Public Health England

Protecting and improving the nation's health

Mandatory enhanced MRSA, MSSA and Gram-negative bacteraemia, and *Clostridium difficile* infection surveillance

Protocol version 4.2

This protocol supersedes version 4.1 dated March 2017

April 2019

About Public Health England

Public Health England exists to protect and improve the nation's health and wellbeing, and reduce health inequalities. It does this through world-class science, knowledge and intelligence, advocacy, partnerships and the delivery of specialist public health services. PHE is an operationally autonomous executive agency of the Department of Health.

Public Health England
Wellington House
133-155 Waterloo Road
London SE1 8UG
Tel: 020 7654 8000
www.gov.uk/phe
Twitter: @PHE_uk
Facebook: www.facebook.com/PublicHealthEngland

Published April 2019

This document is available in other formats on request. Please call 020 8327 6868 or email mandatory.surveillance@phe.gov.uk

Hyperlinks
All hyperlinks included in this document can be identified by the use of burgundy colour text in body text (example type face).

1. Amendments to the protocol in this version

The following changes have been made to the protocol in this version. A full list of changes can be found in 13.14 Appendix 14. Changes to the mandatory surveillance protocol

- *C. difficile* infection cases are now classified into four possible onset statuses according to the prior healthcare exposure of the patient:
    - hospital-onset, healthcare associated (HOHA),
    - community-onset, healthcare associated (COHA),
    - community-onset, indeterminate association (COIA)
    - community-onset, community associated (COCA).

  This makes the CDI surveillance more comparable with international definitions
- Surveillance of *S. aureus* bacteraemia now includes *S. argenteus* and *S. schweizeri*
- Text added regarding change of classification of *Clostridium difficile* to *Clostridoides difficile*
- Due to the reclassification of *Enterobacter aerogenes* to *Klebsiella aerogenes*, the inclusion criteria for surveillance of *Klebsiella* spp. has been expanded to include this species
- CPE testing of screening samples at acute trusts has been added to the data captured by the QMLR
- Added text of the QMLR questions regarding *C. difficile* infection testing has been clarified, based on user feedback
- Added requested risk factor question for all collections to include whether the patient had received anticancer chemotherapy in the past 28 days

2. Glossary

CCG Clinical Commissioning Group. The main commissioners of services funded by the NHS in England. CCGs replaced Primary Care Trusts (PCTs) in April 2013

CDC Centers for Disease Control and Prevention The national health protection agency for the USA

CDI *Clostridium difficile* infection

CDRN *Clostridium difficile* ribotyping network service. A network of nine participating laboratories that uses ribotype analysis to investigate clustering of CDI cases.

CEO Chief Executive Officer. In the context of the HCAI DCS this is the individual responsible for confirming that their Trust's MRSA, MSSA and Gram-negativebacteraemias and CDI figures are correct by signing off the data each month

CMO Chief Medical Officer

CPE Carbapenemase-producing *Enterobacteriaceae*

CQC Care Quality Commission. The CQCs role is to regulate, inspect and review all adult social care services in the public, private and voluntary sectors in England

DBS Demographics Batch Service. The service used to trace data

DH The Department of Health. The government department responsible for public health issues. PHE collects the surveillance data described in this protocol on behalf of the DH

DPH Director of Public Health. DPHs carry out public health duties of their local authority. All MRSA, MSSA and Gram-negative bacteraemia and CDI reports are mapped to a DPH from January 2009 onwards based on the patient's mapped CCG

DoB Date of Birth

ECDC European Centre for Disease Prevention and Control The European Union agency aimed at strengthening Europe's defences against infectious diseases.

EIA Enzyme immunoassay

GDH Glutamate dehydrogenase. An antigen produced by C. difficile which can be used as a diagnostic indicator in conjuction with other tests

GRE Glycopeptide resistant enterococci (sometimes referred to as VRE)

HCAI Healthcare associated infections

HCAI DCS Healthcare associated infections data capture system. The web-based system where patient-level mandatory surveillance data on MRSA, MSSA and Gram-negative

bacteraemia and *C. difficile* infection are collected. Aggregate-level quarterly mandatory laboratory returns (see QMLR below) are also entered on this site

HES Hospital Episode Statistics. Maintained by NHS Digital and contains details of all admissions, outpatient appointments and A&E attendences at NHS hospitals in England. The HCAI DCS has used the same definitions for many fields as those found on HES

IS Independent Sector. Privately run healthcare facilities which may, or may not, treat NHS patients. This term is used in this protocol to refer to the sector as a whole, rather than a specific hospital or group. The term IS facility is used to refer to specific hospital or group of hospitals. See section 3 for a definition

ISP Independent Sector Provider. A non-NHS organisation providing secondary healthcare through hospital sites.

ISS Independent Sector Site. A hospital site operated by an Independent Sector Provider.

KH03 A quarterly return managed by NHS England, which provides data on the average occupied overnight beds for all NHS Trusts in England; providing an indication of how busy NHS Trusts were for a specific period in time. As there is no population data for NHS Trusts, as their services are not geographically restricted, KH03 data are used as a proxy for the denominator in the calculation of NHS acute trust rates

MRSA Meticillin resistant *Staphylococcus aureus*

MSSA Meticillin susceptible *Staphylococcus aureus*

NAAT Nucleic acid amplification techniques. A family of molecular diagnostic techniques that rely on the amplification of genetic material.

NHS National Health Service

NHS Digital The national provider of information, data, and IT systems for health and social care. Reports are traced against the NHS Spine via NHS Digital and the Demographics Batch Service. NHS Digital also holds most of the administrative codes required for unambiguous identification of NHS and Independent Sector organisations

NHS Improvement The NHS body responsible for regulating NHS trusts

NHS Patient Safety A group within the NHS Commissioning Board Special Health Authority which receives confidential reports of patient safety incidents. http://www.nrls.npsa.nhs.uk/ From 1 April 2016, NHS Patient Safety became part of NHS Improvement

ODS https://digital.nhs.uk/organisation-data-service. Provided by NHS Digital and is responsible for the publication of all organisation and practitioner codes. These codes form part of the NHS data standards.

PII Patient Identifiable Information. This refers to any data that allows an individual to be unambiguously identified

PIR Post Infection Review. A review process applied to all MRSA bacteraemia reports made to the mandatory surveillance scheme between 1st April 2013 and 1st April 2018. The aim of the PIR was to determine lessons learned from each MRSA bacteraemia report

PHE Public Health England

PHEC Public Health England Centre. Local PHE teams responsible for supporting local areas to deliver health and wellbeing strategies and co-ordinating local PHE activities.

QMLR Quarterly Mandatory Laboratory Returns. The monthly aggregate totals of various laboratory results which are entered onto the DCS

3. List of definitions and useful terms

Acute renal failure
Where kidney failure develops suddenly rather than after long term kidney disease

Assignment
The process of assigning MRSA bacteraemia reports only to an acute trust, CCG, or 'third party' as part of the PIR process. Reports were provisionally assigned based on the apportionment algorithm (13.7 Appendix 7. Algorithms to determine the onset status of cases) and finally assigned to the reporting Trust, attributed CCG or a 'third party', once the PIR process had been finalised. Trust assigned reports were always assigned to the Trust reporting the specimen, CCG assigned reports were always assigned to the CCG to which the report is attributed. 'Third party' reports were not assigned to any specific organisation and included cases in patients resident in England but who had received care from a third party organisation (i.e. neither the reporting organisation nor the commissioning CCG), cases in patients resident outside England or intractable cases. Further details of assignment for MRSA bacteraemia can be found in the MRSA PIR toolkit

CCG attribution
All MRSA, MSSA, and Gram-negative bacteraemia and CDI reports are attributed to a CCG. This is regardless of whether the report is Hospital-onset . Reports are attributed to a CCG by a tracing algorithm which matches the patient to a record on the NHS Spine and then attributing to a CCG based on information (or lack thereof) on the NHS Spine. Further information on CCG attribution can be found in section 13.6 Appendix 6. CCG Attribution Process

Commissioning Pathway
Refers to a way of mapping reports on the system that reflects which organisations were involved in the commissioning of the patient's care. The primary organisations that are part of this pathway are: CCGs; NHS local offices, DPHs and NHS Commissioning Regions. The Commissioning Pathway for each report is determined by the CCG to which the report is attributed. Based on the CCG, the report is mapped up to a DPH, NHS Area Team and Commissioning Region. Note that PHECs and PHE Regions are entitled to view reports mapped to CCGs within their geographic boundary although PHE organisations are not strictly part of the Commissioning Pathway. Note that PHECs and PHE Regions are able to view Reporting and Commissioning Pathways

Commissioning Region
The NHS England region (London, Midlands and East of England, North of England, South of England) within which the CCG that each MRSA, MSSA, Gram-negative bacteraemia and CDI report is mapped to, based on the CCG attribution process. Each MRSA, MSSA, Gram-negative bacteraemia and CDI report has a Commissioning Region associated with it, however QMLR records cannot have a Commissioning Region associated with them as they are an aggregate-level data collection and do not undergo the CCG attribution process. For any given report of MRSA, MSSA, Gram-negative bacteraemia and CDI the Commissioning Regions (above) and Reporting (below) may be the same or may be different; please refer to the example below under 'Reporting Region'

Day case
A patient receiving care in an acute trust and care is expected to last at least half a day, but the patient will not stay overnight.

Established renal failure
A loss of kidney function to a point where it becomes life threatening. Haemodialysis is one of the treatments for this condition. In contrast to acute renal failure, established renal failure usually develops slowly

Emergency assessment
A patient in an Emergency Assessment Unit (EAU) for assessment of symptoms prior to admission.

Inpatient
A patient admitted to an acute trust for care and is expected to stay overnight

IS provider
A generic term relating to an Independent Sector healthcare provider. The provider may be a single hospital/site or a large group with many hospitals/sites

IS group
A collection of two or more IS hospitals owned by the same provider

IS provider site
A single location from which an IS provider operates. A site may be a hospital or a site within a hospital

Line listings
Patient-level data downloaded from the DCS that can be opened in spreadsheet software. Only specific users have access to line listings. The line listing may or may not include PII

Lockdown
When the QMLR dataset is automatically locked by the DCS. After this happens the dataset is locked and cannot be amended by users without first contacting PHE. The QMLR dataset is automatically locked down 6 weeks after the end of the reporting quarter

Locked dataset
A dataset that has been signed off and is locked. Such datasets cannot be amended by users without first contacting PHE. See the DCS user guide for method for requesting unlocks

NHS Spine
An information system that connects essential national services including summary care records and patient demographic information. NHS Spine is provided by NHS Digital.

Onset Status
The term trust apportioned has change to hospital-onset and non-trust apportioned has changed to community-onset.
The process whereby reports from NHS acute trusts of bacteraemia and *Clostridium difficile* infection (CDI) are separated into ‘’Hospital-onset’ and ‘Community-onset’ reports. Hospital-onset cases represent reports that are thought to most likely be the responsibility of the acute

trust which reported the infection episode, whilst ‘Community-onset’’ refers to those reports that are not determined to be ‘Hospital-onset’’. The sum of the number of ’Hospital-onset’ and ‘Community-onset reports adds up to the total number of reports made by the NHS to PHE for a given time period. All bacteraemia and CDI cases are subject to this algorithm.which is given in section 13.7 Appendix 7. Algorithms to determine the onset status of cases

Outpatient
A patient receiving care at an acute trust that is not admitted and care is not expected to last more than 6 hours.

PHE National infections Service (NIS)
The directorate within PHE that is responsible for microbiology and epidemiology of infectious diseases. It aims to protect the population in England from infectious disease and reduce the burden of infectious disease.

PHE Regions
Provide local support and guidance to NHS organisations within their region

Record Owner
A term used to refer to users who enter and save records onto the HCAI DCS. These are NHS acute trust users or IS provider/IS site users

Reporting Pathway
Refers to a way of mapping reports on the system to the organisations associated with the reporting organisation, i.e. the NHS acute trust or IS Provider making the report. Organisations involved in this pathway are the reporting Trust or IS Provider, PHEC and PHE Region. Reports are mapped to a PHEC and PHE Region based on the reporting Trust or IS Provider. Note that PHECs and PHE Regions are able to view Reporting and Commissioning Pathways

Reporting Region
The PHE Region (London, Midlands and East of England, North of England, South of England) within which the Reporting Organisation (NHS acute trust or IS Provider Site) is located. Each MRSA, MSSA, Gram-negative bacteraemia and CDI report, and each QMLR record has a Reporting Region associated with it. For any given report of MRSA, MSSA, Gram-negative bacteraemia and CDI the Reporting and Commissioning Regions may be the same or may be different. For example a report of MRSA could be made by a Trust in London for a patient presenting at a London Reporting Organisation. If the patient was also traced to a CCG in the London Commissioning Region then the Reporting and Commissioning Regions would be the same. However, if the patient was traced to a CCG in another Commissioning Region (e.g. if the patient lived in Manchester and was visiting London when presenting to a London Reporting Organisation) then the Reporting and Commissioning Regions would differ.

Reporting Organisation
The organisation reporting the case of MRSA, MSSA, Gram-negative bacteraemia or CDI or QMLR data. The Reporting Organisation is associated with each of the records entered onto the system based on the user’s login details, thus by default each record on the HCAI DCS has a Reporting Organisation associated with it. All cases are currently reported by NHS acute trusts or IS Provider sites.

Sign-off
When the Reporting Organisation's CEO/Sign-off authority declares that the data submitted on the DCS is correct by using the sign-off feature on the HCAI DCS. After data is signed-off it is 'locked' and cannot be amended by users without first contacting PHE,as per the Unlock Request User Guide

Soundex
Encrypted version of a surname. A soundex takes the form of a letter followed by 3 numbers. In the context of the HCAI DCS, when a patient's surname is entered onto the system it is automatically converted into a soundex

STP (Sustainability and Transformation Partnership)
NHS organisations responsible for collaborating between local NHS organisations and local government

Unlock request
A request made by a record owner (Reporting Organisation) to unlock records which have been signed-off in order to make amendments, or add or delete records. See CEO sign-off and unlock requests

4. Introduction

Public Health England (PHE) maintains an enhanced reporting system for Meticillin Resistant *Staphylococcus aureus* (MRSA) bacteraemia, Meticillin Susceptible *Staphylococcus aureus* (MSSA) bacteraemia, Gram-negative (*Escherichia coli, Klebsiella* spp. and *Pseudomonas Aeruginosa*) bacteraemia and *Clostridium difficile* infection (CDI).

A series of letters from the Chief Medical Officer (CMO) introduced the mandatory requirements for National Health Service (NHS) acute trusts to report each case of MRSA bacteraemia (effective from 1st of October 2005), MSSA bacteraemia (effective from 1st January 2011), *E. coli* bacteraemia (effective from 1st June 2011) and CDI (effective from 1st April 2007) that fulfil the case definitions (see Inclusion criteria for reporting to the surveillance system) to this system. [1-5] The Health and Social Care Act 2008 and the Code of Practice on the prevention and control of infections and related guidance provided a requirement for NHS Trust Chief Executives to report all cases of MRSA, MSSA, CDI and *E. coli* to PHE.[6 7]

From April 2010 Independent Healthcare Sector (IS) Providers treating NHS patients were mandated to report cases of MRSA bacteraemia and CDI fulfilling the same case definitions. MSSA bacteraemia (effective from 1st January 2011) and *E. coli* bacteraemia (effective from 1st June 2011) surveillance was added later. From October 2010 all IS Providers required to register with the Care Quality Commission were obliged to undertake surveillance of Health Care Associated Infections (HCAI). These requirements were reinforced in the Competition and Markets Authority Order 2014 which reiterated the requirement to provide patient-level information on facility-acquired infection rates.[8] These Providers can report cases to PHE.

From April 2017 a government initiative extended the surveillance of bacteraemias caused by Gram-negative organisms to include *Klebsiella* species and *P. aeruginosa* in addition to the existing *E. coli* collection with the intention of reducing such infections by 50% by 2021.

5. The HCAI Data Capture System

The enhanced surveillance system, hereafter HCAI Data Capture System (HCAI DCS), captures information on each MRSA, MSSA and Gram-negative bacteraemia, and CDI case in order to give Trusts and IS Providers a more accurate picture of their situation allowing targeted intervention in problem areas and to contribute to building a better evidence base regarding risk factors for infection.

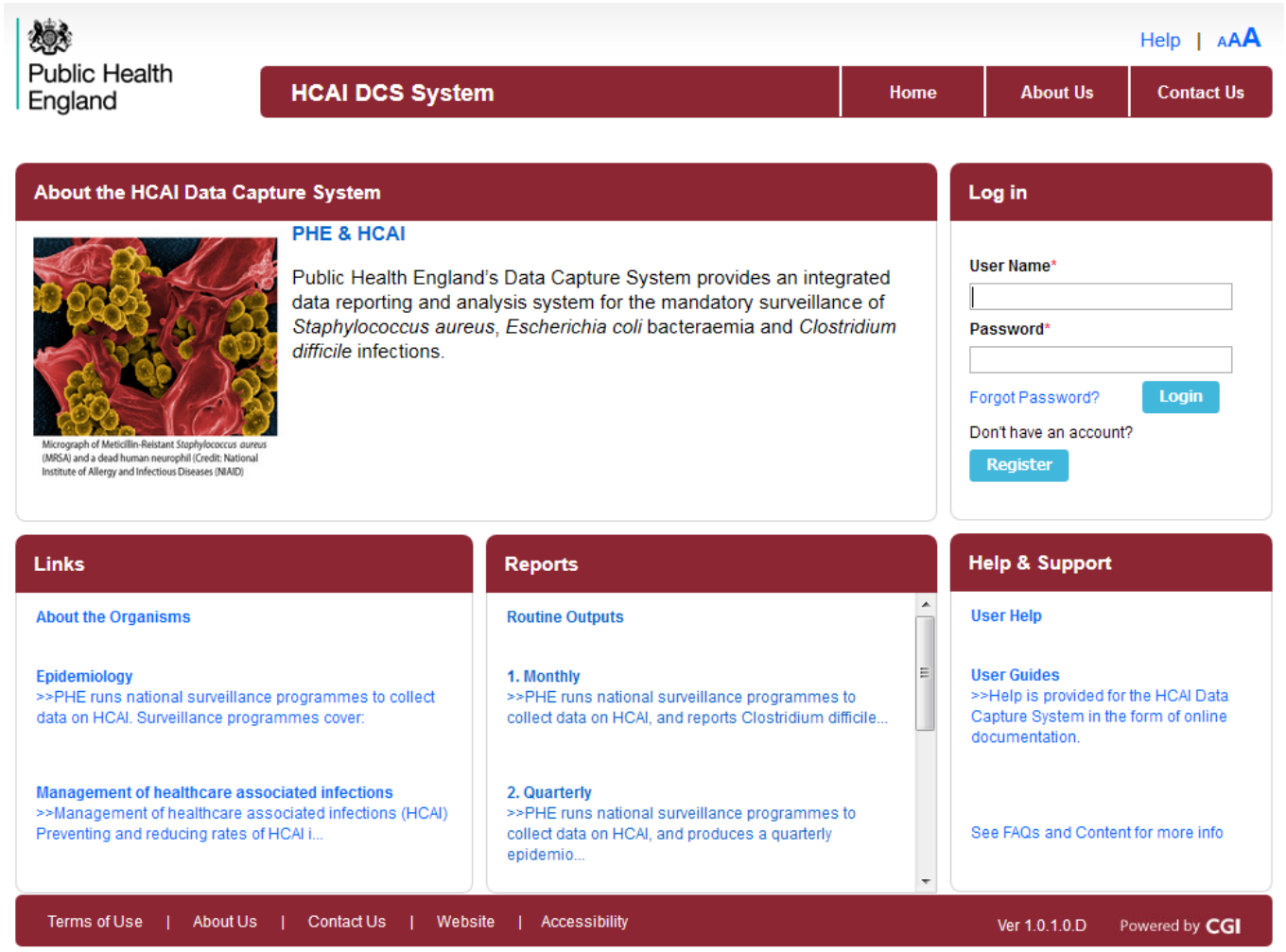
The HCAI DCS allows the following:

- Reports to be entered in 'real time' as they occur;
- Authorised Trust/IS Provider users to download patient level data for cases they have entered;
- All users to download tables of aggregated data on the system;

  All bacteraemia and CDI cases to be separated into 'Hospital-onset' (i.e. cases that are considered to have been acquired in that Trust during that admission) and 'Community-onset' (i.e. cases that are not thought to have been acquired in that Trust during that admission). See 13.7 Appendix 7. Algorithms to determine the onset status of cases for more information.
- All cases to be attributed to a CCG via the tracing process. The HCAI DCS does not currently require patient CCG details to be recorded for any MRSA, MSSA, Gram-negative bacteraemia or CDI cases. To obtain these data, patient name, sex, NHS number and date of birth are submitted to the Health and Social Care Information Centre on a daily basis to identify patient GP details and patient residential postcode, and patients are attributed to a CCG based on this process. More details about CCG attribution can be found in 13.6 Appendix 6. CCG Attribution Process;
- Enhanced data (e.g. data on risk factors and causes) on these HCAIs to be collected. This enables better understanding of the epidemiology behind these infections and helps to develop and monitor interventions to reduce their incidence. More details on the risk factor data collected can be found in 13.2 Appendix 2: Risk factor data to be collected

Please note that the quarterly mandatory laboratory return (QMLR) surveillance scheme, collecting aggregate information, continues to operate independently of this enhanced scheme and as such this information must also be completed using the facility within the HCAI DCS. Details of the QMLR surveillance scheme are provided in 13.9 Appendix 9. Quarterly mandatory laboratory returns (QMLRs).

Figure 1: The front page of the HCAI DCS



6. Inclusion criteria for reporting to the surveillance system

This reporting guidance applies to English NHS acute trusts and the Independent Sector.

Acute trusts are responsible for ensuring that all specimens tested at their trust and meeting the inclusion criteria are reported to the DCS. This includes specimens taken from other trusts or in community settings. Where one acute trust or associated pathology laboratory tests specimens for another trust, local service level agreements should be in place to allow the trust where the specimen was taken to report the case to the DCS. In the case of specimens taken in the community, cases should be reported by the trust where the testing laboratory is located, except where local service level agreements exist. The trust where a laboratory is located is determined by the Parent Organisation Code for the testing laboratory in the ODS file eplab.

6.1 Changes to microbial taxonomy

Over time, the understanding of how bacterial species are classified changes as diagnostic methods improve. As a general principle, the surveillance will start to include cases of bacteraemia if a bacterial species in one genus is reclassified to a genus under surveillance. Organisms under surveillance which are reclassified to a different taxon will remain under surveillance to maintain consistent time trends.

The following changes in taxonomy have occurred during the period of surveillance:

- In 2015, two species of *Staphylococci* (*Staphylococcus schweizeri* and *Stapylococcus argenteus*) which are phenotypically identical to *S. aureus* were identified. The three species together form the *S. aureus*-related complex and all are covered by the surveillance. [9]
- In 2016, *Clostridium difficile* was reclassified as *Clostridoides difficile*. *Clostridium difficile* remains in widespread use in the scientific literature and this surveillance will continue to refer to the organism as *Clostridium difficile* for the foreseeable future.[10]
- In 2017, *Enterobacter aerogenes* was reclassified to *Klebsiella aerogenes*. *K. aerogenes* was eligible for surveillance from April 2017 and trusts which identify isolates on or after 01/04/2017 are expected to report them as *K. aerogenes*.[11]

6.2 MRSA bacteraemia

The following blood cultures positive for *S. aureus*-related complex organisms (*S. aureus*, *S. argenteus* and *S. schweitzeri*) must be reported to PHE:

- All cases of bacteraemia caused by *S. aureus*-related complex bacteria resistant to meticillin, oxacillin, cefoxitin or flucloxacillin
- All cases of bacteraemia caused by *S. aureus*-related complex bacteria which are positive for *mec-A* or *mec-C.*

Exclusions

- Cases identified post-mortem are excluded

6.3 MSSA bacteraemia

The following blood cultures positive for *S. aureus*-related complex bacteria must be reported to PHE:

- All cases of bacteraemia caused by *S. aureus*-related complex bacteria which are not resistant to meticillin, oxacillin, cefoxitin, or flucloxacillin i.e. not subject to MRSA reporting

Exclusions

- Cases identified post-mortem are excluded

Notes

Isolates that are highly resistant to meticillin but are *mec-A* or *mec-C*-negative are an anomaly and should be investigated with possible referral to the national reference laboratory.

6.4 Gram-negative bacteraemia

Blood cultures positive for the following organinisms must be reported to PHE

- All laboratory confirmed cases of *E. coli* bacteraemia
- All laboratory confirmed cases of *Klebsiella* spp. (including *Klebsiella aerogenes* formerly in the *Enterobacter* genus) bacteraemia
- All laboratory confirmed cases of *P. aeruginosa* bacteraemia

Exclusions

- Cases identified post-mortem are excluded

6.5 *C. difficile* infection

Any of the following defines a *C. difficile* infection in patients aged 2 years and above and must be reported to PHE:

- Diarrhoeal stools (Bristol Stool types 5-7) where the specimen is *C. difficile* toxin positive*
- Toxic megacolon or ileostomy where the specimen is *C. difficile* toxin positive*
- Pseudomembranous colitis revealed by lower gastro-intestinal endoscopy or Computed Tomography
- Colonic histopathology characteristic of *C. difficile* infection (with or without diarrhoea or toxin detection) on a specimen obtained during endoscopy or colectomy
- Faecal specimens collected post-mortem where the specimen is *C. difficile* toxin positive or tissue specimens collected post-mortem where pseudomembranous

colitis is revealed or colonic histopathology is characteristic of *C. difficile* infection

Please note: In contrast to other collections, *C. difficile* infections identified post-mortem are included

Current guidelines* recommend a combination of two tests (first; toxin gene detection by NAAT or GDH EIA, second; a sensitive toxin EIA test) for the diagnosis of CDI.

* DH/ARHAI guidance which incorporates *C. difficile* testing recommendations

For additional information, please refer to the Frequently Asked Questions (13.11 Appendix 11. Frequently Asked Questions).

6.6 Episode categories

The DCS allows for three different episode types; new infection, continuing infection, a repeat infection or relapsing infection.

- **New infection** – Infection in patient with no known history of bacteraemia or CDI caused by organism of interest,
  or
  Patient has previously had an episode of bacteraemia (or CDI as appropriate) but more than three months have elapsed since its resolution and there have been no positive specimens in the intervening time
- **Continuing infection** – New episode of infection (> 14 for bacteraemia or 28 days for CDI since first positive specimen) without negative tests in between samples
- **Repeat/relapsing infection** – New episode of infection (> 14 for bacteraemia or 28 days for CDI since first positive specimen) with negative tests between first positive sample and most recent positive sample

6.7 Quarterly Mandatory Laboratory Returns

The following must be reported to PHE:

- Total number of blood culture sets
- Total number of positive blood culture sets
- Total number of *S. aureus*-positive blood culture sets
- Total number of Glycopeptide-Resistant Enterococci (GRE) positive blood culture episodes
- Total number of stool specimens examined for *C. difficile* infection
- Total number of stool specimens tested for diagnosis of *C. difficile* infection. A two-stage test of GDH and toxin counts as a single test, as does a NAAT for toxin gene followed by a toxin EIA
- Total number of *C. difficile* toxin positive reports in people ≥ 65 years old
- Total number of *C. difficile* toxin positive reports in people between 2 and 64 years old

- Total number of faecal specimens and rectal swabs taken for CPE screening

Table 6.1: Definitions of data items for Quarterly Mandatory Laboratory Returns

Laboratory finding	Definition
Total number of blood culture sets	A sample arising from a single venipuncture, irrespective of number of bottles tested
Total number of positive blood culture sets	All samples positive for bacterial growth, including repeat specimens and contaminants
Total number of *S. aureus*-positive blood culture sets	Excludes repeat specimens within a 14-day episode
Total number of Glycopeptide-Resistant Enterococci (GRE) positive blood culture episodes	Excludes repeat specimens within a 14-day episode. GRE episodes should be reported at a genus level and concurrent reports of different species within the Enterococcus genus do not constitute separate episodes
Total number of stool specimens examined	All stools, not limited to those that can be classified according to Bristol Stool Chart. Also includes those stool samples used for *C. difficile* toxin testing.
Total number of *C. difficile* toxin tests carried out	All *C. difficile* tests performed, positive and negative. Includes duplicates
Total number of *C. difficile* toxin positive reports in people ≥ 65 years old	Total number of *C. difficile* episodes in people ≥ 65 years old. Excludes multiple samples within same 28-day episodes
Total number of *C. difficile* toxin positive reports in people between 2 and 64 years old	Total number of *C. difficile* episodes in people 2 to 64 years old. Excludes multiple samples within same 28-day episodes
Total number of faecal specimens and rectal swabs taken for CPE screening	The total number of faecal specimens and rectal swabs taken at a trust with the purpose of identifying CPE carriage. If not possible to distinguish rectal and perineal swabs, report total number of swabs.

6.8 Method of reporting data on the HCAI DCS

The HCAI DCS is a web portal designed by PHE to facilitate the collection of the enhanced data set.
The HCAI DCS can be accessed at the following URL:
https://hcaidcs.phe.org.uk/WebPages/GeneralHomePage.aspx

For complete guidance on the HCAI DCS please refer to the User Manuals which are available using the link above under the section ‘Help & Support’. A password to the HCAI DCS is not required to view the documentation.

Access to the HCAI DCS is regulated by a system of differing user roles which grant different levels of access, as described in the user roles and permissions user guide. Access to the HCAI DCS can be requested by following the 'Request' link on the front page of the HCAI DCS. Local administrators will approve account requests for all users in their organisation. User accounts will be requested based on different roles which will give the user different persmissions on the system. User roles are detailed in Table 4.2 below:

Table 6.2:User roles and persmissions on the HCAI DCS

Role	Permissions
System Administrator	Full access to the system. Able to authorise requests for local administrator accounts. National team responsible for mandatory surveillance only.
Local Administrator	Able to authorise local accounts. Unable to perform data entry or export line listing reports
Sign Off Authority	Able to sign off monthly data collections. Unable to perform data entry.
Data Entry	Creates new cases on system. Can edit saved cases. Only role that can view 'Find duplicates' report.
Read Only (PII)	Read access only, PII not visible.
Read Only (No PII)	Read access only, PII visible.
Renal Data Entry	Able to edit data on cases shared with renal unit
Renal Read Only (No PII)	Able to view data on cases shared with renal unit. PII not visible.
Renal Read Only (PII)	Able to view data, including PII on cases shared with renal unit.
PIR Data Entry User	Can edit PIR tabs on existing cases. Unable to view PIR case summary.
PIR Assignment	Able to perform assignment of PIR case. Unable to enter or edit PIR data. Can view PIR case summary.
PIR Arbitrator	Able to perform arbitration of PIR case. Unable to enter or edit PIR data. Can view PIR case summary.
PIR View Only	Can view PIR case summary. Unable to enter or edit PIR data.
CCG Data Entry Role	Can edit the Risk Factors tab **only** on existing Gram-negative cases.

DPH and Local Authority roles do not have PII priviliges and are unable to view PII on the HCAI DCS.

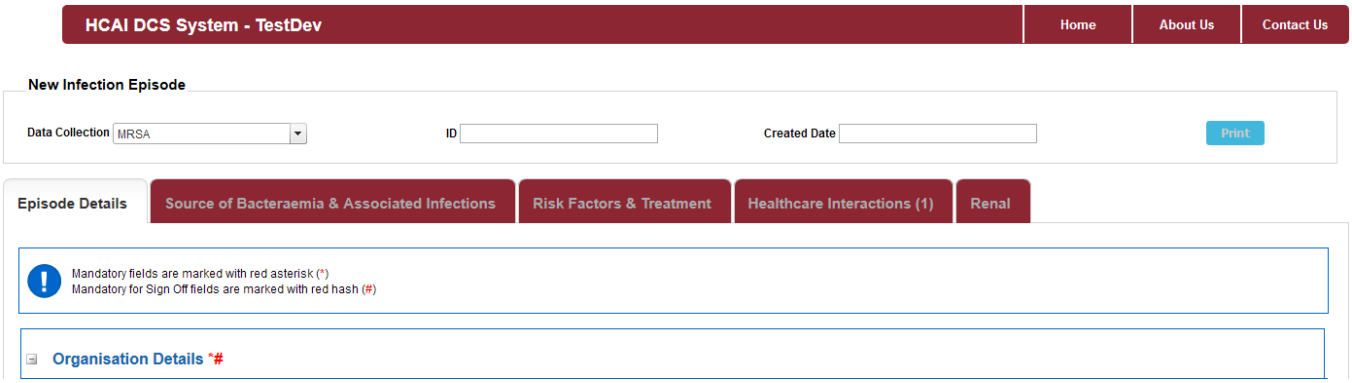
Trusts using the website have access to all the data they have entered, which enables them to assess their burden of these HCAIs. This allows Trust-to-Trust comparisons. CCGs, Local Authorities, Directors of Public Health (DPH), NHS Area Teams, Field Epidemiology, PHE Region and PHE Centres are also able to have accounts and will be able to view cases mapped to their organisations.

7. Data collection question layout

The HCAI DCS separates common questions\fields into groups on separate tabs within a record i.e. questions about the source of bacteraemia can be found on the riskfactors tab (see Figure 2). Fields and tabs vary between organism collections; e.g. Gram-negative bacteraemia and CDI have different fields in the Risk Factors tab.

Fields regarding the infection episode itself are grouped together on the Episode Details tab, which is common across all organism collections. Within this tab there are fields that are mandatory for completion and optional for completion. Mandatory fields are further subdivided into mandatory for sign-off and mandatory for saving. Fields that are mandatory for saving must be completed in order for a record to be saved. Fields that are mandatory for sign-off must be completed in order for the CEO/sign-off authority to complete the sign-off. Further details about data items can be found in 13.1 Appendix 1. Episode details to be collected and 13.2 Appendix 2: Risk factor data to be collected and also in the Case Capture User Guide.

Figure 2: HCAI DCS showing tabs for MRSA data collection.



8. Renal records

The HCAI DCS is designed to allow capture of data on patients with established renal failure and receiving dialysis. The data model provides for two modes of access to data. A record is ‘owned’ by the reporting organisation, and then ‘shared’ with the renal unit responsible for providing renal care. Renal units can enter data on the ‘Renal’ tab within a case screen but will not be able to add or edit data on any of the other tabs.

Once a record has been shared with a renal unit, registered users within the unit will receive an email notification that the record has been shared with the unit.

Details about the data items collected under the renal tab are described in13.5 Appendix 5: Renal data items . Instructions on sharing and entering renal data can be found in the Case Capture Renal User Guide.

8. Deadline for entering and signing-off data

The deadline for entering and signing-off data is the same for both the NHS and Independent Sector. All cases with specimen dates during a specific month must be entered onto the website by the 15th of the following month. The month's data must then be signed-off by the an individual who has sufficient authority and the correct user role (usually a Trust's Chief Executive Officer (CEO) or senior individual other than the CEO for Independent Sector organisations) by the 15th of every month. For example, data concerning specimens collected in October must be entered and signed-off by the 15th of November.

QMLR data for each 3 month period must be submitted within 6 weeks of the end of the data collection period (up to and including 14th). After this point the dataset is automatically locked and it is not possible to enter further data.

Once a period has been signed-off, it will not be possible to edit the episode details and renal tabs of a record, or to add or remove cases from the system. It is possible to request that a period or record is unlocked. The process for requesting an unlock is described in the Unlock Request User Guide.

9. CEO sign-off and unlock requests

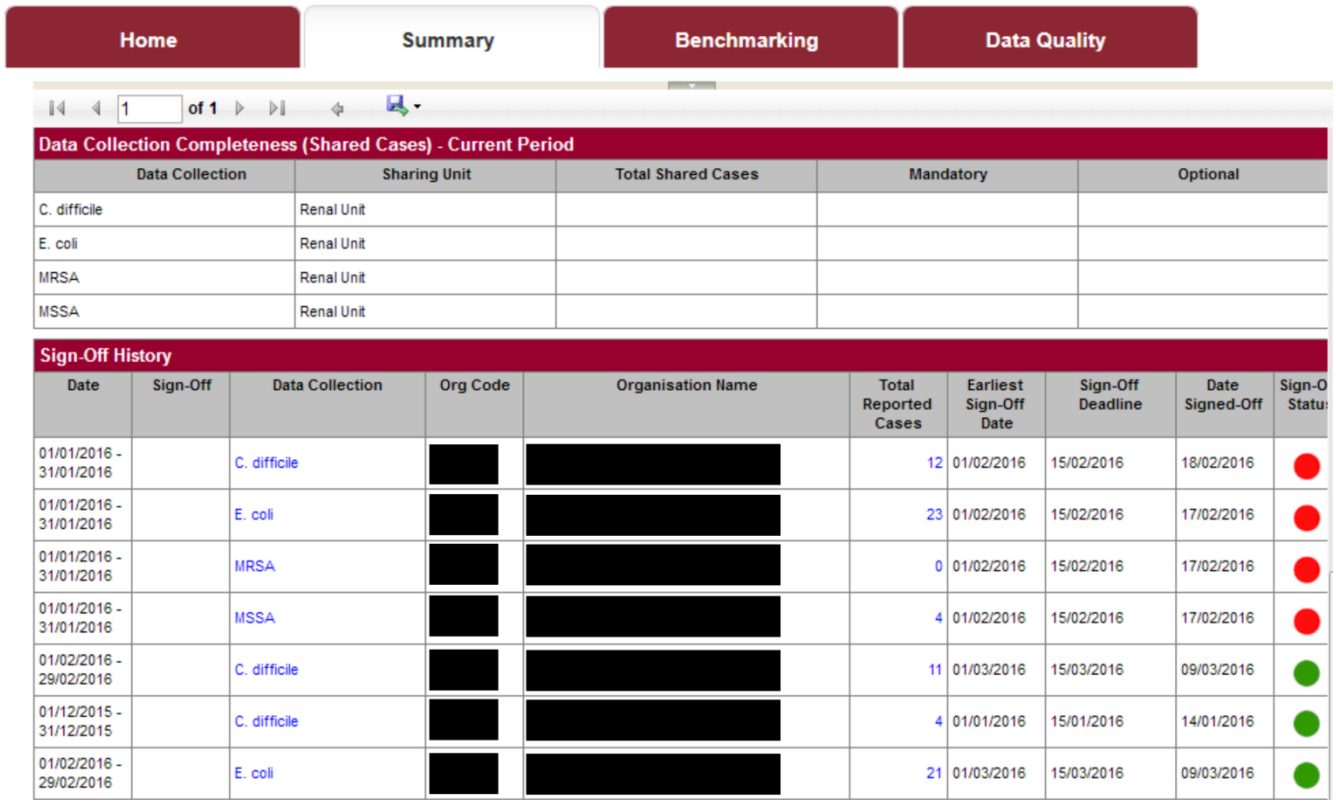
9.1 CEO sign-off

The mandatory surveillance data for healthcare associated infections must be signed-off on a monthly basis. This is the responsibility of the Chief Executive Officer (CEO) of an NHS acute trust or the 'authorised person' for Independent Sector Healthcare Providers (where the 'authorised person' is defined as a senior manager within the organisation who has been given the responsibility to sign off the data).

This process was introduced in order to make sure the data has been verified and is accurate. It is the personal responsibility of the CEO or 'authorised person' to make sure that the data returns are accurate, complete and that they are submitted on time, as mandated by the Chief Medical Officer (CMO) and the Department of Health.

This process provides reassurance that data that are included in a period which has been signed-off by an NHS acute trust's CEO or an Independent Sector Healthcare Provider's 'authorised person' are valid. Features within the new HCAI DCS allow you to differentiate between signed-off and unsigned-off periods of data, by filtering data returned in various reports and in the Summary dashboard 'Summary' and 'Trends' graphical elements.

Figure 3: Sign-off history in the Summary dashboard of the DCS



Data Collection Completeness (Shared Cases) - Current Period

Data Collection	Sharing Unit	Total Shared Cases	Mandatory	Optional
C. difficile	Renal Unit			
E. coli	Renal Unit			
MRSA	Renal Unit			
MSSA	Renal Unit			

Sign-Off History

Date	Sign-Off	Data Collection	Org Code	Organisation Name	Total Reported Cases	Earliest Sign-Off Date	Sign-Off Deadline	Date Signed-Off	Sign-O Statu
01/01/2016 - 31/01/2016		C. difficile	[redacted]	[redacted]	12	01/02/2016	15/02/2016	18/02/2016	
01/01/2016 - 31/01/2016		E. coli	[redacted]	[redacted]	23	01/02/2016	15/02/2016	17/02/2016	
01/01/2016 - 31/01/2016		MRSA	[redacted]	[redacted]	0	01/02/2016	15/02/2016	17/02/2016	
01/01/2016 - 31/01/2016		MSSA	[redacted]	[redacted]	4	01/02/2016	15/02/2016	17/02/2016	
01/02/2016 - 29/02/2016		C. difficile	[redacted]	[redacted]	11	01/03/2016	15/03/2016	09/03/2016	
01/12/2015 - 31/12/2015		C. difficile	[redacted]	[redacted]	4	01/01/2016	15/01/2016	14/01/2016	
01/02/2016 - 29/02/2016		E. coli	[redacted]	[redacted]	21	01/03/2016	15/03/2016	09/03/2016	

9.2 Identification of duplicate records

Prior to sign-off records should be check to ensure duplicate entries have not been made. The 'Find duplicates' report will identify duplicated records based on a configurable selection of criteria including NHS number, date of birth, surname soundex, specimen date, specimen number and hospital number. Identified duplicates should be double checked and deleted prior to sign-off if the records are confirmed as true duplicates. Note, for users using manual data entry the system will also flag possible duplicate entries for cases reported by their organisation on attempting to save a record.

9.3 Sign-off process

In order to be able to sign-off a data period, all of the records within that period need to be complete. This means that every record for a data collection that you wish to sign-off needs to have every mandatory field completed. Mandatory fields are denoted in the DCS with a red * or # symbol.

Once all of the records for the data collection(s) to be signed-off have had all of their mandatory fields completed, users will be able to sign-off the data for the period. The CEO or sign-off authority should then log in to the DCS and use the 'Sign-Off Episodes' functionality to approve the data for the month. The sign-off process is detailed in the Sign-off User Guide. Once a reporting period has been signed-off for an organisation it will become locked, i.e. signing off a month will lock it no additional cases will than be able to be added to that month nore will cases be able to be removed with out requesting an unlock.

9.4 Unlock requests

Unlock requests serve two purposes:

- To allow the modification of a record, such as to add data to or amend mandatory fields in the record, and
- To allow the reporting of additional cases or deletion of incorrectly reported cases.

Unlock requests should be sent by email to mandatory.surveillance@phe.gov.uk. Requests should come from the reporting organisation and should copy in the CEO for amendment requests, or come from the CEO for deletion/addition requests. The email should detail the organism, month, type of change and reason for unlock and the case id generated by the HCAI DCS.

Unlock requests should not include any PII such as patient name, date of birth or NHS number in unlock requests.

Unlock requests for QMLR data do not need to come from the CEO/sign-off authority and do not need to copy in the CEO/sign-off authority.

Detailed guidance on the unlock process, can be found in the Unlock Requests User Guide.

10. Denominator data

10.1 NHS

NHS acute trust-level population data does not currently exist in England as NHS acute trusts do not treat patients within defined geographical boundaries. Therefore, a suitable proxy for population is required in order to calculate Hospital-onset rates. The occupied overnight beds (from the national KH03 dataset) provides the daily average overnight bed occupation for a specific time period; full financial years for 2007/08 to 2009/10 and by quarter for financial years 2010/11 to 2014/15. This dataset is an open access return published by NHS England and provides a measure of clinical activity in each trust. Data for the most recently published quarter may be used to substitute values for the current surveillance quarter in instances where later data is yet to be released/published (e.g. substituting data from 2014/15 for 2015/16).

If any KH03 data for an individual Trust is more than 20% higher or lower than both the previous quarter and the same quarter in the previous year, then NHS Patient Safety will be informed.

If any KH03 data are missing, the same quarter in the previous year are used.

In the Official Statistics published from the surveillance the specific quarter is used to get the most accurate results. In contrast, the DCS needs to be able to calculate rates over any time period and the denominator data is therefore slightly different. For definitive rates and counts always refer to the official statistics not DCS reports.

KH03 data is downloaded from the NHS England website, as it is for the Official Statistics reports; however, data is then scaled up to the total number of occupied overnight beds for a given financial year. This is then uploaded to the HCAI DCS. Then, in order for the system to calculate a rate for a specific time period, the total occupied overnight beds for the financial year is divided by the number of days in the financial year and then multiplied by the number of days in the time period in question. For example, in order to calculate the number of occupied overnight beds for January 2014 you would follow equations (1) and (2):

$$\text{Number of occupied overnight beds for January 2014} = \left(\frac{\text{Total occupied overnight beds in financial year 2013/14}}{\text{Total number of days in financial year 2013/14}}\right) \times \text{Total number of days in January 2014} \quad (1)$$

$$\text{Number of occupied overnight beds for January 2014} = \frac{34327781}{365} \times 31\text{days} = 2915510 \quad (2)$$

As the data starts off as a financial year as opposed to a quarter, any seasonal differences in bed day values are removed and so the rates will be slightly different.

NB. The rates produced by the HCAI DCS should be used as an estimate only, please see the official outputs on the PHE gov.uk pages for the actual infection rates. In addition, if you wish to use rates from the DCS for organisations other than your own please contact us at mandatory.surveillance@phe.gov.uk for confirmation that the rates are accurate and suitable to be used for more than an estimate.

10.2 Independent Sector

The denominator used for IS providers is a combination of bed days per year plus the number of discharges per year. This denominator is more appropriate for short-stay facilities with higher numbers of day patients. Further information on IS denominator calculation can be found in

13.12 Appendix 12. .

Data on bed days and discharges are directly supplied by IS providers to PHE on an annual basis for the most recent financial year. Currently the IS site-based denominators are not collected.

10.3 Geographic population denominators

Various organisations (CCGs, Area Team, NHS regional teams) have defined geographical boundaries. As a result, patient populations can be estimated for each of the geographical organisations. The Office for National Statistics provides mid-year population estimates and so rates can be calculated per 100,000 population for these organisations.

11. Analysis of data

11.1 NHS Official Statistics

Different reports can be obtained from the HCAI DCS on demand, depending on the users role. Please note PHE publish data tables on a regular basis. These outputs are classed as 'Official Statistics' and as such constitute the final monthly/annual position. These reports should be used as the benchmark against which individual numbers can be compared.

11.1.1 Monthly report outputs

The following NHS data are produced by PHE each month:

MRSA bacteraemia:
- Monthly MRSA by acute trust and by onset status*
- Monthly MRSA by counts by CCG and onset status*
- Monthly MRSA counts by Clinical Commissioning Group*

* MRSA reports based on PIR assignment were published previously, and are avalible online and via the DCS reports

MSSA bacteraemia:
- Monthly MSSA counts by acute trust and onset status
- Monthly MSSA counts by Clinical Commissioning Group and onset status

E. coli bacteraemia
- Total monthly counts of *E. coli* bacteraemia by acute trust
- Monthly counts of *E. coli* bacteraemia by Clinical Commissioning Group
- Monthly counts of E.coli bacteraemia split by onset of infection by NHS acute trust
- Monthly counts of E.coli bacteraemia by onset of infection by attributed clinical commissioning group

Klebsiella species bacteraemia
- Monthly counts of Klebsiella spp. bacteraemia split by onset of infection, by NHS acute trust
- Monthly counts of Klebsiella spp. bacteraemia by onset of infection, by attributed clinical commissioning group

Pseudomonas aeruginosa bacteraemia
- Monthly counts of P. aeruginosa bacteraemia split by onset of infection, by NHS acute trust
- Monthly counts of P. aeruginosa bacteraemia by onset of infection, by attributed clinical commissioning group

CDI

- Monthly CDI counts in patients aged 2 years and over by acute trust and by prior healthcare exposure
- Monthly CDI counts by Clinical Commissioning Group in patients aged 2 years and over

11.1.2 Quarterly report outputs

The following data are produced by PHE each quarter:

- Epidemiological commentaries on MRSA, MSSA and Gram-negative bacteraemia and CDI by financial quarter, from the start of surveillance for each collection. The exact content of these commentaries will differ each quarter; however the following standard analyses will be produced
  - Count and rate of total cases over time for bacteraemia and CDI
  - Counts and rates of 'Hospital-onset' cases over time for all bacteraemia and CDI

11.1.3 Annual report outputs

The following outputs using NHS data are produced by PHE annually:

- Annual epidemiological commentary on MRSA, MSSA, Gram-negative bacteraemia and *C. difficile* infection.
- Annual counts and rates by financial year for MRSA, MSSA and Gram-negative bacteraemia and CDI. Data are presented at both Trust and CCG level.

11.2 Independent Sector report outputs

The following IS data are produced by PHE every year:

- Counts and rates of MRSA, MSSA and Gram-negative bacteraemia and CDI by IS organisation

12. Contact us

If there are any outstanding queries after reading this protocol or the user guides please contact us:

For queries regarding the surveillance or its' outputs from PHE and NHS organisations please email: mandatory.surveillance@phe.gov.uk

For questions regarding the use of the DCS, please email support.hcaidcs@phe.gov.uk

For questions regarding the PIR process, please email pir.hcai@phe.gov.uk

For queries from the Independent Sector please email: independentsector@phe.gov.uk

Telephone: 020 8327 7000 – ask to be put through to the HCAI department

Please note that automatic emails generated by the HCAI DCS come from the hcai.dcs@phe.gov.uk email address. Emails **to** this address are not monitored and will not be replied to.

13. Appendices

13.1 Appendix 1. Episode details to be collected

The following table provides detailed information about the data items to be collected regarding the details of the infection episode, including whether the data are mandatory and the rationale for including the data collection on the system. Details about the risk factor data collected are in the next section (13.2 Appendix 2: Risk factor data to be collected).

Table 13.1: Properties of data items included in core data set.

Field	Completion	Rationale for inclusion
Organisation Details		
Reporting organisation	Automatic	Identifies the organisation (Trust) reporting the case.
Attributed Organisation	Automatic	CCG responsible for commissioning the patient's care
Specimen Details		
Specimen Date	Mandatory	When the specimen was taken or was received in the laboratory. Useful when assessing timing of detection. Date specimen taken is preferred over date received in laboratory.
Type of Specimen Date	Mandatory	Specifies whether the specimen date refers to when the sample was take or received in the laboratory .
Specimen No	Optional	A unique identifier for the specimen.
Laboratory where specimen processed	Optional	Laboratory providing diagnostics on specimen.Provides a useful identifier.
Patient Details		
NHS Number	Mandatory	Unique identifier for each individual patient. Allows tracing and attribution to a CCG. Can be used to identifying duplicate records for the same individual.
Forename	Mandatory	Useful Patient Identiifable Information. Allows tracing. Can be used to identifying duplicate records for the same individual.
Surname	Mandatory	Useful Patient Identiifable Information. Allows tracing. Used to create soundex. Can be used to

Field	Completion	Rationale for inclusion
		identifying duplicate records for the same individual.
Date of Birth	Mandatory	Useful Patient Identiifable Information. Allows tracing. Allows age calculation and associated age related anlyses. Where date of birth is not available the date 01/01/1900 should be entered. Can be used to identifying duplicate records for the same individual.
Sex	Mandatory	Important for epidemiologic analysis
Hospital Number	Optional	Unique local hospital identifier specific for patient and particular addmission useful in identifying duplicate records for the same individual where other information is missing.
Episode Category	Optional	Information on whether a particular record is a new infectious episode, a continuing infection or a repeat infection/relapse. Useful for epidemiological categorisation
Admission Details		
Patient Location	Mandatory	Where the patient was when the specimen was taken. Used in the algorithm to determine the onset status for bacteraemia and CDI. Also used in the algorithm for establishing which organisation should lead on a PIR for a MRSA.
Trust/Provider	Mandatory where triggered	Organisation providing care at time of specimen collection. Only triggered if patient location is NHS acute trust, Non-Acute NHS Provider, Independent Sector Provider, Mental Health Provider.
Hospital Site	Mandatory where triggered	Allows stratification of cases by site. Triggered if Patient Location is any of NHS acute trust, Non-acute NHS Provider, Independent Sector Provider, Mental Health Provider,
Patient Category	Mandatory	Admission status of patient at time of

Field	Completion	Rationale for inclusion
	where triggered	specimen. Used in the onset status algorithm. Only triggered if patient location is NHS acute trust, Non-acute NHS Provider, Independent Sector Provider or Mental Health Provider.
Other Patient Category	Mandatory where triggered	Allows completion of detail in other patient categories. Triggered only when Patient Category is Other. Free text field
Date admitted	Mandatory where triggered	Allows calculation of time between admission and onset. Only triggered if patient category is one of inpatient, outpatient, day patient or emergency assessment.
Admission Method	Mandatory where triggered	Allows stratification of rates by method of admission. Only triggered where Patient Category is inpatient, day patient, emergency assessment or other.
Provenance	Optional	Where the patient was prior to arriving at the healthcare facility. Useful for data analysis involving patient history.
Trust/Provider admitted from	Optional	Allows epidemiological analysis of risk of infection by originating organisation. Only triggered when provenance is Hospital (UK or abroad), Non-Acute NHS Provider, Independent Sector Provider, Mental Health Provider,.
Non-UK Country	Optional	Allows epidemiological analysis of risk of infection by originating country. Only triggered when provenance is Non-UK resident
Treatment details		
Admitted any time during episode	Optional	Provides information on if the patient was admitted at any point during the episode. Useful for data analysis.
On dialysis	Mandatory	Provides information on whether the patient was on dialysis. Allows record

Field	Completion	Rationale for inclusion
		to be shared with renal units.
Main Specialty	Mandatory where triggered	Allows stratification of counts and rates by Main Specialty. Triggered when Patient Location is NHS acute trust, Non-Acute NHS Provider, Independent Sector Provider or Mental Health Provider.
Treatment Specialty	Mandatory where triggered	Allows stratification of counts and rates by Treatment Specialty. Triggered when Patient Location is NHS acute trust, Non-Acute NHS Provider, Independent Sector Provider or Mental Health Provider.
Augmented Care	Mandatory where triggered	Allows stratification of counts and rates by type of augmented care unit. Triggered when Patient Location is NHS Acute trust, Non-Acute NHS Provider, Independent Sector Provider or Mental Health Provider.
	Additional comments	
Comments	Optional	Free text field for comments regarding case, please refrain from putting patient identifiable information in this field.

13.2 Appendix 2: Risk factor data to be collected

The following table provides detailed information about the risk factor data to be collected using the HCAI DCS, including whether the data are mandatory and the rationale for including the data collection on the system. Details about the episode details data collected are in the preceding section (13.1 Appendix 1. Episode details to be collected).

Table 13.2: Risk factor fields for CDI

Field	Completion	Rationale for inclusion
Best estimate of date of onset of diarrhoea	Optional	Allows analysis of time between onset of diarrhoea, admission, date sample taken etc.
Was patient on antimicrobials when specimen was taken?	Optional	Antibiotic therapy is an important risk factor for *C. difficile* infection.
Select antimicrobials when specimen was taken	Mandatory if triggered	Allows analysis of which antimicrobials result in increased risk of *C. difficile* infection.
Was patient on any other antimicrobials in the preceding 7 days	Optional	Antibiotic therapy is an important risk factor for *C. difficile* infection.
Select antimicrobials in the preceding 7 days	Mandatory if triggered	Allows analysis of which antimicrobials result in increased risk of *C. difficile* infection.
Was the specimen sent for typing?	Optional	Allows linkage with Clostridium difficile ribotyping network (CDRN) data.
Specimen category	Mandatory if triggered	Allows linkage with Clostridium difficile ribotyping network (CDRN) data.

Table 13.3: Risk factor fields for Gram-negative collections *(E.coli, Klebsiella, P. aeruginosa)*

Field	Completion	Rationale for inclusion
Primary focus of bacteraemia	Mandatory	Provides information about organ system in which bacteraemia arose.
Urinary catheter in last 28 days prior	Mandatory, if triggered	Allows epidemiologic analysis of trends behind infection risk factors
Urinary catheter inserted, removed or manipulated 28 days prior	Mandatory, if triggered	Allows epidemiologic analysis of trends behind infection risk factors
Vascular device inserted, removed or manipulated 28 days prior	Mandatory, if triggered	Allows epidemiologic analysis of trends behind infection risk factors
Intubated (ET or PT) or extubated 28 days prior	Mandatory, if triggered	Allows epidemiologic analysis of trends behind infection risk factors
Surgery (30 days or 12 months prosthetic material) prior	Mandatory, if triggered	Allows epidemiologic analysis of trends behind infection risk factors
Minimally invasive surgery	Mandatory, if triggered	Allows epidemiologic analysis of trends behind infection risk factors
Hepatobiliary procedure (ERCP or MRCP) 28 days prior	Mandatory, if triggered	Allows epidemiologic analysis of trends behind infection risk factors
UTI treatment 28 days prior to onset	Mandatory, if triggered	Allows epidemiologic analysis of trends behind infection risk factors
Open wounds or ulcer in prior 28 days	Mandatory, if triggered	Allows epidemiologic analysis of trends behind infection risk factors
Open wounds or ulcer prior 28 days	Mandatory, if triggered	Allows epidemiologic analysis of trends behind infection risk factors
Diabetic foot ulcer or infection 28 days prior	Mandatory, if triggered	Allows epidemiologic analysis of trends behind infection risk factors
Absolute neutrophil count less than 500 (0.5) at time	Mandatory, if triggered	Allows epidemiologic analysis of trends behind infection risk factors
Has the patient been on anti-cancer chemotherapy in 28 days prior to specimen date?	Voluntary	Allows epidemiologic analysis of trends behind infection risk factors
Number of antibiotic courses prescribed 28 days prior*	Mandatory, if triggered	Allows epidemiologic analysis of trends behind infection risk factors

Completing primary focus of bacteraemia will trigger further risk factor questions. These risk factor questions are all mandatory dropdown boxes when triggered and are defined in 13.2.2 Definitions of risk factors for Gram-negative collections (*E. coli, Klebsiella, P. aeruginosa*)

* Up to 5 sets of antibiotics can be entered against each case.

Table 13.4: Risk factor and treatment fields for MRSA and MSSA

Field	Completion	Rationale for inclusion
Were there any pre-disposing risk factors for the bacteraemia	Optional	Allows epidemiologic analysis of trends behind infection risk factors
Peripheral IV device	Mandatory if triggered	Allows epidemiologic analysis of trends behind infection risk factors
Central IV device	Mandatory if triggered	Allows epidemiologic analysis of trends behind infection risk factors
Surgical wound	Mandatory if triggered	Allows epidemiologic analysis of trends behind infection risk factors
Assisted ventilation (Current)	Mandatory if triggered	Allows epidemiologic analysis of trends behind infection risk factors
Assisted ventilation (Past 7 days)	Mandatory if triggered	Allows epidemiologic analysis of trends behind infection risk factors
Urinary catheter	Mandatory if triggered	Allows epidemiologic analysis of trends behind infection risk factors
Liver disease	Mandatory if triggered	Allows epidemiologic analysis of trends behind infection risk factors
Prosthesis	Mandatory if triggered	Allows epidemiologic analysis of trends behind infection risk factors
Person who injects drugs	Mandatory if triggered	Allows epidemiologic analysis of trends behind infection risk factors
Immunosupressed	Mandatory if triggered	Allows epidemiologic analysis of trends behind infection risk factors
Diabetic	Mandatory if triggered	Allows epidemiologic analysis of trends behind infection risk factors
Other	Mandatory if triggered	Allows epidemiologic analysis of trends behind infection risk factors
Prior *S. aureus* history	Optional	Allows assessment of risk posed by prior history of *S. aureus* infection
When	Mandatory if triggered	Allows classification of prior *S. aureus* infection
Has the patient been on anti-cancer chemotherapy in 28 days prior to specimen date?	Voluntary	Allows epidemiologic analysis of trends behind infection risk factors
Treatment of bacteraemia	Optional	Allows assessment of trends in *S. aureus* bacteraemia treatements. Includes an 'Other' option, which will trigger a free-text field.
If Other treatment	Mandatory if triggered	Provides opportunity to identify other risk factors for bacteraemia

13.2.1 Definitions of risk factors for MRSA or MSSA

Vascular device: Any device inserted into peripheral or central vascular sites, up to 14 days prior to infection, with the intention of being left in situ for > 1 hour. Excludes intravenous injections or venepuncture for blood samples.

Surgical wound: The patient had an unhealed wound at time of onset of bacteraemia.
Assisted ventilation: Any mechanical ventilation through a tracheostomy or by endotracheal intubation.

Note: Lung expansion devices such as intermittent positive-pressure breathing (IPPB); nasal positive end-expiratory pressure (PEEP); and continuous nasal positive airway pressure (CPAP, hypoCPAP) are not considered ventilators unless delivered via tracheostomy or endotracheal intubation (e.g., ET-CPAP).

Neutropaenia: absolute neutrophil count < 1500 per microliter.

Wound/ulcer: A break in the skin or mucus membrane of sufficient depth to have caused bleeding. Ulcers are wounds that have failed to heal with necrosis of involved tissues.

Urinary catheter: Urinary catheter inserted and left in for any duration up to 14 days prior to the date of onset of infection.

Prosthesis: Prosthesis or implant intended to be left in for >1 day, inserted within 1 year of onset of infection. e.g. pacemaker, surgical mesh or patch, aortic valve replacement, surgical drain.

Person who injects drugs: Patient injects non-medically sanctioned psychoactive, including but not limited to, opioids, amphetamines and cocaine. Injection may be through intravenous, intramuscular, subcutaneous or other routes. Does not include injectors of non-psychoactive drugs such as steroids for body shaping or improving athletic performance.

Immunosuppressed: The patient has received therapy that suppresses resistance to infection, e.g. immunosuppression, chemotherapy, radiation, long-term or recent high dose steroids, or has a disease that is sufficiently advanced to suppress resistance to infection, e.g. leukaemia, lymphoma, AIDS.

Diabetic : Patient has ever had a diagnosis of type I or type II diabetes.

13.2.2 Definitions of risk factors for Gram-negative collections (*E. coli*, *Klebsiella, P. aeruginosa*)

Urinary catheter: Urinary catheter present in the 28 days prior to the of onset of infection.

Urinary catheter manipulated in last 28 days: Whether urinary catheter had been manipulated for clinical purpose in 28 days prior to the of onset of infection.

Intubated or extubated in 28 days prior to onset: Whether endotracheal or PT intubation was inserted or removed in last 28 days.

Surgery: The patient has undergone surgery in the past 30 days (if no implant was inserted), or past year if an implant was inserted.

Surgical methods used (multiselect, tick all that apply):

- Open, including endoscopy-assisted procedures, not involving implant in last 30 days
- Open, including endoscopy-assisted procedures, involving implant in last 12 months
- Solely endoscopic not involving implant in last 30 days
- Solely endoscopic involving implant in last 12 months
- Unknown details of surgery

Hepatobiliary procedure 28 days prior: Any procedure performed on hepatobiliary organs, such as Magnetic Resonance Cholangiopancreatography (MRCP) or Endoscopic Retrograde Cholangio-Pancreatography (ERCP)

UTI treatment 28 days prior: Patient has received medical care in 28 days prior to onset of bacteraemia with intention of treating a urinary tract infection.

Open wounds or ulcers: Patient has an unhealed wound or ulcer in 28 days prior to onset of bacteraemia

Diabetic foot ulcer or infection: Patient has had an unhealed diabetic ulcer or diabetes-related infection of the foot in the 28 days prior to onset of bacteraemia.

Absolute neutrophil count < 500 (0.5) cells/µl: Patient has an absolute neutrophil count of less than 500 cells/ µl at time of onset of bacteraemia.

Number of antibiotic courses prescribed in 28 days prior: Number of antibiotic courses patient has received in 28 days prior to onset of bacteraemia

Has the patient been on anti-cancer chemotherapy in 28 days prior to specimen date?: Whether the patient had received chemotherapy to treat cancer in 28 days prior to the infection.

13.3 Appendix 3: Source of bacteraemia & Associated Infections

Data items on this tab are limited to MRSA and MSSA only.

Table 13.5: Data items for the Source of bacteraemia & Associated Infections tab

Field	Mandatory?	Rationale for inclusion
Source of bacteraemia		
Do you know the source of bacteraemia	No	If 'Yes' triggers appearance of field 'Source of bacteraemia'
Source of bacteraemia	Mandatory if triggered	Provides options for recording source of bacteraemia. Allows epidemiological analyses of sources of bacteraemia
Certainty	Mandatory if triggered	Clinical judgement on degree of certainty. Only triggered by certain responses to 'Source of bacteraemia' question
Associated Clinical Infections		
Associated clinical infection	No	Provides information on infection site, when patient has co-infection with the same organism
Certainty	Mandatory if triggered	Clinical judgement on degree of certainty
Inpatient details		
For inpatients, what specialty was the infection thought to have been acquired in (Augmented Care)?	No	Allows specification of an augmented care unit in which the infection is believed to have been acquired Only for records where patient was inpatient at time of specimen
Date from	No	Date admitted to ward. Allows cross-checking with date of sample
Date to	No	Date discharged or transferred from ward. Allows cross-checking with date of sample

13.4 Appendix 4: Healthcare Interactions

All collections have a tab to complete prior trust exposure. This asks whether a patient had been discharged from the reporting trust within a certain time period prior to the specimen date. For bacteraemia cases, this is 28 days, for *C. difficile* infection cases, this is 84 days. Outpatient appointments are not included for discharges.

Table 13.6: Details of prior trust exposure data items

Field	Mandatory?	Comment
Has the patient been discharged from an elective or emergency hospital admission in the reporting trust in the last 28/84 days?	Yes, for sign-off	Triggers date picker if 'Yes'. Allows apportioning according to prior trust exposure.
Please provide the date of discharge for the most recent elective or emergency hospital admission prior to the patient's positive specimen	Yes, to save	Date picker field.

In addition, for MRSA, MSSA and CDI, users have the option to provide information on prior healthcare interactions, which might provide information on sources of infection and risk factors. Four health care interactions can be provided per Healthcare Interaction tab. Further Healthcare Interaction tabs can be added by selecting 'Yes' for the final 'Do you want to add another interaction', up to a maximum of nine tabs for MRSA and MSSA, and five for CDI.

Table 13.7: Details of prior healthcare interaction data items for MSSA and MRSA.

Field	Mandatory?	Comment
When	Yes	Allows specification of when prior healthcare interaction occurred
Type of interaction	Yes	Type of patient care provided (i.e. inpatient, outpatient, A&E only, Emergency assessment, Regular attender, Primary care, Day patient or Other)
Where	Yes	Specification of type of organisation providing care
Date from	Yes	First day of prior healthcare interaction
Date to	Yes	Last day of prior healthcare interaction
Reason for interaction	Yes	Choice of medical specialty of prior healthcare interaction
Admission method	Yes	Admission method for prior healthcare interaction

13.5 Appendix 5: Renal data items

Table 13.8: Definitions of renal data items

Field	Description
Renal provider	
Usual provider of renal care (Mother Unit)	The renal unit that normally provides care
Usual provider of renal care (Satellite Unit)	
Other (incl. non-UK) mother &/or satellite unit	Any other unit that provides care. Free text field
Dialysis	
Dialysis details (Modality)	The method by which dialysis was delivered.
Type of access being used	Access to bloodstream through which dialysis is delivered.
Other type of access being used	Only triggered if 'Type of access being used' is 'Other'. Free text field.
Catheter last 28/7	Whether an intravenous catheter was used in seven days prior to blood culture or 28 days prior to positive stool specimen.
What type of catheter	Triggered if 'Catheter last 28/7' was 'Yes'. Drop-down options for type of venous catheter.

13.6 Appendix 6. CCG Attribution Process

All cases of MRSA MSSA and Gram-negative bacteraemia and CDI are attributed to a CCG. Cases are attributed to a CCG by tracing patient identifiers (name, NHS number, sex and date of birth) via the Demographics Batch Service (DBS). To obtain these data, identifiers are automatically passed from the DCS to NHS Spine provided by NHS Digital, via DBS, to identify patient GP registration details and patient residential postcode. As such, it is important for data providers to ensure they enter correct patient identifiers for all cases entered onto the HCAI DCS.

13.6.1 Overview of CCG attribution

If the patient is successfully traced (e.g. a record is returned with the patient's GP practice code or patient postcode) patients are attributed to a 'Responsible' CCG. A responsible CCG is the CCG with which the patient's GP practice is listed, or, in cases where an English patient has no registered GP listed in the Spine, the CCG based on patient residency. The responsible CCG is identifiable by querying the Organisation Data Service (ODS) database which holds a list of all English listed GP practice codes and all English postcodes by CCG boundary.

If neither the patient's GP practice nor patient's postcode is populated in the Spine, then the patient is attributed to the lead CCG. The lead CCG is the main commissioning vehicle for the acute trust at which the patient's specimen was processed. It is possible a single CCG is lead to one or more acute trusts but another CCG is not lead to any acute trust.

13.6.2 CCG attribution algorithm

Attribution to a CCG relies on a patient being traced through the NHS spine. Spine tracing is a two stage process using the following rules:

1. If the NHS Number is present, a cross-check is performed. This checks that the NHS Number and all elements of the date of birth provided match a record on the Spine. If they do, the patient's demographics are returned. Optionally, surname and forename can be included in the match by including them in the input file. If the cross-check fails, the system moves to the next step.
2. If the NHS Number is not present or the cross-check fails, an alphanumeric trace is performed. At a minimum, surname, given name, gender and date of birth must be provided. This searches both current and historical information held on the Spine. Wildcard searching is not performed in this case.

The algorithm, below attributes infection cases to a CCG in the following order:

1. If the GP code where a patient is registered is identified through DBS tracing and is based in England, the case will be attributed to the CCG at which the patient's GP is listed;
2. If the patient GP code is not identified through DBS tracing, but the patient is known to reside in England and a residential postcode has been obtained, the patient case will be attributed to the Residence CCG based on the patient's residential postcode;
3. If any of the above are not available or valid, then then patient is attributed to a CCG based on the postcode of the Trust headquarters (Trust HQ) address. For example, patients registered to GPs outside England who have had specimens processed by laboratories based in English trusts are attributed to English lead CCGs. Similarly, any foreign patients who have no NHS number are attributed to lead CCGs.

Please see Figure A1 for a detailed schematic regarding the attribution of cases to CCGs.

13.6.3 Overview of timescales

Acute trusts must ensure they enter all their infection cases on to the HCAI DCS. New or amended cases are traced twice daily via DBS and are usually loaded on to the DCS the following day.

Timely input of data is encouraged, as this will ensure accurate linkage of data through the batch tracing. The tracing prodecure used to gain GP code and/or residential postcode relies on linking patient information from the Spine to our HCAI DCS. In the unfortunate incident of a deceased patient the Spine information for that patient would be moved to a historial section which is inaccessible to us. In such cases a C-code of 127 is returned and the postcode of the Trust HQ is used to identify the attributed CCG.

Organisations may request a re-trace by providing updated patient information. However, retraces will only be performed up to 45 days after the initial trace as data may change on the NHS Spine, resulting in an incorrect CCG attribution.

13.6.4 Attribution of IS cases

Cases reported by the IS are traced in the same batch as those reported by the NHS. As per the NHS, the tracing results are available on the DCS. However, as not all patients treated within the IS will have an NHS number it is possible that more IS cases will have a C code of zero, compared to the NHS.

‘C codes’

Once patients have been traced, details of the tracing (including CCG type, CCG code, and C Code) are loaded onto the DCS. If a patient has been successfully traced, their record will have a C code of 20, 30, 122, 123 or 125 (see Table for C Code definitions).

If a case has NOT been successfully traced, then the Trust should verify records with a C code of 0 or 1 to ensure patient NHS number and other identifiers such as date of birth, forename, surname and gender are correct.

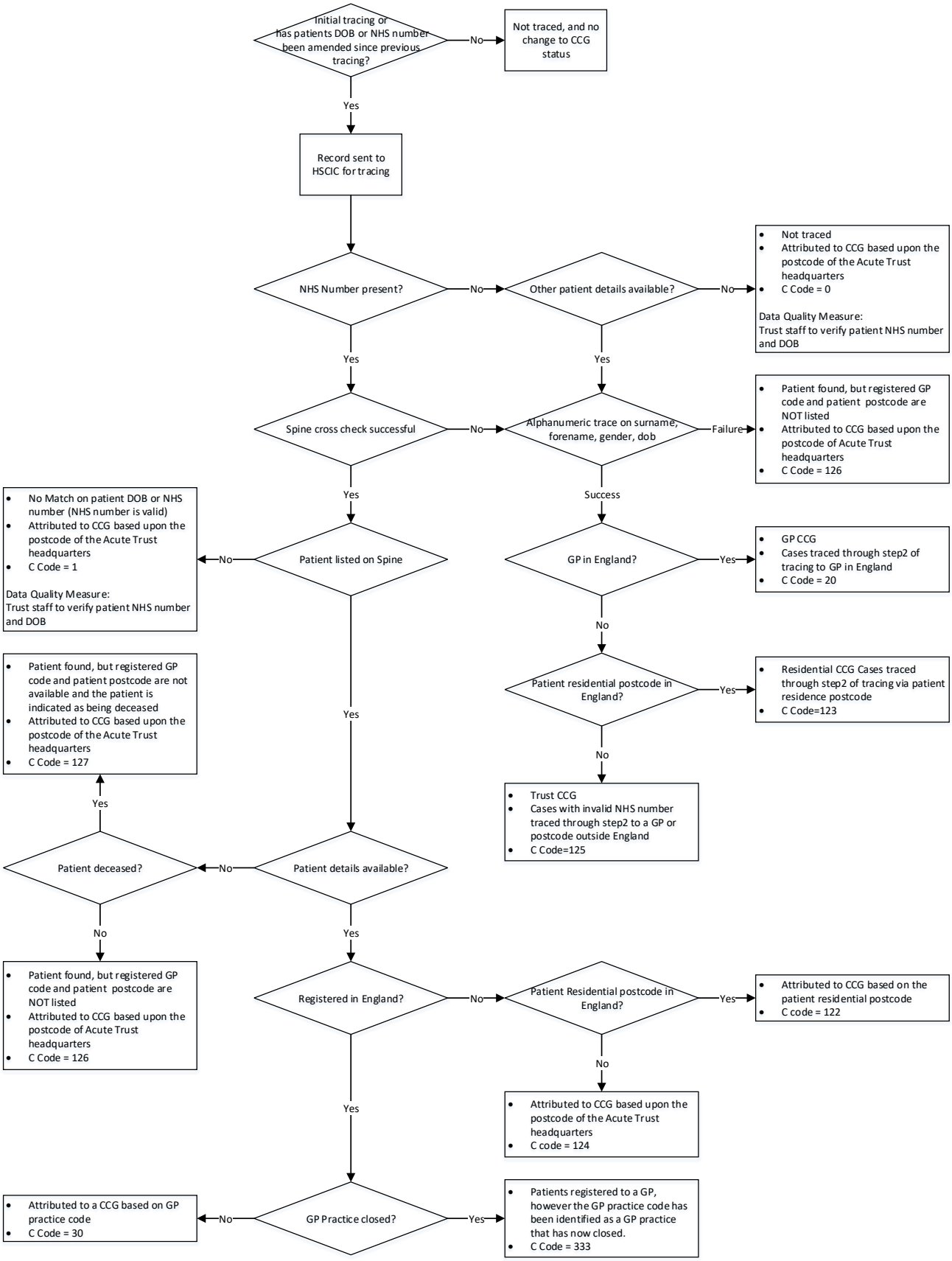
Please note that with the exception of code 30, these codes do NOT correspond with either the former NSTS tracing codes, or with the current DBS tracing codes.

Table 13.9: Definitions of 'C-Code' field in DCS

CCG attribution	C Code	Clarification
GP CCG	30	Cases with a valid NHS Number and date of birth are successfully traced via DBS to an English GP
Residential CCG	122	Cases which are traced via patient postcode (only when GP code is not available)
Trust CCG	0*	Cases with an invalid NHS number and patient details
Trust CCG	1*	Cases with a valid NHS number and patient details, but are not listed in Spine
Trust CCG	124	Cases with valid NHS number and date of birth are traced to a GP or postcode outside England
Trust CCG	126	Cases which have been successfully traced against Spine, but patient details (i.e. residential postcode or registered GP code) are not available
Trust CCG	127	Cases which have been successfully traced against Spine, but patient details (i.e. residential postcode or registered GP code) are not available and the patient is indicated as being deceased
Trust CCG	333	Cases with valid NHS number and date of birth are traced to a GP which has since closed
GP CCG	20	Cases with valid patient details (first name, surname, DoB and gender) and are successfully traced to a GP in England
Residential CCG	123	Cases which are traced through Step 2 of DBS tracing (i.e. first name, surname, DOB, gender), via patient postcode (only when GP code is not available and postcode is in England)
Trust CCG	125	Cases with invalid NHS number however traced through Step 2 of DBS tracing (i.e. first name, surname, DOB, gender) are traced to a GP or postcode outside of England

* **Note**: Patients with C code 0 or 1 may potentially be traced if either NHS number and/or date of birth, forename, surname and gender are added/corrected.

13.3.5 Figure A1. Summary of the CCG attribution process



13.6.6 Appeals against attribution

Cases may only be appealed within 45 days of tracing and only if the patient's postcode or GP practice code listed in the Spine was incorrect at time of tracing. Cases will only be retraced once PHE has been informed by the acute trust or CCG that the discrepant details have been amended in the Spine and the amendments are made within the 45 day window of the initial trace.

13.6.7 Contacts/information

Any queries regarding case allocation should in the first instance be directed to mandatory.surveillance@phe.gov.uk

13.7 Appendix 7. Algorithms to determine the onset status of cases

Please note that the algorithm applied to bacteraemia cases differs to that used for CDI in terms of the number of days between specimen collection and admission used to determine the onset status of the cases. The underlying principle is, however, the same. The algorithm used to determine the onset status of the cases is outlined below (see also Figure A2.).

Please note that the algorithm to determine the onset status is not applied to IS data.

It is not possible for PHE to change the onset status of a case as it is based on the data entered by the acute trust and the algorithm is applied to the entire dataset not on a case-by-case basis; a case may only change from one category to another if the relevant case details are incorrect and require amendment by the Trust.

In addition to being identified by the location of onset, all cases are also attributed to a CCG (see Appendix 3). All cases regardless of whether they are hospital-onset or community-onset cases are attributed to a CCG.

In the development of the new DCS, some of the data values used in the old algorithm changed. Previously, users could leave the patient location blank and the patient location would be recorded as null. This is no longer possible, and has been replaced with the data value 'Unknown'. Similarly, it was possible for users to leave patient category blank and the patient category would be recorded as null. This has also been replaced with 'Unknown'. The old algorithm was applied to records entered prior to the launch of the new DCS (26/10/2015) . The new algorithm has been applied to records entered after this date.

13.7.1 Bacteraemia

Hospital-onset:
Any NHS patient specimens taken on the third day of admission onwards (e.g. day 3 when day 1 equals day of admission) at an acute trust (including cases with unspecified specimen location) for In-patients, Day-patients, Emergency Assessment, or unspecified patient category.

Records with an unknown admission date (where the specimen location is acute trust or unknown and the patient category is In-patient, Day-patient, Emergency Assessment, or unspecified) are also included.

Community-onset:
Any NHS patient specimens not determined to be hospital-onset. This will typically include the following groups:

- Any acute trust specimens taken on either the day of admission or the subsequent day (e.g. days 1 or 2, where day 1 equals day of admission)
- Any specimens from patients attending an acute trust who are not Inpatients, Day patients or under Emergency Assessment (i.e. non admitted patients)
- Any specimens from patients attending an identifiable healthcare location **except** an acute trust. This includes GP, nursing home, non-acute NHS provider, Independent Sector Provider, Mental Health Provider, residential home, penal establishment, unknown or other.

A summary of how bacteraemia cases are determined to be hospital or community onset is illustrated in Figure A2. below.

13.7.2 *Clostridium difficile* infection

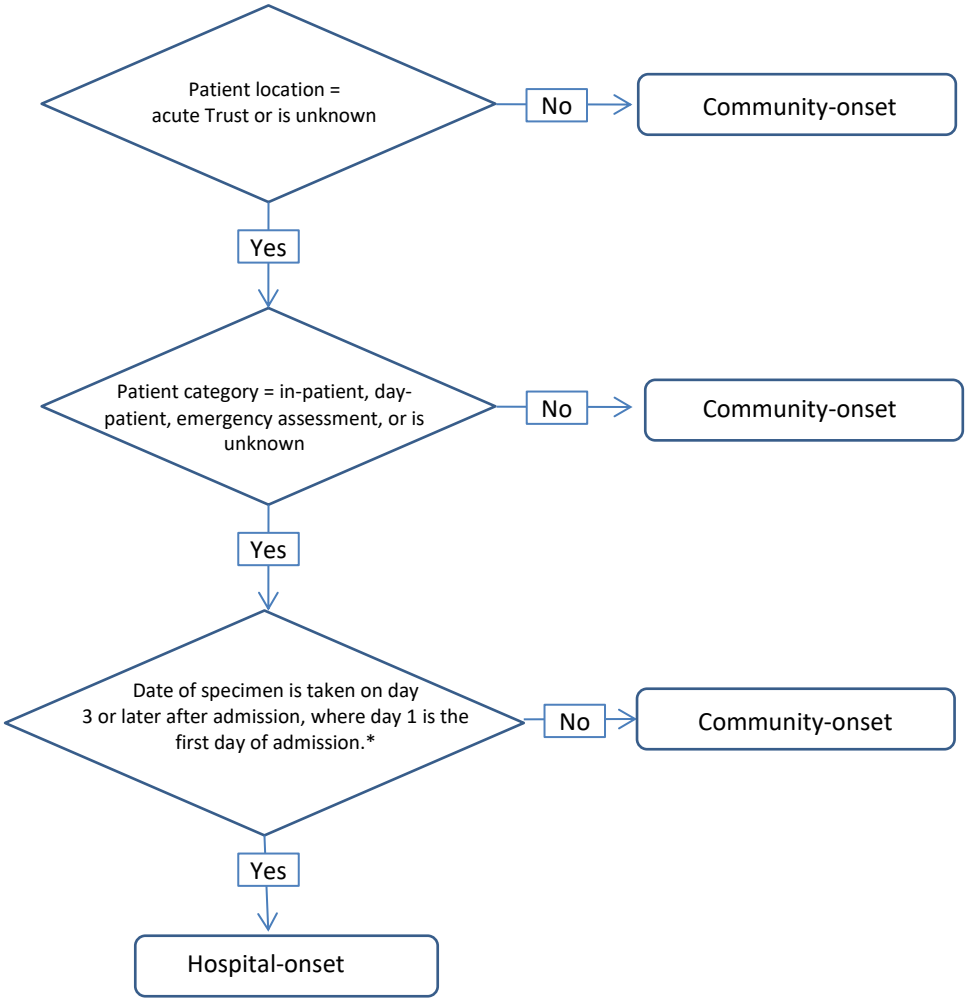
Hospital-onset:
Any NHS patient specimens taken on the fourth day of admission onwards (e.g. day 4 when day 1 equals day of admission) at an acute trust (including cases with unspecified specimen location) for In-patients, Day-patients, Emergency Assessment, or unspecified patient category

Records with an unknown admission date (where the specimen location is acute trust or missing and the patient category is In-patient, Day-patient, Emergency Assessment, or unspecified) are also included.

Community-onset:
Any NHS patient specimens not determined to be hospital-onset . This will typically include the following groups:

- Any acute trust specimens taken on either the day of admission or the subsequent day (e.g. days 1 - 3, where day 1 equals day of admission)
- Any specimens from patients attending an acute trust who are not In-patient, Day-patient or under Emergency Assessment (e.g. non-admitted patients)
- Any specimens from patients attending an identifiable healthcare location **except** an acute trust. This will typically include GP, nursing home, CCG hospital and private patients

A summary of how CDI cases are determined to be hospital or community onset is illustrated in Figure A2., below, and prior healthcare apportionment algorithim can be seen in Figure A3.



*Additionally include records where admission date is missing and the specimen location is acute Trust or unknown and the patient category is in-patient, day-patient, emergency assessment or is null

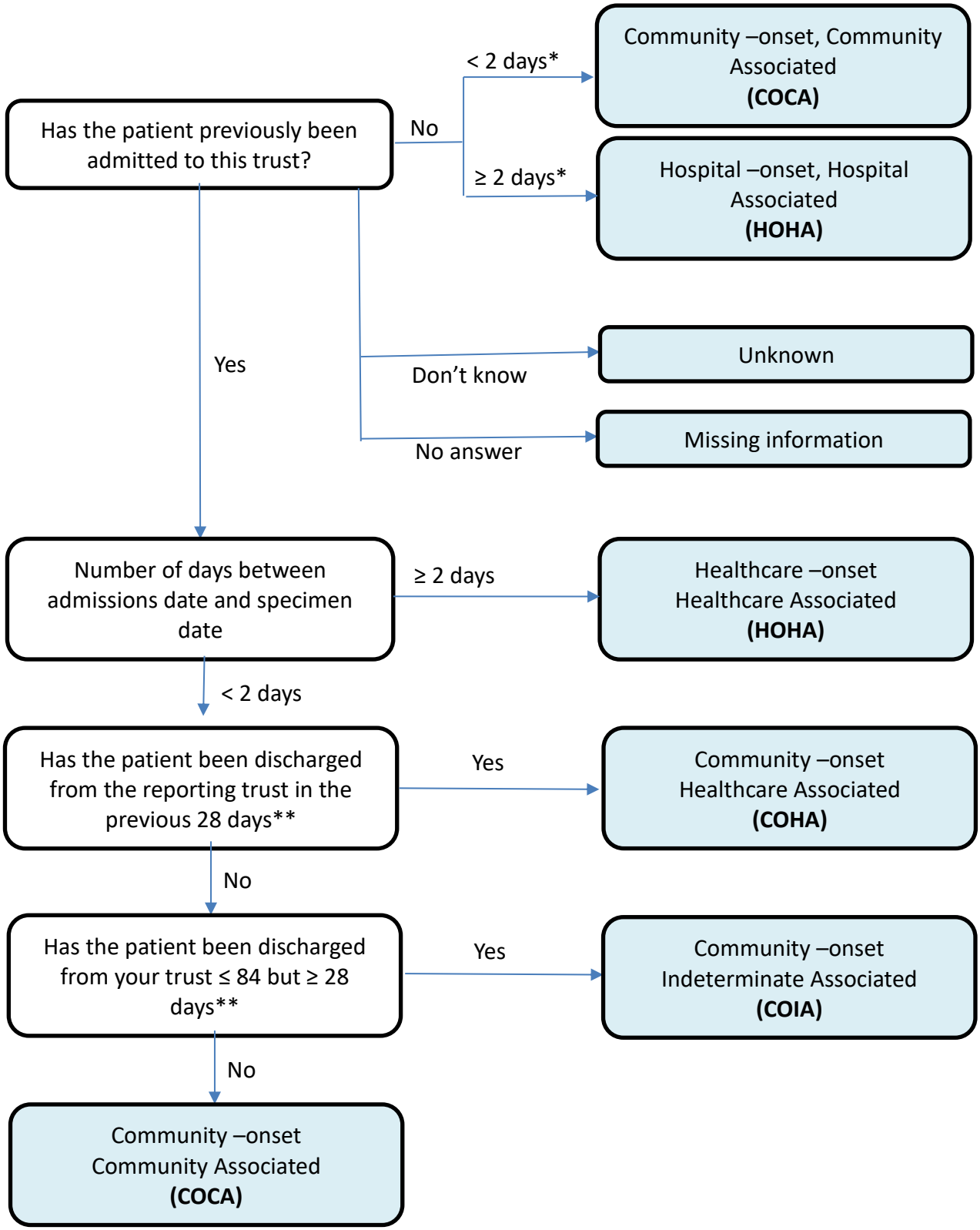
Figure A2. Summary of the process to determine the onset status for bacteraemia and CDI

13.7.3 Prior trust exposure

From April 2017, the HCAI DCS was updated so that information on a CDI patient's prior admission to the reporting trust could be added to the record of the current infection. This was included to align the surveillance more closely with that of the European Centre for Disease Prevention and Control and the Center for Disease Control and Prevention in the USA.

A new tab, the prior healthcare exposure tab, asks whether the patient has been admitted to the reporting trust, prior to the current infection episode. Cases are then allocated according to figure A3. Note, the DCS does not currently calculate the prior trust exposure categories, either calulate these yourself or refer to the national statistics. The DCS will be able to output cases group by this algorithm by mid 2019.

Figure A3: Prior health trust exposure of bactermia and CDI cases



**Days between admission date and specimen date*
*** With day of discharge being counted as Day 1*

Cases for which the answer to the question ‘has the patient previously been admitted to the reporting trust’ is “Don’t know” will be allocated to the ‘Unknown’ category (previously allocated to the COHA category), and cases where the answer is missing will be allocated to the ‘Missing information’ category (previously COCA category).

13.8 Appendix 8. The Post Infection Review process (PIR)

The Post-Infection Review of MRSA cases ran from 1 April 2013 to 31 March 2018. From 1 April 2018, the PIR process became local-only and is no longer administered through the DCS. Only trusts with the highest rates of MRSA bacteraemia are required to complete a PIR. Further details on the updated PIR process are available at https://improvement.nhs.uk/documents/2512/MRSA_post_infection_review_2018_changes.pdf The information below is retained for the purposes of historical context and interpreting previously published results.

13.8.1 The purpose of the Post Infection Review

The NHS Commissioning Board's NHS planning guidance '*Everyone counts: Planning for Patients 2013/14'* set out a zero tolerance approach to MRSA bacteraemia. As such a requirement was initiated on 1 April 2013 to institute a Post Infection Review in all cases of MRSA bacteraemia in order to identify any possible failings in care and the organisation best placed to ensure improvements are made. As of 1 April 2014, cases could be assigned to a third party if the outcomes suggested that there have been no possible failings in care and that neither the acute trust or the CCG are best placed to ensure improvements are made.

13.8.2 Aim of the PIR process:

The PIR process aimed to:

- help identify factors that may have contributed to a MRSA bacteraemia;
- help to identify any parts of the patient's care pathway which may have contributed to the infection, in order to prevent a similar occurrence;
- help providers of healthcare and CCGs to identify any areas of non-optimal practice that may have contributed to the MRSA bacteraemia;
- help to promptly identify the lessons learned from the case, thereby improving practice for the future;
- identify the organisation best placed to ensure that any lessons learnt are acted on.

Previously, when an MRSA bacteraemia was entered onto the HCAI DCS, the system woold automatically provisionally assign an organisation with the responsibility for leading the PIR process. This does not necessarily assume that the provisionally assigned organisation was responsible for the bacteraemia, but considers that they are best placed to lead and coordinate the PIR process. Provisional assignment was based on the following;

Provisionally Trust assigned
Any patients who were in-patients, day-patients or emergency assessment in an acute trust and the MRSA bacteraemia sample was taken from the patient on or after the third day of admission (where the day of admission is Day 1).

Provisionally CCG assigned
Patients not assigned as above. in particular, any patients not admitted at the time the specimen was taken, for example those in Accident and Emergency or outpatients.

13.8.3 Assigning MRSA bacteraemia cases

The lead organisation was responsible for completing the PIR within fourteen working days of being notified that a PIR is required. This involved making a decision (an assignment) of the organisation best placed to learn from the occurrence (acute trust or CCG) or Third Party if there were no learning outcomes identified for either the reporting acute trust or attributed CCG.

If the duly assigned organisation was the same as the organisation leading the PIR this would end the process. If the duly assigned organisation was different from the organisation leading the PIR, a notification will be sent to the assisting organisation who was be provided a further two working days, plus any days left from stage 1, to indicate whether they agreed or disagreed with the outcome of the PIR.

If the PIR outcome suggested that there had been no possible failings in care and that neither the acute trust or the CCG were best placed to ensure improvements are made then Third Party assignment may have been considered and finalised as such by the arbitrator.
If the lead provisional organisation and the assisting organisation were unable to come to an agreement over the final assignment or if a Third Party case was been indicated, a notification would be sent to the arbitrating NHS England Regional Medical Director or Regional Director of Nursing who would be provided with a further 28 working days to define the outcome of the PIR and establish the organisation to which the MRSA bacteraemia should be finally assigned (either acute trust, CCG or Third party).

If an organisation failed to respond within the set time period at ether stage one or stage two, the final assignment of the case would remain with that organisation, unless:

1. The organisation was a third party, in which case the PIR would have gone to arbitration
2. The case was a contaminant case (non-third party) where the case was automatically assigned to the organisation responsible for taking the sample (i.e. the acute trust if the sample was taken in an acute trust, or CCG if the sample was taken elsewhere)

Contaminated blood cultures should continue to be reported as part of mandatory reporting and the PIR would have been completed indicating any agreed contaminants. In these circumstances the organisation at which the blood culture specimen was taken would be assigned the case as they were best placed to ensure that any lessons learned are acted upon.

13.9 Appendix 9. Quarterly mandatory laboratory returns (QMLRs)

NOTE: The mandatory reporting scheme described below is distinct from the enhanced surveillance system described above.

On a quarterly basis NHS acute trusts are mandated to report the following data, aggregated for a three-month period (definitions below):

- Total number of blood culture sets examined
- Total number of these that were positive
- Total number of *S.aureus* positive blood culture episodes
- Total number of glycopeptide resistant enterococci (GRE) blood culture episodes[1]
- Total number of stool specimens examined
- Total number of stool samples tested for diagnosis of *Clostridium difficile* infection
- Total number of *Clostridium difficile* toxin positive reports in people aged > 65 years
- Total number of *Clostridium difficile* toxin positive reports in people aged 2 - 64 years
- Total number of faecal specimens and rectal swabs taken for CPE screening

Data for each 3 month period must be submitted within 6 weeks of the end of the data collection period (up to and including 14th). After this point the dataset is automatically locked and it is not possible to enter further data. Organisations must contact the PHE mandatory surveillance team if data needs to be entered after this point in time.

Table 13.10:Data collection periods and system lockdown dates for QMLR data

Data collection period	System lockdown
October – December	23.59 on 14 February
January – March	23.59 on 14 May
April – June	23.59 on 14 August
July – September	23.59 on 14 November

These data are also entered via the HCAI DCS. Please see Table below for a list of fields required for the QMLR.

[1] Voluntary as of 2013.

Table 13.11: Details of fields included in QMLR

Field	Mandatory?	Rationale
Total number of blood culture sets examined	Yes	This is referring to a sample arising from a single venepuncture, irrespective of the number of bottles tested
Total number of positive blood culture sets	Yes	This is referring to all positive results for bacterial growth, including repeat specimens and contaminants
Total number of *S. aureus*-related complex positive blood culture episodes	Yes	This does not include duplicate episodes*; i.e. when the same patient has more than one sample taken which are less than 14 days apart
Total number of GRE positive blood cultures	No	This does not include duplicate episodes*; i.e. when the same patient has more than one sample taken which are less than 14 days apart
Total number of stool specimens examined	Yes	This is referring to 'all stools' not just the ones that fit the Bristol Stool Scale; it also includes the number of stool specimens used for *C. difficile* toxin testing
Total number of stool samples tested for diagnosis of *C. difficile* infection	Yes	This is referring to all *C. difficile* toxin tests done that have been found positive and negative and it will include duplicate records. However, two-stage testing on a single sample should be counted as a single test.
Total of *C. difficile* toxin positive results for ≥65 years	Yes	This is referring to the total number of *C. difficile* toxin-positive stool samples in patients aged 65 years and above; it should not include duplicates i.e. when the same patient has more than one sample taken which are less than 28 days apart If single-stage testing is employed, this will include all positive samples. However, if two-stage testing is employed, only samples that are positive for both tests should be included.

Field	Mandatory?	Rationale
Total No. of *C. difficile* toxin positive results for 2-64 year olds	Yes	This is referring to the total number of *C. difficile* toxin-positive stool samples in patients aged 2-64 years; it should not include duplicates i.e. when the same patient has more than one sample taken which are less than 28 days apart If single-stage testing is employed, this will include all positive samples. However, if two-stage testing is employed, only samples that are positive for both tests should be included.
Total number of faecal specimens and rectal swabs taken for CPE screening	No	This field will collect denominator data for the surveillance of Carbapenemase-producing Enterobacteriaceae. Collecting this data will allow PHE to understand which trusts are doing screening for CPE and will set cases of CPE in context. If not possible to distinguish rectal and perineal swabs, report total number of swabs.

* For calculating duplicates, episode duration is 14 days from preceding sample for bacteraemias and 28 days from preceding sample for CDI.

13.10 Appendix 10. Organisation mappings in the DCS

Organisation hierarchies are mapped according to the hierarchies provided by the **Error! Reference source not found.** Digital's **ODS**. Cases are mapped upwards to higher level health geographies (NHS local office, NHS Region, PHE Centre and PHE region) in one of three ways: by the reporting pathway, commissioning pathway or resident pathway.

13.10.1 Reporting pathway

Direct mappings are available from trust to NHS local office and NHS region. Trusts are mapped to local authorities on the basis of the postcode of the trust headquarters. Local authorities are then mapped to PHEC.

13.10.2 Commissioning pathway

CCGs are mapped to a local authority based on the postcode of the CCG HQ. The postcode of the CCG headquarters office is determined from the data provided by NHS Digital ODS. This is mapped onto the local authority boundaries provided by the ONS. Direct mappings are available for CCG to local office and to NHS region.

13.10.3 Resident pathway

The patient's postcode is used to map to local authority and then PHEC and PHE Region

13.10.4 Director of Public Health mappings

Directors of Public Health are embedded within local authorities. CCGs are mapped to Directors of Public Health in the same way as CCGs are mapped to local authorities.

13.10.5 Trust site mappings

Sites are mapped to trusts based on information provided by NHS Digital. The ODS provides direct mappings.

13.10.6 Maintenance of organisation mappings

The orgcurrdev database provided by NHS Digital is updated on a monthly basis. The most recent version of the database is downloaded from the website (https://digital.nhs.uk/organisation-data-service/data-downloads/access-databases) and changes are incorporated into the system.
Post code mappings to local authorities are performed by PHE's GIS team.

13.11 Appendix 11. Frequently Asked Questions

13.10.1 MRSA bacteraemia reporting: Frequently Asked Questions

Q. How long is an episode?
A. The episode length of MRSA bacteraemia is 14 days with day 1 being the date of specimen collection.

Q. Do all positive blood samples need to be reported, even if the patient wasn't treated?
A. Yes, all positive blood samples must be reported, whether clinically significant or not and whether the patient was treated or not. This includes cultures from intravenous catheters even if blood culture from venipuncture is negative or has not been performed.

Q. Do I need to report mecA-negative isolates?
A. mec-A negative isolates should be reported if they are mec-C positive. Where isolates are mec-A and mec-C negative they are not regarded as MRSA in this instance, and need not be reported as MRSA bacteraemia cases, irrespective of their level of meticillin resistance. Such cases should, however, be reported as MSSA bacteraemia. Please note, that this distinction is only with respect to the submission of isolates to the surveillance scheme and should not affect patient treatment decisions. NB Isolates that are highly resistant to meticillin but are mecA-negative are an anomaly and should be investigated with possible referral to the national reference laboratory.

Q. Do I need to report positive specimens from deceased patients?
A. No, positive specimens from taken from patients after death should not be reported. However, positive specimens taken from a live patient who subsequently dies should be included.

Q. Do I need to report positive specimens that come from patients not located within a hospital at the time of testing, or taken on admission?
A. Yes, all cases of MRSA bacteraemia that conform to the case definition must be reported, regardless of where or when the specimen was collected.

Q. Do I need to report positive specimens from Welsh patients diagnosed in English laboratories?
A. Yes, all cases of MRSA bacteraemia that conform to the case definition must be reported even if they are from Welsh patients tested/diagnosed in an English laboratory

Q. Do I need to report positive specimens sent from the Independent Sector (private hospital)?
A. Yes, all cases of MRSA bacteraemia that conform to the case definition must be reported, regardless of where the specimen originated from.

Q. Should positive specimens from the same patient and the same episode be reported?
A. No, only report a second positive from the same patient if it is defined as a new episode.

Q. If a single specimen cultures more than one *S. aureus* Related Complex species, which should I report?
A. Both species should be reported separately.

13.10.2 MSSA bacteraemia reporting: Frequently Asked Questions

Q. How long is an episode?
A. The episode length of MSSA bacteraemia is 14 days with day 1 being the date of specimen collection.

Q. Do all positive blood samples need to be reported, even if the patient wasn't treated?
A. Yes, all positive blood samples must be reported, whether clinically significant or not and whether the patient was treated or not. This includes cultures from intravenous catheters even if blood culture from venipuncture is negative or has not been performed.

Q. Do I need to report positive specimens from deceased patients?
A. No, positive specimens from taken from patients after death should not be reported. However, positive specimens taken from a live patient who subsequently dies should be included.
Q. Do I need to report positive specimens that come from patients not located within a hospital at the time of testing, or taken on admission?
A. Yes, all cases of MSSA bacteraemia that conform to the case definition must be reported, regardless of where or when the specimen was collected.

Q. Do I need to report positive specimens from Welsh patients diagnosed in English laboratories?
A. Yes, all cases of MSSA bacteraemia that conform to the case definition must be reported even if they are from Welsh patients tested/diagnosed in an English laboratory

Q. Do I need to report positive specimens sent from the Independent Sector (private hospital)?
A. Yes, all cases of MSSA bacteraemia that conform to the case definition must be reported, regardless of where the specimen originated from.

Q. Should positive specimens from the same patient and the same episode be reported?
A. No, only report a second positive from the same patient if it is defined as a new episode.

Q. If a single specimen cultures more than one *S. aureus* Related Complex species, which should I report?
A. Both species should be reported separately.

13.10.3 Gram-negative bacteraemia reporting: Frequently Asked Questions

Q. How long is an episode?
A. The episode length of Gram-negative bacteraemia is 14 days with day 1 being the date of specimen collection.

Q. Do all positive blood samples need to be reported, even if the patient wasn't treated?
A. Yes, all positive blood samples must be reported, whether clinically significant or not and whether the patient was treated or not. This includes cultures from intravenous catheters even if blood culture from venipuncture is negative or has not been performed.

Q. Do I need to report positive specimens from deceased patients?
A. No, positive specimens from taken from patients after death should not be reported. However, positive specimens taken from a live patient who subsequently dies should be included.

Q. Do I need to report positive specimens that come from patients not located within a hospital at the time of testing, or taken on admission?
A. Yes, all cases of Gram-negative bacteraemia that conform to the case definition must be reported, regardless of where or when the specimen was collected.

Q. Do I need to report positive specimens from Welsh patients diagnosed in English laboratories?
A. Yes, all cases of Gram-negativebacteraemia that conform to the case definition must be reported even if they are from Welsh patients tested/diagnosed in an English laboratory

Q. Do I need to report positive specimens sent from the Independent Sector (private hospital)?
A. Yes, all cases of Gram-negative bacteraemia that conform to the case definition must be reported, regardless of where the specimen originated from.

Q. Should positive specimens from the same patient and the same episode be reported?
A. No, only report a second positive from the same patient if it is defined as a new episode

Q. If more than one *Klebsiella* species is identified in a single culture specimen, how many cases should be reported?
A. One record per species should be reported to the DCS.

Q. Is *Enterobacter aerogenes* subject to mandatory reporting?
A. In 2017, E. aerogenes was reclassified to Klebsiella aerogenes. Trusts which identify isolates from 01/04/2017 onward are expected to report them as K. aerogenes [11]*.*

13.10.4 *C. difficile* Infection Reporting: Frequently Asked Questions

Q. How long is an episode?
A. An episode of CDI is 28 days, with day 1 being the date of specimen collection.

Q. Do I need to report positive specimens from deceased patients?
A. Yes, unlike other collections positive specimens from deceased patients should be reported. Unlike bacteraemias, CDI testing is less likely to be affected by contamination during sample collection.

Q. Do I need to report positive specimens that come from patients not located within a hospital at the time of testing, or taken on admission?
A. Yes, all cases of CDI that conform to the case definition must be reported, regardless of where or when the specimen was collected.

Q. Do I need to report positive specimens from Welsh patients diagnosed in English laboratories?
A. Yes, all cases of CDI that conform to the case definition must be reported even if they are from Welsh patients tested/diagnosed in an English laboratory

Q. Do I need to report positive specimens sent from the Independent Sector (private hospital)?
A. Yes, all cases of CDI that conform to the case definition must be reported, regardless of where the specimen originated from.

Q. Should positive specimens from the same patient and the same episode be reported?
A. No, only report a second positive from the same patient if it is defined as a new episode.

Q. What stools should be tested for *CDI*?
A. If a patient has diarrhoea (Bristol Stool Chart types 5-7) that is not clearly attributable to an underlying condition (e.g. inflammatory colitis, overflow) or therapy (e.g. laxatives, enteral feeding) then it is necessary to determine if this is due to C. difficile. The stool sample must take on the shape of the container and ideally be at least ¼ filled (to indicate the patient has diarrhoea) before it is sent to the laboratory for testing. If in doubt please seek advice for example from your microbiologist, Director of Infection Prevention and Control or your Infection Prevention and Control Team. All diarrhoeal samples from hospital patients aged ≥2 years and, as a minimum, all diarrhoeal samples from those aged ≥65 years in the community where clinically indicated. Ideally, samples from community patients ≤ 65 years old should also be collected.

In suspected cases of 'silent CDI' such as ileus, toxic megacolon or pseudomembranous colitis without diarrhoea, other diagnostic procedures, such as colonoscopy, white cell count (WCC), serum creatinine and abdominal computerised tomography (CT) scanning, may be required, potentially with referral to a gastroenterologist or gastrointestinal surgeon.

Q. Do I need to report cases in patients aged under 2 years?
A. Cases in patients aged under 2 years need not be reported; however Trusts may use the system to record these cases if they so wish. These will be excluded from data for publication.

Q. The current primary care PHE advice on definition of diarrhoea is: 3 or more episodes a day, <14 days apart (NB this should not be confused with the definition of an episode of CDI for the

purposes of mandatory reporting to the PHE which is 28 days) and the sample takes the shape of the container. Can you have a 'diarrhoeal illness' after just one episode?
A. The frequency of diarrhoea varies in definitions of CDI. Usually, definitions cite the need for at least 3 episodes of diarrhoea, for at least 2 consecutive days. Such a stringent definition is appropriate for clinical trials, but less so in a setting where transmission of infection is a concern. In primary care (excluding institutions such as nursing homes), it is reasonable to use the more stringent definition of CDI; in practice, patients would very rarely consult their GP for diarrhoea comprising 1-2 episodes per day, unless perhaps this continued for several days. Conversely, in the healthcare setting, using a single episode of unexplained diarrhoea as the threshold to instigate testing and pre-emptive patient isolation is reasonable. Whichever the scenario, some flexibility is required to ensure that unexplained diarrhoea is appropriately investigated and managed, especially in high risk individuals.

Q. Should all patients with diarrhoea in the community setting be tested?
A. The current PHE guidance adequately covers when to investigate patients in the community with unexplained diarrhoea. Whenever a diarrhoeal sample is submitted, relevant clinical details should be supplied, e.g. antibiotic, travel, diarrhoea contact histories. Without such information it cannot be assumed that laboratories will test a faecal sample from a person in the community for evidence of CDI.

Q. Is it acceptable to use a cytotoxin test instead of a sensitive toxin EIA.
A. Yes it is acceptable to use a cytotoxin test instead of a sensitive toxin EIA as part of the recommended two-stage algorithm. In DH/PHE evaluations, the cytotoxin test was more sensitive than the toxin EIAs. Clearly, the cytotoxin assay yields slower results than the toxin EIA, and this needs to be accounted for when making management and infection prevention decisions regarding suspected CDI cases.

Q. Are samples takes for research or assessing patients' response to treatment egligible for mandatory reporting?.
A. Stool samples taken for research, from non-syptomatic patients (i.e. less than 5 (i.e. 1-4) on the Bristol Stool Chart), but are C. difficile toxin positive should not be reported. For example, a stool sample taken from a non-symptomatic patient to determine C. difficile carriage should not be reported even if C. difficile toxin positive. However, if this result is subsequently used for a clinical diagnosis, it becomes subject to mandatory surveillance and should be reported.If there is no record of the patient being symptomatic at time of sample it must be assumed that they were and a positive case must therefore be reported.

13.12 Appendix 12. Independent Sector denominator data calculations

The denominator used, which is more appropriate for shorter stay hospitals is

Bed days in year + discharges in year

Instead of counting the number of midnights the patient was resident for, this counts the number of different days on which they were in the hospital. A day case will count 1, a one night stay in the year will count 2.

Bed days in the financial year 2014/15

This is the sum of the number of occupants in a bed each midnight during the year:

Those in a bed at midnight *at the end of the day* 1 April 2014 +

...+ those in a bed at midnight *at the end of the day* 31 March 2015

If it is being derived from admission dates and discharge dates, you work out the contribution that each patient makes to the year's bed days by a formula.

The only patients who can contribute a bed day to the year are those who are admitted *strictly before* 1 April 2015 and discharged *strictly after* 1 April 2014. That is, the latest date they could have been admitted was 31 March 2015 and the earliest date they could have been discharged was 2 April 2014.

For these we work out

Discharge date or 1 April 2015, whichever is earlier

MINUS

Admission date or 1 April 2014, whichever is later

then add up over all the patients.

This counts the number of bed days the patient contributes to the year.

If the patient is still in hospital and does not yet have a discharge date then the first expression should be taken as 1 April 2015.

Discharges in the financial year 2014/15

This is the number of patients with a discharge date between 1 April 2014 and 31 March 2015 i.e.

number of patients discharged on 1 April 2014 +
... + number of patients discharged on 31March 2015

It should include any day cases that took place during the year.

Examples of bed day calculation

If a patient was admitted on 17 March 2014 and discharged on 1 April 2014 they will contribute no bed days to 2014/15.

If a patient was admitted on 17 March 2014 and discharged on 2 April 2014 they will contribute 1 bed day to 2014/15.

If a patient was admitted on 17 March 2014 and discharged on 1 April 2015, they will contribute 365 bed days to 2014/15

If a patient was admitted on 23 April 2014 and discharged on 23 April 2014 they will contribute no bed days (however they will contribute one discharge).

If a patient was admitted on 1 March 2015 and is still in hospital today (12 July 2015) they will contribute

Minimum of (discharge date, 1 April 2015) - maximum of (admission date, 1 April 2014)

= 1 April 2015 - maximum (1 March 2015, 1 April 2014)

= 1 April 2015 - 1 March 2015

= 31 Days

13.13 Appendix 13. List of hyperlinks

New DCS
https://hcaidcs.phe.org.uk/WebPages/GeneralHomePage.aspx

Updated guidance on the diagnosis and reporting of *Clostridium difficile*
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/215135/dh_133016.pdf

MRSA bacteraemia:
Monthly MRSA PIR assigned counts by acute trust and onset status
https://www.gov.uk/government/statistics/mrsa-bacteraemia-monthly-data-by-post-infection-review-assignment

Monthly MRSA counts by Clinical Commissioning Group and onset status
https://www.gov.uk/government/statistics/mrsa-bacteraemia-monthly-data-by-attributed-clinical-commissioning-group

Annual data tables – counts and rates, by acute trust and CCG, by quarter and year
https://www.gov.uk/government/statistics/mrsa-bacteraemia-annual-data

MSSA bacteraemia:
Monthly MSSA counts by acute trust and onset status
https://www.gov.uk/government/statistics/mssa-bacteraemia-monthly-data-by-nhs-acute-trust

Monthly MSSA counts by Clinical Commissioning Group and onset status
https://www.gov.uk/government/statistics/mssa-bacteraemia-monthly-data-by-attributed-clinical-commissioning-group

Annual data tables – counts and rates, by acute trust and CCG, by quarter and year
https://www.gov.uk/government/statistics/mssa-bacteraemia-annual-data

***E. coli* bacteraemia:**

Monthly counts of *E.coli* bacteraemia split by onset of infection by NHS acute trust.
https://www.gov.uk/government/statistics/e-coli-bacteraemia-monthly-data-split-by-location-of-onset-by-nhs-trust

Monthly counts of *E.coli* bacteraemia by onset of infection by attributed clinical commissioning group
https://www.gov.uk/government/statistics/e-coli-bacteraemia-monthly-data-split-by-location-of-onset-by-ccg

Annual data tables – counts and rates, by acute trust and CCG, by quarter and year
https://www.gov.uk/government/statistics/escherichia-coli-e-coli-bacteraemia-annual-data

***Klebsiella* species:**
Monthly counts of *Klebsiella* spp. bacteraemia split by onset of infection, by NHS acute trust.
https://www.gov.uk/government/statistics/klebsiella-spp-bacteraemia-monthly-data-split-by-location-of-onset-by-nhs-trust

Monthly counts of *Klebsiella* spp. bacteraemia by onset of infection, by attributed clinical commissioning group.
https://www.gov.uk/government/statistics/klebsiella-species-bacteraemia-monthly-data-split-by-location-of-onset-by-ccg

Annual data tables – counts and rates, by acute trust and CCG, by quarter and year
https://draft-origin.publishing.service.gov.uk/government/statistics/klebsiella-species-klebsiella-spp-bacteraemia-annual-data

Pseudomonas aeruginosa
Monthly counts of *P. aeruginosa* bacteraemia split by onset of infection, by NHS acute trust.
https://www.gov.uk/government/statistics/p-aeruginosa-bacteraemia-monthly-data-split-by-location-of-onset-by-nhs-trust

Monthly counts of *P. aeruginosa* bacteraemia by onset of infection, by attributed clinical commissioning group.
https://www.gov.uk/government/statistics/p-aeruginosa-bacteraemia-monthly-data-split-by-location-of-onset-by-ccg

Annual data tables – counts and rates, by acute trust and CCG, by quarter and year

***Clostridium difficile* infection:**
Monthly *C. difficile* counts by acute trust in patients aged 2 years and over and prior healthcare exposurehttps://www.gov.uk/government/statistics/clostridium-difficile-infection-monthly-data-by-nhs-acute-trust

Monthly *C. difficile* counts in patients aged 2 years and over by Clinical Commissioning Group and prior healthcare exposure
https://www.gov.uk/government/statistics/clostridium-difficile-infection-monthly-data-by-attributed-clinical-commissioning-group

https://www.gov.uk/government/statistics/clostridium-difficile-infection-annual-data

Epidemiological commentaries on all collections

Quarterly Epidemiological commentaries on MRSA, MSSA and Gram-negative bacteraemia and *C. difficile*
https://www.gov.uk/government/statistics/mrsa-mssa-and-e-coli-bacteraemia-and-c-difficile-infection-quarterly-epidemiological-commentary

Annual epidemiological commentaries for MRSA, MSSA and Gram-negative bacteraemia and *C. difficile* https://www.gov.uk/government/statistics/mrsa-mssa-and-e-coli-bacteraemia-and-c-difficile-infection-annual-epidemiological-commentary

Annual data for independent sector healthcare organisations
https://www.gov.uk/government/statistics/mrsa-mssa-and-e-coli-bacteraemia-and-clostridium-difficile-infection-annual-data-for-independent-sector-healthcare-organisations

Six monthly commentary for Independent Sector MRSA, MSSA, *E. coli* bacteraemia and *C. difficile*
https://www.gov.uk/government/statistics/mrsa-mssa-and-e-coli-bacteraemia-and-clostridium-difficile-infection-6-monthly-data-for-independent-sector-healthcare-organisations

DCS User Guides

User guides for the DCS can be found at:
https://hcaidcs.phe.org.uk/WebPages/InternalContentPage.aspx?gjvD2ZhVtrnMlb222Qn7yv+1xgGCdd9b

13.14 Appendix 14. Changes to the mandatory surveillance protocol

Date	Version	Changes
	4.2	• Added prior healthcare apportioning for *C. difficile* infection • Added surveillance of *S. argenteus* and *S. schweizeri* • Included *K. aerogenes* (previously *Enterobacter aerogenes*) in surveillance • Data collection on prior trust exposure expanded to include all collections, based on discharge within past 28 days for bacteraemia and 84 days for CDI • Added new question to QMLR data regarding CPE screening • Added chemotherapy question to risk factor data for all collections

References

1. Chief Medical Officer. Reporting MRSA data: overview of arrangements. *http://wwwdhgovuk/en/Publicationsandstatistics/Lettersandcirculars/Professionalletters/Chiefmedicalofficerletters/DH_4132578* 2006 2006. http://www.dh.gov.uk/en/Publicationsandstatistics/Lettersandcirculars/Professionalletters/Chiefmedicalofficerletters/DH_4132578.
2. Chief Medical Officer. Changes to the mandatory healthcare associated infection surveillance system for Clostridium difficile associated diarrhoea from April 2007. *Department of Health* 2007 4/11/2007. http://webarchive.nationalarchives.gov.uk/20081105143757/dh.gov.uk/en/Publicationsandstatistics/Lettersandcirculars/Professionalletters/Chiefmedicalofficerletters/DH_073767 (accessed 9/2/2014).
3. Chief Nursing Officer. Extension of mandatory surveillance to Meticillin Sensitive Staphylococcus aureus and updated Healthcare Associated Infections clinical guidance. 2011 2011. https://www.gov.uk/government/publications/extension-of-mandatory-surveillance-to-meticillin-sensitive-staphylococcus-aureus-mssa-and-updated-healthcare-associated-infections-clinical-guidance-hcai-compendium.
4. Chief Medical Officer. Extension of mandatory surveillance to *E. coli* bloodstream infections. 2011 2011. https://www.gov.uk/government/publications/extension-of-mandatory-surveillance-to-e-coli-bloodstream-infections-june-2011.
5. Department of Health. Surveillance of healthcare associated infections. London: Department of Health, 2001.
6. Health and Social Care Act, 2008.
7. The Health and Social Care Act 2008 Code of Practice on the prevention and control of infections and related guidance. In: Department of Health, ed., 2015.
8. Competition & Markets Authority. Private Healthcare Market Investigation Order 2014. 2014. https://assets.digital.cabinet-office.gov.uk/media/542c1543e5274a1314000c56/Non-Divestment_Order_amended.pdf (accessed 10/03/2016).
9. Tong SY, Schaumburg F, Ellington MJ, et al. Novel staphylococcal species that form part of a Staphylococcus aureus-related complex: the non-pigmented Staphylococcus argenteus sp. nov. and the non-human primate-associated Staphylococcus schweitzeri sp. nov. *Int J Syst Evol Microbiol* 2015;65(Pt 1):15-22. doi: 10.1099/ijs.0.062752-0 [published Online First: 2014/10/02]
10. Lawson PA, Citron DM, Tyrrell KL, et al. Reclassification of Clostridium difficile as Clostridioides difficile (Hall and O'Toole 1935) Prevot 1938. *Anaerobe* 2016;40:95-9. doi: 10.1016/j.anaerobe.2016.06.008 [published Online First: 2016/07/03]
11. Tindall BJ, Sutton G, Garrity GM. Enterobacter aerogenes Hormaeche and Edwards 1960 (Approved Lists 1980) and Klebsiella mobilis Bascomb et al. 1971 (Approved Lists 1980) share the same nomenclatural type (ATCC 13048) on the Approved Lists and are homotypic synonyms, with consequences for the name Klebsiella mobilis Bascomb et al. 1971 (Approved Lists 1980). *Int J Syst Evol Microbiol* 2017;67(2):502-04. doi: 10.1099/ijsem.0.001572 [published Online First: 2016/12/03]