



Public Health
England

Protecting and improving the nation's health

Quarterly Epidemiological Commentary:

Mandatory MRSA, MSSA and *E. coli* bacteraemia, and *C. difficile* infection data (up to January-March 2017)

June 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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We are always striving to ensure that routine outputs meet user need as much as possible. If you have any suggestions for changes and/or additions please email mandatory-surveillance@phe.gov.uk

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Citation

Public Health England. Quarterly analyses: mandatory MRSA, MSSA and *E. coli* bacteraemia and *C. difficile* infection in England (up to January-March 2017) London: Public Health England, June 2017.

Published: March 2017

PHE publications gateway number: 2017096



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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 of *E. coli* bacteraemia (*E. coli* bacteraemia are not subject to apportionment).
- counts and rates of all cases and trust-apportioned (hospital-onset) cases of MRSA¹ and MSSA 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
- counts and rates of all reported MRSA, MSSA and *E. coli* bacteraemia and CDI cases by age

A hospital-onset case is one where a bacteraemia or infection is identified within 3 days (4 for CDI infections) of a known hospital admission. All hospital-onset cases will also be trust-apportioned however not all trust-apportioned cases will be hospital-onset cases e.g. when a patient's location, patient's category or patient's admission date is not known.

All data tables associated with this report are included in an [accompanying 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 and Official 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; trust-apportioned cases only](#)

¹ 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 (data are not apportioned):

- 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; 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 24 April 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 an overall decreasing trend in the counts and rates of all reported MRSA bacteraemia since the mandatory surveillance of MRSA bacteraemia began in April-June 2007 (figures 1b, table S1a) and a similar overall decrease in counts and rates of trust-apportioned cases since apportioning of MRSA bacteraemia cases began in April-June 2008 (figure 1a, table S1a).

There was a steep decline in the rates of all reported and trust-apportioned cases between April-June 2007 (April-June 2008 for trust-apportioned 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, there has been a 14% increase in the rates of all reported cases (1.5 to 1.8 cases per 100,000 population) and a 4% increase in trust-apportioned cases (1.0 to 1.1 cases per 100,000 bed-days), respectively, between that time and the most recent quarter (January-March 2014 to January-March 2017).

The current quarter (January-March 2017) has seen the highest rate (1.8 cases per 100,000 bed-days) of all reported MRSA bacteraemia within in the last 3 financial years.

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 72 cases and 0.7 to 0.5 cases per 100,000 population respectively between April-June 2014 and the most

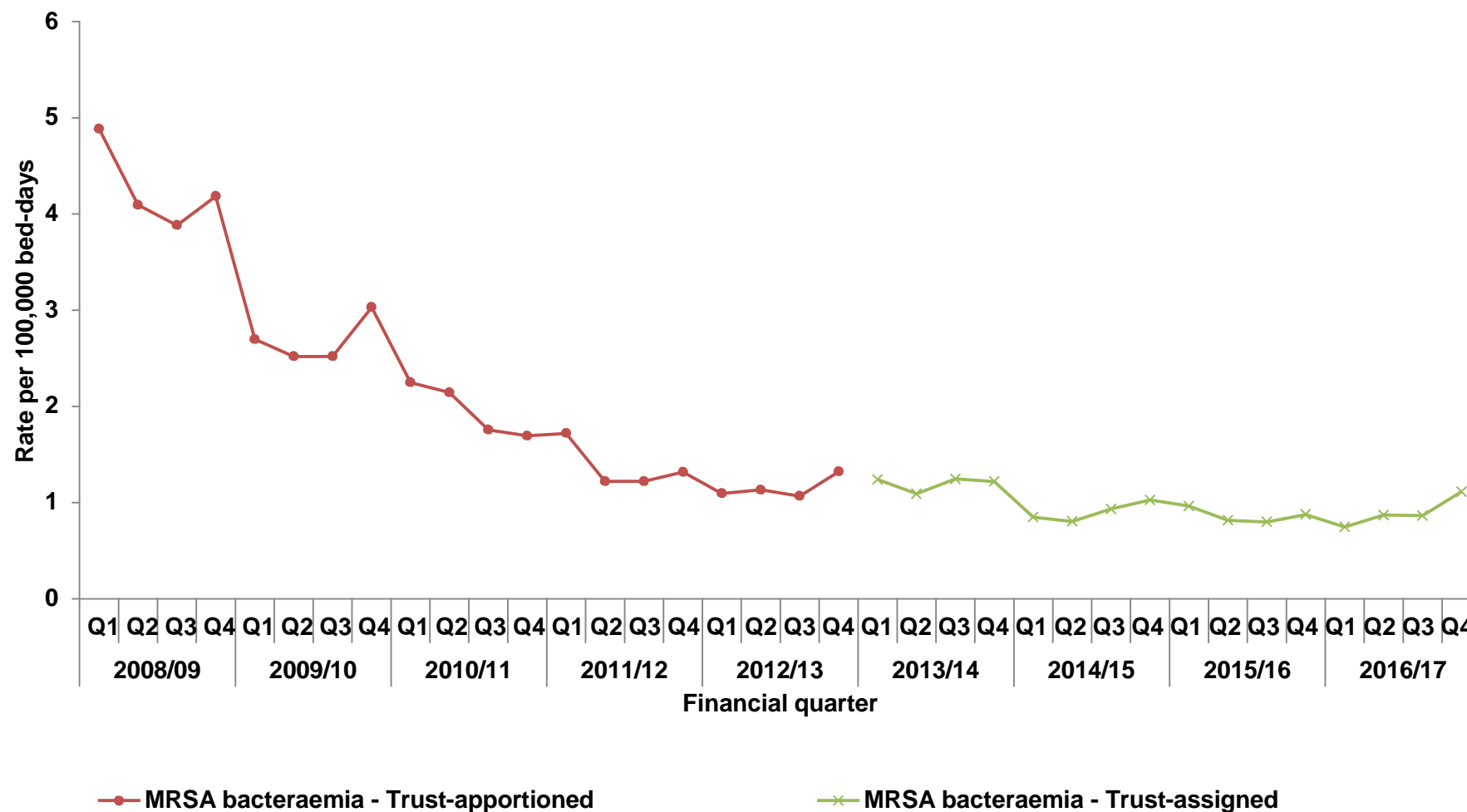
² Please refer to www.gov.uk/government/collections/staphylococcus-aureus-guidance-data-and-analysis for more information.

recent quarter (January-March 2017). This decrease is mostly due to the introduction of a 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 January-March 2017), counts and rates of trust-assigned cases increased from 73 to 99 cases and 0.8 to 1.1 cases per 100,000 bed-days respectively. Similarly within the same period, counts and rates of third-party assigned cases increased from 17 to 66 cases and 0.1 to 0.5 cases per 100,000 population respectively (figure 1a, 1b, 1c and table S1b).

When comparing the most recent quarter with the same quarter in the previous financial year (January-March 2016 to January-March 2017), rates of trust-assigned cases increased from 0.9 to 1.1 rates per 100,000 bed-days while CCG-assigned and third party-assigned cases both remained stable at 0.5 cases per 100,000 population.

Figure 1a: Quarterly rates of trust-apportioned/assigned MRSA bacteraemia: April-June 2008 to January-March 2017³



³ Since April 2013, MRSA bacteraemia have been reported by PIR assignment. Trust-apportioned MRSA bacteraemia are presented for historical purposes only.

Figure 1b: Quarterly rates of all reported MRSA bacteraemia: April-June 2007 to January-March 2017

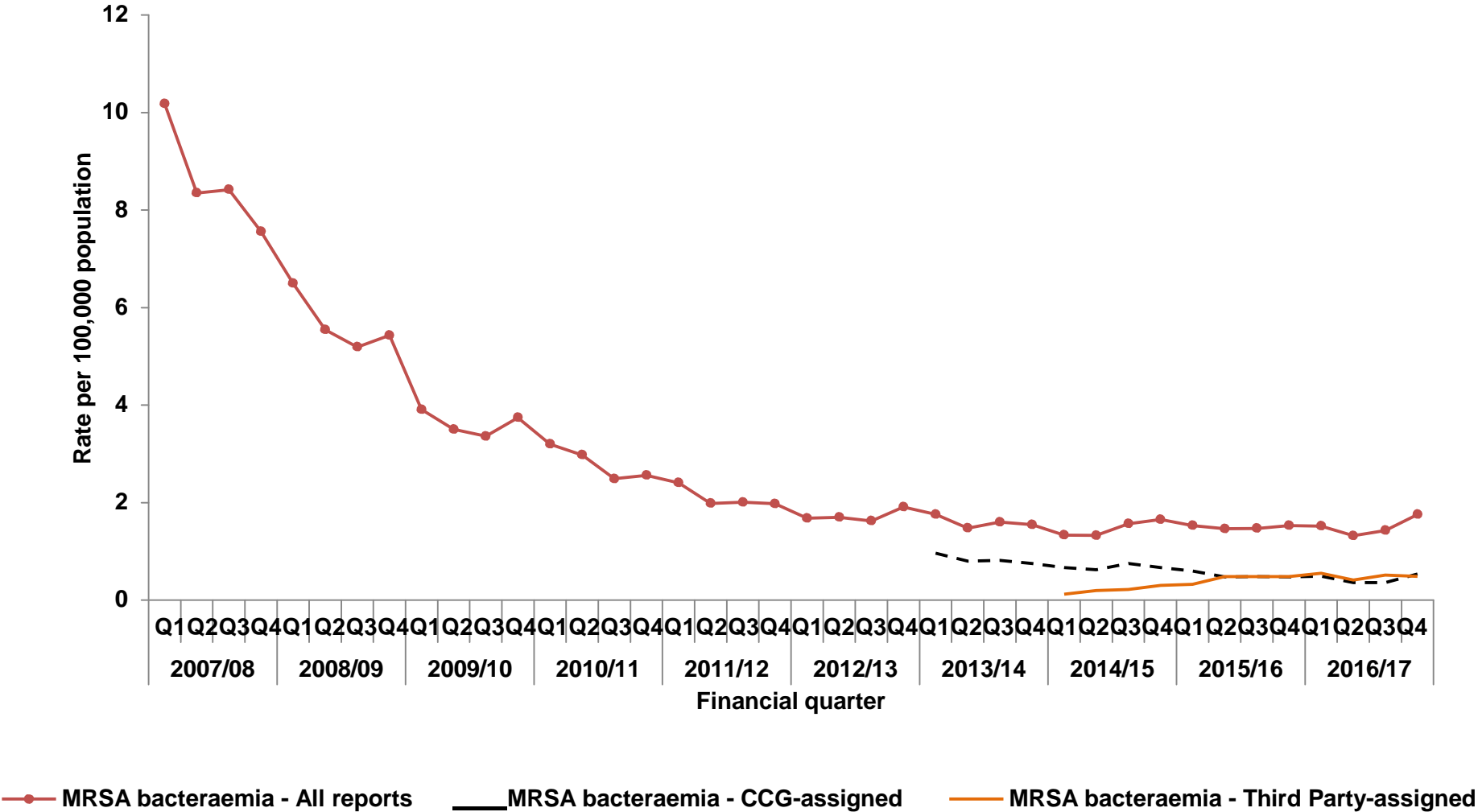
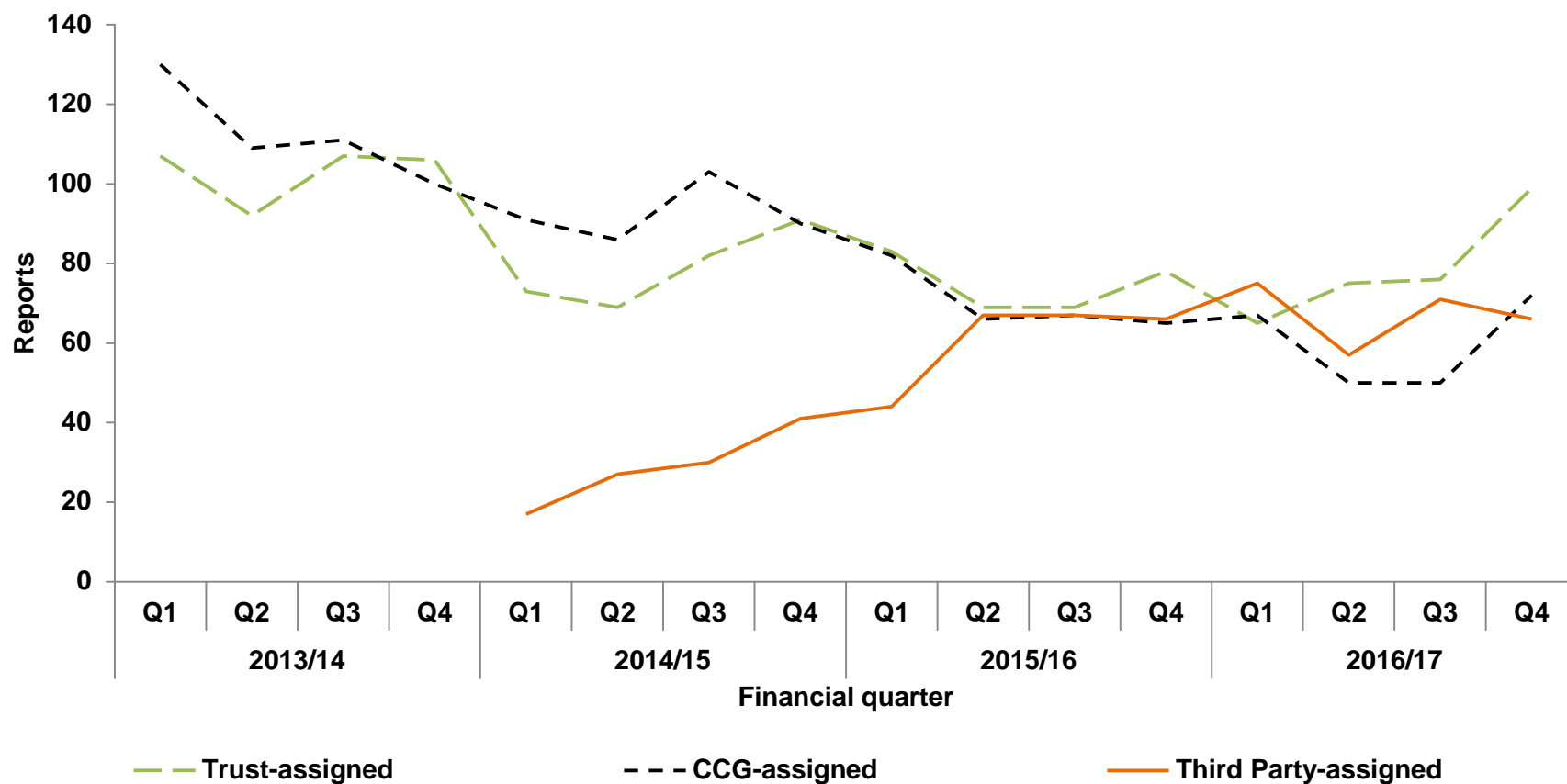


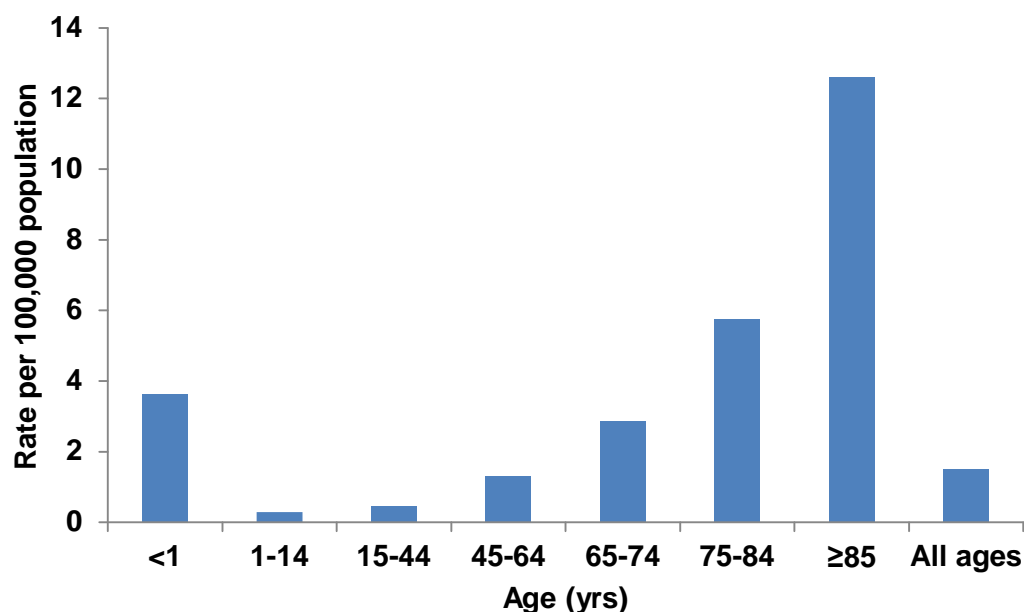
Figure 1c: Quarterly counts of all reported MRSA bacteraemia by PIR assignment: April-June 2013 to January-March 2017



Age distribution of MRSA bacteraemia: April 2016 to March 2017

It is clear from figure 1d that in the financial year 2016/17, rates of MRSA increased with age from the age group 1-14 years upwards. The age group with the highest rate was among those aged over 85 years at 12.6 cases per 100,000 population, the lowest rate was for the age group 1-14 years at 0.3. Among infants under 1 year old, the rate was 3.6.

Figure 1d: Age distribution of all reported MRSA: April 2016-March 2017



MSSA bacteraemia

Since the mandatory reporting of MSSA bacteraemia began in January-March 2011 there has been a general trend of increasing counts and rates. The counts of MSSA bacteraemia have increased by 36% (2,199 in Q1 2011 to 2,995 in Q1 2017) and the rates have increased by 31% (16.9 cases per 100,000 population in Q1 2011 to 22.2 in Q1 2017, figure 2b, table S2a)

However, over the same period (January-March 2011 to January-March 2017), counts and rates of trust-apportioned MSSA bacteraemia increased at a much slower pace: 5% (from 735 to 774 cases) and 4% (8.4 to 8.7 cases per 100,000 bed-days), respectively, (figure 2a, table S2a). Rates of all reported and trust-apportioned 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 January-March 2017) saw an increase in the rates of all reported and trust-apportioned MSSA bacteraemia by 23% (18.1 to 22.2 cases per 100,000 population) and 10% (7.9 to 8.7 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 January-March 2017), the percentage of all cases that were defined as trust-apportioned decreased over the same the period from 33% to 26%, indicating that over time there has been a greater increase in community-onset cases compared to trust-apportioned (hospital-onset) cases.

When comparing the most recent quarters (January-March 2016 and January-March 2017), there was an 11% increase in the rates of all reported MSSA bacteraemia (20.1-22.2 cases per 100,000 population) while the rates of trust-apportioned cases fluctuated at around 8.7 cases per 100,000 bed-days.

Figure 2a: Quarterly rates of trust-apportioned MSSA bacteraemia: January-March 2011 to January-March 2017

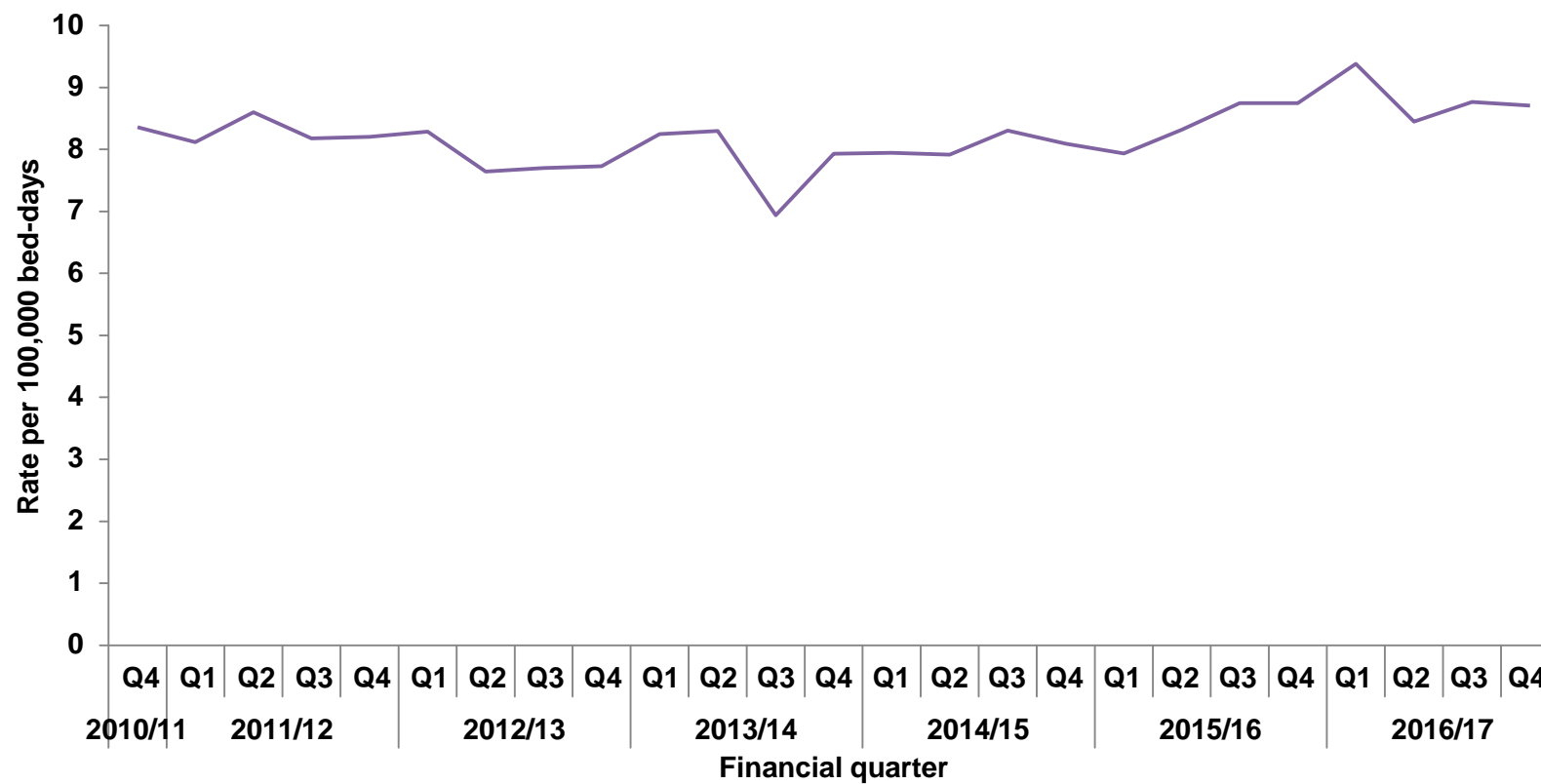
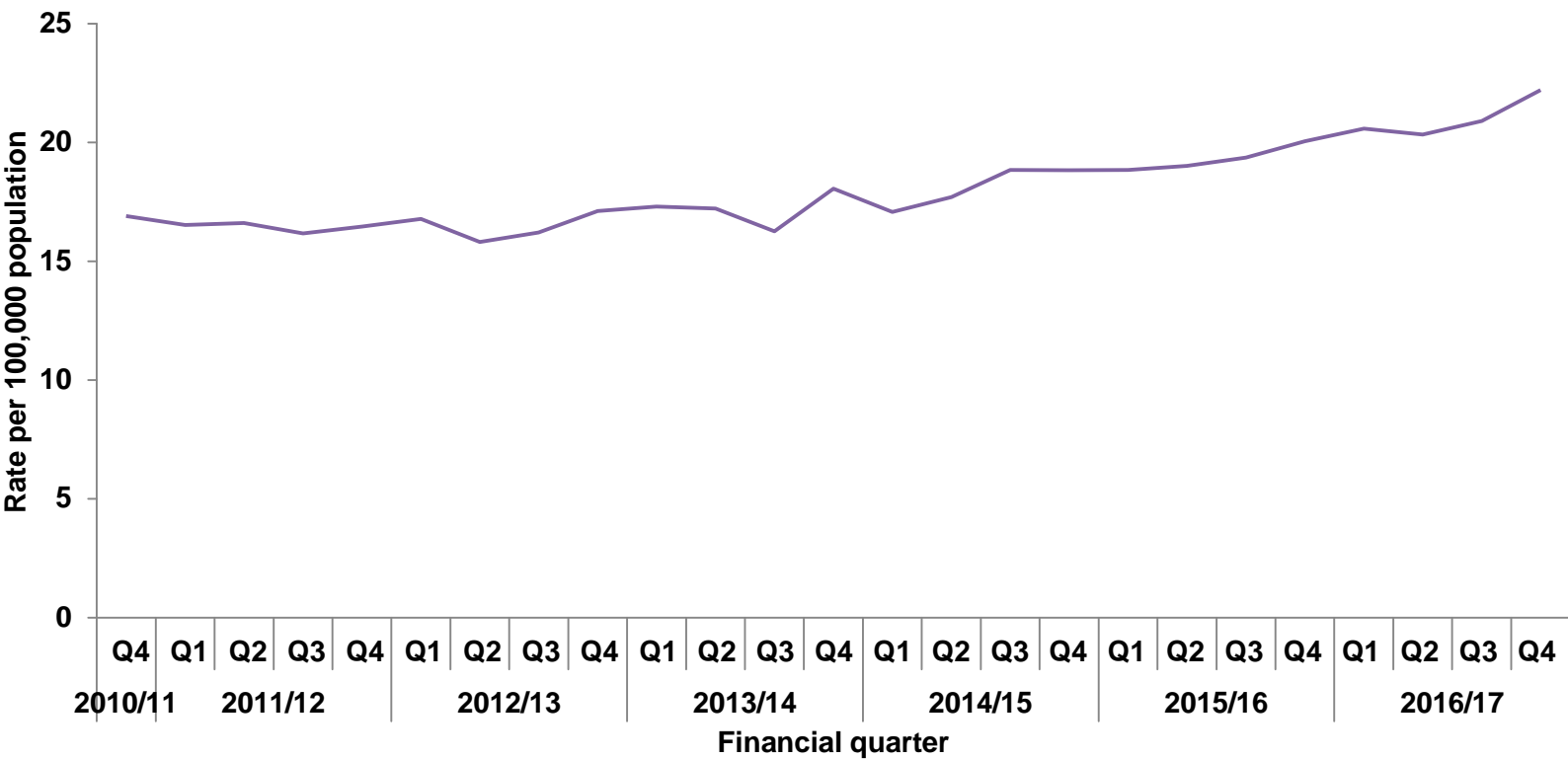


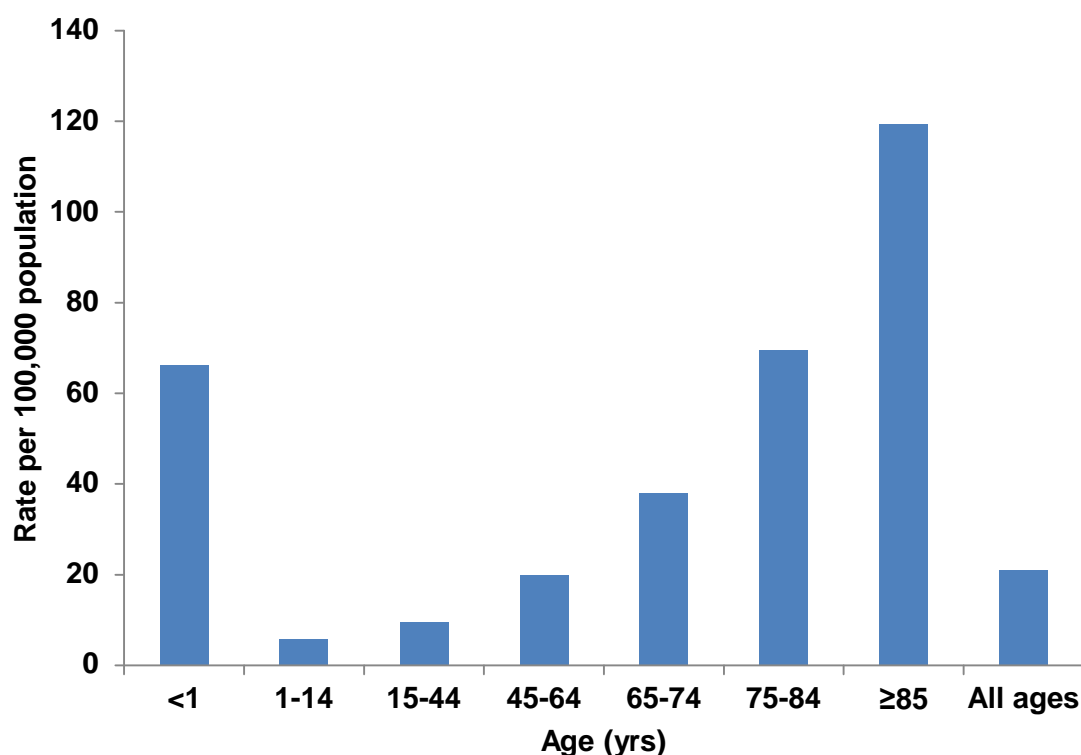
Figure 2b: Quarterly rates of all reported MSSA bacteraemia: January-March 2011 to January-March 2017



Age distribution of MSSA bacteraemia: April 2016 to March 2017

Between April 2016 and March 2017 (financial year 2016/17), the rate of all reported MSSA bacteraemia generally increased with age in patients aged 1 year or older, with the highest rate (119.4 cases per 100,000 population) observed in elderly patients (≥ 85 years old) and the lowest rate (5.8 cases per 100,000 population) observed in children (1-14 years old). A rate 66.2 cases per 100,000 population was observed among infants (<1 year old). This shows a greater burden of MSSA bacteraemia on infants compared to MRSA bacteraemia (figure 1d and 2c).

Figure 2c: Age distribution of all reported MSSA: April 2016-March 2017

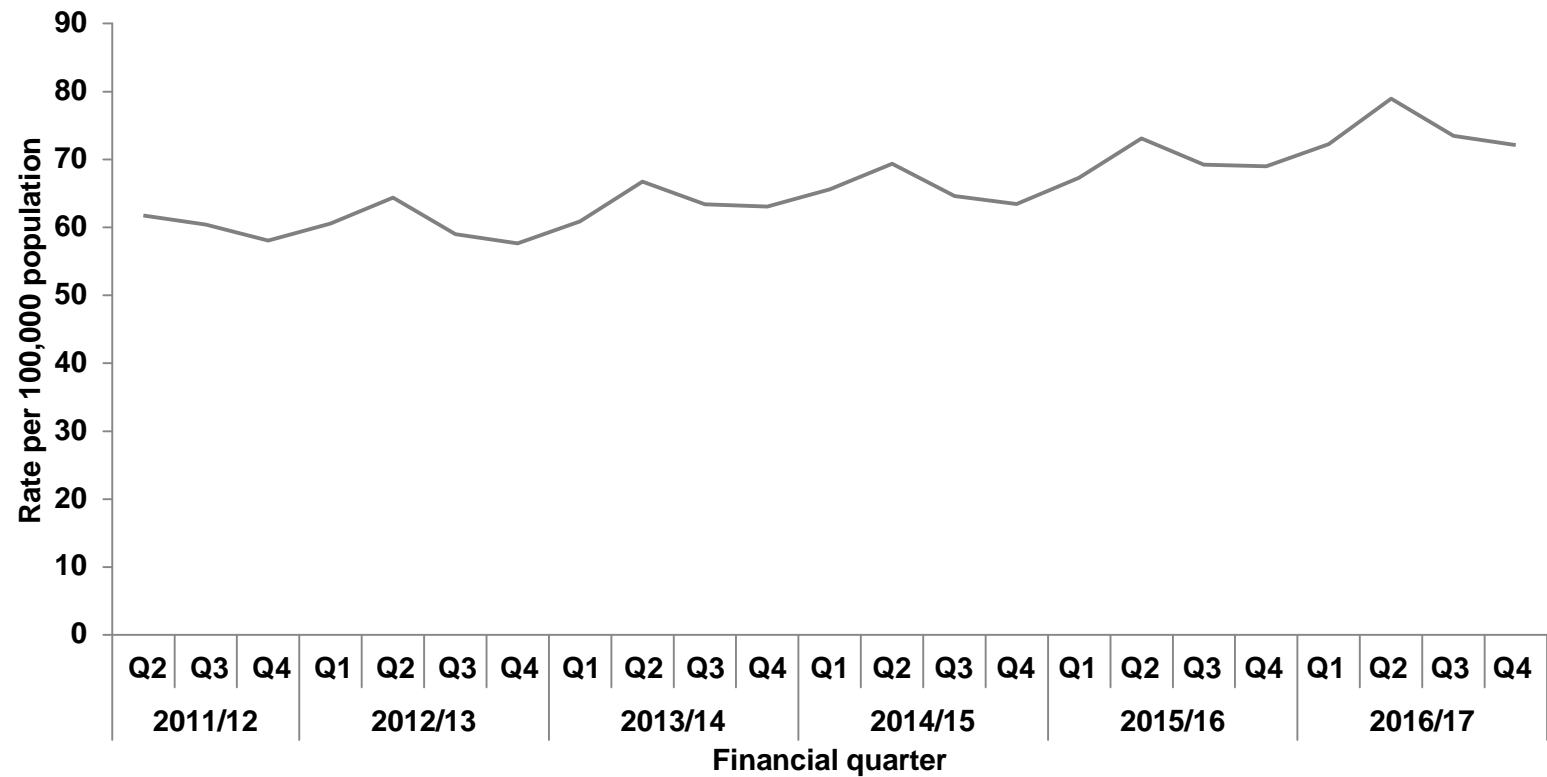


Epidemiological analyses of *Escherichia coli* bacteraemia data

The counts and rates of all reported *E. coli* bacteraemia has increased steadily since the initiation of mandatory surveillance of *E. coli* bacteraemia in July 2011 (figure 3a). Counts and rates of all reported *E. coli* bacteraemia increased by 18% (8,275 to 9,724 cases) and 17% (61.7 to 72.1 cases per 100,000 population), respectively, between July-September 2011 and January-March 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 time period.

This overall increase is also observed in the most recent quarters. Between January-March 2016 and January-March 2017, there was a 3% increase in counts (9,417 to 9,724 cases) and a 5% increase in rates (69.0 to 72.1 cases per 100,000 population) of all reported cases (figure 3a, table S3a). The highest rate of all reported cases since the beginning of the mandatory reporting of *E. coli* bacteraemia was also reported within this period: 79.0 cases per 100,000 populations in July-September 2016 (table S3a).

Figure 3a: Quarterly rates of *E. coli* bacteraemia: April-June 2007 to January-March 2017⁴

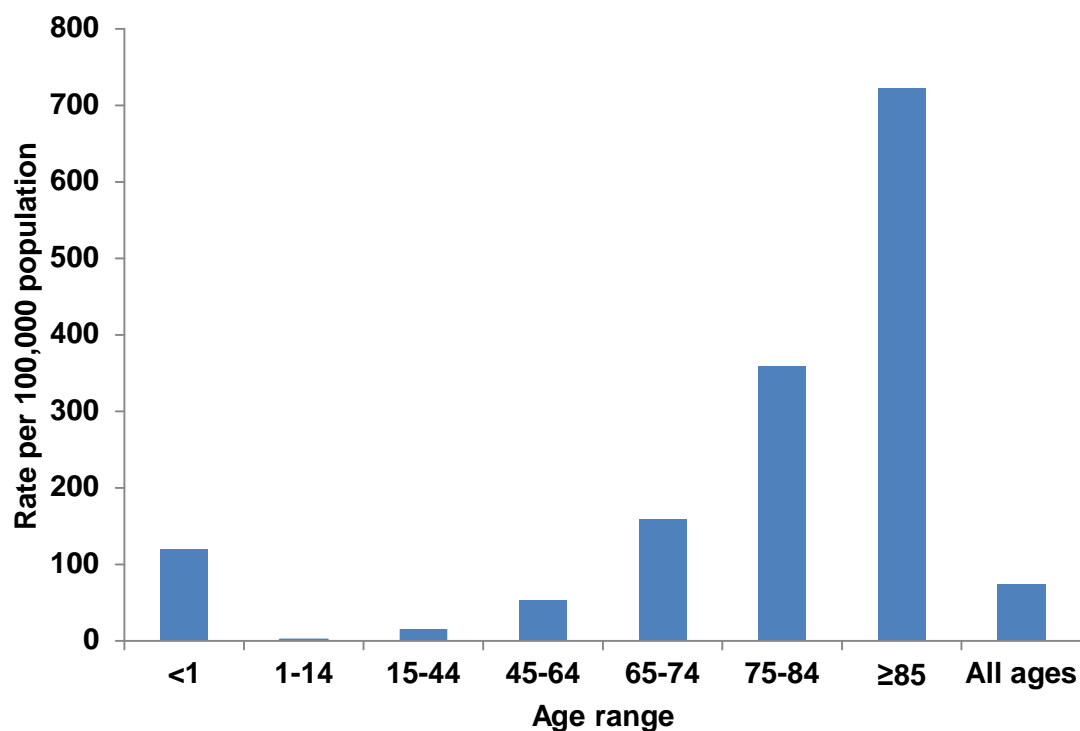


⁴ *E. coli* bacteraemia are not subject to apportionment

Age distribution of *E. coli* bacteraemia: April 2016 to March 2017

In financial year 2016/17, the rate of all reported *E.coli* bacteraemia generally increased with age in patients aged 1 year or older, with the highest rate of 721.6 cases per 100,000 (figure 3c) population observed in patients 85 years or older. The lowest rate (2.7 per 100,000 population) was observed in the age group 1-14 years old while a rate of 119.4 was observed in those less than 1 year old.

Figure 3c: Age distribution of all reported *E. coli*: April 2016-March 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 trust-apportioned cases of *C. difficile* infection (CDI). Seasonal peaks are present in the July-September quarter of most years (figure 4a, 4b and table S4a), this is particularly apparent among trust-apportioned 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 a 20% and 21% reduction in the counts (3,711 to 2,985 cases) and rates (28.0 and 22.1 cases per 100,000 population) of CDI between January-March 2012 and the most recent quarter (January-March 2017) (figure 4b, table S4a).

A similar trend was observed in trust-apportioned 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 22% in both counts and rates of trust-apportioned cases (1,163 to 1,094 cases and 18.2 to 12.3 cases per 100,000 bed-days respectively) between January-March 2012 and the most recent quarter.

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

In the most recent quarters (January-March 2016 and January-March 2017), counts and rates of all reported CDI increased slightly by 1% (2,944 to 2,985 cases) and 3% (21.6 to 22.1 cases per 100,000 population) respectively. However, the counts and rates of trust-apportioned CDI cases both decreased by 7% (1,176 to 1,094 cases and 13.2 to 12.3 cases per 100,000 bed-days, respectively).

Figure 4a: Quarterly rates of trust-apportioned CDI: April-June 2007 to January-March 2017

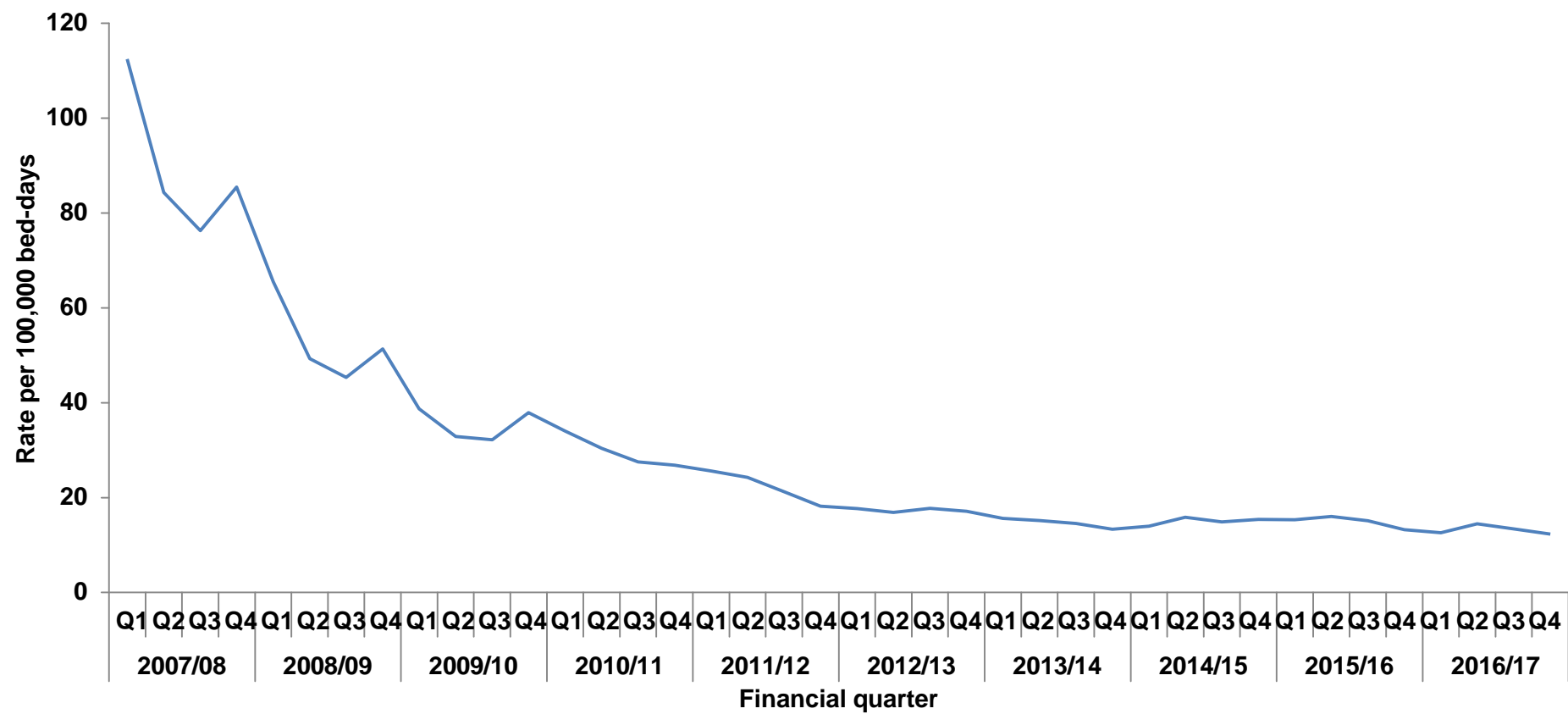
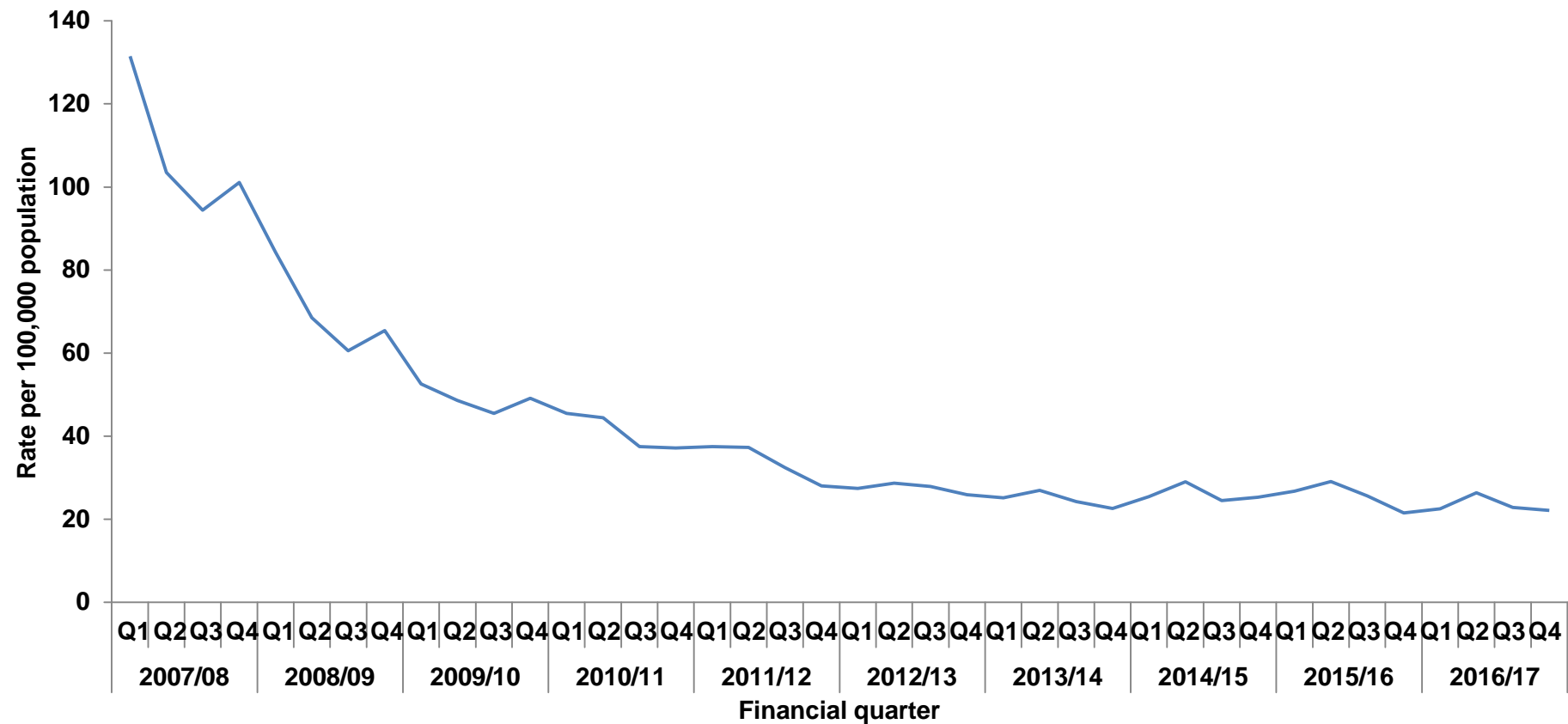


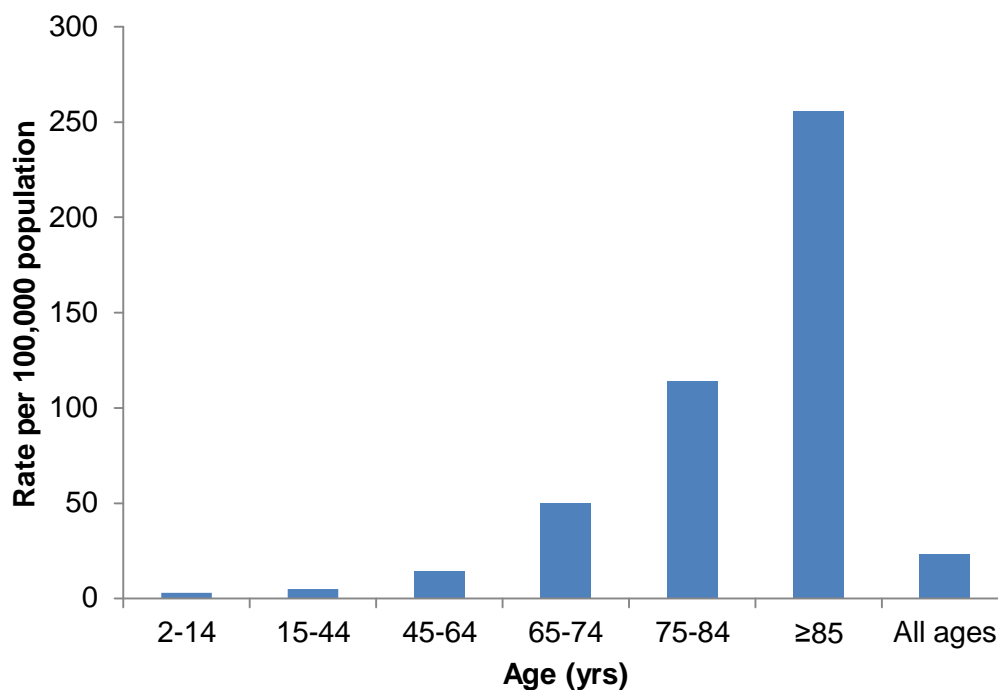
Figure 4b: Quarterly rates of all reported CDI: April-June 2007 to January-March 2017



Age distribution of CDI: April 2016 to March 2017

In financial year 2016/17, the rate of all reported CDI generally increased with age in patients aged 2 year or older, with the highest rate observed in over 85 year olds (255.7 cases per 100,000 population) and the lowest rate observed in the age group 2-14 years old (3.0 cases per 100,000 population) (figure 4c).

Figure 4c: Age distribution of all reported CDI: April 2016-March 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 Q3 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 will use the data as published in the KH03 dataset. This affects all reports published since 1 December 2015. 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 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 trust-apportioned/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

The KH03 data used for this report was published on 24 November 2016. 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 2007-2015 mid-year resident population estimates which are based on the 2011 census for England (2016 estimates are based on 2015 mid-year estimates). These are available at:

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 bacteraemia 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 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').

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

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

MRSA and MSSA bacteraemia and CDI trust-apportioned incidence:

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

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

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*.

Rate ratio (RR):

This is the ratio between two rates. This is an expression of the likelihood that an outcome will occur in a in a group compared to another group. For example, if the rate

of MRSA bacteraemia was two per 100,000 population in a year among men, and four per 100,000 population in a year among women, the rate ratio would be two. The rate would be two times higher among women than men. This is calculated as follows:

$$= \frac{\text{rate of infection among women (per 100,000 population)}}{\text{rate of infection among men (per 100,000 population)}}$$

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