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 October-December 2016)

March 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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Contents

Data included in the quarterly epidemiological commentary

This document contains quarterly, national and sub-national (NHS local offices) level epidemiological commentaries for MRSA, MSSA and *E. coli* bacteraemias 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 cases of MRSA[1] 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

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
- 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 18 January 2017.

[1] Since April 2013, MRSA cases have been reported by PIR assignment. This is presented for historical purposes only.

Epidemiological analyses of *Staphylococcus aureus* bacteraemia data

MRSA bacteraemia

Since April 2013, all NHS organisations reporting positive 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.

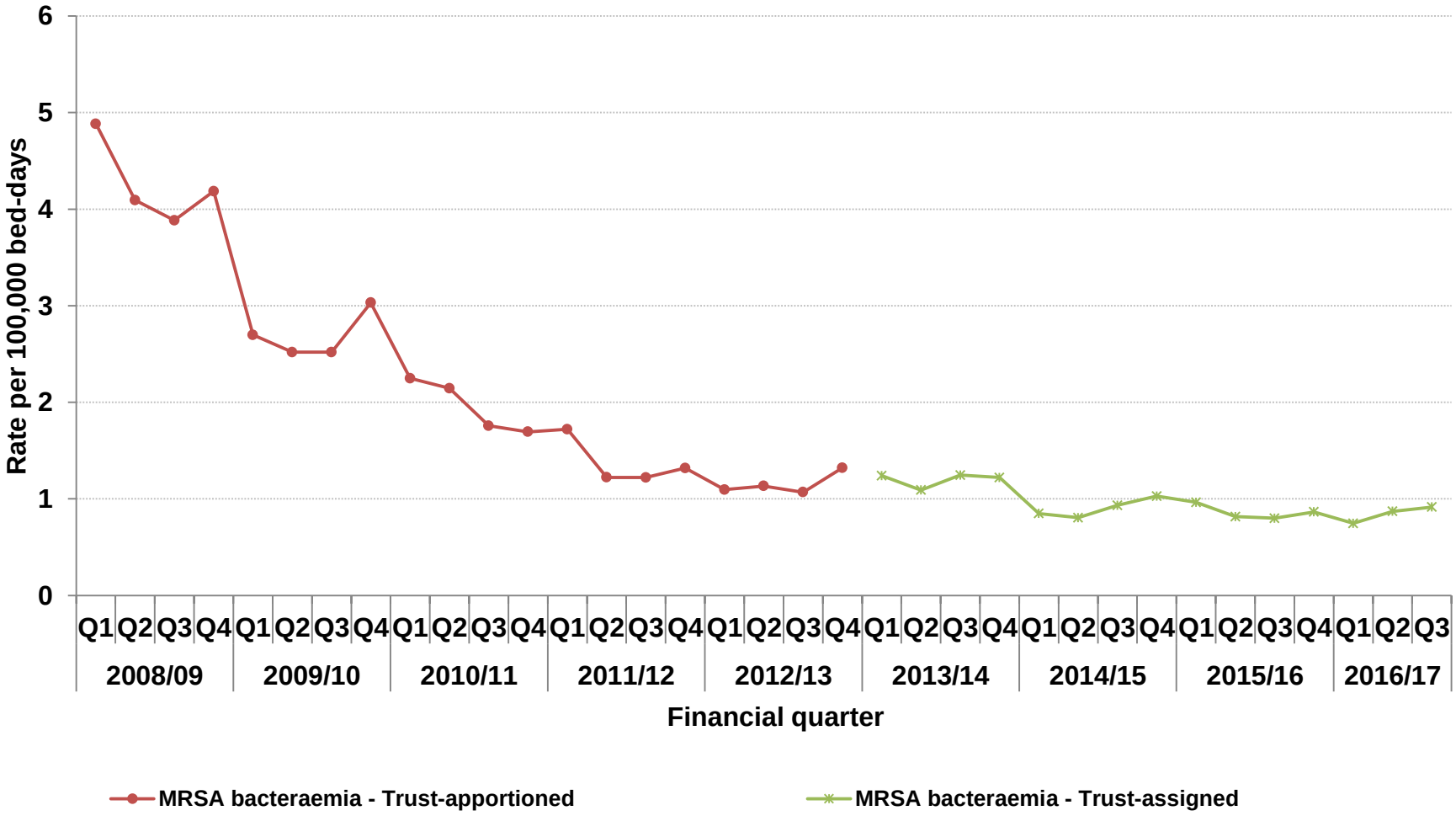
There has been an overall decreasing trend in the counts and rates of all reported MRSA bacteraemia since the mandatory surveillance of MRSA bacteraemia began in April-June 2007 (figures 1b, table 1a) and a similar overall decrease in counts and rates of trust-apportioned cases since apportioning of MRSA bacteraemia cases began in April-June 2008 (figure 1a, table 1a). 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 2013 – 85% (10.2 to 1.7 cases per 100,000 population) and 78% (4.9 to 1.1 cases per 100,000 bed-days) respectively. This was followed by a further 15% and 21% decrease in the rates of all reported (1.7 to 1.4 cases per 100,000 population) and trust-apportioned cases (1.1 to 0.9 cases per 100,000 bed-days) respectively between that time and the most recent quarter (January-March 2013 to October-December 2016). The decrease in rates of all reported cases continued was also observed when comparing most recent quarter and the same quarter in the previous financial year (October-December 2015 to October-December 2016) - from 1.5 to 1.4 cases per 100,000 population.

PIR process for all MRSA bacteraemia cases began in April 2013. Between that time and January-March 2014 (financial year 2013/14), the rates of trust-assigned case 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. Subsequently after the introduction of third-party assignment category in April 2014, counts and rates of CCG assigned cases decreased from 91 to 77 cases and 0.7 to 0.6 cases per 100,000 population respectively between April-June 2014 and the most recent quarter (October-December 2016). Over the same period, counts and rates of trust-assigned cases increased from 73 to 79 cases and 0.8 to 0.9 cases per 100,000 bed-days respectively. Similarly within the same period, counts and rates of third-party assigned cases increased from 17 to 41 cases and 0.1 to 0.3 cases per 100,000 population respectively (figure 1a, 1b, 1c and table 1b).
When comparing the most recent quarter with the same quarter in the previous financial year (October-December 2015 to October-December 2016), rates of trust and CCG-

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

assigned cases increased from 0.8 to 0.9 cases per 100,000 bed-days and 0.5 to 0.6 cases per 100,000 population respectively while rates of third party-assigned cases decreased from 0.5 to 0.3 cases per 100,000 population.

Figure 1a: Quarterly rates of trust-apportioned/assigned MRSA bacteraemia: April-June 2008 to October-December 2016[3]



[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 October-December 2016

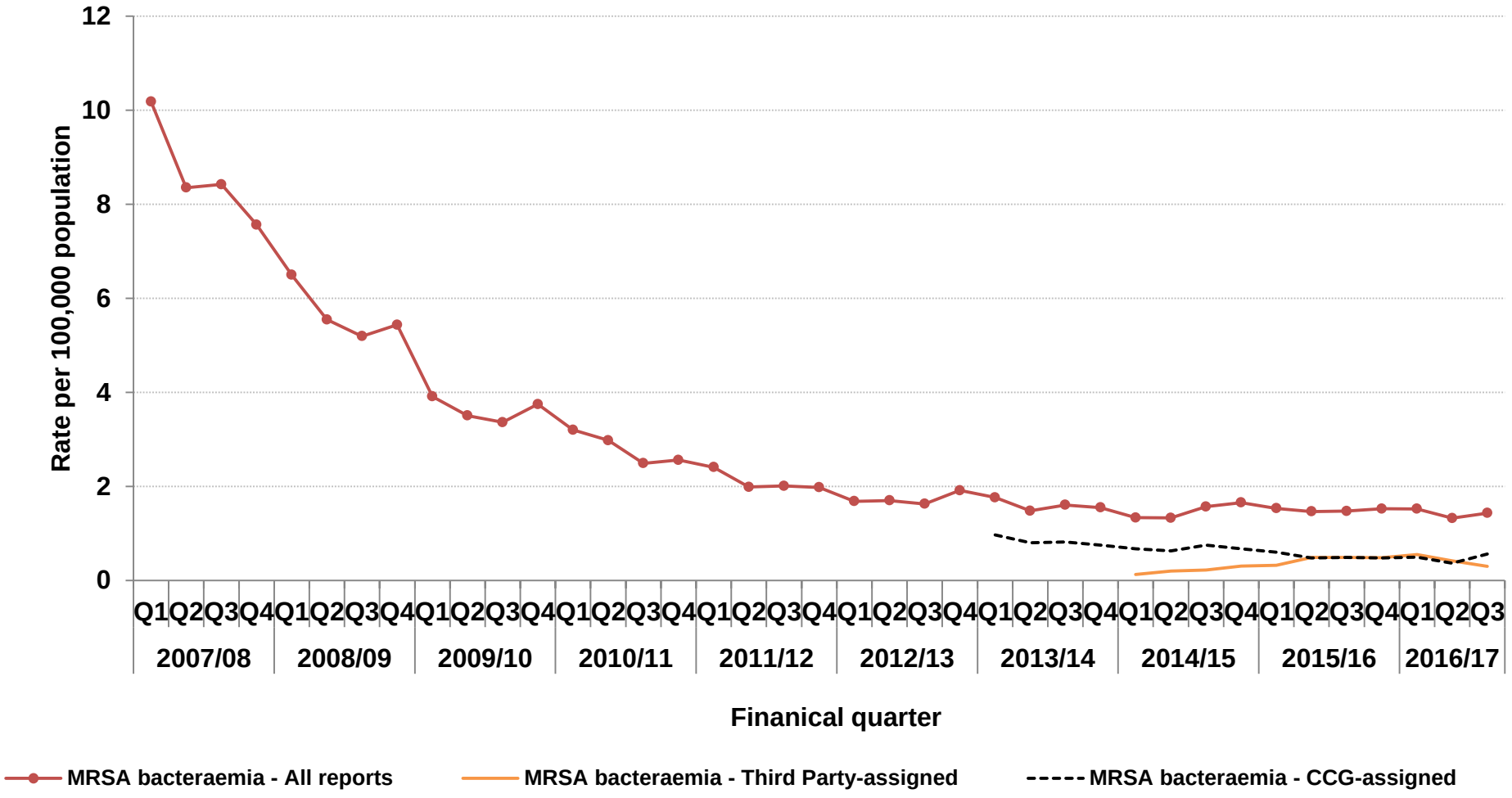
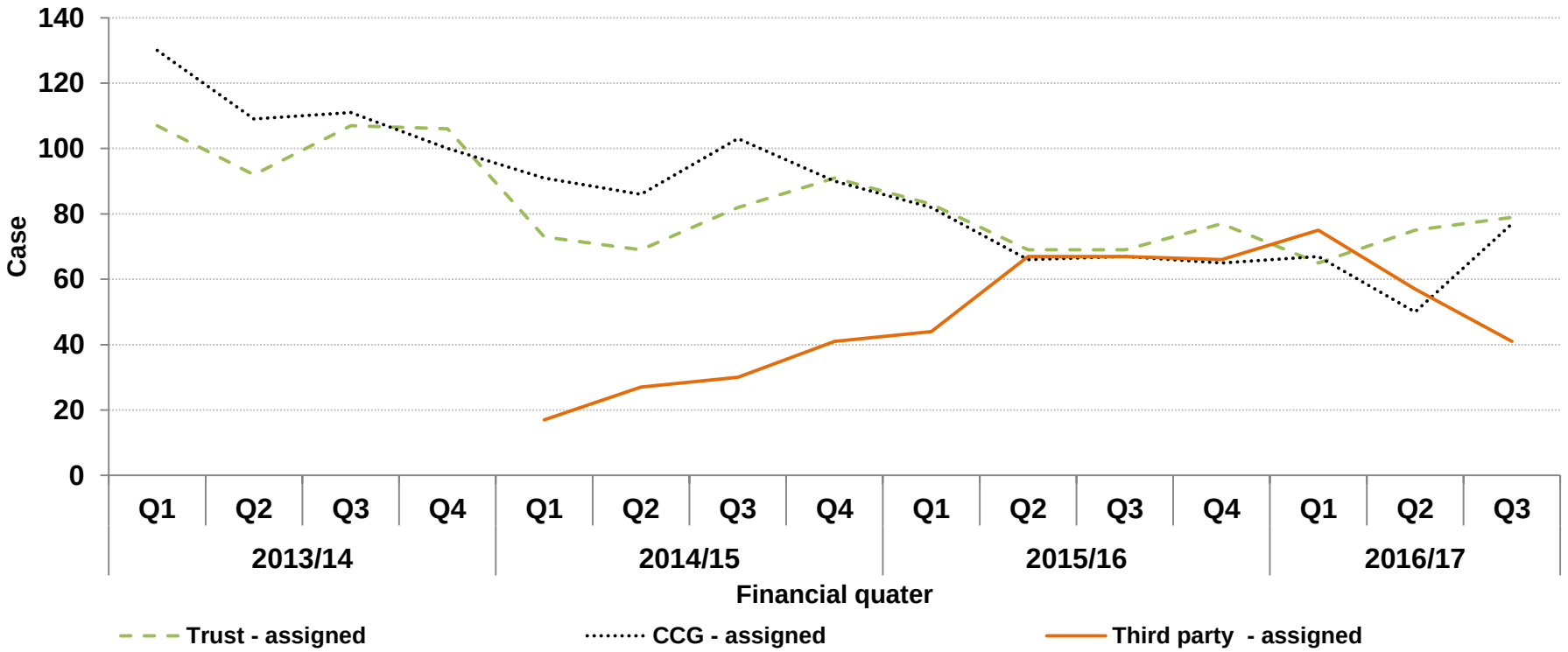


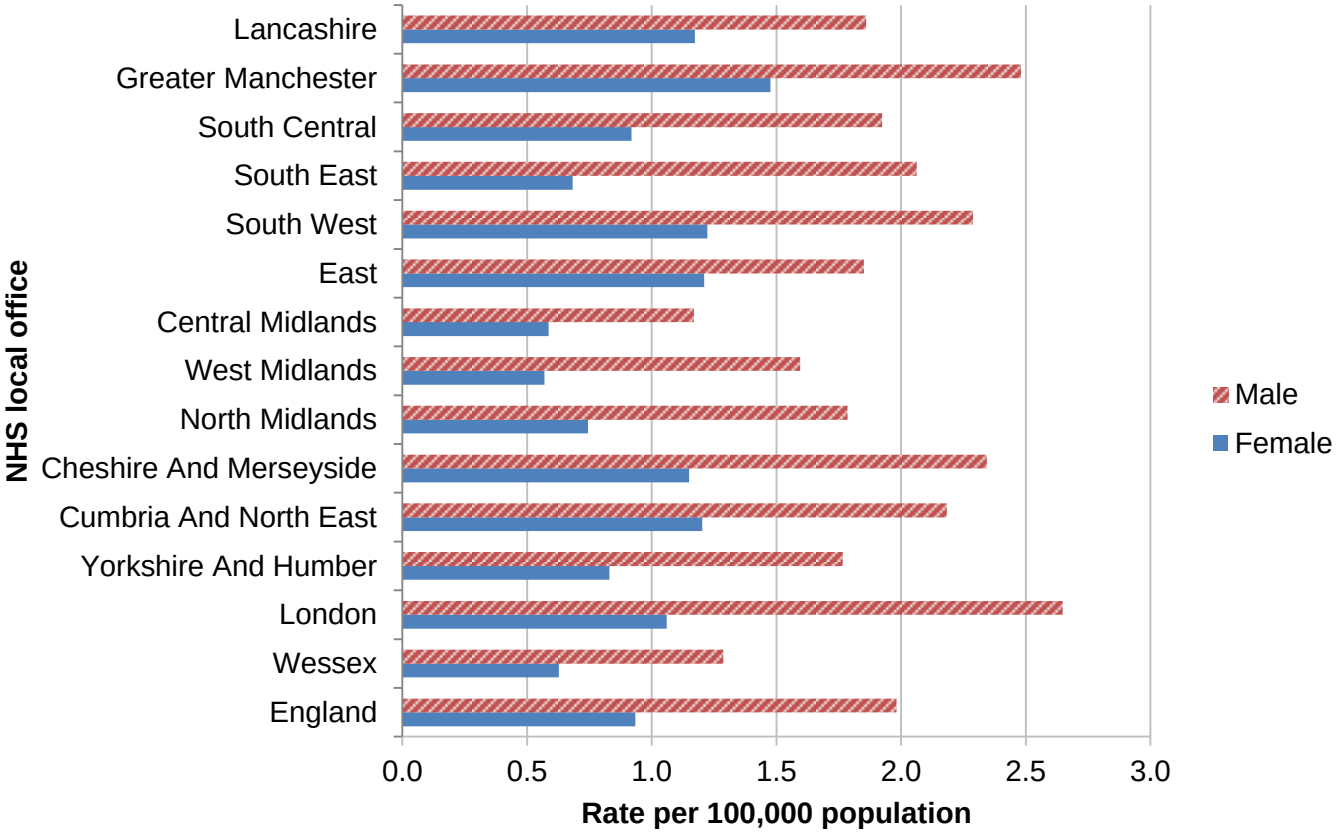
Figure 1c: Quarterly counts of all reported MRSA bacteraemia by PIR assignment: April-June 2013 to October-December 2016



Demographic distribution of MRSA bacteraemia: October 2015 to December 2016

Between October 2015 and December 2016, the rate of all reported MRSA bacteraemia was higher among males (2.0 cases per 100,000 population) compared to females (0.9 cases per 100,000 population). Incidence of MRSA bacteraemia in males was twice as likely compared to females (Rate Ratio (RR): 2.1) (figure 1d, table 1c). This trend was observed across different NHS local offices; however the difference in rates between genders varied greatly in some areas. The highest difference in rates was observed in South East where an infections in males was three times more likely compared to females (RR: 3.0), while the lowest difference was in East with a one and half times higher likelihood of infection in males compared to females (RR: 1.5)

Figure 1d: Gender distribution of all reported MRSA bacteraemia by NHS local offices: October 2015-December 2016



MSSA bacteraemia

There has been a general trend of increasing counts (31%; from 2,199 to 2,879 cases) and rates (24%; from 16.9 to 20.9 cases per 100,000 population) of all reported MSSA bacteraemia respectively since the mandatory reporting of MSSA bacteraemia began in January-March 2011 (figure 2b, table 2a). Rates of all reported cases from earlier quarters between January-March 2011 and October-December 2013 were relatively stable, fluctuating between 16-17 cases per 100,000 population. However, in subsequent quarters between October-December 2013 and the most recent quarter (October-December 2016) the rates of all reported MSSA bacteraemia increased each quarter when compared to the

same quarter from the previous financial year. The largest increase in rates of all reported MSSA bacteraemia occurring over this period (October-December 2013 to October-December 2016) with a 28% from 16.8 to 20.9 cases per 100,000 population (figure 2b, table 2a). However, counts and rates of trust-apportioned MSSA bacteraemia increased at a much slower rate compared to that of all reported cases over the same period. Between January-March 2011 and October-December 2016, the counts and rates of trust-apportioned cases increased by only 5% (from 735 to 728 cases) and 7% (8.4 to 8.9 cases per 100,000 bed-days) respectively, (figure 2a, table 2a).

While the number of all reported MSSA bacteraemia increased throughout the surveillance period of MSSA (January-March to October-December 2016), the percentage of these cases that were trust-apportioned decreased from 33% to 27% over the same period, indicating that overtime there has been greater increase in community onset cases compared to those that are trust-apportioned (and hospital onset cases).

These overall increases were also observed when comparing the most recent quarters. Between October-December 2015 and October-December 2016, there was an 8% increase in both counts and rates of all reported MSSA bacteraemia (2,672-2,879 cases; 19.4-20.9 cases per 100,000 population respectively) (figure 2b, table 2a). Similarly over the same period there was a 2% increase in both counts and rates of trust-apportioned cases (755-770 cases; 8.7-8.9 cases per 100,000 bed-days respectively) (figure 2a, table 2a).

Figure 2a: Quarterly rates of trust-apportioned MSSA bacteraemia: January-March 2011 to October-December 2016

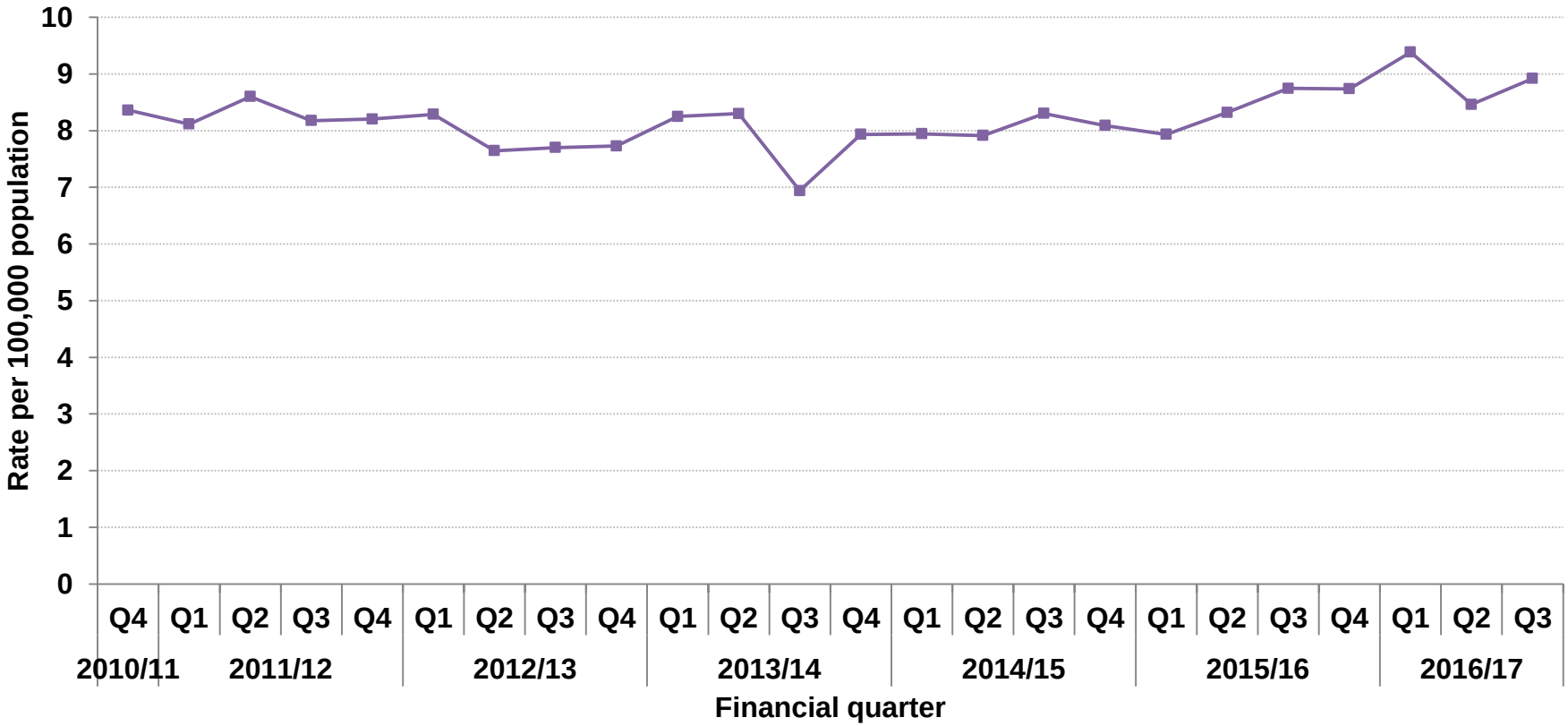
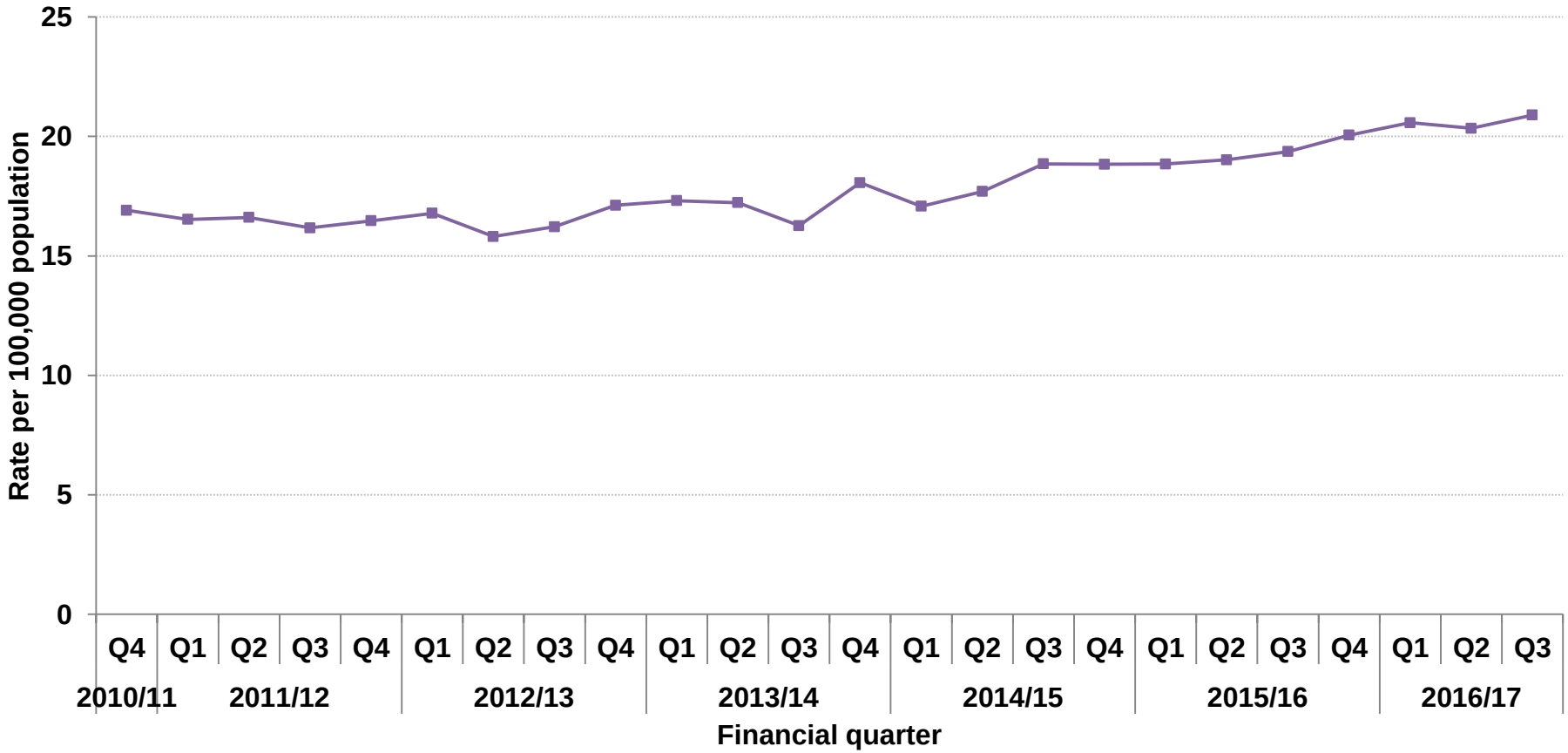


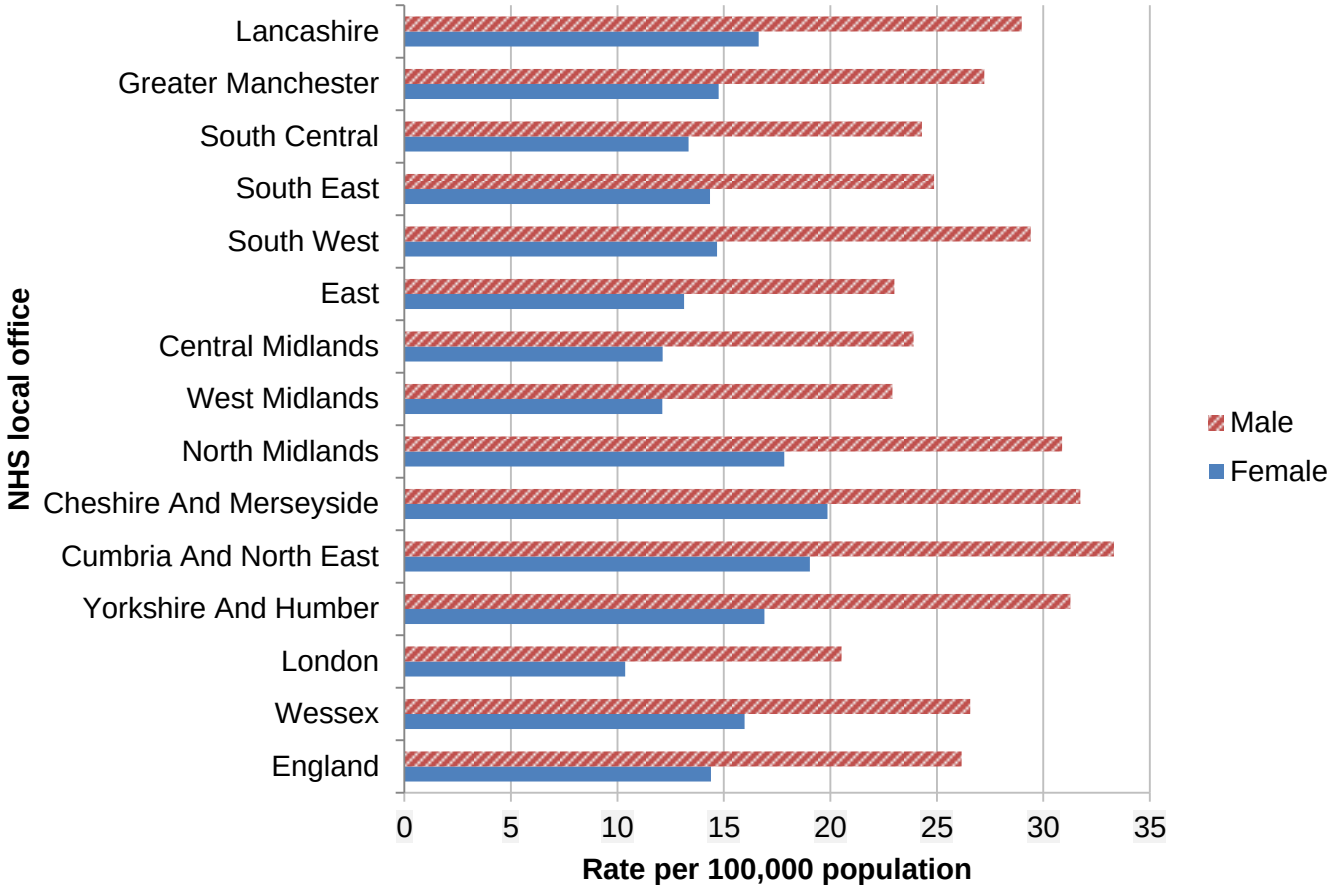
Figure 2b: Quarterly rates of all reported MSSA bacteraemia: January-March 2011 to October-December 2016



Demographic distribution of MSSA bacteraemia: October 2015 to December 2016

Between October 2015 and December 2016 the rate of all MSSA bacteraemia reported in England was higher among males (26.2 cases per 100,000 population) compared to females (14.4 cases per 100,000 population). Similar to the incidence of MRSA bacteraemia among the genders, MSSA bacteraemia in males was about twice as likely compared to females (RR: 1.8) (figure 2c, table 2b). However this difference was less varied across NHS local offices, when compared to the incidence of MRSA. The lowest difference was observed in Cheshire And Merseyside with a one and half times more higher likely of MSSA bacteraemia in men compared to women (RR: 1.6) while the highest differences were observed in London, Central Midlands and South West where there was a twice as much higher likely of MSSA bacteraemia in men compared to women (RR: 2 each) (figure 2c, table 2b).

Figure 2c: Gender distribution of all reported MSSA bacteraemia by NHS local offices: October 2015-December 2016

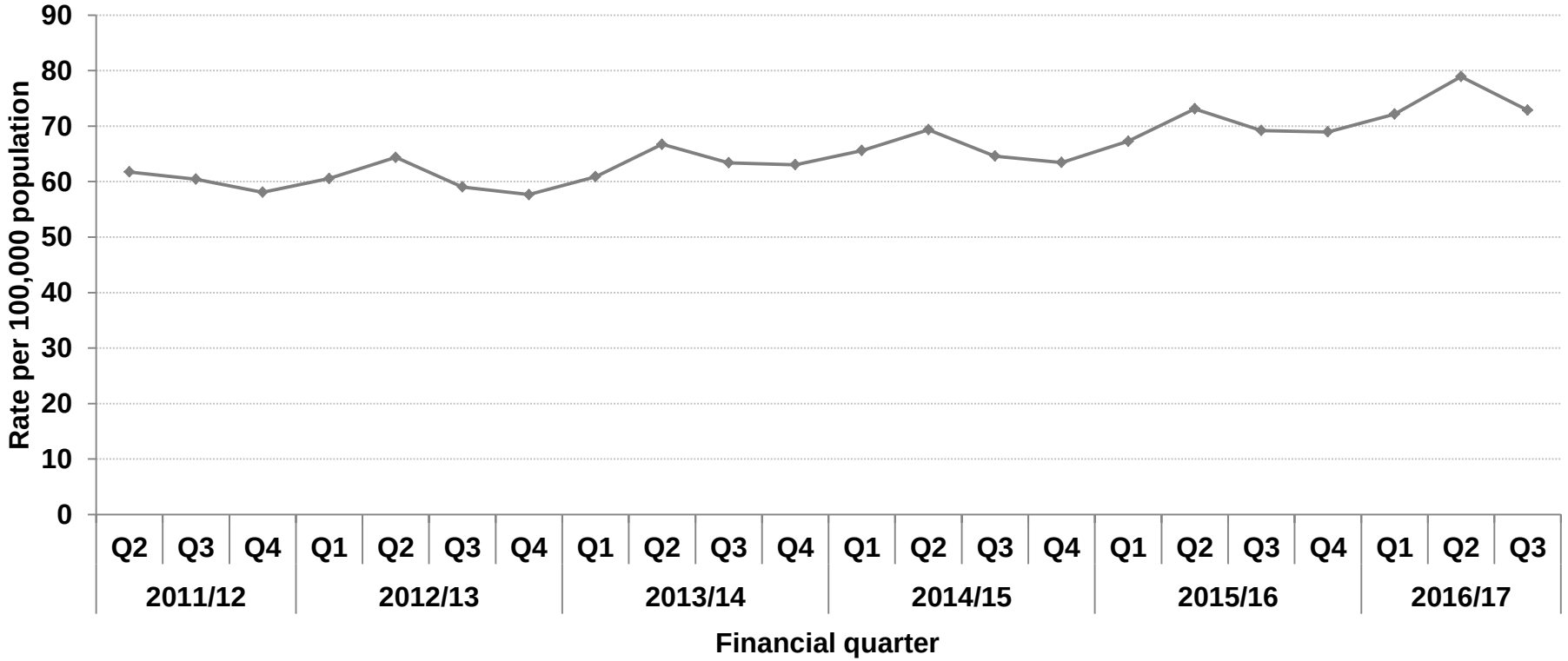


Epidemiological analyses of *Escherichia coli* bacteraemia data

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). Count and rates of all reported *E. coli* bacteraemia increased by 21% (8,275 to 10,042 cases) and 18% (61.7 to 72.9 cases per 100,000 population) respectively between July-September 2011 and October-December 2016, with seasonal peaks generally reported between July and September each year (figure 3a, table 3a). 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 has also been observed in the most recent quarters. Between October-December 2015 and October-December 2016, there was a 5% increase in both counts (9,551to 10,042 cases) and rates (69.2 to 72.9 cases per 100,000 population) of all reported cases (figure 3a, table 3a). The highest rate of all reported cases since the beginning of the mandatory reporting of *E. coli* bacteraemia was also reported within this period: 78.9 cases per 100,000 populations in July-September 2016 (table 3a).

Figure 3a: Quarterly rates of *E. coli* bacteraemia: April-June 2007 to July-September 2016[4]

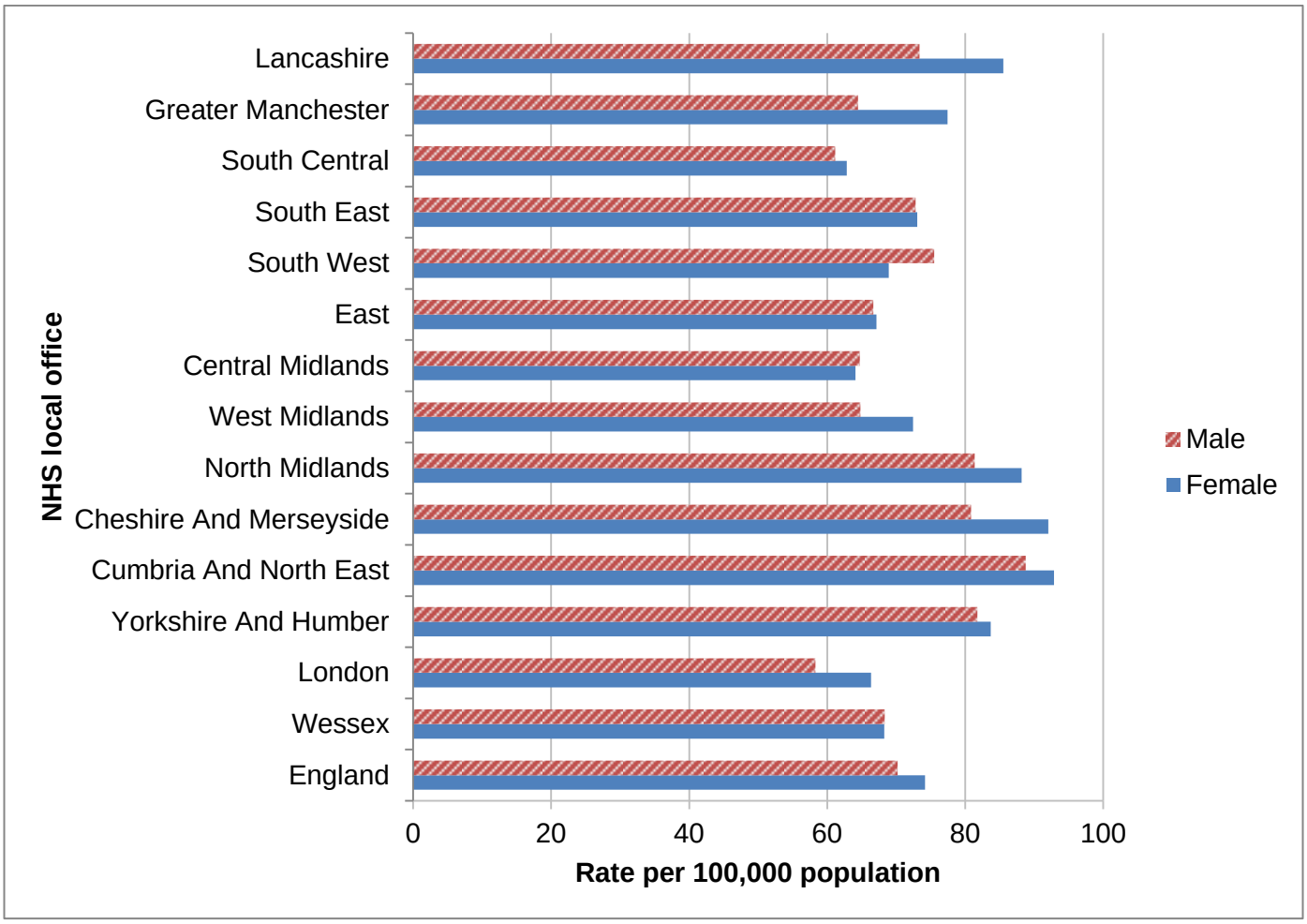


[4] *E. coli* bacteraemia are not subject to apportionment

Demographic distribution of *E. coli* bacteraemia: October 2015 to December 2016

Between October 2015 and December 2016, the rate of all *E. coli* bacteraemia reported in England among females (74.2 cases per 100,000 population) and males (70.2 cases per 100,000 population) were similar (RR: 1.1) (figure 3b, table 3b). This trend was also observed in most NHS local offices.

Figure 3b: Gender distribution of all reported *E. coli* bacteraemia by NHS local offices: October 2015-December 2016



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* infections (CDI) with seasonal peaks in July-September quarter of each year (figure 4a, 4b and table 4a) particularly 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), subsequently followed by a 15% and 18% reduction (3,711 to 3,155 and 28.0 and 22.9 cases per 100,000 population respectively) between January-March 2012 and the most recent quarter (October-December 2016) (figure 4b, table 4a). A similar trend was observed in trust-apportioned CDI with greater decreases in counts and rates over the same period compared to all reported cases. Counts and rates of trust-apportioned CDI decreased by an initial 85% (10,436 to 1,613 cases) and 84% (112.5 to 18.2 cases per 100,000 bed-days) respectively between April-2007 and January-March 2012, followed by a further 27% (1,163 to 1,179 cases) and 25% (18.2 to 13.7 cases per 100,000 bed-days) respectively between January-March 2012 and the most recent quarter (figure 4a, table 4a).

These decreases are also observed when comparing the most recent quarters - October-December 2015 and October-December 2016. Counts and rates of all reported CDI both decreased by 11% (3,535 to 3,155 cases and 25.6 to 22.9 cases per 100,000 population respectively) while counts and rates of trust-apportioned CDI cases both decreased by 10% (1,307 to 1,179 cases and 15.1 to 13.7 cases per 100,000 bed-days respectively) over the same time period (figure 4a, table 4a)

Figure 4a: Quarterly rates of trust-apportioned CDI: April-June 2007 to October-December 2016

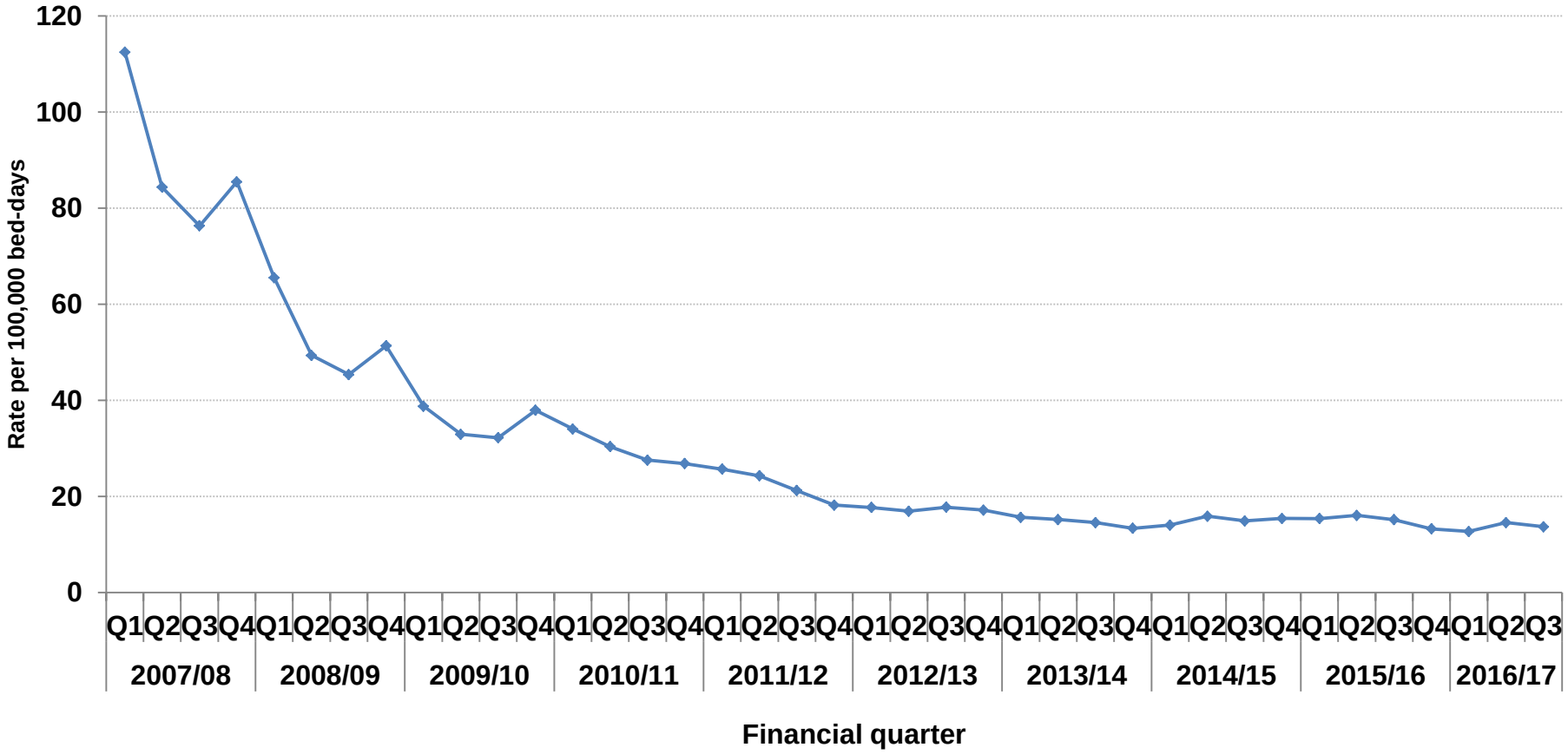
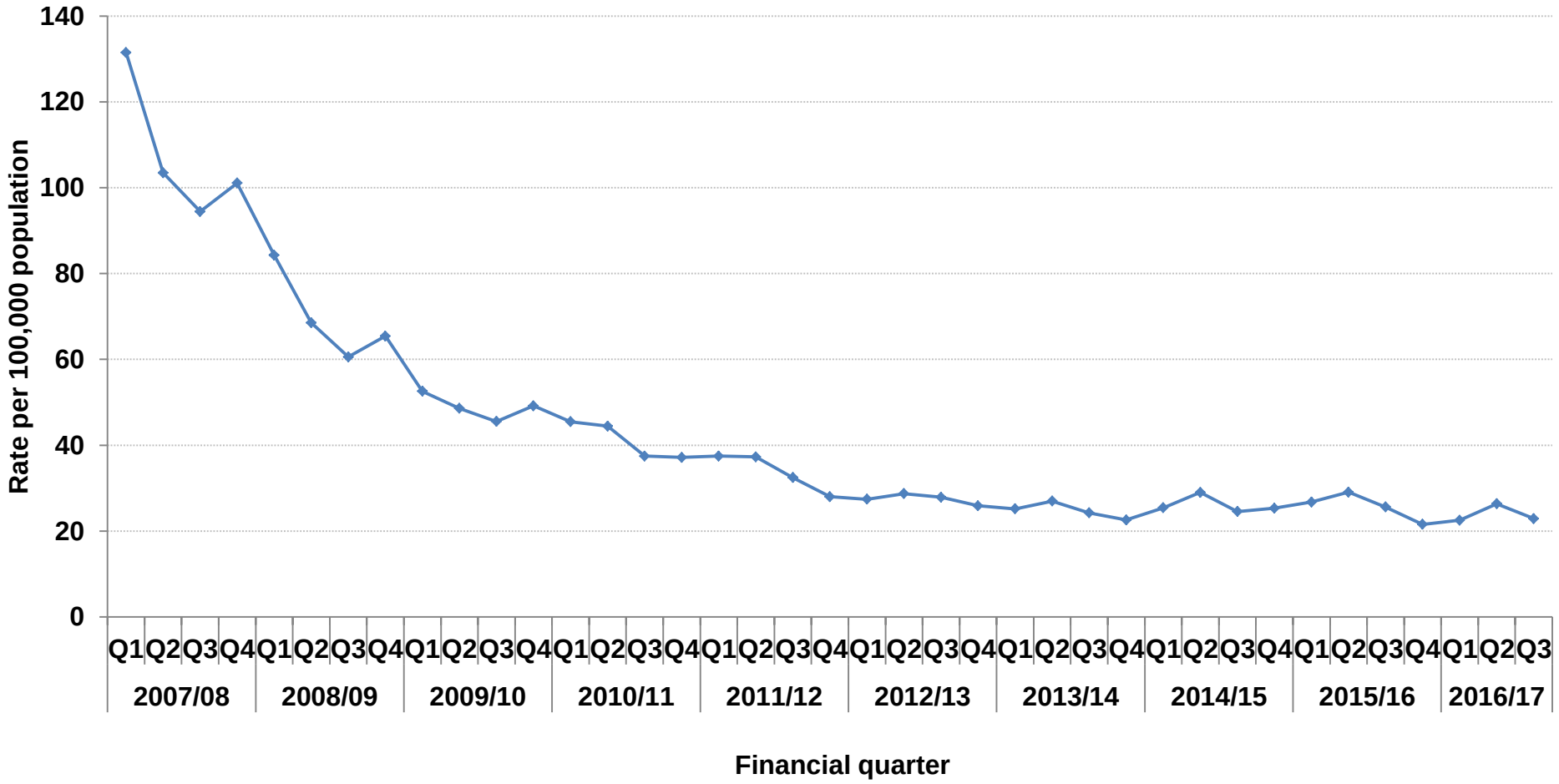


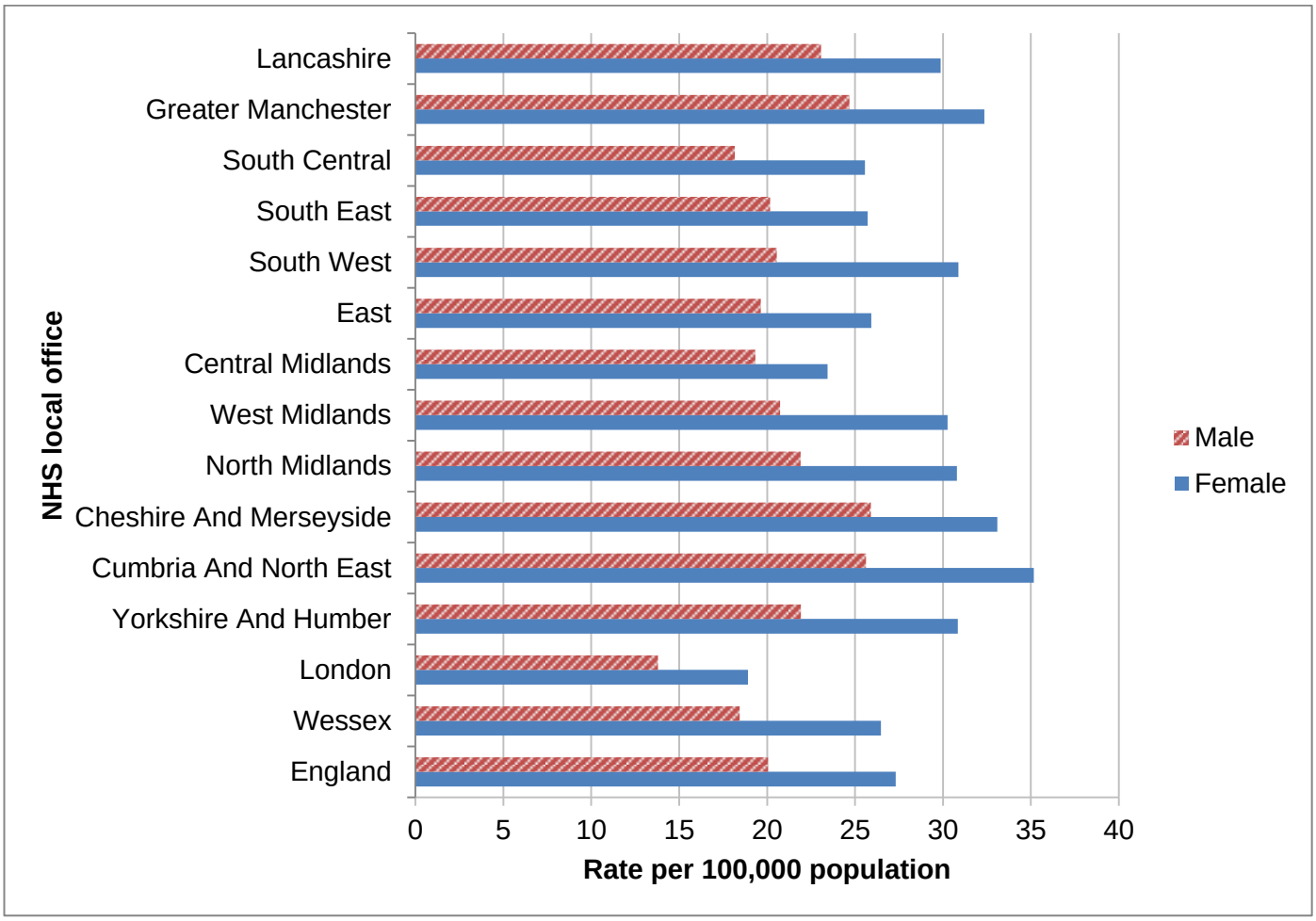
Figure 4b: Quarterly rates of all reported CDI: April-June 2007 to October-December 2016



Demographic distribution of CDI: October 2015 to December 2016

Between October 2015 and December 2016, the rate of all CDI reported in England was higher among females (27.3 cases per 100,000 population) compared to males (20.1 cases per 100,000 population) (RR 1.4). A similar gender distribution was observed across all NHS local offices, with the largest difference observed in West Midlands and South West (RR: 1.5 in both) while the lowest difference was observed in Central Midlands (RR: 1.2) (figure 4c, table 4b).

Figure 4b: Gender distribution of all reported CDI by NHS local offices: October 2015-December 2016



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 July-September 2016 KH03 figures. Replaced with April-June 2015 to July-September 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

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

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:

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

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:

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

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