UK Health Security Agency

ICCQIP infection in critical care quality improvement programme

Surveillance of bloodstream infections in intensive care units in England

Protocol version 4.3

Infection in Critical Care Quality Improvement Programme

Contents

Abbreviations

Table 1. List of abbreviations

BC	blood culture
BSI	bloodstream infection (see 'Case definitions' section)
CL	central line
CVC	central *vascular* catheter (as defined in 'Central Line Data tab' section)
DCS	Data Capture System
HCAI	healthcare-associated infection
ICCQIP	Infection in Critical Care Quality Improvement Programme
ICU	intensive care unit
ICU-CLABSI	ICU-associated central line-associated BSI (see 'Case definitions' section)
ICU-CLRBSI	ICU-associated central line-related BSI (see 'Case definitions' section)
ICU-CLBSI	ICU-associated central line BSI (see 'Case definitions' section)
PBC	positive blood culture
PDS	Personal Demographics Service
SICBL	Integrated Care Board sub-location
UKHSA	UK Health Security Agency

Introduction

Background

Patients in critical care represent a particularly vulnerable patient population at risk of developing healthcare associated infections (HCAI) due to a variety of factors, such as disease severity, comorbidities, the need to undergo invasive procedures, and greater antibiotic exposure. The prevalence of HCAIs is higher in intensive care units (ICU) compared to other ward specialties, as highlighted by the 2023 point prevalence survey in England, which found HCAI prevalence in ICU to be 15.9% compared to 8.0% overall. The same study found that antimicrobial use in ICUs was higher than the overall prevalence (47.5% compared to 34.1%).

The impact of HCAIs on morbidity, mortality, length of stay, and cost is well documented (Eber 2010); many interventions have been developed to reduce HCAI incidence (Johnson 2012), although most interventions in England have historically been focussed on reductions in the incidence of specific organisms (predominantly Meticillin Resistant *Staphylococcus aureus* bacteraemia (MRSA) and *Clostridioides difficile* infection) rather than more generally on the ICU setting or device related infections. However, in 2009 the National Patient Safety Agency ran a large initiative aimed to reduce central line related bloodstream infections (BSI) in adult and paediatric ICUs in England. The 2-year programme was called "Matching Michigan", in reference to an earlier American study, which demonstrated a large reduction in central line-related BSI using a range of technical and behavioural interventions. The Matching Michigan study observed a 60% reduction in central line-linked BSI rates in adult ICUs after the intervention, with a smaller (48%) non-significant reduction in paediatric rates. However, the effects of the intervention were difficult to disentangle from a wider secular trend of declines in rates of BSIs associated with a range of interventions over time. Matching Michigan and a parallel ethnographic study identified the need for a more systematic collection and reporting of infection data.

Infection in Critical Care Quality Improvement Programme

The Infection in Critical Care Quality Improvement Programme (ICCQIP) was established in 2012 as a group of professionals from across the NHS, professional organisations, and UKHSA predecessor Public Health England, to develop a national surveillance and quality improvement programme for HCAIs in the critical care setting.

An initial survey of ICUs in England was conducted to garner opinion on priorities and potential data collections (Critical eye 2013). The results showed considerable support for surveillance of infections in ICUs, with central line-associated BSI highlighted as the main priority.

Sentinel surveillance started in May 2016. England's Chief Medical Officer endorsed ICCQIP in November 2016, when the programme was rolled out nationally.

Aims and objectives

The objectives of the ICCQIP ICU BSI surveillance are to:

1. Monitor the incidence of BSI (and association with central lines) in ICUs in England over time
2. Provide benchmarking for units against national aggregates
3. Inform and evaluate local and national interventions to reduce the incidence and impact of these infections

Methods

Setting

This surveillance programme is conducted in intensive care units in England.

All intensive care units are invited to participate, including adult, paediatric, and neonatal units, covering both general and specialist critical care settings, across both the NHS and independent sector.

NHS England stated in its Service Specifications for Adult Critical Care (updated in November 2021) that units 'should participate in […] ICCQIP'. Participation for paediatric and neonatal units, and for all private sector units, is voluntary.

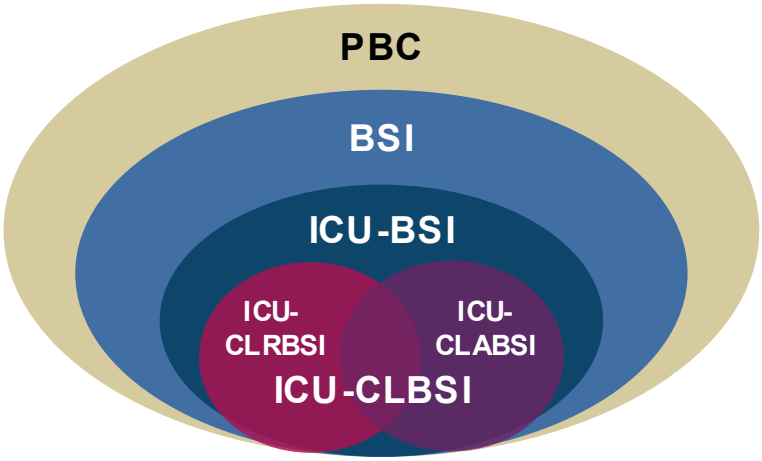
Surveillance is continuous, capturing data on an ongoing basis.

Case definitions

Units must submit all positive blood cultures (PBC) identified in their unit, as defined below. Units do not determine which PBCs meet specific case definitions; this is to minimise reporting bias. Instead, the UKHSA team classifies each reported PBC based on data submitted by units and according to standard case definitions (Venn diagram in Figure):

- Bloodstream infection (BSI)
- Intensive care unit-associated bloodstream infection (ICU-BSI)
- ICU central line-associated bloodstream infection (ICU-CLABSI)
- ICU central line-related bloodstream infection (ICU-CLRBSI)
- ICU central line bloodstream infection (ICU-CLBSI)

Figure 1. Venn diagram of case definitions



Positive blood culture (PBC)

PBCs are defined as blood culture sets that meet all inclusion criteria and no exclusion criteria listed below.

Inclusion criteria

- The blood culture sample was taken at any point from the time of ICU admission to the time of ICU discharge (even if the results were received after the patient was discharged from the unit).
- At least one of the bottles in the blood culture set was positive for one or more organisms (even if they are considered contaminants or skin commensals, as defined in Appendix Table 16).

Exclusion criteria

- The blood culture sample was taken after the patient's death.
- A blood culture set taken within the preceding 7 days was positive for the same organism (if a single organism was isolated from both cultures) or for the same combination of organisms (if more than one organism was isolated from either culture).

Further information

Examples of complex scenarios, with multiple organisms or multiple positive blood cultures for the same patient, are presented in Appendix Table 14 and Appendix Table 15.

Bloodstream infection (BSI)

The case definition of BSI is determined based on the type of ICU in which the patient was receiving care (adult, paediatric, neonatal).

All definitions distinguish between recognised pathogens and skin commensals. Please see Appendix Table 16 for a list of these organisms.

BSI in adult units

A positive blood culture that meets one of the following criteria:

- A recognised pathogen from at least one blood culture
  or
- Both of the following criteria:
    - A common skin commensal from 2 blood cultures drawn on separate occasions and taken within a 48-hour period
      and
    - The patient has at least one of the following signs or symptoms:
        - Fever > 38°C
        - Chills
        - Hypotension

BSI in paediatric units

A positive blood culture that meets one of the following criteria:

- A recognised pathogen from at least one blood culture,
  or
- Both of the following criteria:
    - A common skin commensal from 2 blood cultures drawn on separate occasions and taken within a 48-hour period
      and
- The patient has at least two of the following signs, at least one of which must be abnormal temperature or abnormal leukocyte count:
    - Abnormal temperature (core temperature > 38.5°C or < 36°C)
    - Abnormal leukocyte count
    - Tachypnoea
    - Tachycardia
    - Bradycardia (for children under the age of 1)

BSI in neonatal units

A positive blood culture that meets both the following criteria:

- Either of the following:
    - A recognised pathogen from at least one blood culture
      or
    - Both of the following:
        - A common skin commensal from at least one blood culture
        - One of the following:
            - C-reactive protein >2.0 mg/dL (>190 nmol/L)
            - Immature/total neutrophil ratio (I/T ratio) >0.2
            - Leukocyte count <5/nL
            - Platelet count <100/nL

  and
- The patient has at least two of the following:
    - Temperature >38°C or <36.5°C or temperature instability
    - Tachycardia
    - Bradycardia
    - Apnoea
    - Extended re-capillarisation time
    - Metabolic acidosis
    - Hyperglycaemia

- One of the following:
  - Lethargy, irritability, poor handling, or apathy
  - Increased oxygen requirement or ventilator support, or tachypnoea
  - Fall in urine output
  - Hypotension
  - Glucose intolerance

ICU-associated bloodstream infection (ICU-BSI)

The case definition of BSI is determined based on the availability of time data of ICU admission and specimen collection.

If the times of both ICU admission and specimen collection are available: a BSI is considered ICU-associated if the specimen was collected >48 hours after ICU admission.

Otherwise, if the time of ICU admission *or* specimen collection is unavailable: a BSI is considered ICU-associated if the specimen was collected on or after day 3 of ICU admission, where day 1 is the date of ICU admission.

BSI and central lines

Central lines (CLs), also referred to as central vascular catheters (CVCs), are defined in section 'Data collection', 'Central Line Data tab'.

Three partially overlapping definitions are illustrated below (also see the Venn diagram in Figure).

ICU central line-associated bloodstream infection (ICU-CLABSI)

Meets all the following criteria:

- ICU-BSI as defined above
- at least one central line was in place within 48-hours (2-days) of the first blood culture being taken (even if it was used only intermittently)
- the signs and symptoms, and the positive laboratory results, including pathogen cultured from the blood, are not primarily related to an infection at another site

ICU central line-related bloodstream infection (ICU-CLRBSI)

Meets all the following criteria:

- ICU-BSI as defined above
- at least one central line was in place within 48-hours (2-days) of the first blood culture being taken (even if it was used only intermittently)
- at least one of the following:
  - differential delay of positivity of blood cultures: central line blood sample culture positive **for the same microorganism** 2 hours or more before peripheral blood culture (blood samples drawn at the same time)

OR

- symptoms improve within 48hr of removal of central line

ICU central line bloodstream infection (ICU-CLBSI)

A BSI that is classified as ICU-CLABSI or ICU-CLRBSI or both.

Polymicrobial infection

A polymicrobial infection is defined as multiple organisms grown from blood cultures taken from the same patient on the same day. These could have been reported within the same PBC record or from multiple PBC records.

Data sources

ICU Data Capture System

Units collect data from their local health records and submit via the ICU Data Capture System (DCS), a purpose-built web portal designed by UKHSA and accessible at the following address: https://icudcs.ukhsa.gov.uk.

Guidance on how to use the ICU DCS, including how to sign up, is available via the user guides in the website's Support section (login not required).

Data linkage

Information collected by units via the ICU DCS is enriched with other demographic, clinical and microbiological data via linkage to other healthcare datasets.

PDS mortality data

The Personal Demographics Service (PDS) is the national master database of all NHS patients in England, Wales and the Isle of Man. Data linkage to the PDS allows to obtain mortality outcomes. It is conducted by the Demographic Batch Service (DBS) and the NHS Spine; records are considered linked if they match for both NHS number and date of birth. Please see section 'Mortality analysis' below for further information.

PDS geographical data

Linkage to PDS is also performed to retrieve patients' GP and residential details. This information is used to attribute PBC cases to health geographies (Local Authorities and ICB sub-locations), as documented in Appendix C, 'Attribution to healthcare geographies'. This linkage is automatically performed by the ICU DCS on a daily basis, using patient NHS number, forename, surname, sex and date of birth as linking variables.

SGSS

The Second-Generation Surveillance System (SGSS) is a national laboratory reporting system maintained by UKHSA. This linkage is currently only used on an *ad hoc* basis to obtain antimicrobial susceptibility data or validate PBC data from the ICU DCS.

HES

Hospital Episode Statistics (HES) Admitted Patient Care (APC) is a dataset managed by NHS England. This linkage can be used on an *ad hoc* basis to determine prior healthcare interactions in other facilities for patient transfers and subsequent outcomes or to determine comorbidities and procedures associated with the ICU admission.

Data collection

Overview

Data are collected by staff in participating ICUs and reported to the ICU DCS (see section 'Data sources' above). Surveillance data comprise:

- Positive blood cultures (see 'Submission of positive blood cultures' section)
- Unit activity (see 'Reporting of unit activity' section)

Units are invited to submit data promptly, according to the timeline outlined in Table 13.

A senior member of staff in each unit should verify the reported data for accuracy and completeness before signing them off (see 'Data sign-off' section). Once this is done, the data are locked for editing and can only be amended on request.

UKHSA staff then enrich ICU DCS data with other information via data linkage (see 'Data linkage' section above).

Submission of positive blood cultures

Submission of PBC data is done on the ICU DCS by completing data collection 'ICU Blood Stream Infections' (please note that, despite its name, this data collection refers to all PBCs, not just those that the unit considers to be true infections).

This data collection can be completed either via Case Capture or via the Data Upload Wizard (please see the user guides for details).

Submitted cases can later be freely amended if required or (if entered in error) deleted, until a period is signed off and locked (see 'Data sign-off' section below).

Questions (data fields)

Units must complete questions marked with a red asterisk (*) to save each PBC episode or continue to the next tab.

Information for certain questions, marked with a red hash (#), might not be available at the time of initial data collection. Units can complete these questions if data becomes available after initial data entry, but this must be completed prior to the quarterly sign-off.

Units are also invited to complete some optional questions.

Certain questions will only be displayed if specific answers were provided to earlier questions.

Questions are divided into 6 tabs in Case Capture:

- Episode Details (Table 2)
- Positive Blood Culture (Table 3)

- Clinical Symptoms (Table 4)
- Repeat Positive Blood Culture (this is only displayed if one or more organisms are skin commensals; Table 5)
- Treatment (Table 6)
- Central Line Data (Table 7)
- Source of Infection (Table 8)

Episode Details tab

This tab includes essential information about the patient, their ICU admission and the specimen. Completing the mandatory questions in this tab, together with the 'Positive Blood Culture' tab, is the minimum requirement to save a case.

Table 2. Questions in 'Episode Details' tab

Question	Completion	Guidance	Rationale
Critical care unit	Mandatory	Name of the critical care unit where the patient was admitted at the time of specimen collection. In Case Capture, if the user is only registered with one unit, this question is automatically populated by DCS; otherwise, there will be a dropdown menu. For the Data Upload Wizard, a unit code (made up of the NHS ODS code for the unit's Trust followed by a sequential number) needs to be inserted; this is accessible by using the Data Dictionary Report.	Assignment of cases to specific units. Identification of duplicates.
Specimen Date	Mandatory	Date when the blood culture sample was taken. It must be during the patient's ICU stay.	Calculation of age at the time of specimen collection. Identification of duplicates. Calculation of days since admission, used to identify ICU-associated cases.
Specimen Time	Optional	Time when the blood culture sample was taken.	Calculation of hours since admission, used to identify ICU-associated cases.
Specimen No	Mandatory	Unique code used in the hospital to identify this specimen.	Identification of specimen. Potential data linkage with laboratory data.
NHS Number	Mandatory	If the NHS number is unknown at the time of data collection, insert 9999999999. Please update the record as soon as the actual NHS number becomes known.	Identification of patient and multiple episodes. Identification of duplicates. Data linkage to acquire further patient information.
Forename	Mandatory	If this is unknown at the time of data entry, please enter "Unknown". Please update the record once this information becomes available.	Identification of patient and multiple episodes. Identification of potential duplicates. Data linkage to acquire further patient information.

Surname	Mandatory	If this is unknown at the time of data entry, please enter "Unknown". Please update the record once this information becomes available.	Identification of patient and multiple episodes. Identification of potential duplicates. Data linkage to acquire further patient information.
Date of Birth	Mandatory	If the date of birth is unknown at the time of data collection, insert 01/01/1900. Please update the record once this information becomes available.	Calculation of age. Identification of duplicates. Data linkage to acquire further patient information.
Sex	Mandatory	Options: Male, Female, Unknown. If you select Unknown, please update as soon as the information becomes available.	Stratification of analyses by sex.
Hospital Number	Mandatory	Unique code used in the hospital to identify this patient.	May be used locally to identify patients.
Patient Postcode	Optional	Postcode of residence (or, in the case of neonates, predicted postcode of residence at the time of discharge).	Identify wider geographical area of residence.
ICU Admission Date	Mandatory	Date when this patient was admitted to this ICU.	Calculation of age at the time of admission. Calculation of days since admission, used to identify ICU-associated cases.
ICU Admission Time	Optional	Time of admission to this intensive care unit.	More precise calculation of time since admission.
ICU Discharge Date	Optional	Date of discharge from this intensive care unit (due to any of the following: admission to a different ward in the hospital, transfer to a different ICU or hospital, direct discharge home, or death)	Calculation of length of stay in the unit.

Positive Blood Culture tab

This tab captures the organisms identified in this positive blood culture.

Completing the mandatory questions in this tab, together with the 'Episode Details' tab, is the minimum requirement to save a case.

Table 3. Questions in 'Positive Blood Culture' tab

Question	Completion	Guidance	Rationale
How many organisms were cultured from the same culture bottle set?	Mandatory	Options: 1, 2, 3, 4. If 5 or more organisms are isolated from a single set, please report 4 in this record and then add a new record with the remaining organisms.	Quantifying the organisms detected in a blood culture set.
Organism 1	Mandatory	A list of organisms (or organism groups) is available in Table 16 in the Appendix; the most up to date version is accessible in Case Capture and in the Data Dictionary report.	Analysing the distribution of causative microorganisms. Identification of potential duplicates. Identifying skin commensals, which contributes to establishing which PBCs meet the BSI case definitions.

Organism 2	If ≥2 organisms: mandatory. Otherwise: do not complete.	Only needed if more than one organism was cultured in this same blood culture set. As above. Please note that the same organism species cannot be inserted more than once.	As above.
Organism 3	If ≥3 organisms: mandatory. Otherwise: do not complete.	As above.	As above.
Organism 4	If 4 organisms: mandatory. Otherwise: do not complete.	As above.	As above.

Clinical Symptoms tab

The questions on clinical signs and symptoms refer to the time when the specimen was taken and vary according to the ICU age type (adult, paediatric, or neonatal). They align with CDC and ECDC definitions.

Table 4. Questions in 'Clinical Symptoms' tab

Question	Completion	Guidance	Rationale
Did the patient have any signs or symptoms at the time the specimen was taken?	Mandatory for sign-off	Select "Yes" if any signs or symptoms as defined in the following age-specific questions were present when the specimen was taken. If any other signs or symptoms were present, or no signs and symptoms were presented, please select "No".	Contributes to identifying which skin commensals PBCs meet the BSI case definition
What type of critical care unit was the patient in the care of?	If Q1 answered with "Yes": mandatory. Otherwise: do not complete	Options: • Adult (patients aged ≥13 years), • Paediatric (patients aged >28 days and <13 years) • Neonatal (patients aged ≤28 days or patient of any age in neonatal ICU)	Displaying age-appropriate signs and symptoms.
Adult- What signs/symptoms was the patient experiencing at the time the specimen was taken?	If Q2 answered with "Adult […]": mandatory. Otherwise: do not complete.	Select all that are met: • Fever >38°C • Chills/rigors • Hypotension Only displayed if the patient was in an adult ICU.	Contributes to identifying which skin commensals PBCs meet the adult BSI case definition

Paediatric- What signs/symptoms was the patient experiencing at the time the specimen was taken?	If Q2 answered with "Paediatric […]": mandatory. Otherwise: do not complete.	Select all that are met: • Tachycardia • Bradycardia (<1 year only) • Temperature >38.5°C or <36°C • Elevated respiratory rate • Leukocyte (elevated/depressed for age) Only displayed if the patient was in a paediatric ICU.	Contributes to identifying which skin commensals PBCs meet the paediatric BSI case definition
Enter leukocyte count	If Q4 answered with "Leukocyte […]": mandatory. Otherwise: do not complete.	Enter the value per nanolitres. Only displayed if "Leukocyte" was selected in the question above.	Contributes to identifying which skin commensals PBCs meet the paediatric BSI case definition
Neonatal- What signs/symptoms was the patient experiencing at the time the specimen was taken?	If Q2 answered with "Neonatal […]": mandatory. Otherwise: do not complete.	Select all that are met: • Apnoea • Increased oxygen requirement or ventilator support/Tachypnoea • Tachycardia • Bradycardia • Hypotension • Impaired peripheral perfusion (CRT > 3s pallor/mottling/core-peripheral/temp gap >2 degrees C) [Extended re-capillarisation time] • Fall in urine output • Temperature > 38°C or < 36.5°C • Temperature instability • Hyperglycaemia • Glucose intolerance • Ileus/onset of feed intolerance • Lethargy/irritability/poor handling/apathy • Metabolic acidosis [base deficit < - 10 mmol/L] • C-reactive protein > 2.0 mg /dL • Immature/total neutrophil ratio (I/T ratio) > 0.2 • Leukocytes < 5 × 10^9/L • Platelets < 100 × 10^9/L Only displayed if the patient as in a neonatal ICU.	Contributes to identifying which skin commensals PBCs meet the neonatal BSI case definition

† - 'Hypotension' includes a requirement for vasopressors to treat hypotension.

Repeat Positive Blood Culture tab

The 'Repeat Positive Blood Culture' tab is only relevant if one or more skin commensals are listed in the Organism questions in the 'Positive Blood Culture' tab. It captures information on whether the skin commensal was cultured in a repeat culture.

Table 5. Questions in 'Repeat Positive Blood Culture' tab

Question	Completion	Guidance	Rationale
Were the following organisms cultured in the repeat blood culture bottle set? {ORGANISM NAME}	If a skin commensal was entered in the Positive Blood Culture tab: mandatory for sign-off. Otherwise: do not complete.	This question is repeated for each skin commensal reported in the 'Positive Blood Culture' tab. The question will be displayed as the skin commensal organism(s) entered in the 'Positive Blood Culture' tab. For example, if the Organism 1 was listed as "AEROCOCCUS SPECIES", this question will be named "AEROCOCCUS SPECIES". If one or more repeat blood cultures were taken within a 48-hour window: • Select 'Yes' if at least one was positive for this same organism • Select 'No, blood culture sample taken but negative' if all were negative If no repeat blood cultures were taken within 48 hours, select 'No repeat blood sample taken'.	Contributes to identifying which skin commensals PBCs meet the adult and paediatric BSI case definition
Was the repeat blood sample taken within 2 days/48 hours of the first positive specimen date?	If Q1 was answered with "Yes" or "No, blood sample taken but negative": mandatory. Otherwise: do not complete.	Options: Yes, No.	Contributes to identifying which skin commensals PBCs meet the adult and paediatric BSI case definition
Date of repeat blood culture	If Q1 was answered with "Yes" or "No, blood sample taken but negative": mandatory. Otherwise: do not complete.	dd/mm/yyyy format. The date must be greater than the first specimen date but no later than 2 days from it.	Contributes to identifying which skin commensals PBCs meet the adult and paediatric BSI case definition
Time Taken	If Q1 was answered with "Yes" or "No, blood sample taken but negative": optional. Otherwise: do not complete.	hh:mm format.	Contributes to identifying which skin commensals PBCs meet the adult and paediatric BSI case definition

Treatment tab

This tab captures data on whether antimicrobial therapy was required at any time to treat the positive blood culture. It is not limited to treatment provided at the time of the specimen collection or when culture results were received.

Table 6. Question in 'Treatment' tab

Question	Completion	Guidance	Rationale
Did this positive blood culture require treatment with a course of antimicrobial therapy	Mandatory for sign-off	Options: Yes, No, Don't know	Exploratory analyses of clinical significance of a PBC

Central Line Data tab

This tab captures information about central lines

Central lines in ICCQIP

A central line, also referred to as central *vascular* catheter (CVC), is defined as an intravascular catheter that ends close to the heart or in one of the great vessels, and is used for infusion, withdrawal of blood, or haemodynamic monitoring.

The following are considered great vessels: aorta, pulmonary artery, superior vena cava, inferior vena cava, brachiocephalic veins, internal jugular veins, subclavian veins, external iliac veins, common iliac veins, femoral veins, and (in neonates) the umbilical artery/vein.

The insertion site and the type of device are not relevant to determine if a device is considered a central line.

Central lines include, but are not limited to: temporary central lines, peripherally inserted central catheters (PICC), temporary haemodialysis catheters, tunnelled dialysis catheters, arterial lines in the femoral artery, umbilical catheters (in neonates), pulmonary artery catheters.

Table 7. Questions in 'Central Line Data' tab

Question	Completion	Guidance	Rationale
Was a CL in situ within 48 hours (2 days) of the first blood culture being drawn?	Mandatory for sign-off	Please refer to the CL definition above. Options: Yes, No.	Contributes to the identification of CLABSI and CLRBSI.
If a CL was removed after the positive blood culture, did the patient's symptoms improve within 48 hours?	If Q1 was answered with "Yes": mandatory. Otherwise: do not complete.	Options: Yes, No, Not Applicable. Answer 'Not Applicable' if the CL was not removed.	Provides clinical evidence of CLRBSI.

If paired blood cultures were taken, and both were positive for this same organism, was the differential time to positivity >=2 hours? (CL blood culture positive >=2 hours before peripheral blood culture)	If Q1 or Q2 were answered with "Yes": mandatory. Otherwise: do not complete.	The differential time to positivity (DTP) refers to the culture of two blood samples taken one from a peripheral vein and one from a central line lumen (usually at the same time). Answer: • 'Yes' if DTP >=2 hours • 'No' if it did not meet this criterion or if the cultures were not positive for the same organism • 'Not Applicable' if this test was not performed. If the blood culture was positive for two or more organisms, consider 'this same organism' in this question to mean 'at least one organism isolated from the blood culture'.	Provides microbiological evidence of central line-related BSI.
How many uninterrupted periods, during this critical care admission, did the patient have one or more central line in place?	Optional.	• If no CLs were used during this admission, select 0. • If a single CL was used during this admission, select 1. • If a CL was inserted on admission, later removed, then a period in which no CLs were in place, then another CL was inserted, select 2. If more CLs overlapped, you do not need to report them separately. For example, if there was a femoral CL from 1 May to 4 May and an internal jugular CL from 3 May to 8 May, you only report these as one uninterrupted period, from 1-8 May.	Determines how many date questions to display below.
Start date of CL period {number}	Optional.	Cannot be before ICU admission date. If a CL was already in place at time of ICU admission, enter the CL start date as the same as the ICU admission date.	Provides more granular information on CL exposure.
End date of CL period {number}	Optional.	Cannot be after ICU discharge date. If a CL was still in place at time of ICU discharge, enter the CL end date the same as the ICU discharge date.	Provides more granular information on CL exposure.

Source of Infection tab

This tab captures information on whether this bloodstream infection was secondary to infection at another site, excluding a CL.

Table 8. Questions in 'Source of Infection' tab

Question	Completion	Guidance	Rationale
Was there an alternative source for this bloodstream infection (other than central line)?	Mandatory for sign-off	• If there was an infection (at another site, except CL) identified in the 7 days preceding the positive blood culture and that the team thinks likely led to this bloodstream infection, select Yes. • If there ~~wasn't~~was not another infection that likely led to this bloodstream infection (or if this BSI is judged to be secondary to a CL infection), select No. • If no data was available to establish this, select 'No Data Available'.	Contributes to the identification of CLABSI.
What evidence is there for this alternative infection source? Please tick all that apply	If Q1 answered with Yes: mandatory. Otherwise: do not complete.	Options (more can be selected): • Microbiologically confirmed (same organism, different site) • Clinical syndrome • Radiological or other diagnostic procedure	Determines the method of diagnosis.
Which is the most likely site for this infection?	If Q1 answered with Yes: mandatory. Otherwise: do not complete.	Options: • Pulmonary • Skin/soft tissue • Genito-urinary • Bone/joint • Digestive (inc. liver) • Central nervous system • Surgical site infection • Cardio-vascular system • Other	Allows description of the underlying focus of infection for BSIs that are not associated with a CL
If other site, please specify	If Q3 answered with Other: mandatory. Otherwise: do not complete.	Free text field.	As above

Reporting of unit activity

Units are required to report aggregate unit activity data pertaining to occupied bed-days, use of central lines and number of blood cultures taken. These are then used as denominators to calculate incidence rates. Central lines are defined in the 'Submission of positive blood culture', 'Questions (data fields)' section.

Reporting of unit activity is done on the DCS by completing one of these two data collections, according to unit preference:

- 'ICU Monthly Census'

- ‘ICU Daily Census’

At the end of each month, the DCS automatically aggregates all daily values in a month to generate an ‘ICU Monthly Census’ record. If a unit has reported daily values only for some days in a given month, the system will calculate an average aggregated monthly value.

ICU Monthly Census

Units can report their activity at a monthly aggregate level by completing the ‘ICU Monthly Census’ collection, instead of using the ‘ICU Daily Census’. This needs to be completed at the end of every month.

See Table 9 for details of the fields collected.

Table 9. Fields in the ‘ICU Monthly Census’ collection

Field	How to calculate	Rationale
Total number of occupied patient days in the unit for the month	For each patient who spent at least 1 midnight in the unit this month, count the number of midnights spent in the unit this month. Then sum these individual values.	Used as denominator to calculate rate of PBC and BSI
Total number of CL days in the unit	For each patient who spent at least 1 midnight in the unit this month, count the number of midnights spent in the unit this month with at least one central line (CL) in situ. Then sum these individual values. The CL definition used in this surveillance programme is listed in the ‘Central Line Data tab’ section.	Used as denominator to calculate rate of CLABSI
Total number of occupied patient days in the unit, restricted to include only patients in the unit for >2nights	For each patient that spent more than 2 midnights in the unit this month, count the number of midnights spent in the unit this month (including the first two). Then sum these individual values.	Used as denominator to calculate rate of ICU-BSI
Total number of CL days in the unit, restricted to include those in patients in the unit for >2nights	For each patient that spent more than 2 midnights in the unit this month, count the number of midnights spent in the unit this month (including the first two) with at least one central line (CL) in situ. Then sum these individual values. The CL definition used in this surveillance programme is listed in the ‘Central Line Data tab’ section.	Used as denominator to calculate rate of ICU-CLABSI
Total number of blood culture sets taken for the unit	For each patient that spent at least 1 midnight in the unit this month, count the number of blood culture sets taken during these months (positive and negative). Then sum these individual values.	Used as denominator to calculate blood culture positivity

Patient	31 Dec	01 Jan	02 Jan	03 Jan	04 Jan	…	30 Jan	31 Jan	01 Feb	Bed-days	ICU-days
A		D1	D2	D3	D4					4	4
B				D1	D2					2	0
C			D1	D2	D3					3	3

D	(D1)	D2	D3	D4						3	3
E								D1	(D2)	1	0
F			D1							1	0
G		D1	D2	D3			D1	D2		5	3
Total										**19**	**13**

$D_{(n)}$ indicates that the patient was in the unit at 00:00 on that day.

($D_{(n)}$) indicates that the patient was in the unit, but the delay falls outside of the submission month, i.e., December or February in this example.

ICU-days refers to the number of days spent in ICU when the patient has spent more than 2 days on the unit.

ICU Daily Census

Units can report their activity on a daily basis using the 'ICU Daily Census' data collection. See Table 10 for details of the fields collected.

Occupied beds

Bed occupancy is assessed as a snapshot at a specific time each day. For consistency, this should be done at the same time every day, preferably at midnight.

For example, when assessing bed occupancy for 15 January:

- A patient admitted on 14 Jan at 11 pm and discharged 3 hours later, at 2 am, was occupying a unit bed at midnight, so **is** counted as having occupied a bed on 15 Jan.
- A patient admitted on 15 Jan at 1 am and discharged on the same day at 10 pm, was not occupying a unit bed at midnight, so is **not** counted as having occupied a bed on 15 Jan.

Users can save a daily census if there is at least one non-blank field.

Table 10. Fields in the 'ICU Daily Census' collection

Field	How to calculate	Rationale
Total number of patients in the unit	Number of patients in the unit, as assessed at a given time (preferably midnight)	Used as denominator to calculate rate of PBC and BSI
Total number of patients in the unit with >= 1 CL	Number of patients who had at least one CL in place, as assessed at a given time (preferably midnight) The CL definition used in this surveillance programme is listed in the 'Central Line Data tab' section.	Used as denominator to calculate rate of CLABSI and CLRBSI

Number of patients in the unit for >2nights	Number of patients who spent at least 2 nights in the unit, as assessed at a given time (preferably midnight)	Used as denominator to calculate rate of ICU-BSI
Of the number of patients in the unit for >2nights, what number of patients have >=1 CL	Number of patients who had at least one CL in place AND spent at least 2 nights in the unit, as assessed at a given time (preferably midnight) The CL definition used in this surveillance programme is listed in the 'Central Line Data tab' section.	Used as denominator to calculate rate of CLABSI and CLRBSI
Total number of blood culture sets taken for all patients in the unit	Number of blood culture sets taken in the unit, as assessed at a given time (preferably midnight)	Used as denominator to calculate blood culture positivity

Quality assurance of data

Data validation

The ICU DCS runs some automatic data validation at the point of data entry and notifies users of errors and inconsistencies.

- It ensures that fields follow the correct data type format (e.g., dates)
- It ensures certain essential fields are not left blank
- It validates NHS numbers
- It verifies logical timelines; for example, the date of specimen collection cannot be prior to the date of ICU admission or date of birth.
- It automatically detects duplicated PBC records and does not allow users to enter exact duplicates. (Further de-duplication is performed during the analysis stage; see section 'De-duplication of PBC episodes' below).
- It conducts cross-validation on unit census values and provides a warning for illogical values; for example, if the total number of occupied bed-days is lower than number of occupied bed-days restricted to patients who spent over two nights in the unit. (Further validation is performed during the analysis stage; see 'Processing of unit census data' below).

These features help maintain the quality and reliability of surveillance data.

Data sign-off

Once a unit has entered all data marked as mandatory for sign-off for a given month, a senior member of staff in each unit should verify them for accuracy and completeness. Some ICU DCS tools facilitate the identification of data quality issues: the ICU Summary dashboard, the Duplicates report, the Data Quality dashboard and the ICU Denominator report (see the relevant user guides for details).

If there are inaccuracies, missing records or incomplete fields, the unit should amend these data.

Once the senior staff member is satisfied, they should sign off that month's data. The month will become locked for editing and will only be able to be amended after a request is agreed with the UKHSA ICCQIP surveillance team.

Data should be signed off within 1.5 months of the end of each reporting quarter, in time for the data analysis (Table 13. Quarterly reporting cycles in 'Reporting and dissemination' section).

Guidance on how to conduct this process can be found in the 'Sign-off' user guide under the 'Support' section of the ICU DCS.

Data processing and analysis

Routine analyses and reports are based at the ICU level or national level.

Separately, each PBC is also attributed to a Local Authority, ICB sub-location (SICBL) and higher-level organisations; please see Appendix C for details.

Data extraction

Extracts of the ICU DCS are taken on a quarterly basis, after the sign-off deadline (Table 13 in 'Reporting and dissemination' section below).

Processing of unit census data

Selection of monthly values

For each unit and month:

- If only monthly census data have been provided by the unit, then these are used.
- If only daily census data have been submitted, the monthly value is calculated as follows:
  Monthly value = (sum of daily values of metric / total days denominator data has been entered) × number of days in the month
  For example, if in February 2023 a unit submitted the following 8 daily values for total occupied beds {14, 16, 16, 16, 15, 14, 12, 15}, the monthly value would be:
  Monthly value = (14 + 16 + 16 + 16 + 15 + 14 + 12 + 15) / 8 * 28 = 413
- If the unit entered both daily data and total monthly data then the entered monthly data is used, unless a unit had informed us in writing that the daily data aggregated to monthly totals should be used instead of the entered monthly data.

Validation

Census data is considered missing when units submit PBC data but no census data for the same time period. They are also quality checked against the following validation rules:

- number of occupied patient bed-days in the unit cannot be fewer than the number of occupied patient bed-days in the unit restricted to only include patients in the unit for more than 2 nights (that is ICU patient bed-days)
- number of occupied patient bed-days in the unit cannot be fewer than the number of occupied patient bed-days in the unit restricted to only include patients with at least one central line (CL) in place (that is CL-days)
- number of occupied patient-days in the unit cannot be less than the number of occupied patient-days in the unit restricted to patients in the unit for more than 2 nights with at least one central line (CL) in place (that is ICU-CL-days)
- number of occupied patient bed-days in the unit restricted to patients with at least one central line (CL) in place (that is CL-days) cannot be less than the number of occupied

patient bed-days in the unit restricted to only include patients in the unit for more than 2 nights with at least one central line (CL) in place (that is ICU-CL-days)

- number of occupied patient bed-days in the unit restricted to patients in the unit for more than 2 nights (that is ICU patient bed-days) cannot be less than the number of occupied patient bed-days in the unit restricted to only include patients in the unit for more than 2 nights with at least one central line (CL) in place (that is ICU-CL-days)

Unit census data that breaches validation rules (for example, a greater number of ICU bed-days than patient bed-days) or is missing (even though data on positive blood cultures is submitted for the same period) are verified with the units, who may update the records.

Imputation

Missing census data and census data that continues to breach validation rules or erroneous data (notified by the unit) is deleted and is imputed from other data entered by the same unit. Each unit census metric, that is patient bed-days, ICU bed-days, CL-days, ICU-CL-days and blood cultures per month, is imputed individually.

Data for a given missing unit census metric is imputed following a 3-step hierarchical process whereby if data is still missing after the current step, the next step is started. Missing data is imputed with:

- data provided by the unit for the same month that is missing but for the previous year
- data provided by the unit for the most recent previous month
- data provided by the unit for the most recent future month (this is possible because units provide data in quarters)

After imputation, data for a given unit census metric in any particular month where there is a more than 100% increase or 50% decrease compared with the previous month is flagged, along with the previous month. The flagged values are checked with the unit, then assessed in the context of all provided data for that metric by the unit and the values dropped if it does not fit in with the rest of the time series. The data is then reimported, rechecked to confirm no unusual values. If the first imputation used historic data as per the hierarchical selection process, this may not reflect capacity or activity change within a unit, then one of the later imputation selection steps may be used to select data for imputation.

Units who have not supplied any unit census data for a particular metric cannot have this metric imputed for them. As such, rates which require this unit census metric cannot be calculated.

As some units may provide some but not all unit census metrics, there could be different numbers of units that contribute to the unit-type overall totals and rates.

Aggregation

Processed monthly census data are aggregated up at different levels:

- Organisational (ICU, NHS region, England)
- Unit age type (adult, paediatric, neonatal, all)

- Temporal (quarterly, financial yearly)

Calculation of participation

A unit is considered to have participated in a given quarter if it has submitted either of the following:

- Any complete monthly census data during that quarter (even if no PBCs were reported)
- Any PBC records *and* had imputable denominator data based on previous submissions.

Processing of infection data

De-duplication of PBC episodes

PBC episodes are defined as a dynamic 7-day period. Patients are identified using NHS number, date of birth and intensive care unit.

If a patient has two or more PBCs with all the same organisms within this period, the following sequential steps are followed to identify which record to retain:

- The record(s) with the earliest specimen date is/are retained.
- The record(s) with the fullest information is retained.
- The record entered first (lowest ICU DCS ID number) is retained.

Classification of infections

The case definitions are applied to the PBC episodes reported by units, as described in the 'Case definitions' section above, to identify BSI, ICU-BSI, and ICU-CLABSI, ICU-CRBSI and ICU-CLBSI.

Counting of infections

Cases of each infection metric are counted at different levels:

- Organisational (ICU, NHS region, England)
- Unit age type (adult, paediatric, neonatal, all)
- Temporal (quarterly, financial yearly)

Calculations of metrics

Table 11 indicates which census data are used as denominators in the calculation of each infection metric, along with short denominator names.

Table 11. Denominators used in the calculation of each metric

Metric	Census data used as denominator	Denominator (short name)

Blood culture positivity	Total number of blood culture sets taken	blood cultures taken
PBC rate, BSI rate	Total number of occupied patient days in the unit	bed-days
ICU-BSI rate, CL utilisation	Total number of occupied patient days in the unit, restricted to include only patients in the unit for >2nights	ICU-days
ICU-CLRBSI rate, ICU-CLABSI rate, ICU-CLBSI rate	Total number of CL days in the unit, restricted to include those in patients in the unit for >2nights	ICU-CL-days

Calculation of blood culture positivity

Blood culture positivity is calculated as follows.

$$Blood\ culture\ positivity = \frac{number\ of\ PBCs}{blood\ cultures\ taken} \times 100$$

If a unit has not provided the total number of blood cultures for a given month (and that number cannot be imputed), the PBCs are excluded from blood culture positivity calculation for that month, to avoid overestimation.

Calculation of incidence rates

For each organisation and time period, incidence rates are calculated as follows.

$$Rate\ of\ \boldsymbol{PBC}s\ per\ 1{,}000\ bed\ days = \frac{number\ of\ PBCs}{bed\ days} \times 1{,}000$$

$$Rate\ of\ \boldsymbol{BSI}s\ per\ 1{,}000\ bed\ days = \frac{number\ of\ BSIs}{bed\ days} \times 1{,}000$$

$$Rate\ of\ \boldsymbol{ICU\_BSI}s\ per\ 1{,}000\ ICU\_days = \frac{number\ of\ ICU\_BSIs}{ICU\_days} \times 1{,}000$$

$$Rate\ of\ \boldsymbol{ICU\_CLRBSI}s\ per\ 1{,}000\ ICU\_CL\_days = \frac{number\ of\ ICU\_CLRBSIs}{ICU\_CL\_days} \times 1{,}000$$

$$Rate\ of\ \boldsymbol{ICU\_CLABSI}s\ per\ 1{,}000\ ICU\_CL\_days = \frac{number\ of\ ICU\_CLABSIs}{ICU\_CL\_days} \times 1{,}000$$

$$Rate\ of\ \boldsymbol{ICU\_CLBSI}s\ per\ 1{,}000\ ICU\_CL\_days = \frac{number\ of\ ICU\_CLBSIs}{ICU\_CL\_days} \times 1{,}000$$

If unit has not provided a denominator for a given month (and that denominator cannot be imputed), the related infection counts are excluded from incidence rate calculations for that month, to avoid overestimation.

Calculation of central line utilisation

Central line utilisation is the proportion of days that patients staying in the ICU for more than 2 nights have a CL in place, relative to their total stay for more than 2 nights:

$$CL\ utilisation = \frac{ICU\_CL\_days}{ICU\_days} \times 100$$

Analysis of organism distribution

Entered organism data is aggregated into groups as listed in Appendix Table 16.

Percentages out of total isolates are calculated by each infection metric (PBC, BSI, ICU-BSI, ICU-CLBSI) and unit type (adult, paediatric, neonatal) as follows:

$$Percentage\ of\ organism\ x\ isolates = \frac{number_x}{number_{total}} \times 100$$

where *x* is a given organism.

Mortality analysis

Mortality data is acquired via data linkage, as described in the 'PDS mortality data' section above.

Where multiple PBC records have the same NHS number and date of birth within the 30-day fatality window, only the record with the specimen date closest to the date of death is used in the mortality analysis. This is done to avoid overestimating the numbers of deaths. This deduplication algorithm is applied to both the 30-day fatality, traced and total number of reports to prevent an inflated count of deaths and reports.

The case fatality rate (CFR) is the number of deaths from any cause occurring within 30 days of specimen date as a percentage of all reported cases. As this is a measure of all-cause mortality, it includes deaths that may not be directly attributable to the infections.

$$\boldsymbol{CFR} = \frac{number\ of\ deaths\ from\ any\ cause\ within\ 30\ days\ of\ specimen\ date}{number\ of\ total\ cases} \times 100$$

Quality assurance of results

Quality assurance of results relies on two epidemiological scientists conducting all analyses independently using separate code and confirming when results match. All code used for data processing and analysis is version controlled using a local Git repository.

Results are sense checked with previously reported trends and available microbiological knowledge. Tables and graphs are automatically generated from the quality assured data tables by using Stata and R (quarterly reports) or R and Quarto Markdown (annual reports).

Senior members of the team and UKHSA Statistics Production Division staff review the annual statistics before publication.

Confidentiality

Personal and confidential data is collected, processed, and used in accordance with the UKHSA Privacy Notice. All UKHSA staff with access to personal or confidential information must complete mandatory information governance training, which must be refreshed every year. Information is stored on computer systems that are kept up-to-date and regularly tested to make sure they are secure and protected from viruses and hacking. UKHSA staff do not store data on their own laptops or computers. Instead, data is stored centrally on UKHSA servers.

Processing of patient identifiable information for this surveillance programme is covered by Caldicott Advisory Panel reference CAP-2018-90.

The ICU DCS is covered by a Data Protection Impact Assessment that was originally approved in 2023 (as of publication of version 4.3 of this protocol, the DPIA was last updated on 31 March 2026).

Reporting and dissemination

DCS dashboards and reports

ICU DCS users can access automatically generated reports and dashboards based on their data, depending on their ICU DCS role.

Details on these tools are listed in Table 12.

For guidance on how to access these, please refer to the relevant user guides.

Table 12. ICU DCS dashboards and reports

Tool	Contents
Counts and rates report	System-calculated counts and rates through time
ICU Benchmarking dashboard	Comparison of system-calculated rates across participating ICUs. Please note that these rates need to be interpreted with caution as they are not adjusted for factors that may differ across units, such as case mix.
Device utilisation report	Summary of central line utilisation through time
Line Listing report	Table of all records (or a subset of them), either infection or census data, submitted by the units a DCS user has access to. The table can be downloaded.

Quarterly reports

Surveillance data is analysed on a quarterly basis. These reports include the latest 7 quarters and includes counts and rates of infection (for the various case definitions), organisms, central line utilisation rates, blood culture positivity.

Reports are disseminated three months after the end of the reference period (Table 13).

Table 13. Quarterly reporting cycles

Data related to	Data sign-off deadline	Quarterly reports published
January to March	15 May	June
April to June	15 August	September
July to September	15 November	December
October to December	15 February of the following year	March of the following year

National reports (by unit age type) are publicly available on:

- the ICU DCS: https://icudcs.ukhsa.gov.uk/WebPages/InternalContentPage.aspx?46S8uoMbwMmSDiiirF5uB5jhCRvSrmFp
- the FICM website: https://www.ficm.ac.uk/iccqip-quarterly-reports

Unit-level reports are sent to the relevant unit/trust only and include benchmarking with national results.

Annual report

In 2024, the first annual output on trends since the start of surveillance was published as Official Statistics in Development on the UK public sector information website, gov.uk. This includes a report, supplementary results for paediatric and neonatal units, supplementary data tables, and quality and methodology information.

Results are aggregated by financial year (April to March).

Future publications are planned to be published on a yearly basis, in October; this means that reports should be published seven months after the end of the reference period.

The annual report is publicly accessible on gov.uk: https://www.gov.uk/government/statistics/surveillance-of-bloodstream-infections-in-critical-care-england

This report and tables are produced in accessible HTML and ODS format, respectively. All figures are produced within UKHSA accessibility guidelines.

Appendices

Appendix A: examples of PBC reporting

Table 14 and Table 15 contain scenarios of PBCs and how to report them onto the ICU DCS, for recognised pathogens and skin commensals, respectively.

Table 14. Scenarios of reporting PBCs with recognised pathogens

Scenario	Action
Patient A has a blood culture set taken on 1st April 2025 and *Escherichia coli* is cultured from it. A second blood culture set was taken on 5th April 2025 and *E. coli* is again cultured. As the same organism has been cultured twice within a 7-day period, this is considered to be the same episode.	A single episode of *E. coli* is entered (1st April 2025).
Patient B has a blood culture set taken on 4th April 2025 and *E. coli* is cultured from it. A second blood culture set was taken on 11th April 2025 and *E. coli* is again cultured. While the same organism has been cultured twice, they are not within a 7-day period (4th April is day 1, 5th April is day 2, 10th April is day 7). Therefore, these two cultures are not considered to be the same episode.	Two episodes of *E. coli* are entered.
Patient C has a blood culture set taken on 13th April 2025 and *Acinetobacter baumanii* is cultured from it. A second blood culture set was taken on 14th April 2025 and *Staphylococcus aureus* is cultured from it. As two different organisms were cultured from different blood culture sets, both are considered to be separate episodes.	Two episodes are entered: an episode of *A. baumanii* and an episode of *S. aureus*.
Patient D has a blood culture set taken on 15th April 2025 and both *S. aureus* and *Candida albicans* are cultured from it. As both organisms were cultured from the same blood culture set, this is considered to be a polymicrobial infection.	A single episode is entered, with Organism 1 listed as *S. aureus* and Organism 2 as *C. albicans*.
Patient E has a blood culture set taken on 18th April 2025 and *Stenotrophomonas maltophilia* was cultured from it. A second blood culture set was taken on 21st April 2025 and both *S. maltophilia* and *E. coli* were cultured from it. While the two blood culture sets were taken within 7 days of each other and *S. maltophilia* was cultured from both sets, they are not identical (i.e. one was a pure growth and the other a mixed growth).	Two episodes are entered: an episode of *S. maltophilia* and an episode of *S. maltophilia* and *E. coli*.
Patient F has a blood culture set taken on 18th April 2025 and *S. maltophilia* and *E. coli* were cultured from it. A second blood culture set was taken on 21st April 2025 and only *E. coli* was cultured from it. While the two blood culture sets were taken within 7 days of each other and *E. coli* was cultured from both sets, they are not identical (i.e. the first was a mixed growth and the other a pure growth).	Two episodes are entered: an episode of *S. maltophilia* and *E. coli* and an episode of *E. coli*.
Patient G has a blood culture set taken on 20th April 2025 and *S. aureus* and *C. albicans* are both cultured. A second blood culture set was taken on 24th April 2025 and both *S. aureus* and *C. albicans* are cultured again. As the second blood culture has provided the exact result of the first blood culture set, the second episode does not need to be recorded onto the ICU DCS.	A single episode is entered, with Organism 1 listed as *S. aureus* and Organism 2 as *C. albicans*.

Patient H has a blood culture set taken on 25th April 2025 and *S. aureus* and *C. albicans* are both cultured. A second blood culture set was taken on 29th April 2025 and both *S. aureus* and *C. albicans* are cultured again. A third culture on 30th April 2025 was taken and only *C. albicans* was cultured. As the second blood culture has provided the exact result of the first blood culture set and is within 7 days of the first positive blood culture, the results of the second culture do not need to be recorded, but as the third culture only included *C. albicans* this will also need to be recorded.	Two episodes are entered: one episode of *S. aureus* and *C. albicans* and one episode of *C. albicans* as a pure growth.

Table 15. Scenarios of reporting PBCs with skin commensals

Scenario	Action
Patient I has a blood culture set taken on 1st April 2025 and *Staphylococcus haemolyticus* is cultured from it. A second blood culture set was taken on 2nd April 2025 and *S. haemolyticus* is again cultured. As the same organism has been cultured twice within a 7-day period, this is considered to be the same episode and so the result from 2nd April 2025 does not need to be entered as its own record. However, as the second blood culture was taken within 2 days of the first positive specimen, details of the repeat positive blood culture should be captured on the existing record for the 1st April 2025 blood culture, on the "Repeat Positive Blood Culture" tab.	A single episode of *S. haemolyticus* is entered, with additional data on the repeat positive blood culture entered on the existing episode record.
Patient J has a blood culture set taken on 1st April 2025 and *S. haemolyticus* is cultured from it. A second blood culture set was taken on 5th April 2025 and *S. haemolyticus* is again cultured. As the same organism has been cultured twice within a 7-day period, this is considered to be the same episode and so the result from 5th April 2025 does not need to be entered onto the ICU data capture system as its own case capture record. In addition, as the second positive blood culture was >2 days after the first specimen was taken, the information on the repeat positive blood culture should not be added to the existing infection episode record on the ICU data capture system.	A single episode of *S. haemolyticus* is entered.
Patient K has a blood culture set taken on 13th April 2025 and *Staphylococcus epidermidis* is cultured from it. A second blood culture set was taken on 14th April 2025 and *S. aureus* is cultured from it. As two different organisms were cultured from different blood culture sets, both of these are considered to be separate episodes.	Two episodes are entered: an episode of *S. epidermidis* and an episode of *S. aureus*.
Patient L has a blood culture set taken on 15th April 2025 and both *S. epidermidis* and *C. albicans* are cultured from it. As both of these organisms were cultured from the same blood culture set, this is considered to be a polymicrobial infection.	A single episode is entered, with Organism 1 listed as *S. epidermidis* and Organism 2 as *C. albicans*.
Patient M has a blood culture set taken on 18th April 2025 and *S. epidermidis* was cultured from it. A second blood culture set was taken on 19th April 2025 and both *S. epidermidis* and *E. coli* were cultured from it. The *S. epidermidis* from the 19th April blood culture set will need to be entered as additional information in the pre-existing record (from 18th April) as this is within 2 days of the first culture AND you will need to enter the second positive blood culture with both the *S. epidermidis* and *E. coli* as this is a mixed growth.	Two episodes are entered: one pure growth of *S. epidermidis* on 18th April (with additional data on the 19th April repeat positive blood culture entered on this episode's record) AND an episode with both *S. epidermidis* and *E. coli.*

Patient N has a blood culture set taken on 19th April 2025 and *S. epidermidis* and *S. aureus* were cultured from it. A second blood culture set was taken on 20th April 2025 and *S. epidermidis* was again cultured. While this is of the same organism, it is a pure growth; however, because it is of the skin commensal and the second blood culture was within 2 days of the first; this second positive blood culture should be entered onto the "Repeat Positive Blood Culture" tab on the base record and not as a separate case.	One episode of *S. epidermidis* and *S. aureus* is entered AND details of the second blood culture should be added to the "Repeat Positive Blood Culture" tab of this one case.
Patient O has a blood culture set taken on 19th April 2025 and *S. epidermidis* and *S. aureus* were cultured from it. A second blood culture set was taken on 20th April 2025 and *S. aureus* was again cultured. While this is the same organism of one of the organisms from the first culture, it is a pure growth and so the second blood culture should be entered as a separate case.	Two episodes is recorded: one episode of *S. epidermidis* and *S. aureus* and one episode of *S. aureus* as a pure growth.
Patient P has a blood culture set taken on 19th April 2025 and *S. epidermidis* and *S. aureus* were cultured from it. A second blood culture set was taken on 20th April 2025 and *S. epidermidis* and *S. aureus* were again cultured. These are the exact same combination of organisms within a 7-day period, so a new case does not need to be entered. However, as the second culture was also within 2 days of the first and one of the organisms cultured is the same skin commensal from the first culture, it needs to be recorded against the original case on the "Repeat Positive Blood Culture" tab.	One episode is recorded: *S. epidermidis* and *S. aureus* AND the second culture of *S. epidermidis* should be added to the "Repeat Positive Blood Culture" tab of this one case.
Patient Q has a blood culture set taken on 19th April 2025 and *S. epidermidis* and *S. aureus* were cultured from it. A second blood culture set was taken on 25th April 2025 and *S. epidermidis* and *S. aureus* were again cultured. These are the exact same combination of organisms within a 7-day period, so a new case does not need to be entered. In addition, the second culture was not within 2 days of the first and so the repeat positive skin commensal culture can also be ignored.	One episode is recorded of *S. epidermidis* and *S. aureus*.
Patient R has a blood culture set taken on 19th April 2025 and *S. epidermidis* and *S. haemolyticus* were cultured from it. A second blood culture set was taken on 20th April 2025 and *S. epidermidis* and *S. haemolyticus* were again cultured. These are the exact same combination of organisms within a 7-day period, so a new case does not need to be entered. However, as the second culture was also within 2 days of the first and both organisms cultured are the same skin commensals as from the first culture, these need to be recorded against the original case on the "Repeat Positive Blood Culture" tab.	One episode should be recorded of *S. epidermidis* and *S. haemolyticus* AND the second culture of *S. epidermidis* and *S. haemolyticus* should be added to the "Repeat Positive Blood Culture" tab of this one case.

Appendix B: microorganisms

Table 16 lists all organism options in the ICU DCS, whether each of them is considered a skin commensal or recognised pathogen for surveillance purposes, and the detailed groupings used in surveillance results.

Please note that options can be one of the following:

- single species (e.g., 'ACINETOBACTER BAUMANNII')
- groups of species not listed in other options (e.g., 'ACINETOBACTER SP., OTHER)

- groups of species not speciated in the laboratory (e.g., 'ACINETOBACTER SP., NOT SPECIFIED')
- all species in a genus (e.g., 'MICROCOCCUS SPECIES')
- phenotypic groupings (e.g., 'GRAM POSITIVE COCCI, OTHER').

For the purposes of graphs certain groups are further aggregated:

- "Streptococcus spp." includes both viridans and non-viridans species
- "Other Gram-negative" includes Acinetobacter spp., Serratia spp., other Enterobacteriaceae, and other Gram-negative bacteria
- "Candida spp." includes all Candida species
- "Other" includes other Gram-positive bacteria, other bacteria, other fungi, parasites.

Table 16. Organism options listed in the ICU DCS

Organism option in ICU DCS	Organism type	Detailed grouping
STAPHYLOCOCCUS EPIDERMIDIS	Skin commensal	Staphylococcus, coagulase-negative
STAPHYLOCOCCUS HAEMOLYTICUS	Skin commensal	Staphylococcus, coagulase-negative
COAGULASE-NEGATIVE STAPHYLOCOCCI, NOT SPECIFIED	Skin commensal	Staphylococcus, coagulase-negative
COAGULASE-NEGATIVE STAPHYLOCOCCI, OTHER	Skin commensal	Staphylococcus, coagulase-negative
STAPHYLOCOCCUS AUREUS	Pathogen	S. aureus
STREPTOCOCCUS AGALACTIAE (B)	Pathogen	Streptococcus spp., non-viridans
STREPTOCOCCUS PNEUMONIAE	Pathogen	Streptococcus spp., non-viridans
STREPTOCOCCUS PYOGENES (A)	Pathogen	Streptococcus spp., non-viridans
OTHER HAEMOL. STREPTOCOCCAE (C, G)	Pathogen	Streptococcus spp., non-viridans
STREPTOCOCCUS SP., OTHER	Pathogen	Streptococcus spp., non-viridans
STREPTOCOCCUS SP., NOT SPECIFIED	Pathogen	Streptococcus spp., non-viridans
STREPTOCOCCUS (VIRIDANS GROUP)	Skin commensal	Streptococcus, viridans group
ENTEROCOCCUS FAECALIS	Pathogen	Enterococcus spp.
ENTEROCOCCUS FAECIUM	Pathogen	Enterococcus spp.
ENTEROCOCCUS SP., NOT SPECIFIED	Pathogen	Enterococcus spp.
ENTEROCOCCUS SP., OTHER	Pathogen	Enterococcus spp.
ESCHERICHIA COLI	Pathogen	E. coli
KLEBSIELLA AEROGENES	Pathogen	Klebsiella spp.
KLEBSIELLA OXYTOCA	Pathogen	Klebsiella spp.
KLEBSIELLA PNEUMONIAE	Pathogen	Klebsiella spp.
KLEBSIELLA SP., NOT SPECIFIED	Pathogen	Klebsiella spp.
KLEBSIELLA SP., OTHER	Pathogen	Klebsiella spp.
PSEUDOMONAS AERUGINOSA	Pathogen	P. aeruginosa
ACINETOBACTER BAUMANNII	Pathogen	Acinetobacter spp.

ACINETOBACTER CALCOACETICUS	Pathogen	Acinetobacter spp.
ACINETOBACTER HAEMOLYTICUS	Pathogen	Acinetobacter spp.
ACINETOBACTER LWOFFI	Pathogen	Acinetobacter spp.
ACINETOBACTER SP., NOT SPECIFIED	Pathogen	Acinetobacter spp.
ACINETOBACTER SP., OTHER	Pathogen	Acinetobacter spp.
SERRATIA LIQUEFACIENS	Pathogen	Serratia spp.
SERRATIA MARCESCENS	Pathogen	Serratia spp.
SERRATIA SP., OTHER	Pathogen	Serratia spp.
SERRATIA SP., NOT SPECIFIED	Pathogen	Serratia spp.
CITROBACTER FREUNDII	Pathogen	Other Enterobacteriaceae
CITROBACTER KOSERI (EX. DIVERSUS)	Pathogen	Other Enterobacteriaceae
CITROBACTER SP., NOT SPECIFIED	Pathogen	Other Enterobacteriaceae
CITROBACTER SP., OTHER	Pathogen	Other Enterobacteriaceae
ENTEROBACTER AGGLOMERANS	Pathogen	Other Enterobacteriaceae
ENTEROBACTER CLOACAE	Pathogen	Other Enterobacteriaceae
ENTEROBACTER GERGOVIAE	Pathogen	Other Enterobacteriaceae
ENTEROBACTER SAKAZAKII	Pathogen	Other Enterobacteriaceae
ENTEROBACTER SP., NOT SPECIFIED	Pathogen	Other Enterobacteriaceae
ENTEROBACTER SP., OTHER	Pathogen	Other Enterobacteriaceae
PROTEUS MIRABILIS	Pathogen	Other Enterobacteriaceae
PROTEUS SP., OTHER	Pathogen	Other Enterobacteriaceae
PROTEUS VULGARIS	Pathogen	Other Enterobacteriaceae
PROTEUS SP., NOT SPECIFIED	Pathogen	Other Enterobacteriaceae
SALMONELLA ENTERITIDIS	Pathogen	Other Enterobacteriaceae
SALMONELLA SP., OTHER	Pathogen	Other Enterobacteriaceae
SALMONELLA TYPHI OR PARATYPHI	Pathogen	Other Enterobacteriaceae
SALMONELLA TYPHIMURIUM	Pathogen	Other Enterobacteriaceae
SALMONELLA SP., NOT SPECIFIED	Pathogen	Other Enterobacteriaceae
SHIGELLA SPECIES	Pathogen	Other Enterobacteriaceae
ENTEROBACTERIACEAE, OTHER	Pathogen	Other Enterobacteriaceae
ENTEROBACTERIACEAE, NOT SPECIFIED	Pathogen	Other Enterobacteriaceae
ACHROMOBACTER SPECIES	Pathogen	Other Gram-negative bacteria
AEROMONAS SPECIES	Pathogen	Other Gram-negative bacteria
AGROBACTERIUM SPECIES	Pathogen	Other Gram-negative bacteria
ALCALIGENES SPECIES	Pathogen	Other Gram-negative bacteria
BACTEROIDES FRAGILIS	Pathogen	Other Gram-negative bacteria
BACTEROIDES SPECIES, NOT SPECIFIED	Pathogen	Other Gram-negative bacteria
BACTEROIDES SP., OTHER	Pathogen	Other Gram-negative bacteria

BURKHOLDERIA CEPACIA	Pathogen	Other Gram-negative bacteria
BURKHOLDERIA SPECIES	Pathogen	Other Gram-negative bacteria
CAMPYLOBACTER SPECIES	Pathogen	Other Gram-negative bacteria
CHLAMYDIA SPECIES	Pathogen	Other Gram-negative bacteria
FLAVOBACTERIUM SPECIES	Pathogen	Other Gram-negative bacteria
GARDNERELLA SPECIES	Pathogen	Other Gram-negative bacteria
HAEMOPHILUS INFLUENZAE	Pathogen	Other Gram-negative bacteria
HAEMOPHILUS PARAINFLUENZAE	Pathogen	Other Gram-negative bacteria
HAEMOPHILUS SP., NOT SPECIFIED	Pathogen	Other Gram-negative bacteria
HAEMOPHILUS SP., OTHER	Pathogen	Other Gram-negative bacteria
HAFNIA SPECIES	Pathogen	Other Gram-negative bacteria
HELICOBACTER PYLORI	Pathogen	Other Gram-negative bacteria
LEGIONELLA SPECIES	Pathogen	Other Gram-negative bacteria
MORAXELLA CATHARRALIS	Pathogen	Other Gram-negative bacteria
MORAXELLA SP., NOT SPECIFIED	Pathogen	Other Gram-negative bacteria
MORAXELLA SP., OTHER	Pathogen	Other Gram-negative bacteria
MORGANELLA SPECIES	Pathogen	Other Gram-negative bacteria
NEISSERIA MENINGITIDIS	Pathogen	Other Gram-negative bacteria
NEISSERIA SP., NOT SPECIFIED	Pathogen	Other Gram-negative bacteria
NEISSERIA SP., OTHER	Pathogen	Other Gram-negative bacteria
PASTEURELLA SPECIES	Pathogen	Other Gram-negative bacteria
PREVOTELLA SPECIES	Pathogen	Other Gram-negative bacteria
PROVIDENCIA SPECIES	Pathogen	Other Gram-negative bacteria
STENOTROPHOMONAS MALTOPHILIA	Pathogen	Other Gram-negative bacteria
YERSINIA SPECIES	Pathogen	Other Gram-negative bacteria
PSEUDOMONADACEAE FAMILY, OTHER	Pathogen	Other Gram-negative bacteria
PSEUDOMONADACEAE FAMILY, NOT SPECIFIED	Pathogen	Other Gram-negative bacteria
OTHER GRAM- BACILLI, NON ENTEROBACTERIACEAE	Pathogen	Other Gram-negative bacteria
GRAM NEGATIVE COCCI, NOT SPECIFIED	Pathogen	Other Gram-negative bacteria
GRAM NEGATIVE COCCI, OTHER	Pathogen	Other Gram-negative bacteria
CANDIDA ALBICANS	Pathogen	Candida albicans
CANDIDOZYMA AURIS	Pathogen	Candidozyma auris
NAKASEOMYCES GLABRATA	Pathogen	Nakaseomyces spp., other
CANDIDA PARAPSILOSIS	Pathogen	Candida spp., other
CANDIDA TROPICALIS	Pathogen	Candida spp., other
CANDIDA SP., OTHER	Pathogen	Candida spp., other
CANDIDA SP., NOT SPECIFIED	Pathogen	Candida spp., other

ACTINOMYCES SPECIES	Pathogen	Other Gram-positive bacteria
AEROCOCCUS SPECIES	Skin commensal	Other Gram-positive bacteria
BACILLUS ANTHRACIS	Pathogen	Other Gram-positive bacteria
BACILLUS SPECIES, OTHER	Skin commensal	Other Gram-positive bacteria
CLOSTRIDIOIDES DIFFICILE	Pathogen	Other Gram-positive bacteria
CLOSTRIDIOIDES OTHER	Pathogen	Other Gram-positive bacteria
CORYNEBACTERIUM SPECIES	Skin commensal	Other Gram-positive bacteria
CUTIBACTERIUM SPECIES	Skin commensal	Other Gram-positive bacteria
LACTOBACILLUS SPECIES	Pathogen	Other Gram-positive bacteria
LISTERIA MONOCYTOGENES	Pathogen	Other Gram-positive bacteria
MICROCOCCUS SPECIES	Skin commensal	Other Gram-positive bacteria
MYCOBACTERIUM TUBERCULOSIS COMPLEX	Pathogen	Other Gram-positive bacteria
MYCOBACTERIUM, ATYPICAL	Pathogen	Other Gram-positive bacteria
NOCARDIA SPECIES	Pathogen	Other Gram-positive bacteria
PROPIONIBACTERIUM SPECIES	Skin commensal	Other Gram-positive bacteria
COAGULASE-POSITIVE STAPHYLOCOCCI, OTHER	Pathogen	Other Gram-positive bacteria
GRAM POSITIVE BACILLI, NOT SPECIFIED	Pathogen	Other Gram-positive bacteria
GRAM POSITIVE BACILLI, OTHER	Pathogen	Other Gram-positive bacteria
GRAM POSITIVE COCCI, NOT SPECIFIED	Pathogen	Other Gram-positive bacteria
GRAM POSITIVE COCCI, OTHER	Pathogen	Other Gram-positive bacteria
MYCOPLASMA SPECIES	Pathogen	Other bacteria
ANAEROBES, NOT SPECIFIED	Pathogen	Other bacteria
OTHER ANAEROBES	Pathogen	Other bacteria
OTHER BACTERIA	Pathogen	Other bacteria
OTHER BACTERIA, NOT SPECIFIED	Pathogen	Other bacteria
YEASTS, OTHER	Pathogen	Other fungi
ASPERGILLUS FUMIGATUS	Pathogen	Other fungi
ASPERGILLUS NIGER	Pathogen	Other fungi
ASPERGILLUS SP., OTHER	Pathogen	Other fungi
ASPERGILLUS SP., NOT SPECIFIED	Pathogen	Other fungi
FILAMENTS OTHER	Pathogen	Other fungi
FUNGI OTHER	Pathogen	Other fungi
FUNGI, NOT SPECIFIED	Pathogen	Other fungi
OTHER PARASITES	Pathogen	Parasites

Appendix C: attribution to healthcare geographies

On a daily basis, the ICU DCS automatically attributes each PBC to a Local Authority, ICB sub-location (SICBL) and higher-level organisations (UKHSA Centres, UKHSA Regions, Area Teams). This is based on patient's GP or residential details obtained via PDS linkage (see section 'PDS geographical data') above. This information then becomes available in the Line Listing reports.

Please note: Local Authority and SICBL mapping in cases prior to October 2018 should be treated with caution, as the original ICU DCS did not perform these automatic processes: this process was run retrospectively for older cases when they were migrated to the current ICU DCS.

Local authority attribution

The Local Authority for each case is attributed, in the following order:

- If the patient's residential postcode is available (and is based in England), the case will be attributed to the Local Authority in which the patient is a resident.
- If the patient's postcode is unavailable but the patient's GP practice code is returned by the tracing process, the case is attributed to the Local Authority catchment area in which the GP practice is based.
- For cases entered by the NHS: If both the patient's GP practice code and patient post code are unavailable or if a patient has been identified as residing outside England, then the case is attributed to a Local Authority based upon the postcode of the Trust HQ of the ICU that reported the case.

SICBL attribution

The SICBL for each PBC case is attributed using the following rules, in order:

- If the patient's GP practice code is available (and is based in England), the case will be attributed to the SICBL at which the patient's GP is listed.
- If the patient's GP practice code is unavailable but the patient is known to reside in England, the case is attributed to the SICBL catchment area in which the patient resides.
- If both the patient's GP practice code and patient post code are unavailable or if a patient has been identified as residing outside England, then the case is attributed to the lead SICBL for the Trust of the reporting ICU.

Appendix D: document history

Version	Authors	Comments
Up to 3.4 (published August 2018)	Sarah Gerver, Rachel Murphy, Julia Abernethy, Charlotte Robin, Miroslava Mihalkova, Dimple Chudasama, Russell Hope	N/A
4.3 (published June 2026)	Andrea Mazzella, Matthew Wilson, Rebecca Oettle, Christy Lee, Zahin Amin-Chowdhury, Dimple Chudasama, Russell Hope, Jasmin Islam	• Restructured outline and appendices • Clarified inclusion and exclusion criteria for reporting of PBCs • Updated terminology to change from reference to CVCs to central lines (CL) • Updated ICU DCS questions on Central Line Data and added question on ICU Discharge Date • Provided additional guidance on how to answer ICU DCS questions, including a flowchart to help select organism • Clarified that 'CVC' refers to all central *vascular* catheters, not only central *venous* catheters. • Added information on quality assurance of data and results. • Replaced section 'Plans for analysis' with details on data processing and analysis. • Added information on quarterly and annual reports, including the quarterly reporting cycle • Incorporated information on attribution to healthcare geographies • Moved information on how to operate the ICU DCS into the user guides; replaced here with cross-references. • Updated organisational branding (PHE with UKHSA)

About the UK Health Security Agency

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

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