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Protecting and improving the nation's health

Quarterly epidemiological commentary

Mandatory MRSA, MSSA, Gram-negative bacteraemias and *C. difficile* infection data (up to April to June 2018)

September 2018

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-leading 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 Social Care, and a distinct delivery organisation with operational autonomy. We provide government, local government, the NHS, Parliament, industry and the public with evidence-based professional, scientific and delivery expertise and support.

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

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DEVELOPMENT **GOALS**

Contents

Data included in this quarterly epidemiological commentary

This document contains quarterly, national-level epidemiological commentaries for MRSA, MSSA, *E. coli, Klebsiella* spp. and *P. aeruginosa* bacteraemia and *C. difficile* infections. 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 *C. difficile* infection

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

- counts and rates (per 100,000 population) of MRSA, MSSA, *E. coli, Klebsiella* spp. and *P. aeruginosa* bacteraemia and *C. difficile* infection by age and sex

The terminologies; 'trust -apportioned' and 'not trust-apportioned' have been updated to 'hospital-onset' and 'community-onset' respectively. Please note that this is only a change in the description and not a change in the methodology for apportionment.

All data tables associated with this report are included in an accompanying OpenDocument spreadsheet.

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

Further information

This publication forms part of the range of National Statistics outputs routinely published by Public Health England (PHE) which include monthly and annual reports on the mandatory surveillance of MRSA, MSSA and *E. coli, Klebsiella* spp. and *P. aeruginosa* 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:

- counts of all reported, hospital and community-onset cases of MRSA bacteraemia by NHS Acute Trust
- counts of all attributed, hospital and community-onset cases of MRSA bacteraemia by CCG
- monthly MRSA counts by CCG

MSSA bacteraemia:

- counts of all reported, hospital and community-onset cases of MSSA bacteraemia by NHS Acute Trust
- counts of all attributed, hospital and community-onset cases of MSSA bacteraemia by CCG
- monthly MSSA counts by acute trust; hospital-onset (trust-apportioned) cases only
- monthly MSSA counts by CCG

E. coli bacteraemia:

- monthly counts of *E. coli* bacteraemia by trust; all reported cases only
- monthly counts of *E. coli* bacteraemia by CCG
- counts of all reported, hospital and community-onset cases of *E. coli* bacteraemia by NHS Acute Trust
- counts of all attributed, hospital and community-onset cases of *E. coli* bacteraemia by CCG

Klebsiella spp. bacteraemia:

- counts of all reported, hospital and community-onset cases of *Klebsiella* spp. bacteraemia by NHS Acute Trust
- counts of all attributed, hospital and community-onset cases of *Klebsiella spp.* bacteraemia by CCG

P. aeruginosa bacteraemia:

- counts of all reported, hospital and community-onset cases of *P. aeruginosa* bacteraemia by NHS Acute Trust
- counts of all attributed, hospital and community-onset cases of *P. aeruginosa* bacteraemia by CCG

CDI:

- monthly CDI counts by acute trust in patients aged 2 years and over; hospital-onset (trust-apportioned) cases only
- monthly CDI counts by acute trust by prior healthcare exposure
- monthly CDI counts by CCG in patients aged 2 years and over
- monthly CDI counts by CCG in patients aged 2 years and over, by prior healthcare exposure

Data for this report was extracted from PHE's healthcare associated infections data capture system (HCAI DCS) on 16 July 2018.

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 1a, table S1a). There was a steep decline of 85% in the incidence rate of all reported cases between April to June 2007 and January to March 2014 from 10.2 cases per 100,000 population to 1.5. The rate has remained broadly stable at around 1.5 cases per 100,000 population between January to March 2014 and April to June 2018.

A similar trend was observed with the incidence rate of hospital-onset cases (figures 1b, table S1a). There was a steep decrease of 79% from 4.9 cases per 100,000 bed-days to 1.0 between April to June 2008 and January to March 2014. Between January to March 2014 and April to June 2018, the rate of MRSA bacteraemia has fluctuated, but remained broadly stable. The rate for April to June 2018 is 15% lower than the rate in January to March 2014.

When comparing the most recent quarter with the same period last year (April to June 2017 and April to June 2018), the incidence rate of hospital-onset MRSA bacteraemia decreased by 8% from 0.93 to 0.86 cases per 100,000 bed-days compared to an 8% decrease in incidence rates of community-onset cases from 1.6 to 1.5 cases per 100,000 population over the same period (table S1a).

Figure 1a: Quarterly rates of all reported MRSA bacteraemia: April to June 2007 to April to June 2018
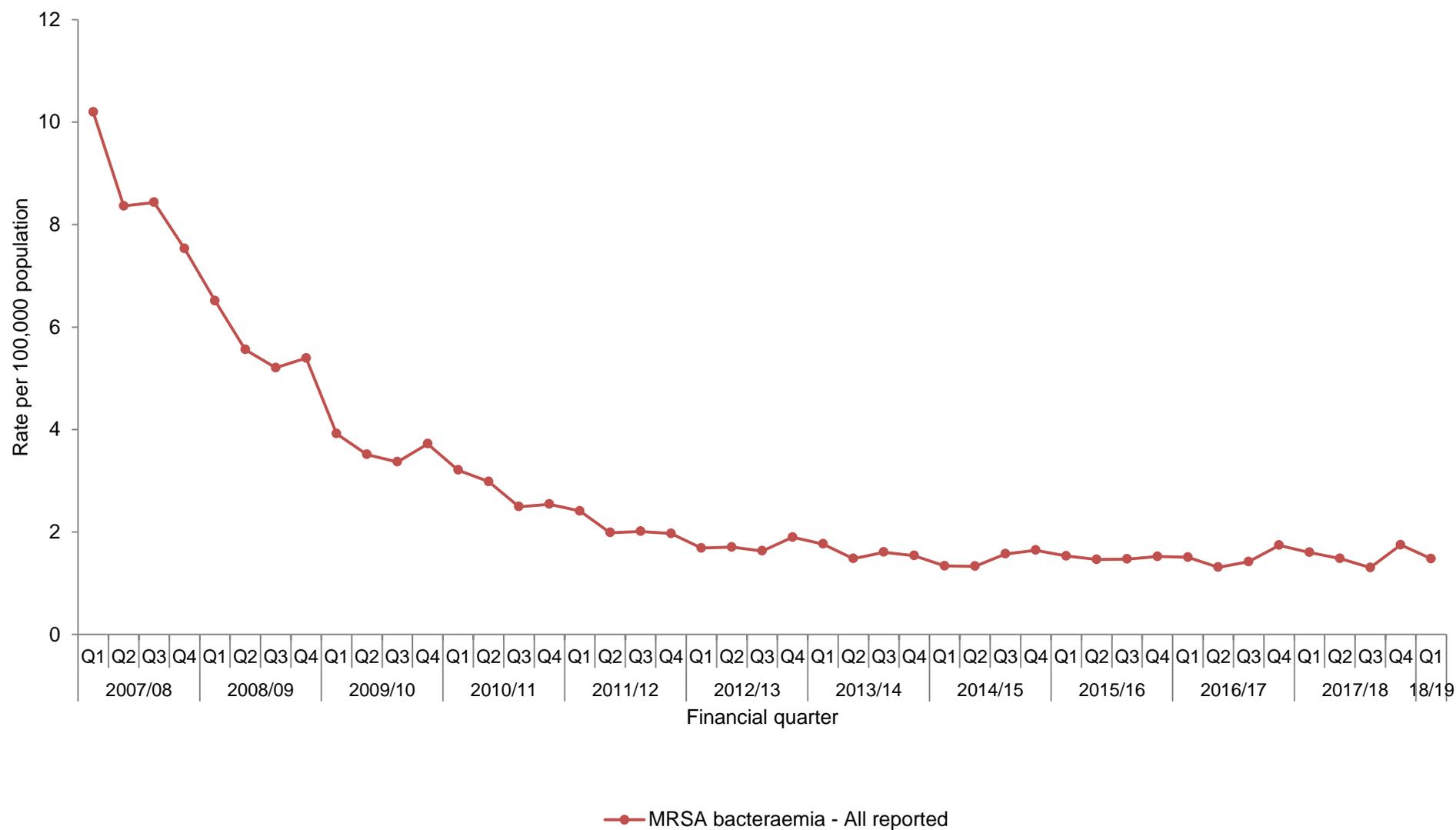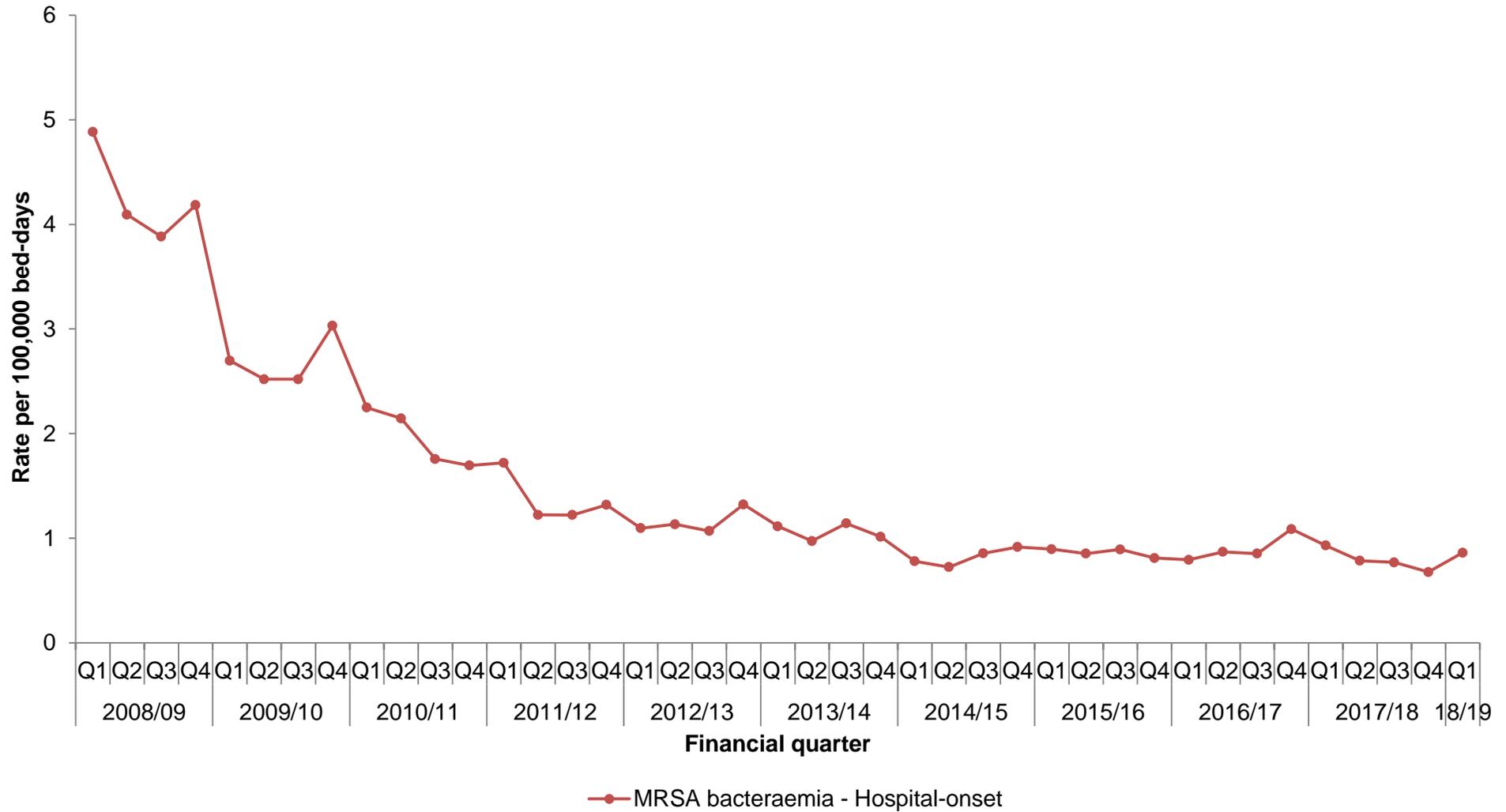
Figure 1b: Quarterly rates of hospital-onset MRSA bacteraemia: April to June 2008 to April to June 2018

Age and Sex rates: 12-month up to and including June 2018

Figure 1c depicts MRSA bacteraemia rates per 100,000 population amongst both sexes and across different age groups in England in the 12 months leading up to and including June 2018. The bacteraemia rate was the highest in the ≥85, 75 to 84 and 65 to 74 years age groups. The rate of bacteraemia per 100,000 population in these age groups was markedly higher amongst males in comparison to females (≥85 years: 24.4 vs. 7.2, 75 to 84 years: 7.4 vs. 3.5 and 65 to 74 years: 3.7 vs 1.5 per 100,000 population).

Figure 1c. MRSA bacteraemia rates per 100,000 population by age and sex: 12 months up to and including June 2018
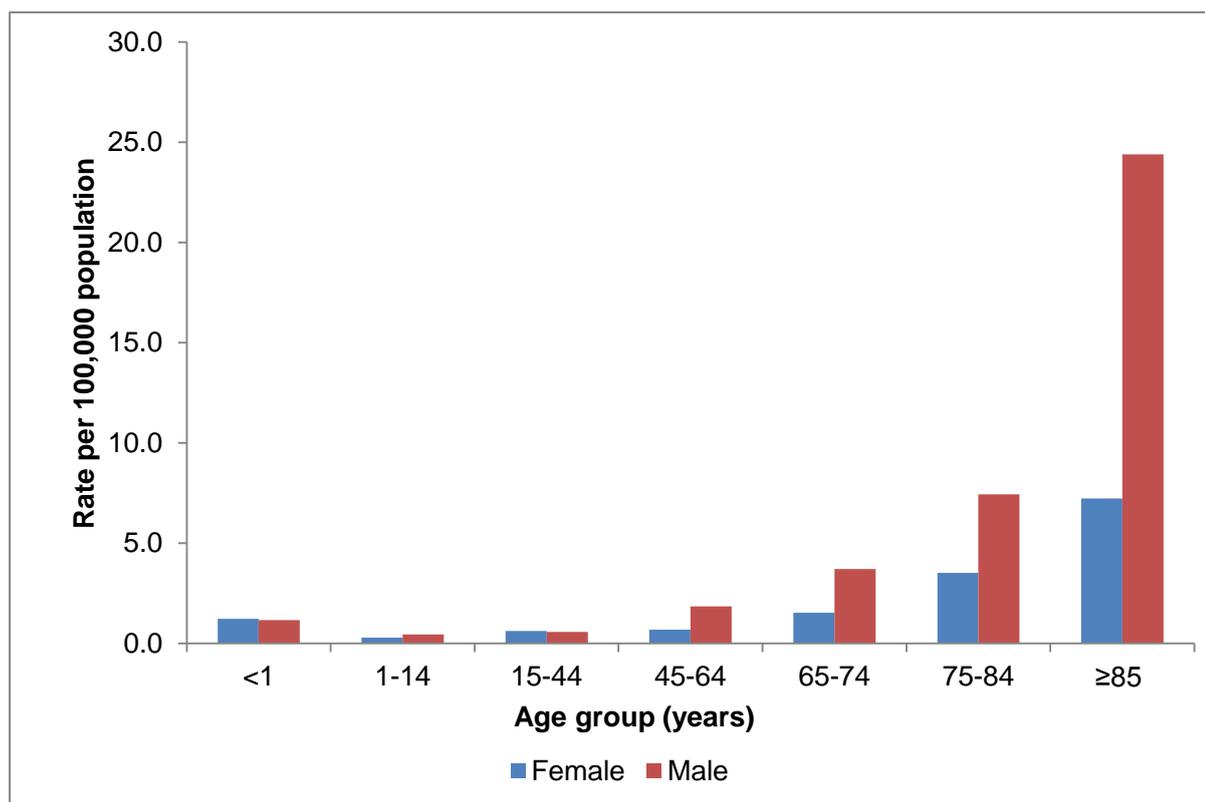
MSSA bacteraemia

Since the mandatory reporting of MSSA bacteraemia began in January 2011 there has been a general trend of increasing counts and incidence rates. All reported cases of MSSA bacteraemia increased by 36% from 2,199 to 2,992 between January to March 2011 and April to June 2018. This was accompanied by a 32% increase in incidence rate (per 100,000 population) from 16.8 to 21.8 (figure 2a, table S2a).

These increases are primarily driven by the increase in community-onset cases. Over the same period (January 2011 to June 2018), counts and incidence rates of community-onset cases increased by 48% and 41% respectively from 1,464 to 2,172 cases and 11.2 to 15.8 cases per 100,000 population. Over the same period both counts and incidence rates of hospital-onset case increased by 12% (735 to 820 cases) and 14% (8.4 to 9.5 cases per 100,000 bed-days figure 2a and 2b, table S2a).

When comparing the most recent quarter with the same period last year (April to June 2017 and April to June 2018), the incidence rate of hospital-onset MSSA bacteraemia increased by 1% from 9.46 to 9.53 cases per 100,000 bed-days compared to a <1% decrease in incidence rates of community-onset cases from 15.9 to 15.8 cases per 100,000 population over the same period.

Figure 2a: Quarterly rates of all reported MSSA bacteraemia: July to September 2011 to April to June 2018
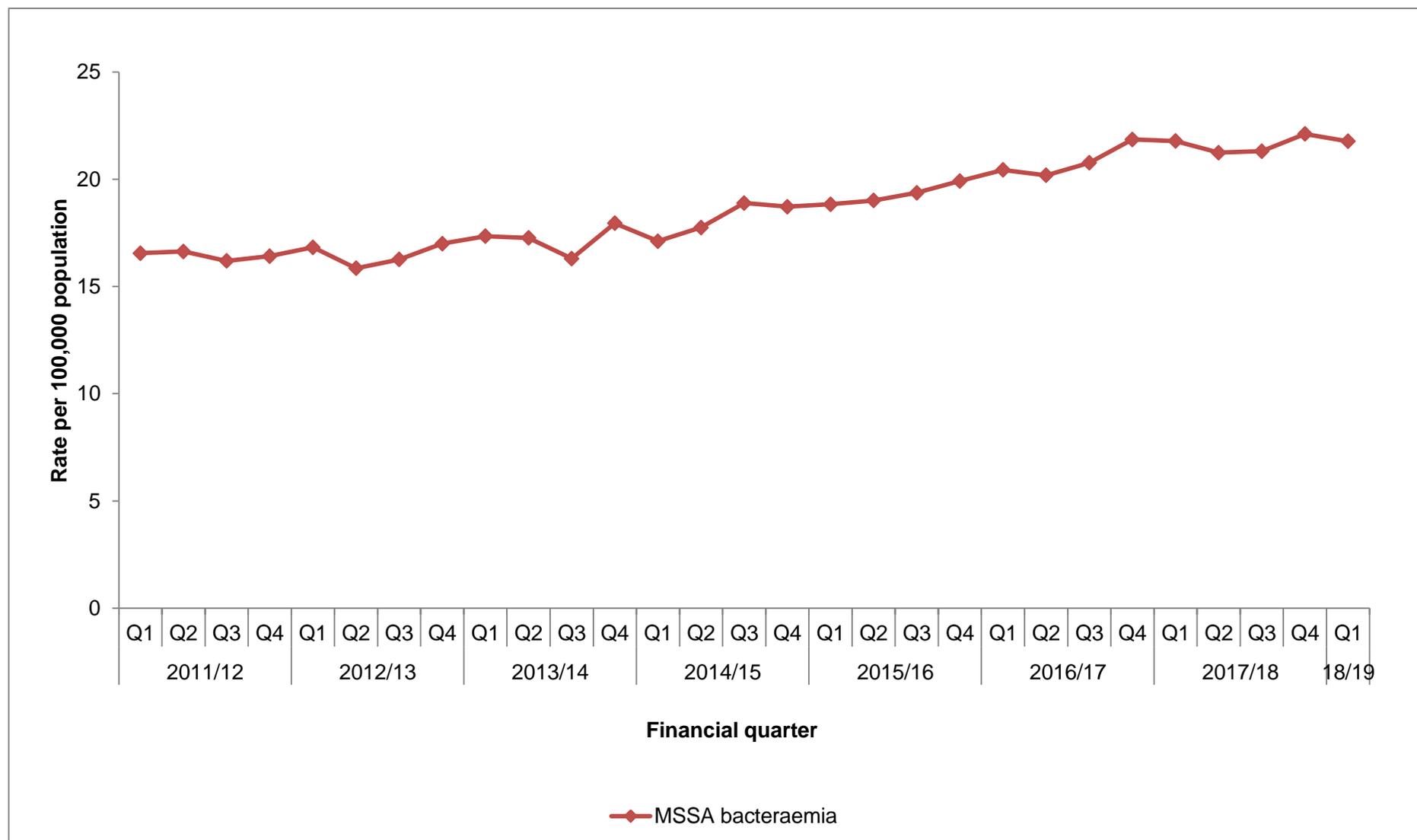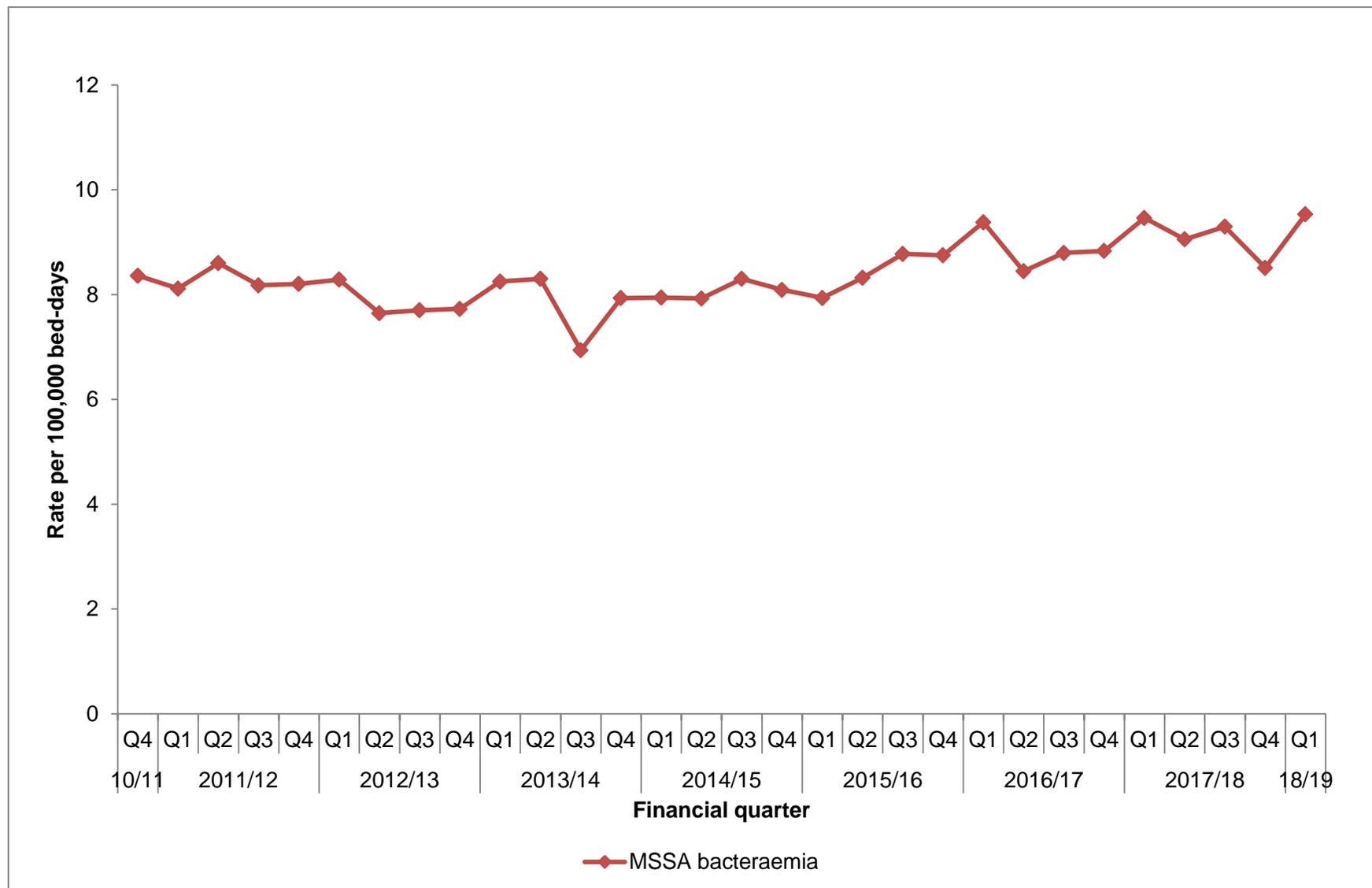
Figure 2b: Quarterly rates of hospital-onset MSSA bacteraemia: July to September 2011 to April to June 2018

Age and Sex rates: 12-month up to and including June 2018

Figure 2c depicts MSSA bacteraemia rates per 100,000 population amongst men and women across different age groups in England in the 12 months leading up to and including June 2018. The bacteraemia rate was the highest in the ≥85, 75 to 84 and <1 year age groups. The rate of bacteraemia per 100,000 population in these age groups was markedly higher amongst males in comparison to females (≥85 years: 186.3 vs. 87.1, 75 to 84 years: 101.7 vs. 47.1 and <1 year: 62.6 vs 41.4 per 100,000 population).

Figure 2c. MSSA bacteraemia rates per 100,000 population by age and sex: 12 months up to and including June 2018
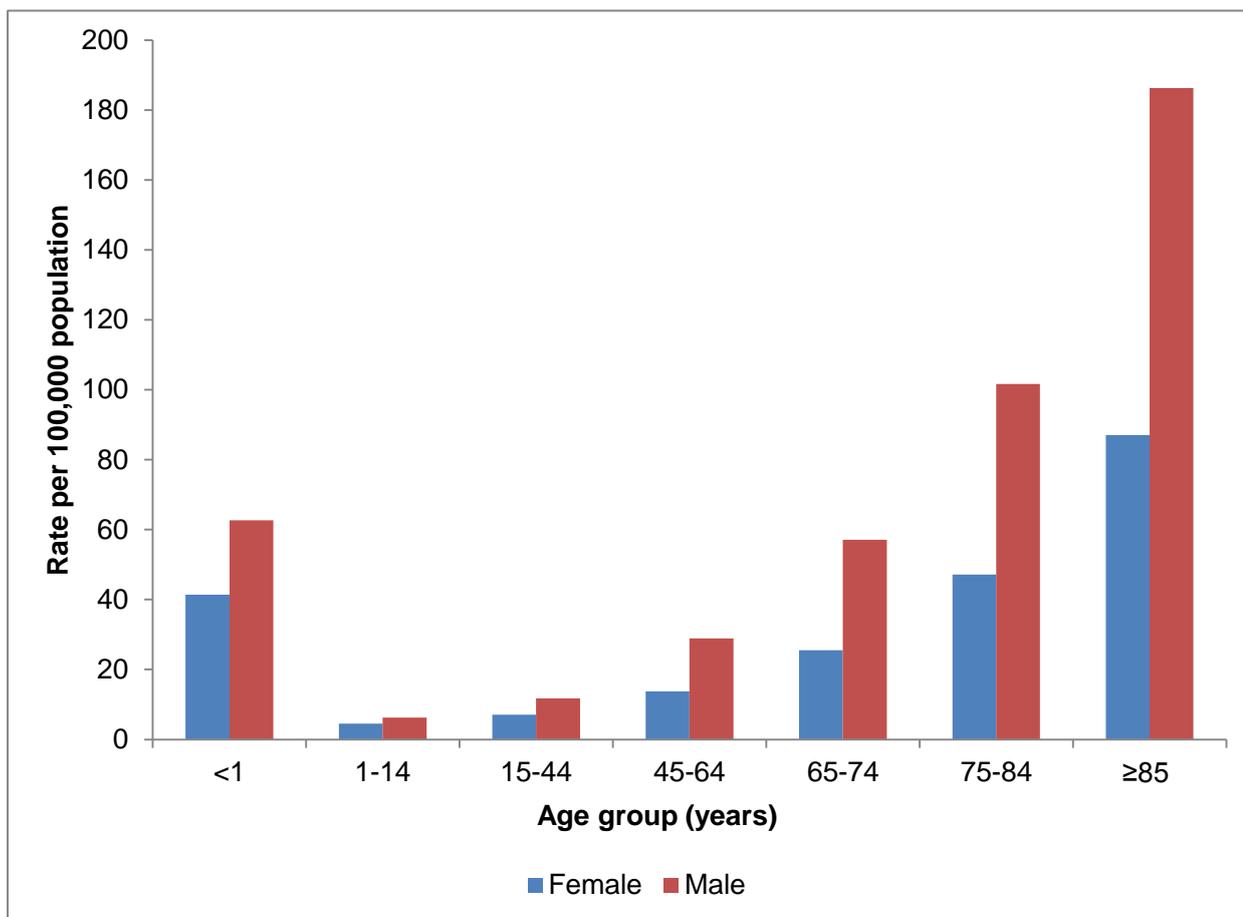
Epidemiological analyses of Gram-negative bacteraemias data

E. coli bacteraemia

The incidence rate of all reported *E. coli* bacteraemia have continued to increase each year since the initiation of mandatory surveillance of *E. coli* bacteraemia in July 2011 (figure 3a). This is primarily driven by the increase in the rate of community-onset cases (table S3a). Conversely, the incidence rate of hospital-onset cases has been relatively stable within the same period (figure 3b).

Seasonal peaks are seen in all reported cases of *E. coli* bacteraemia between July and September each year (figure 3a, table S3a). The seasonal peaks in all reported cases are mainly due to the seasonality of community-onset cases (table S3a).

Between July to September 2011 and April to June 2018, Incidence rates of all reported cases of *E. coli* bacteraemia increased by 26% from 61.8 to 77.9 cases per 100,000 population (n= 8,275-10,700 cases). Similarly over the same period, incidence rates of community-onset cases increased by 36% from 46.9 to 63.9 (n= 6,279-8,785 cases).

Unlike community-onset cases, the count of hospital cases decreased between July to September 2011 and April to June 2018. In July to September 2011, a total of 1,996 cases were reported. In contrast, in April to June 2018 a total of 1,915 cases were reported, a decrease of 6% in the hospital-onset incidence rate from 23.7 to 22.3 per 100,000 bed-days.

Between April to June 2017 and April to June 2018, there was a 5% increase in both counts and incidence rate of all reported cases from 10,197 to 10,700 cases and from 74.2 to 77.9 cases per 100,000 population respectively. Over the same period the counts and the incidence rate of community-onset cases increased by 7% from 8,223 to 8,785 cases and from 59.8 to 63.9 cases per 100,000 population respectively. In contrast, the counts and the incidence rate of hospital-onset cases decreased by 3% between April to June 2017 and April to June 2018, from 1,974 to 1,915 cases and from 22.9 to 22.3 cases per 100,000 bed-days respectively (figure 3a and 3b, table S3a).

Figure 3a: Quarterly rates of all reported *E. coli* bacteraemia: July to September 2011 to April to June 2018
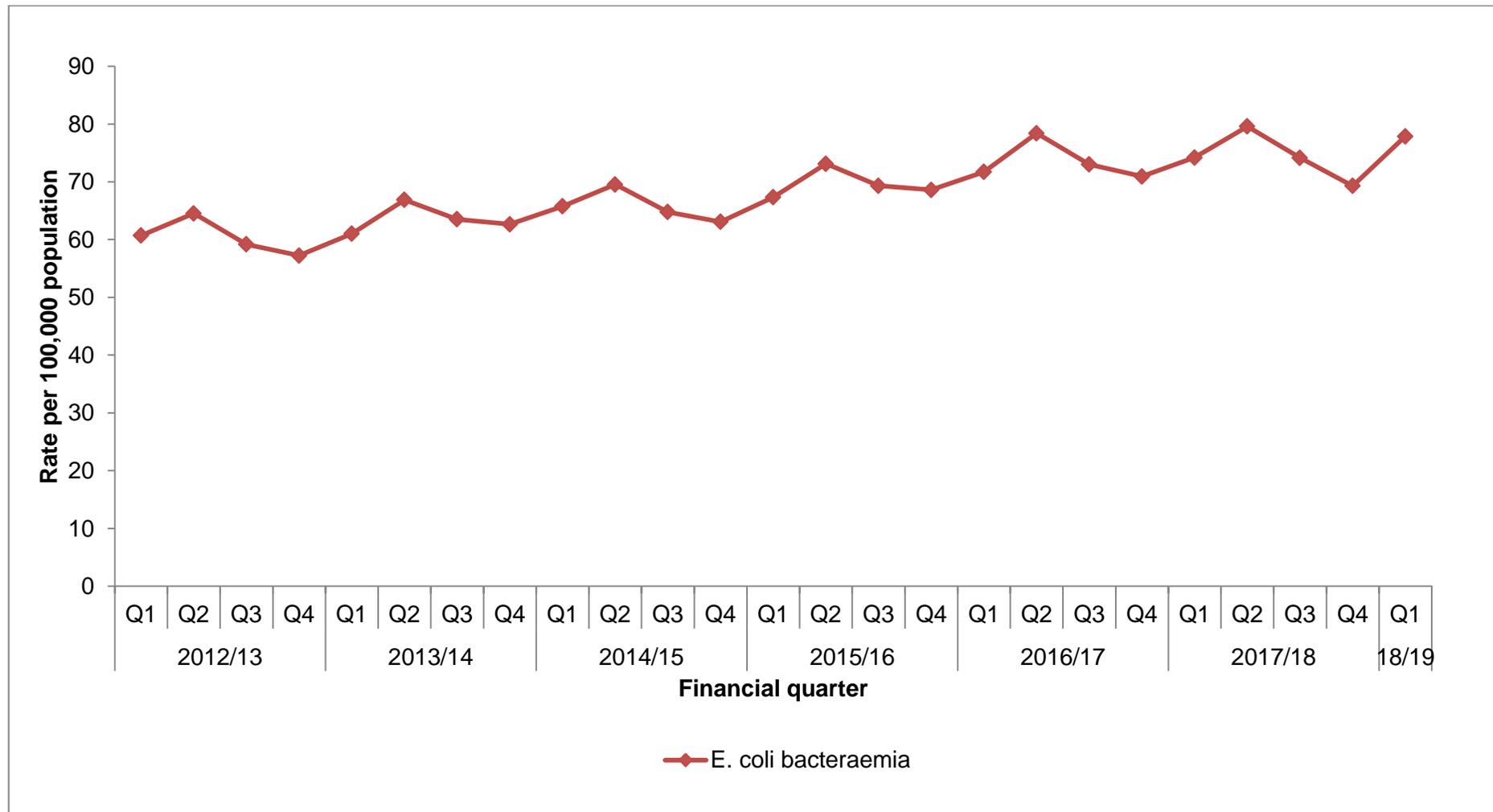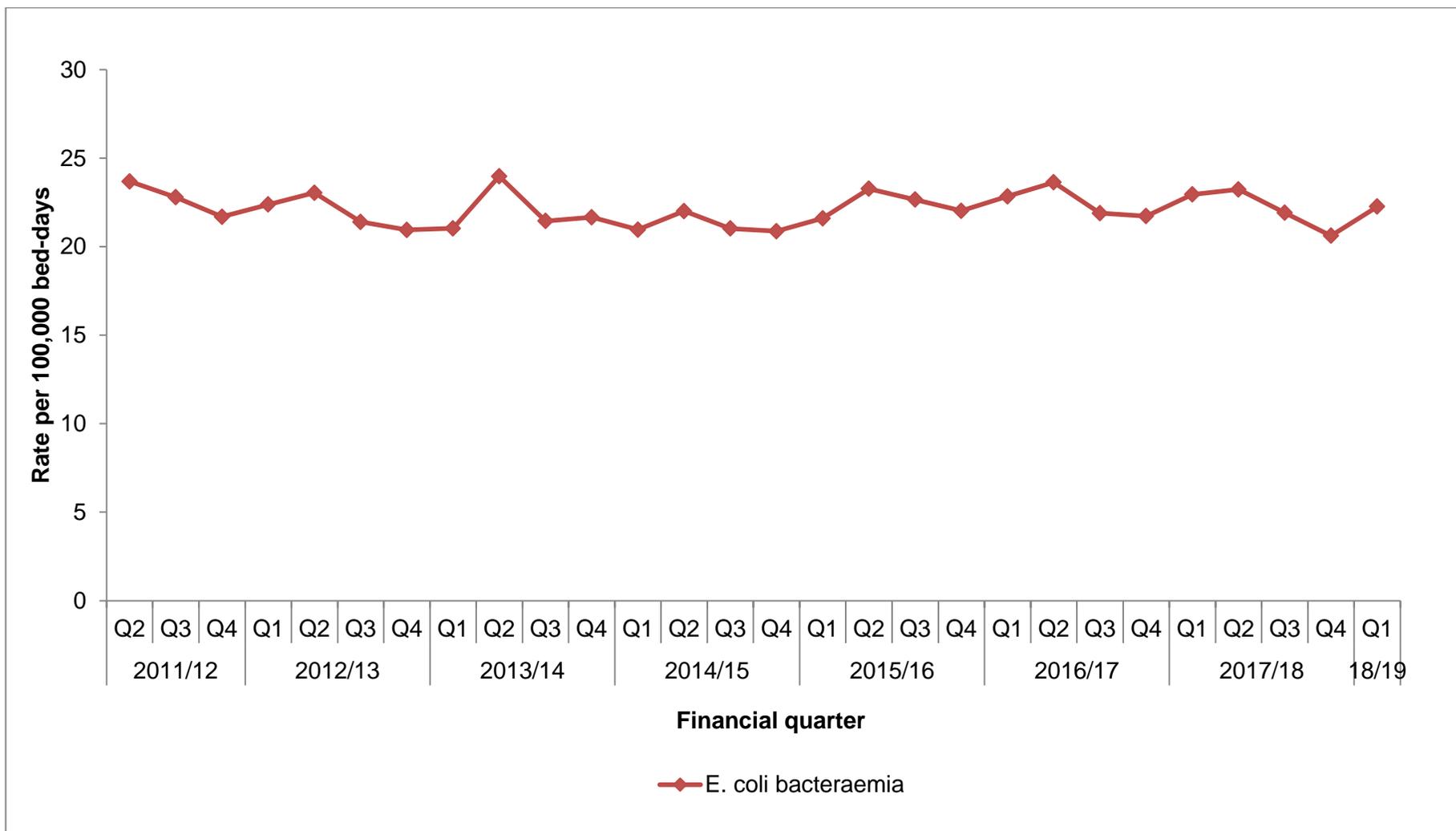
Figure 3b: Quarterly rates of hospital-onset *E. coli* bacteraemia: July to September 2011 to April to June 2018

Age and Sex rates: 12-month up to and including June 2018

Figure 3c depicts *E. coli* bacteraemia rates per 100,000 population amongst men and women across different age groups in England in the 12 months leading up to and including June 2018. The bacteraemia rate was the highest in the ≥85, 75 to 84 and 65 to 74 years age groups. The rate of bacteraemia per 100,000 population in these age groups was higher amongst males in comparison to females (≥85: 912.8 vs. 619.0, 75 to 84: 424.2 vs. 327.3 and 65 to 74 years: 178.4 vs 141.0 per 100,000 population). Rates were also notably high in the <1 year age group, with males having a higher rate than females 122.1 vs 83.2 per 100,000 population respectively.

Figure 3c. *E. coli* bacteraemia rates per 100,000 population by age and sex: 12 months up to and including June 2018
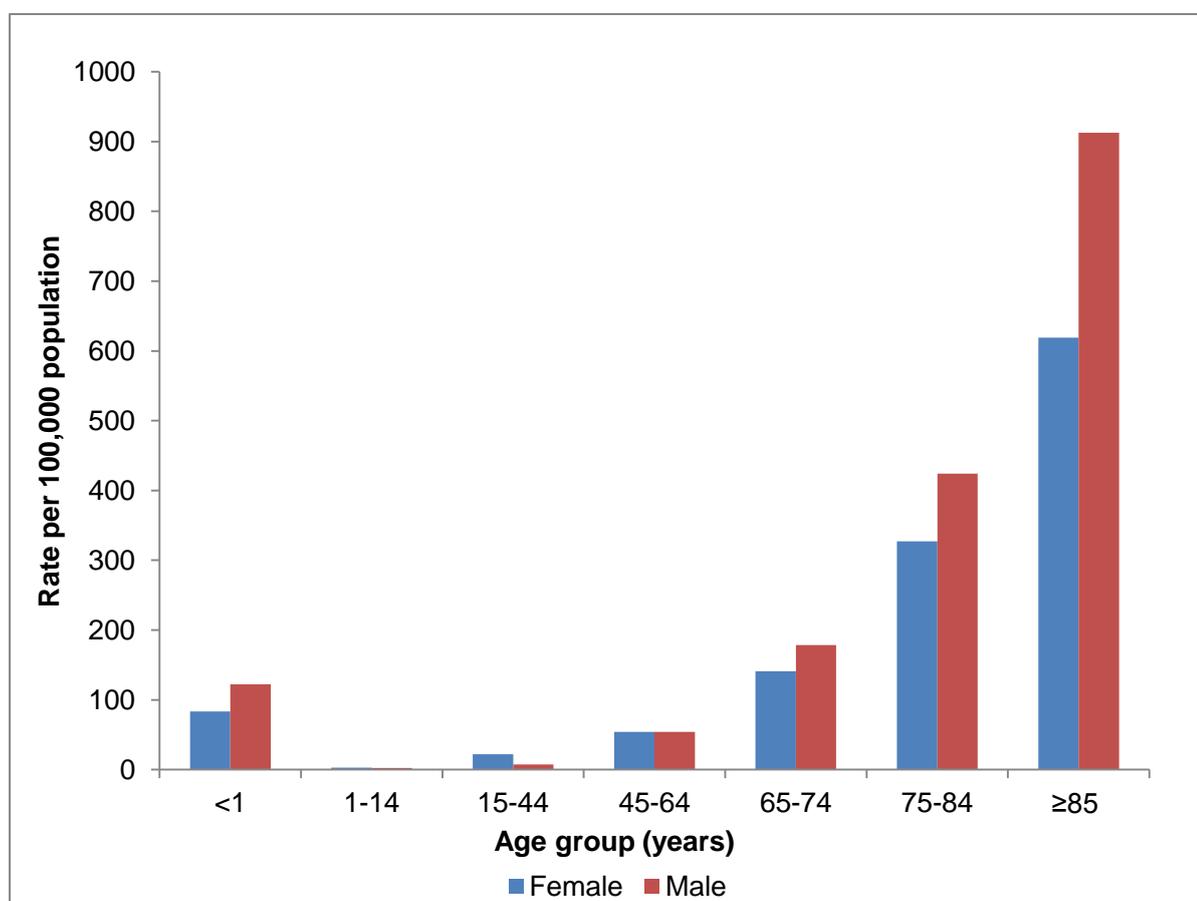
Klebsiella spp. bacteraemia

Between and April to June 2017 and April to June 2018, there was a 8% increase in both counts and incidence rate of all reported *Klebsiella* spp cases from 2,334 to 2,520 and from 17.0 to 18.3 cases per 100,000 population respectively (figure 4a). Also both counts and the incidence rate of community-onset cases decreased by 7% from 1,670 to 1,788 cases and from 12.2 to 13.0 cases per 100,000 population respectively. Over the same period, the counts and the incidence rate of hospital-onset cases increased by 10% from 664 to 732 cases and from 7.7 to 8.5 cases per 100,000 bed-days respectively (figure 4b).

During April to June 2018, 74% (1,861/2,520) of all reported *Klebsiella* spp. bacteraemia were caused *K. pneumoniae* (an increase from 60% in the same quarter in the previous year) compared to 17% (440/2,520) caused by *K. oxytoca*, the same proportion as the same quarter in the previous year. These proportions were similar among hospital-onset *Klebsiella* spp.

Figure 4a: Quarterly rates of all reported *Klebsiella* spp. bacteraemia: April to June 2017 to April to June 2018
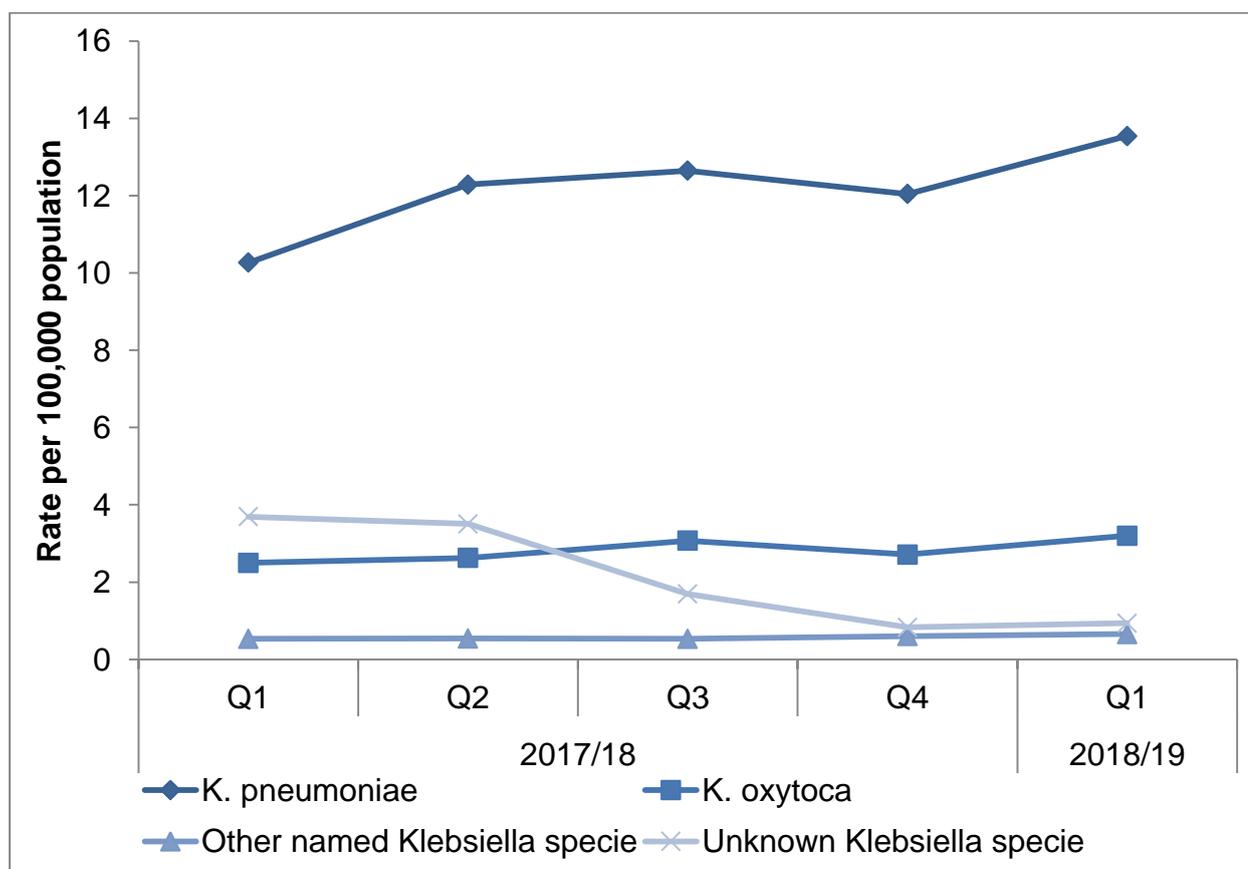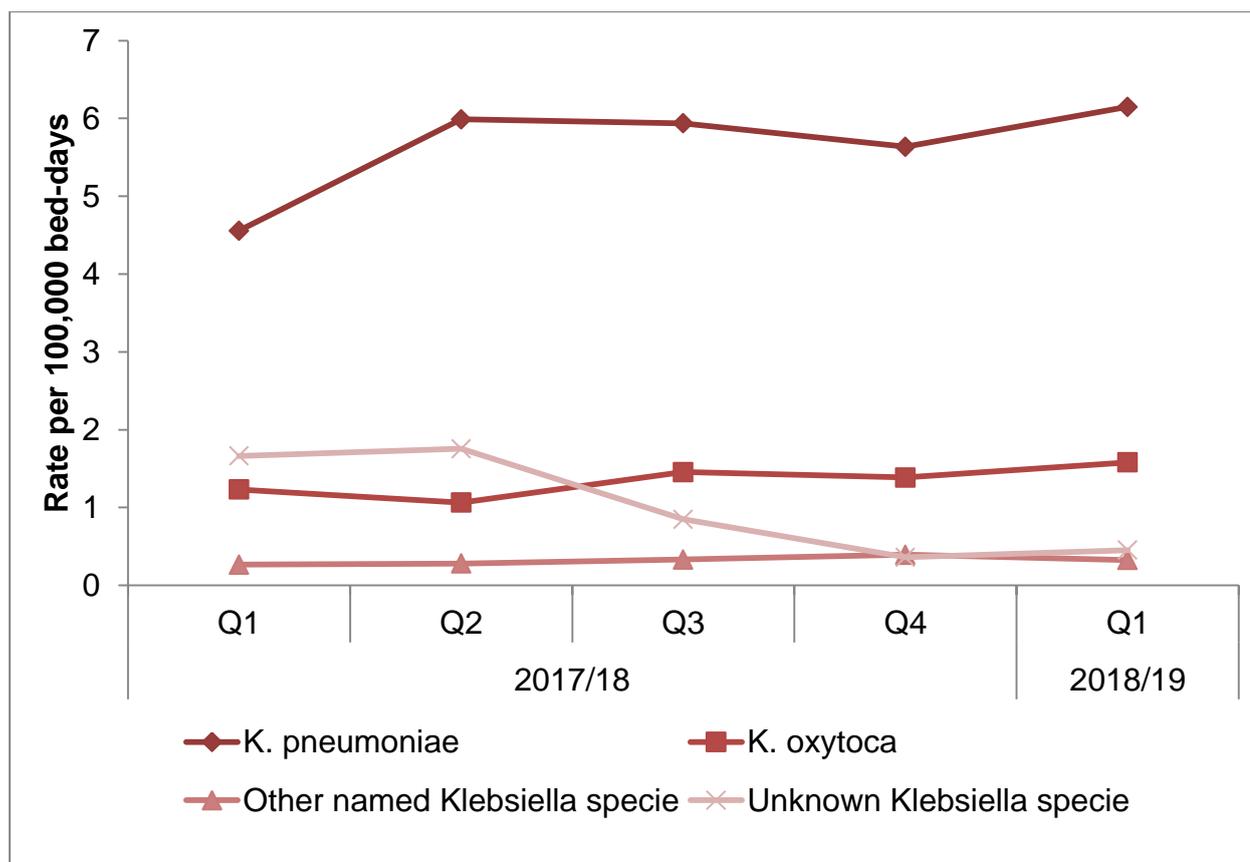
Figure 4b: Quarterly rates of hospital-onset *Klebsiella* spp. bacteraemia: April to June 2017 to April to June 2018

Age and Sex rates: 12-month up to and including June 2018

Figure 4c depicts *Klebsiella* spp bacteraemia rates per 100,000 population amongst men and women across different age groups in England in the 12 months leading up to and including June 2018. The bacteraemia rate was the highest in the ≥85 years, 75 to 84 years and 65 to 74 years age groups. The rate of bacteraemia per 100,000 population in these age groups was markedly higher amongst males in comparison to females (≥85 years: 239.5 vs. 75.5, 75 to 84 years: 119.3 vs. 51.1 and 65 to 74 years: 58.6 vs 29.2 per 100,000 population). Rates were also notably high in the <1 year age group, with males having a higher rate than females 31.8 vs 18.1 per 100,000 population respectively.

Figure 4c. *Klebsiella* spp. bacteraemia rates per 100,000 population by age and sex: 12 months up to and including June 2018
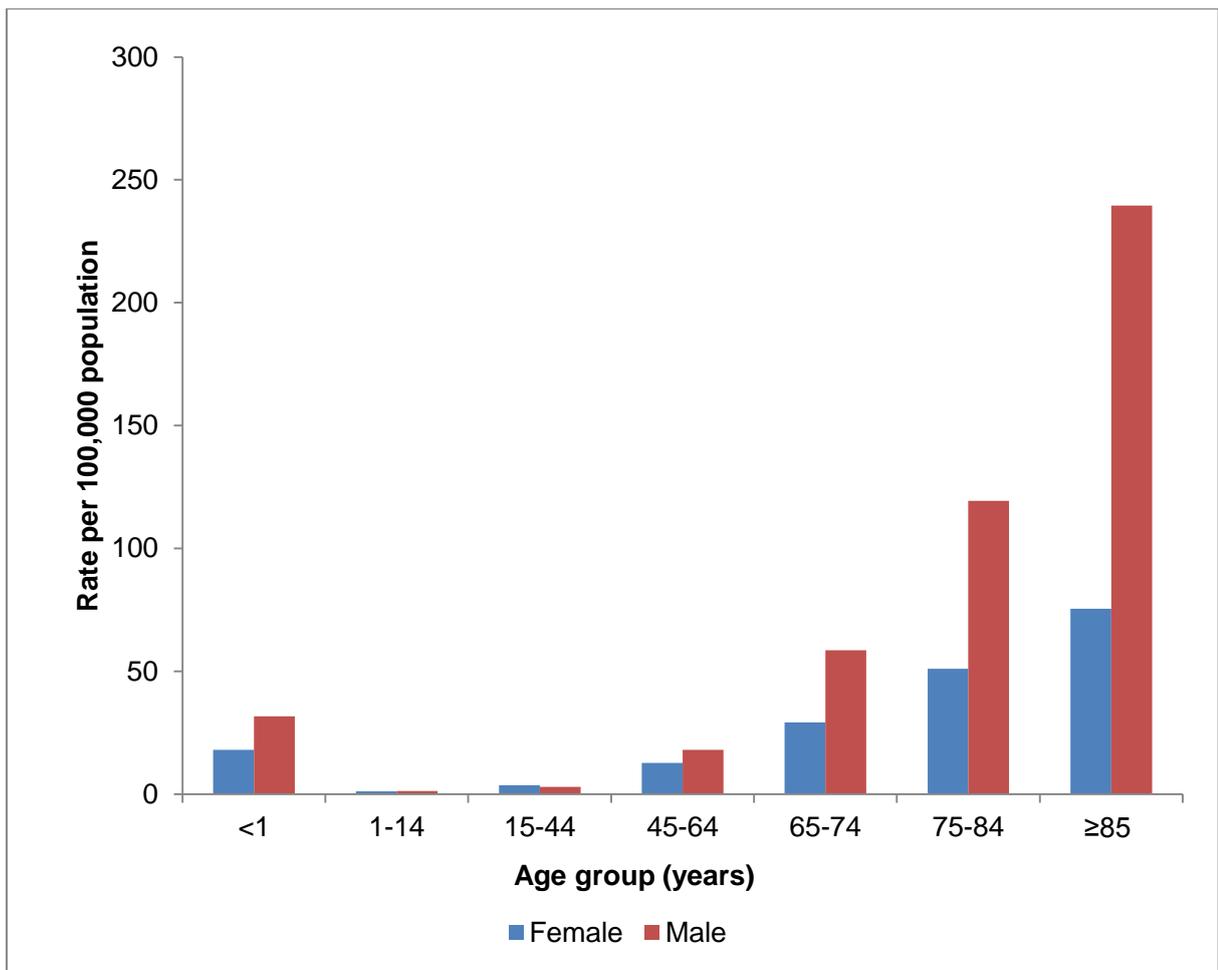
Pseudomonas aeruginosa bacteraemia

Between and April to June 2017 and April to June 2018, there was a 4% decrease in both counts and incidence rate of all reported cases of *P. aeruginosa* from 1,009 to 969 and from 7.3 to 7.1 reports per 100,000 population respectively (figure 5a). Over the same period both counts and the incidence rate of community-onset cases decreased by 3% from 636 to 618 cases and from 4.6 to 4.5 reports per 100,000 population respectively. Over the same period, the counts and the incidence rate of hospital-onset cases decreased by 6% from 373 to 351 cases and from 4.3 to 4.1 reports per 100,000 bed-days respectively (figure 5b).

Figure 5a: Quarterly rates of all reported *P. aeruginosa* bacteraemia: April to June 2017 to April to June 2018
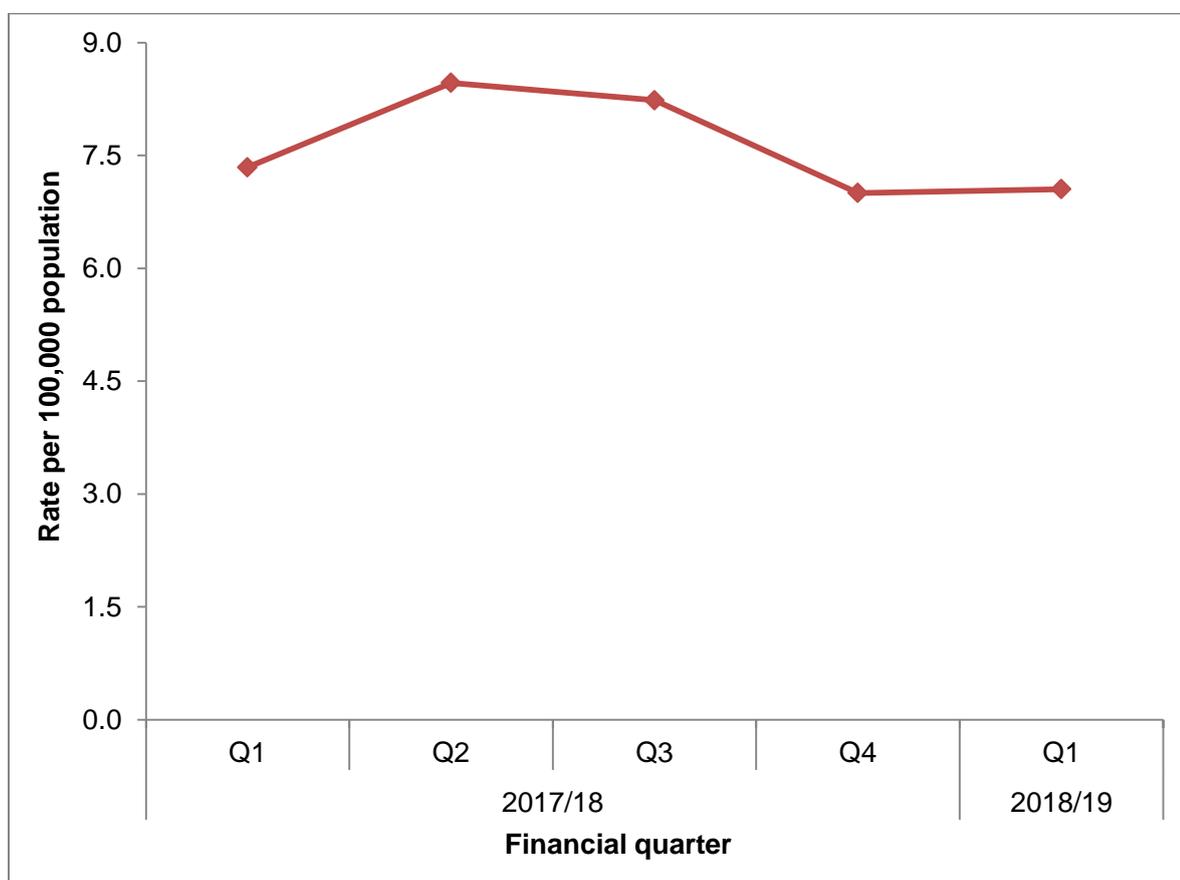
Figure 5b: Quarterly rates of hospital-onset *P. aeruginosa* bacteraemia: April to June 2017 to April to June 2018
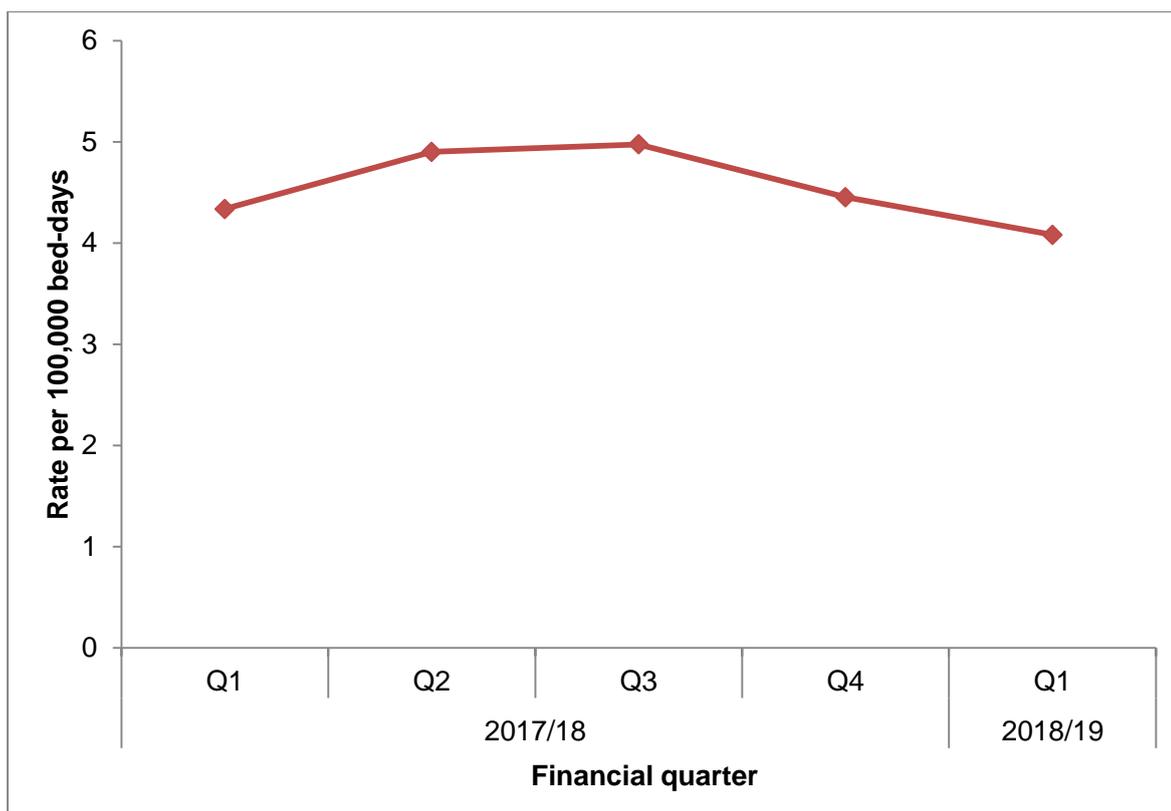
Age and Sex rates: 12-month up to and including June 2018

Figure 5c depicts *P. aeruginosa* bacteraemia rates per 100,000 population amongst men and women across different age groups in England in the 12 months up to and including June 2018. The bacteraemia rate was the highest in the ≥85, 75 to 84 and 65 to 74 years age groups. The rate of bacteraemia per 100,000 population in these age groups was markedly higher amongst males in comparison to females (≥85: 107.1 vs. 33.7, 75 to 84: 53.3 vs. 19.1 and 65 to 74 years: 24.5 vs 12.6 per 100,000 population). Rates were also notably high in the <1 year age group, with males having a higher rate than females 11.1 vs 7.4 per 100,000 population respectively.

Figure 5c. *P. aeruginosa* bacteraemia rates per 100,000 population by age and sex: 12 months up to and including June 2018
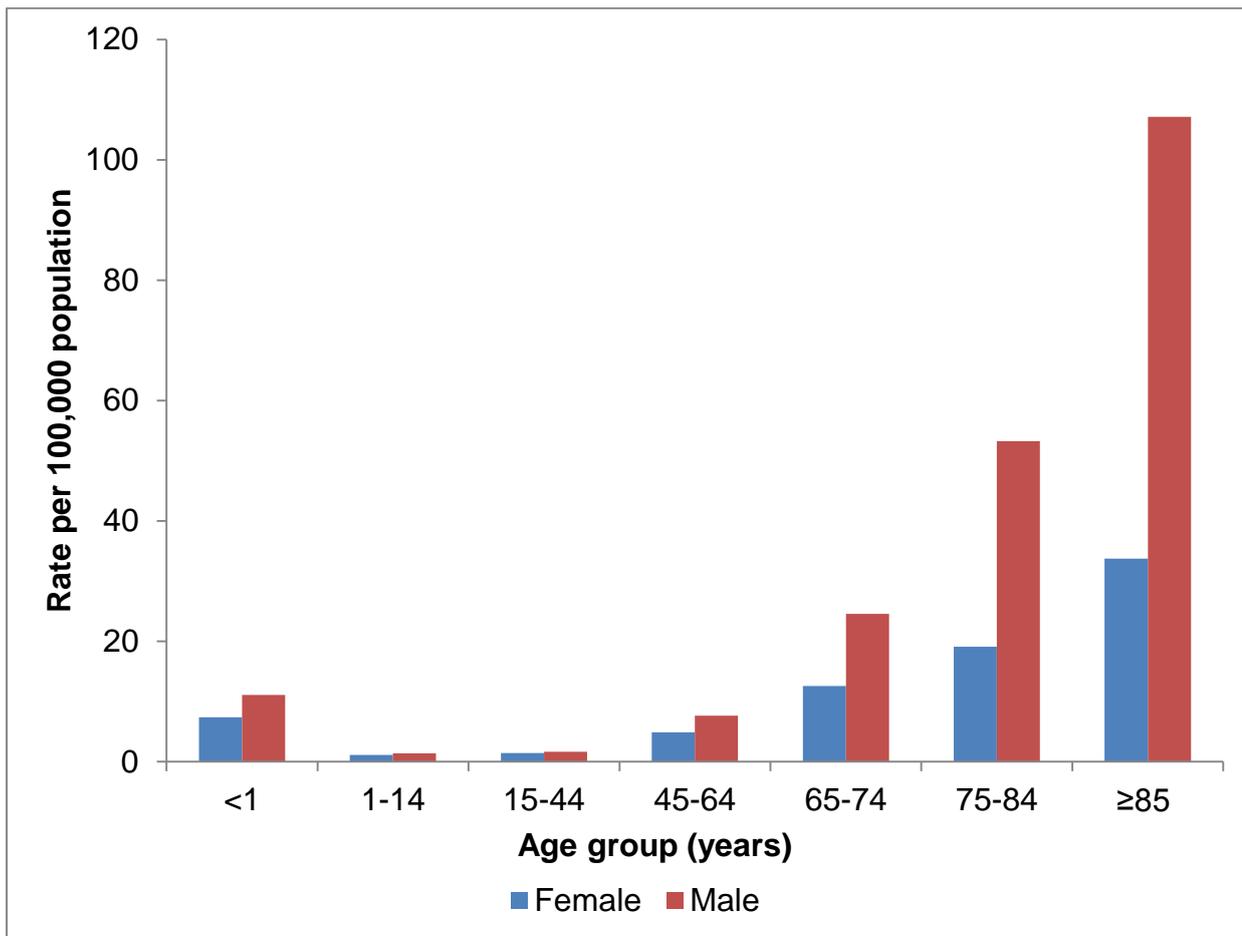
Epidemiological analyses of *Clostridium difficile* infection data

Since the initiation of CDI surveillance in April 2007, there has been an overall decrease in counts and associated incidence rate of both all reported and hospital-onset cases of *C. difficile* infection (CDI). Seasonal peaks are present in the January to March quarters prior to 2014/15 and the July to September quarters between 2014/15 and 2016/17 (figure 6a, 6b and table S6a).

The majority of the decrease in the incidence rate occurred between April to June 2007 and January to March 2012 with a 78% decrease in total (all reported) cases of CDI from 16,864 to 3,711 cases and an associated 79% reduction in incidence rate (per 100,000 population) from 131.6 to 27.9. Subsequently between January to March 2012 and April to June 2018, the count of all reported cases reduced by 13% from 3,711 to 3,224 cases and incidence rate reduced by 16% from 27.9 and 23.5.

There were similar but greater reductions among hospital-onset CDI cases - 85% reduction in cases from 10,436 to 1,613 cases and 84% reduction in incidence rate (per 100,000 bed-days) from 112.5 to 18.2 between April to June 2007 and January to March 2012. This was followed by a further 33% decrease in the count from 1,613 to 1,082 cases and a decrease of 31% in the incidence rate from 18.2 to 12.6 cases per 100,000 bed - days between January to March 2012 and April to June 2018.

When the most recent quarter is compared with the same quarter last year (April to June 2017 and April to June 2018) both counts and incidence rate (per 100,000 population) of all reported CDI decreased by 2% from 3,304 to 3,224 cases and 24.0 to 23.5 respectively, while both counts and incidence rate (per 100,000 bed-days) of hospital-onset CDI cases both decreased by 4% from 1,130 to 1,082 cases and 13.1 to 12.6 respectively.

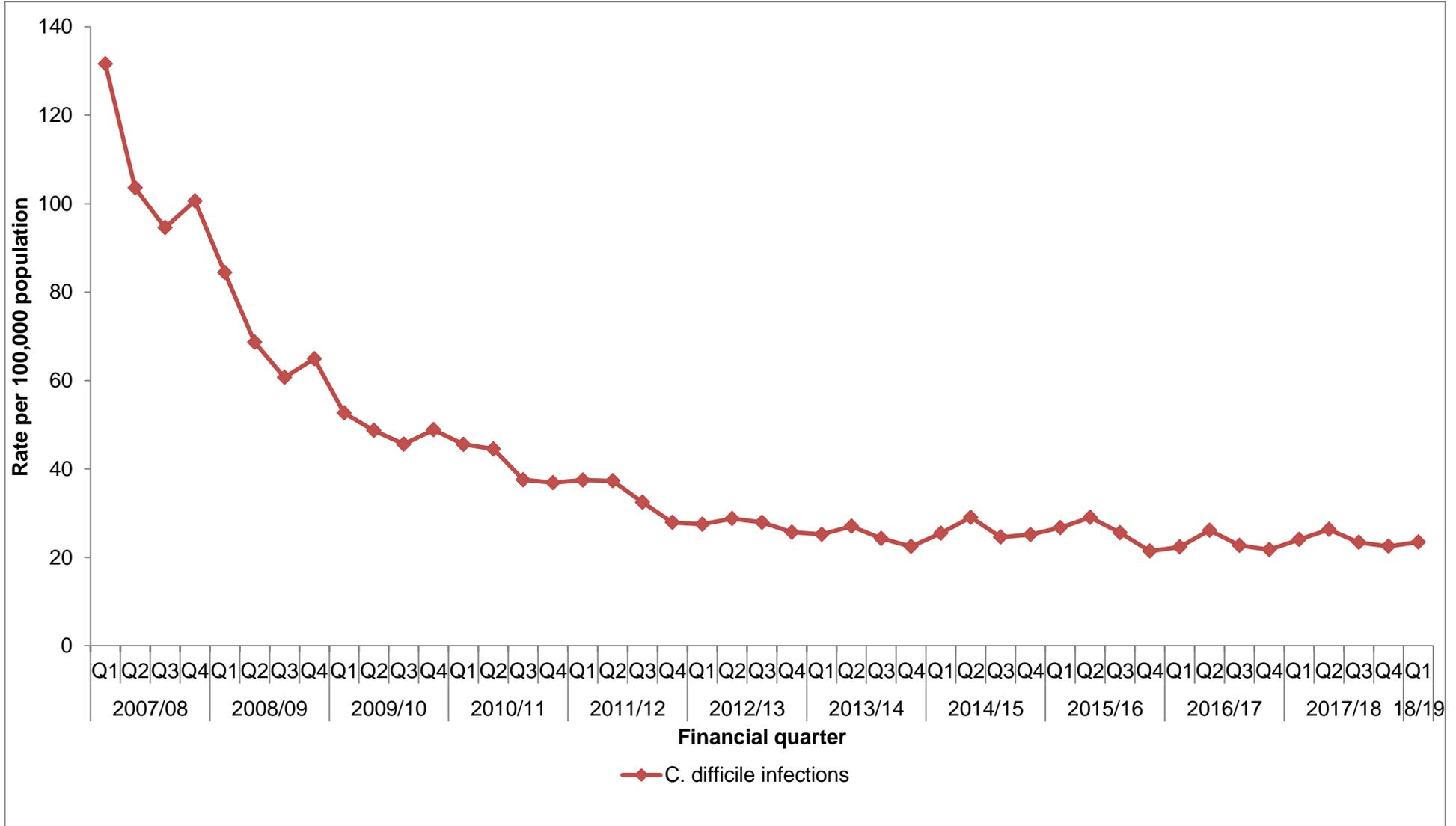**Figure 6a: Quarterly rates of all reported CDI: April to June 2007 to April to June 2018**

Figure 6b: Quarterly rates of hospital-onset CDI: April to June 2007 to April to June 2018
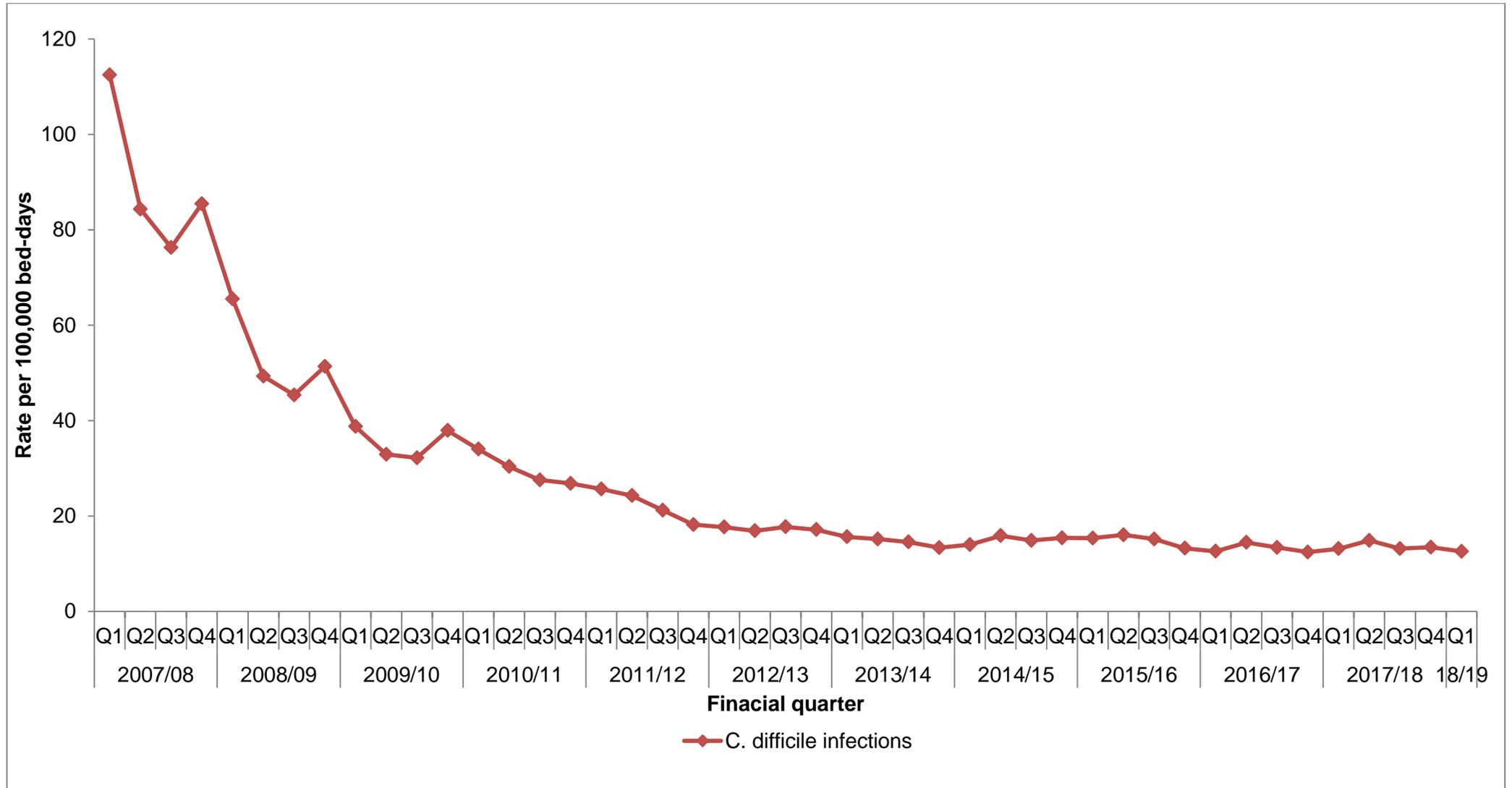
Age and Sex rates: 12-month up to and including June 2018

Figure 6c depicts CDI rates per 100,000 population amongst men and women across different age groups in England in the 12 months leading up to and including June 2018. The bacteraemia rate was the highest in the ≥85, 75 to 84 and 65 to 74 years age groups. The rate of bacteraemia per 100,000 population in these age groups was higher amongst females in all groups with the exception of ≥85 (≥85: 247.5 vs. 260.1, 75 to 84: 123.5 vs. 116.1 and 65 to 74 years: 51.9 vs 46.3 per 100,000 population).

Figure 6c. CDI bacteraemia rates per 100,000 population by age and sex: 12 months up to and including June 2018
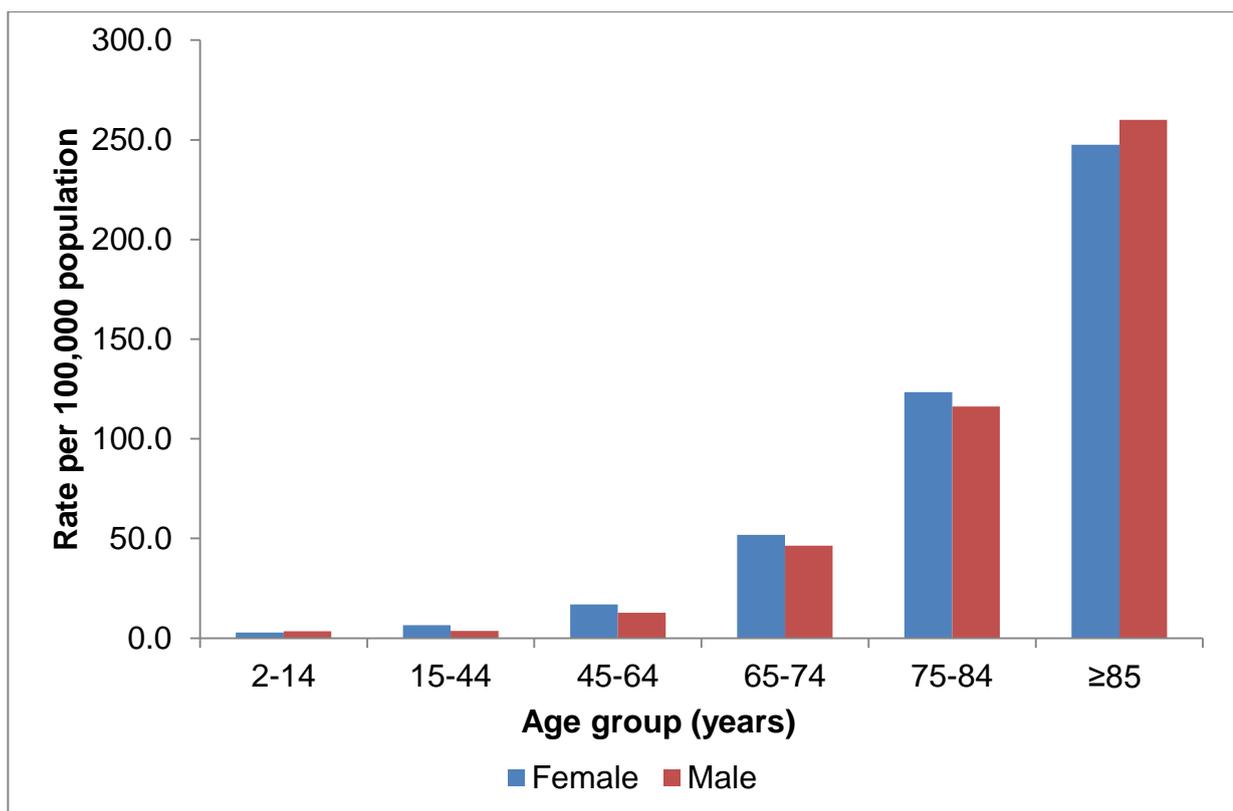
Appendix

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 rate rates (assigned and apportioned). As of Q1 2011/12, bed-day data has been available on a quarterly basis and has been used as such for Q2 2011/12 to Q4 2017/18. 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 2018/19 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 2017/18) was used as a proxy for this quarter.

In Quarterly Epidemiological Commentaries published prior to 1 December 2015, April to June 2014 to October to 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 to June 2013 to October to December 2013).

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

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

The following acute trusts were thus affected:

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

The KH03 data used for this report was published on 11 May 2018. 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 2016 mid-year resident population estimates which are based on the 2011 census for England (2017 estimates are based on 2016 mid-year estimates).

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 (for example, 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

MSSA, *E. coli, Klebsiella* spp. and *P. aeruginosa* 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.

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 and *E. coli* bacteraemia and 28 days for CDI, with the date of specimen being considered day 'one'.

Incidence rate calculations:

MRSA, MSSA and E. coli 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* bacteraemia 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: January to March 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 2014/15: April to June 2014

Q2 2014/15: July to September 2014

Q3 2014/15: October to December 2014

Q4 2014/15: January to March 2015