 Table S7).

Figure 7: CDI rates by prior trust exposure April to June 2017, to July to September 2021



Appendix

Bed-day data

For 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 rate rates (assigned and apportioned). As of Q1 2011 to 2012, bed-day data has been available on a quarterly basis and has been used as such for Q2 2011 to 2012, to Q1 2021 to 2022.

However, UKHSA has reviewed its policy for processing KH03 data. Data irregularities identified have been flagged with colleagues at NHS England (data owners of the KH03 data set). Until we receive confirmation that any identified change in the occupied overnight bed-days for an acute trust is anomalous, UKHSA now uses the data as published in the KH03 data set. This affects all reports published since 1 December 2015 and incidence rate rates published prior that time will differ slightly as a result.

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 to 2015, has been altered to reflect that published in the KH03 data set. 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 to 2008, and 2008 to 2009 KH03 figures: replaced with 2006 to 2007 KH03 figure
- Rotherham NHS Foundation Trust (RFR): 2009 to 2010 and from April to June 2010, to April to June 2011 KH03 figures: replaced with 2008 to 2009 KH03 figure
- Sheffield Teaching Hospitals NHS Foundation Trust (RHQ) from April to June 2010, to April to June 2011 KH03 figures: replaced with 2009 to 2010 KH03 data
- The Princess Alexandra Hospital NHS Trust (RQW) April to June 2014, and October to December 2014 KH03 figures: replaced with April to June 2013, to October to December 2013 KH03 figures, respectively
- Ipswich Hospital NHS Trust (RGQ) January to March 2016 KH03 figure: replaced with January to March 2015 figures
- West Suffolk NHS Foundation Trust (RGR) April to June 2016, to October to December 2016 and April to June 2017 KH03 figures: replaced with April to June 2015, to October to December 2015 KH03 figures
- Gloucestershire Hospitals NHS Foundation Trust (RTE) October to December 2016, to January to March 2017 KH03 figures: replaced with October to December 2015, to January to March 2016 KH03 figures

The KH03 data used for this report was published on 18 November 2021. 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 to 2020 mid-year resident population estimates which are based on the 2011 census for England (2021 estimates are based on 2020 mid-year estimates).

Definitions

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 3 of the admission (admission date is considered day ‘one’). Cases that do not meet these criteria are categorised as community-onset (not-trust apportioned).

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 4 of the admission (admission date is considered day ‘one’). Cases that do not meet these criteria are categorised as community-onset (not-trust apportioned).

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.

Prior trust exposure

From April 2017, reporting trusts were asked to provide information on whether patients with CDI had been admitted to the reporting trust within the 3 months prior to the onset of the current case. This allows a greater granulation of the healthcare association of cases.

Cases are split into one of 6 groups:

1. Hospital-onset healthcare-associated: Date of onset is greater than 2 days after admission (where day of admission is day 1).
2. Community-onset healthcare-associated: Date of onset is less than or equal to 2 days after admission and the patient was admitted to the trust in the 4 weeks prior to the current episode.
3. Community-onset indeterminate association: Date of onset is less than or equal to 2 days after admission and the patient was admitted in the previous 12 weeks, but not the previous 4 weeks prior to the current episode.
4. Community-onset community-associated: Date of onset is less than or equal to 2 days after admission and the patient had not been admitted to the trust in the previous 12 weeks prior to the current episode.

5. Unknown 3 months: The reporting trust answered, "Don't know" to the question regarding admission in the 3 months prior to the current episode.
6. All unknown: The reporting trust did not provide any answer for questions on prior admission.

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 2 years old.

Episode duration

The length of an infection episode is defined as 14 days for MRSA, MSSA, *E. coli*, *Klebsiella* spp. and *P. aeruginosa* bacteraemia and 28 days for CDI, where the specimen date is day 'one'.

Incidence rate calculations

MRSA, MSSA and *E. coli*, *Klebsiella* spp., *P. aeruginosa* bacteraemia, and CDI population incidence rate (episodes per 100,000):

This incidence rate is calculated using the mid-year England population and is:

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

MRSA, MSSA and *E. coli*, *Klebsiella* spp., *P. aeruginosa* and CDI hospital-onset incidence:

This incidence rate is calculated using KH03 average bed-day activity (see bed-day data above) and is calculated as follows:

$$= \frac{\text{n episodes}}{\text{average KH03 beds per day} \times \text{days in quarter}} \times 100{,}000$$

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, that is:

- Q1 2014: April to June 2014
- Q2 2014: April to June 2014
- Q3 2014: July to September 2014
- Q4 2014: October to 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, that is:

- Q1 2014 to 2015: April to June 2014
- Q2 2014 to 2015: July to September 2014
- Q3 2014 to 2015: October to December 2014
- Q4 2014 to 2015: April to June 2015

References

1. Sloot R, Nsonwu O, Chudasama D, Rooney G, Pearson C, Choi H, Mason E, Springer A, Gerver S, Brown C, Hope R. 'Rising rates of hospital-onset Klebsiella spp. and Pseudomonas aeruginosa bacteraemia in NHS acute trusts in England: a review of national surveillance data.' August 2020 to February 2021. Journal of Hospital Infection. 2021 Sep 2020

About the UK Health Security Agency

UKHSA is responsible for protecting every member of every community from the impact of infectious diseases, chemical, biological, radiological and nuclear incidents and other health threats. We provide intellectual, scientific and operational leadership at national and local level, as well as on the global stage, to make the nation heath secure.

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