Public Health England

Protecting and improving the nation's health

Surveillance of Blood Stream Infections in Patients Attending ICUs in England

Protocol version 3.4

Infection in Critical Care Quality Improvement Programme

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.

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Contents

About Public Health England 2
1. List of abbreviations and terms used 6
2. List of definitions 7
3. Introduction 9
   3.1 Background 9
   3.2 Infection in Critical Care Quality Improvement Programme (ICCQIP) 9
4. Aims and Objectives 10
5. Data Collection 11
   5.1 Overview 11
   5.2 Inclusion criteria for reporting to the surveillance system 11
   5.3 Case definitions 20
   5.4 Method of reporting data on the ICU data capture system 20
   5.5 BSI monthly filing/sign-off 20
   5.6 Core BSI dataset to be collected 21
   5.7 BSI Event Form 23
   5.8 Patient/Specimen 23
   5.9 Clinical symptoms 30
   5.10 Repeat positive blood culture 37
   5.11 Treatment 39
   5.12 CVC Data 40
   5.13 Source of infection 43
6. Denominator data 47
   6.1 Denominator data flows 47
   6.2 'ICU Daily Census' tool (formerly 'Month by Days') 48
   6.3 'Monthly Denominator Summary' 51
7. Dashboard 54
   7.1 Introduction 54
   7.2 Summary Dashboard 54
   7.3 Benchmarking Dashboard 54
8. Viewing, updating and deleting BSI event data 56
   8.1 Viewing a case(s) 56
   8.2 Updating a case 57

8.3 Deleting a case 57
8.4 Running a line list report 58
9. Viewing and updating denominator data 60
9.1 Viewing and updating 'Monthly Denominator Summary' 61
9.2 Viewing and updating monthly denominator summary using Daily Census 63
9.3 Running a denominator line listing report 65
10. Sign-off 67
10.1 Signing-off tool 67
10.2 Sign-off episode screen 67
11. Plans for data analysis 71
11.1 Summary of data outputs 71
11.2 Data quality 71
11.3 Reported data 71
11.4 Data outputs 71
12. Confidentiality and data sharing 73
13. Access to the ICU DCS 74
13.1 User Administration 75
13.2 Data linkage and data sharing 76
14. Reference list 77
15. Appendix 1: Case Definitions 78
15.1 Bloodstream infection (BSI) 78
16. Appendix 2: Organism code list 83
17. Appendix 3: Mandatory fields required for period submission/sign-off 87
18. Appendix 4: Denominator forms to aid with data collection 89

1. List of abbreviations and terms used

BC – blood culture

BSI – bloodstream infection

CVC – central venous catheter

CA-BSI – catheter associated bloodstream infection

CR-BSI – catheter related bloodstream infection

CVC-BSI – central venous catheter bloodstream infection

CDC – Centers for Disease Control and Prevention

ECDC – European Centre for Disease Prevention and Control

HCAI – healthcare associated infection

HES – Hospital Episode Statistics

HRA – Health Research Authority

HSCIC – Health and Social Care Information Centre

ICCQIP – Infection in Critical Care Quality Improvement Programme

ICNARC – Intensive Care National Audit and Research Centre

ICU – Intensive care unit

ICU DCS – Intensive care unit data capture system

NDAU – Neonatal Data Analysis Unit

NDS – Neonatal Data Set

NIGB - National Information Governance Board for Health and Social Care

PHE – Public Health England

PICANET – Paediatric Intensive Care Audit Network

PII – Patient Identifiable Information

SGSS – Second Generation Surveillance System

2. List of definitions

Blood Stream Infection Event Form - the data collection form used to report a case on the data capture system. Includes patient details, details of positive blood culture, signs and symptoms at the time of the first blood culture, treatment details, CVC details and source of infection

Central venous catheter (CVC) - a vascular catheter that ends close to or in the great vessels (femoral, subclavian, jugular, aorta etc.); this includes peripherally inserted central catheters. CVCs can be short or long term. Common names (not exclusive) are PICC, CVC, portocath, tesio, hickman, etc.

Central venous catheter bloodstream infection (CVC-BSI) - a bloodstream infection thought to be related to/associated with a central venous catheter

Hospital Episode Statistics (HES) - a data warehouse containing details of all admissions, outpatient appointments and A&E attendances at NHS hospitals in England. To determine prior healthcare interactions in other facilities for patient transfers and subsequent outcomes; to determine co-morbidities and procedures associated with the ICU admission.

Health and Social Care Information Centre (HSCIC) - the national provider of information, data, and IT systems for health and social care

Infection in Critical Care Quality Improvement Programme (ICCQIP) - a clinician-led collaboration of professional organisations in intensive care, healthcare epidemiology, microbiology and infection prevention and control hosted by Public Health England. The overarching aim of ICCQIP is to improve the quality of patient care in ICUs. Specifically the aims of the ICU BSI surveillance are to obtain a national picture of BSI incidence in ICUs in England to inform quality improvement programmes.

Intensive care unit data capture system (ICU DCS) - the online web system where cases and denominator information are entered locally by ICUs

Line list - patient-level data downloaded from the ICU DCS using the report generator

Neonatal Data Analysis Unit (NDAU) - an independent academic unit, part of Imperial College London; the NDAU developed and manages the National Neonatal Research Database as a national resource; the NDAU is the official Developer of the Neonatal Data Set

Neonatal Data Set (NDS) - a defined list of data items extracted from electronic patient records on all admissions to Neonatal Units in England, Scotland and Wales, and held in the National Neonatal Research Database; the NDS is an NHS Digital approved NHS Information Standard

NHS Spine - central NHS repository of patient demographic information to obtain mortality outcome and to map patients to healthcare geographies based on GP and residential details

Second Generation Surveillance System (SGSS) - PHE receives antimicrobial susceptibility data from bacteria tested in NHS laboratories (majority of labs submitting by 2016). This system will be used to validate the hospital level reports and additionally to obtain susceptibility data on bacteria

3. Introduction

3.1 Background

Patients in intensive care represent a particularly vulnerable patient population at risk of developing healthcare association infections (HCAIs) due to a variety of factors such as disease severity, comorbidities, the need to undergo invasive procedures vital for care, and greater antibiotic exposure. The prevalence of healthcare associated infections is higher in intensive care units (ICUs) compared to other ward specialties as highlighted in the 2011 point prevalence survey in England where HCAI prevalence in ICUs was found to be 23.4% compared to 6.4% overall (1). The same study found antimicrobial use to be almost twice as high in ICUs compared to overall prevalence of antimicrobial use (60.8% versus 34.7% respectively) (1).

The impact of HCAIs on morbidity, mortality, length of stay and cost is well documented (2); as such many interventions have been developed to reduce HCAI incidence (3), although historically in England most interventions have been focussed on reductions in the incidence of specific organisms (predominantly Meticillin Resistant *Staphylococcus aureus* bacteraemia (MRSA) and *Clostridium difficile* infection) rather than more generally on the ICU setting or device related infections. However, recently in England a large initiative aimed to reduce central line catheter related blood stream infection (BSI) in adult and paediatric ICUs was run by the National Patient Safety Agency (NPSA) (4). The 2-year programme which started in April 2009 was called “Matching Michigan” in reference to an earlier American study which demonstrated a large reduction in catheter related BSI using a range of technical and behavioural interventions (5).The Matching Michigan study observed a 60% reduction in CVC-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 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 (4;6) and following this conclusion the Infection in Critical Care Quality Improvement Programme (ICCQIP) was developed to act on the recommendations (7).

3.2 Infection in Critical Care Quality Improvement Programme (ICCQIP)

ICCQIP, a group of professionals from across the NHS, charities, and Public Health England, was established in 2012 to develop a national surveillance and quality improvement programme for HCAIs in the intensive care setting. An initial survey of ICUs in England was conducted to garner opinion on priorities and potential data collections (7). The results showed considerable support for surveillance of infections in ICUs with CVC associated bloodstream infections highlighted as the main priority.

4. Aims and Objectives

The overarching aim of ICCQIP is to improve the quality of patient care in ICUs. Specifically the aims of the ICU BSI surveillance are to obtain a national picture of BSI incidence in ICUs in England to inform quality improvement programmes. This will be achieved by collecting the following data from participating English ICUs:

- Each BSI identified in the ICU, including patient identifiers, information about the patient's signs and symptoms, information on repeat blood cultures for skin commensals, treatment, CVC history, and site of infection
- Denominator information allowing rates of BSI and CVC-related BSI to be calculated

Additionally, data linkage to several existing datasets will enable more detailed analysis and case-mix adjustment. It is planned that the following datasets will be linked to the data provided to the ICU DCS to obtain additional clinical information on ICU BSI cases reported to us:

- Intensive Care National Audit and Research Centre (ICNARC)
- Paediatric Intensive Care Audit Network (PICANET)
- Neonatal Data Set (NDS)
- Neonatal Infection Surveillance Network (NeonIN)
- Healthcare datasets:
    - Second Generation Surveillance System (SGSS) - PHE receives antimicrobial susceptibility data from bacteria tested in NHS laboratories (majority of labs submitting by 2016). This system will be used to validate the hospital level reports and additionally to obtain susceptibility data on bacteria
    - Hospital Episode Statistics (HES) - to determine prior healthcare interactions in other facilities for patient transfers and subsequent outcomes; to determine co-morbidities and procedures associated with the ICU admission
    - NHS Spine – central NHS repository of patient demographic information, to obtain mortality outcome and to map patients to healthcare geographies based on GP and residential details

5. Data Collection

5.1 Overview

Participating units are required to submit a Blood Stream Infection (BSI) Event Form for each positive blood culture from blood sample(s) taken during a patients stay within the ICU unit.

In addition to this, participating units are also required to submit denominator information from their unit for each month (see Chapter 6).

The following sections describe the BSI data collection method in more detail.

5.1.1 Blood Stream Infection (BSI) Event Form

Participating units are required to complete a Blood Stream Infection (BSI) Event Form for each positive blood culture from blood samples taken during a patient's stay within the ICU. This includes blood samples taken from patients on admission to the ICU and blood culture results received after patients have been discharged from the ICU but where the blood sample was taken during their ICU stay.

Users are not required to determine whether the positive blood culture conforms to a particular case definition; this is to minimise bias in the reporting of BSIs. Instead, the surveillance system will capture data that will allow positive blood cultures to be categorised according to specific case definitions (Appendix 1). This flexibility in reporting also enables comparison of this dataset with data from other surveillance programmes, such as those from the Centers of Disease Control and Prevention (CDC) and European Centre for Disease Prevention and Control (ECDC). The case definitions used in these surveillance programmes can be replicated using the data items requested.

5.2 Inclusion criteria for reporting to the surveillance system

The infection episode length is 7 days (where day one is the first specimen date) for each organism cultured. BSI Event Forms (case capture) must be completed separately for each infection episode.

NOTE: only polymicrobial infections can be entered as a single event on the same BSI Event Form, where a polymicrobial infection is defined as multiple organism cultures from the same blood culture set. Multiple blood culture sets resulting in multiple organism cultures should be entered on separate BSI Event Forms and will be provided with their own ICU data capture system ID number.

Further reporting criteria differ depending on whether the organism identified is a recognised pathogen (see 5.2.1) or a skin commensal (see 5.2.2).

5.2.1 Blood culture positive for a recognised pathogen

Definition for total number of blood culture sets:

Count of each set, consisting of one aerobic and one anaerobic bottle (1 blood culture set). Multiple sets taken at the same time or repeats should all be counted as individual sets.

Definition for total number of positive blood culture sets:

Count of all blood culture sets positive for bacterial growth, including repeat specimens and contaminants. Regardless of one or both bottles in the blood culture set being positive, it is still only counted once as a positive blood culture set.

All organisms are listed in Appendix 2, those not marked as a skin commensal are considered a recognised pathogen.

Infection episodes to report for recognised pathogens to be reported include:

- Blood cultures that are positive for a recognised pathogen and have been taken during a patients stay in ICU

Exclusions:

- Repeat positive blood cultures taken within 7 days where the same organism(s) has/have been identified
- Common skin commensals (see 5.2.2)

NOTE: Subsequent positive blood cultures of a different species for the same patient should be reported as a new episode unless they are cultured within the same bottle/set – in which case they should be reported as a polymicrobial organism culture.

Examples for recognised pathogens

1. **Patient A** has a blood culture set taken on 1st April 2016 and *E. coli* is cultured from it. A second blood culture set was taken for the same patient on 5th April 2016 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 and so the result from 5th April 2016 does not need to be entered onto the ICU data capture system.

ACTION: Single episode of *E. coli* entered onto the ICU data capture system.

2. **Patient B** has a blood culture set taken on 4th April 2016 and *E. coli* is cultured from it. A second blood culture set was taken for the same patient on 11th April 2016 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 and so both the results from 4th April and 11th April 2016 should be entered separately onto the ICU data capture system.
   ACTION: Two episodes of *E. coli* entered onto the ICU data capture system.

3. **Patient C** has a blood culture set taken on 13th April 2016 and *Acinetobacter baumannii* is cultured from it. A second blood culture set was taken for the same patient on 14th April 2016 and *Staphylococcus 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 and both; therefore, need to be entered separately onto the ICU data capture system.
   ACTION: Two episodes entered onto the ICU data capture system: an episode of *A. baumannii* and an episode of *S. aureus*.

4. **Patient D** has a blood culture set taken on 15th April 2016 and both *Staphylococcus aureus* and *Candida 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**. This means that both organisms should be entered onto the same BSI Event Form (as Organism 1 and Organism 2) and will be listed under the same ICU data capture system ID number.
   ACTION: A single polymicrobial episode entered onto the ICU data capture system.

5. **Patient E** has a blood culture set taken on 18th April 2016 and *Stenotrophomonas maltophilia* was cultured from it. A second blood culture set was taken on 21st April 2016 and both *Stenotrophomonas maltophilia* and *E. coli* were cultured from it. While the two blood culture sets were taken within 7 days of each other and *Stenotrophomonas maltophilia* was cultured from both sets, they are not identical (i.e. one was a pure growth and the other a mixed growth). Therefore, both need to be entered in full onto the ICU DCS.
   ACTION: Two episodes entered onto the ICU data capture system: an episode of *S. maltophilia* and an episode of *S. maltophilia* and *E. coli.*

6. **Patient F** has a blood culture set taken on 18th April 2016 and *Stenotrophomonas maltophilia* and *E. coli* were cultured from it. A second blood culture set was taken on 21st April 2016 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). Therefore, both need to be entered in full onto the ICU DCS.
ACTION: Two episodes entered onto the ICU data capture system: an episode of *S. maltophilia* and *E. coli* and an episode of *E. coli*.

7. **Patient G** has a blood culture set taken on 20th April 2016 and *Staphylococcus aureus* and *Candida albicans* are both cultured. A second blood culture set was taken on 24th April 2016 and both *Staphylococcus aureus* and *Candida 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.
   ACTION: One polymicrobial episode needs to be entered onto the ICU data capture system: of *S. aureus* and *C. albicans*.

8. **Patient H** has a blood culture set taken on 25th April 2016 and *Staphylococcus aureus* and *Candida albicans* are both cultured. A second blood culture set was taken on 29th April 2016 and both *Staphylococcus aureus* and *Candida albicans* are cultured again. A third culture on 30th April 2016 was taken and only *C.* albicans was cultured. 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 BUT as the third culture only included *C. albicans* this will also need to be recorded.
   ACTION: Two episodes should be recoded: one polymicrobial episode of *S. aureus* and *C. albicans* and one episode of *C. albicans* as a pure growth.

5.2.2 Blood culture positive for a common skin commensal

All organisms are listed in Appendix 2. Skin commensals are labelled as such in the “Is a Skin Commensal” column. All other organisms included in Appendix 2 are a recognised pathogen, see 5.2.1 and Figure 5.1 for more details.

Recognised skin commensals include diphtheroids (*Corynebacterium* spp.), *Bacillus* (not *B. anthracis*) spp., *Propionibacterium* spp., coagulase negative *staphylococci* (including *S. epidermidis*), viridans group *streptococci*, *Aerococcus* spp. and *Micrococcus* spp.

Infection episodes to report for skin commensals to be reported include:

- Blood cultures that are positive for a common skin commensal and have been taken during a patients stay in ICU
  - For adults and paediatric cases, a repeat blood culture should be taken within 2 days of the first specimen. If there is a repeat positive blood culture

for the same skin commensal, this should be included on the "Repeat Positive Blood Culture" tab which is part of the BSI Event Form for skin commensals.

Exclusions:

- Repeat positive blood cultures taken within 2 days of the first skin commensal positive blood culture

NOTE: Subsequent positive blood cultures of a different species should be reported as a new episode unless they are cultured within the same bottle/set – in which case they should be reported as a polymicrobial organism culture

Examples for skin commensals

1. **Patient A** has a blood culture set taken on 1st April 2016 and *Staphylococcus haemolyticus* is cultured from it. A second blood culture set was taken for the same patient on 2nd April 2016 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 2016 does not need to be entered onto the ICU data capture system on its own BSI Event Form. **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 2016 blood culture, on the "Repeat Positive Blood Culture" tab
   ACTION: Single episode of *S. haemolyticus* entered onto the ICU data capture system, with additional data on the repeat positive blood culture entered on the existing episode entry.

2. **Patient B** has a blood culture set taken on 1st April 2016 and *Staphylococcus haemolyticus* is cultured from it. A second blood culture set was taken for the same patient on 5th April 2016 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 2016 does not need to be entered onto the ICU data capture system on its own BSI Event Form. **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.
   ACTION: Single episode of *S. haemolyticus* entered onto the ICU data capture system.

3. **Patient C** has a blood culture set taken on 13th April 2016 and *Staphylococcus epidermidis* is cultured from it. A second blood culture set was taken for the same patient on 14th April 2016 and *Staphylococcus 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 and both; therefore, need to be entered separately onto the ICU data capture system.
ACTION: Two episodes entered onto the ICU data capture system: an episode of *S. epidermidis* and an episode of *S. aureus*.

4. **Patient D** has a blood culture set taken on 15th April 2016 and both *Staphylococcus epidermidis* and *Candida 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**. This means that both organisms should be entered onto the same BSI Event Form (as Organism 1 and Organism 2) and will be listed under the same ICU data capture system ID number.
ACTION: A single polymicrobial episode entered onto the ICU data capture system.

5. **Patient E** has a blood culture set taken on 18th April 2016 and *Staphylococcus epidermidis* was cultured from it. A second blood culture set was taken on 19th April 2016 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 onto the "Repeat Positive Blood Culture" tab on the pre-existing case (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.
ACTION: Two episodes entered onto the ICU data capture system: one pure growth of *S. epidermidis* (with additional data entered onto the "Repeat Positive Blood Culture" tab on this episode's BSI Event Form for the *S. epidermidis* from 19th April) AND a polymicrobial episode of *S. epidermidis* and *E. coli*

6. **Patient F** has a blood culture set taken on 19th April 2016 and *Staphylococcus epidermidis* and *Staphylococcus aureus* were cultured from it. A second blood culture set was taken on 20th April 2016 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.
ACTION: One polymicrobial episode of *S. epidermidis* and *S. aureus* should be entered onto the ICU data capture system AND details of the second blood culture should be added to the "Repeat Positive Blood Culture" tab of this one case.

7. **Patient G** has a blood culture set taken on 19th April 2016 and *Staphylococcus epidermidis* and *Staphylococcus aureus* were cultured from it. A second blood culture set was taken on 20th April 2016 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.

ACTION: Two episodes should be recoded onto the ICU data capture system: one polymicrobial episode of *S. epidermidis* and *S. aureus* and one episode of *S. aureus* as a pure growth .

8. **Patient H** has a blood culture set taken on 19th April 2016 and *Staphylococcus epidermidis* and *Staphylococcus aureus* were cultured from it. A second blood culture set was taken on 20th April 2016 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.
   ACTION: One polymicrobial episode should be recoded onto the ICU data capture system: *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.

9. **Patient I** has a blood culture set taken on 19th April 2016 and *Staphylococcus epidermidis* and *Staphylococcus aureus* were cultured from it. A second blood culture set was taken on 25th April 2016 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.
   ACTION: One polymicrobial episode should be recoded of *S. epidermidis* and *S. aureus*.

10. **Patient J** has a blood culture set taken on 19th April 2016 and *Staphylococcus epidermidis* and *Staphylococcus haemolyticus* were cultured from it. A second blood culture set was taken on 20th April 2016 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 of the 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.
    ACTION: One polymicrobial episode should be recoded 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.

Figure 5.1: Data submission flow – blood culture positive for a recognised pathogen excluding common skin commensals

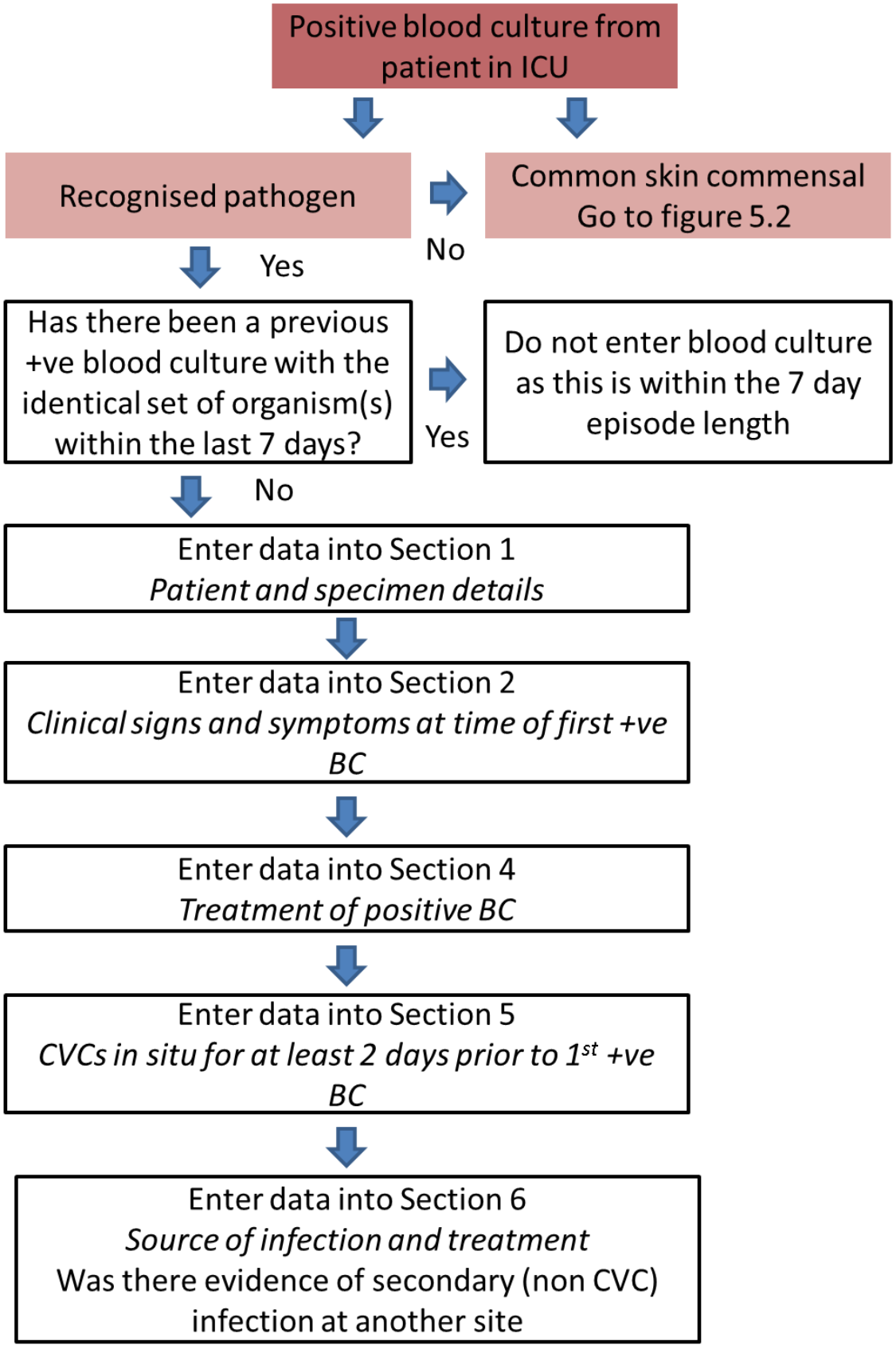
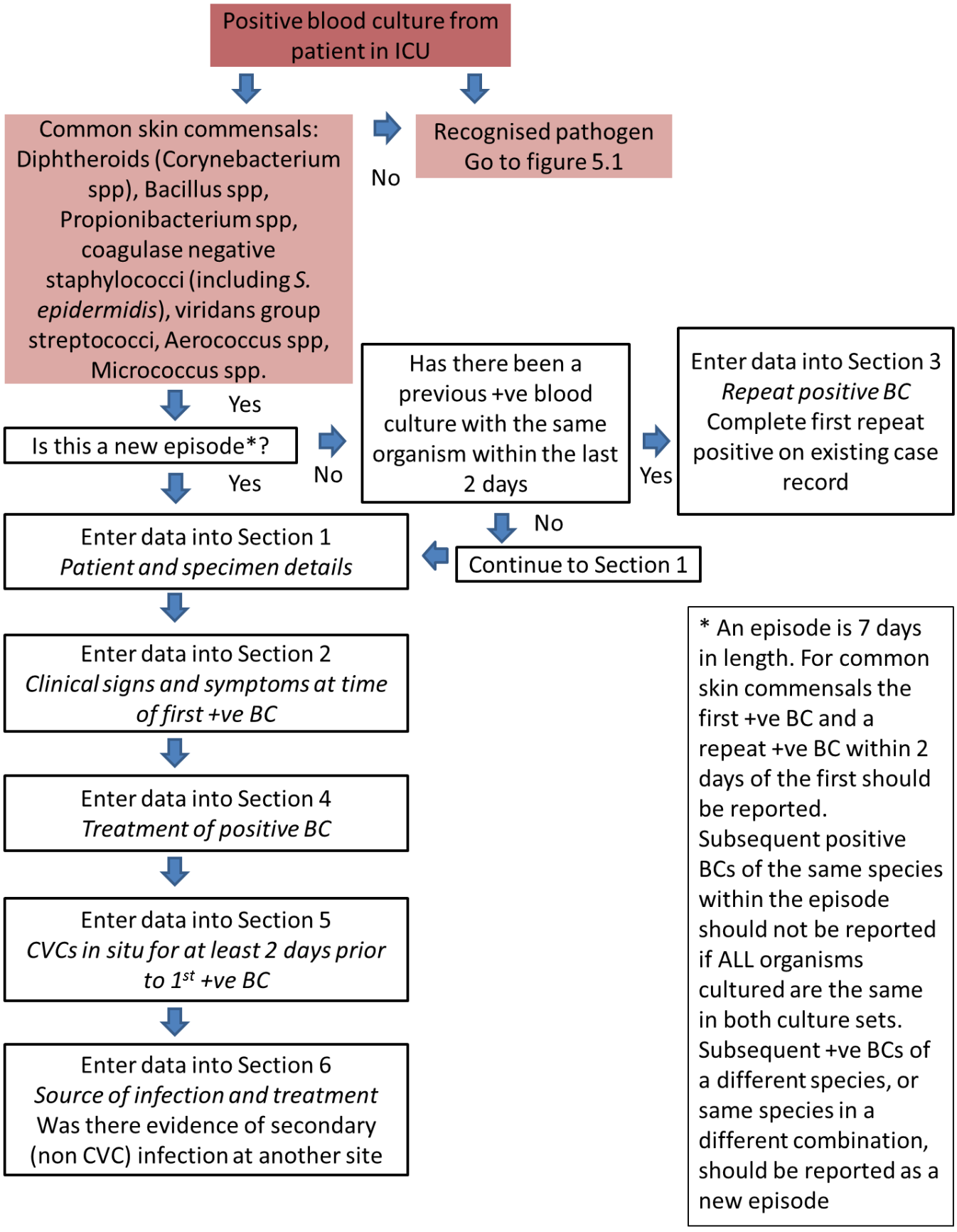


Figure 5.2: Data submission flow – blood culture positive for common skin commensals



5.3 Case definitions

As outlined in Section 5.1, in order to minimise potential bias ICUs submitting data will not be asked to determine whether a positive blood culture conforms to a specific sub-type of bloodstream infection. Instead data will be captured that will allow the reported BSI to be categorised according to standard case definitions and corresponding rates of infection to be reported. The case definitions can be found in Appendix 1.

5.4 Method of reporting data on the ICU data capture system

The ICU data capture system (DCS) is a web portal designed by PHE to facilitate the collection of the BSIs in ICU data set and relevant denominator data.

The ICU DCS can be accessed at the following URL: https://icudcs.phe.org.uk/

For complete guidance on the ICU DCS please refer to the User Guidelines which are available using the link above under the section 'Help'. A password to the ICU DCS is not required to view the self-help documentation.

5.5 BSI monthly filing/sign-off

All BSI events for each ICU must be filed at the end of each month. The monthly filing process helps ensure all BSI data sections are present and correct for each event (see section 5.6.1 and Appendix 3), gives a summary of BSIs which have been entered for the respective month and submits them to the ICU DCS for data linkage and analysis purposes. The ICU DCS monthly filing should be performed once the month has elapsed – months can only be submitted once all mandatory fields are complete for each BSI entry for the respective month. If there are no BSI events recorded for the month, the monthly filing must still be completed once the month has elapsed. Further details for Monthly Filing/Sign-Off can be found in Chapter 10 and in the '*Sign-Off User Guide*' under the section 'Help' on the ICU DCS.

5.6 Core BSI dataset to be collected

The core data required for each BSI episode to be entered onto the ICU DCS include mandatory fields, fields which need to be completed for the month to be submitted and optional fields. Core fields include NHS number, date of birth, ICU admission date, specimen date and organism(s) cultured, if the patient was treated with antimicrobial therapy and if the patient had a CVC in situ at the time the first blood culture was drawn.

More details about the core dataset fields to be collected are in Appendix 3.

5.6.1 Mandatory fields

Mandatory fields include patient, hospital and specimen information such as NHS number, date of birth, gender, patient first name and surname; hospital number, specimen date, organism(s) cultured and specimen number.

Fields mandatory for saving are marked with a "*". These fields need to be completed before the BSI Event Form can be saved, and a unique ID number generated.

More details about the core dataset fields to be collected are in Appendix 3.

5.6.2 Fields required for period submission/sign-off

Positive blood cultures should be entered onto the system as soon as possible. While some patient information and details of the positive blood culture must be completed prior to saving the record, some details, such as source of infection may take time to establish and can be entered later.

Therefore, fields required for period submission/monthly filing include those which are required for ICCQIP to define the infection episode and provide a minimum dataset, but may not be to hand when the BSI is first entered onto the system.

5.6.3 Optional fields

Optional fields are not mandatory, but provide useful information about the patient and the specimen. These fields include ICU admission time, patient postcode and specimen time.

More detailed information about all of the core dataset fields to be collected are in Appendix 3. For complete guidance on using the ICU DCS please refer to the user guides under the 'Help' section on the ICU DCS.

5.7 BSI Event Form

The following pages outline in detail the data items collected in this surveillance programme. It indicates whether the data collected are required for ICCQIP to calculate the various case definitions, so that data from this surveillance programme can be comparable with international surveillance programmes and definitions, and provides further rationale for the collection of each item.

There are 6 sections on the BSI Event Form

I. Episode Details
II. Positive Blood Culture
III. Clinical Symptoms
IV. Details of repeat positive blood culture (only applicable and enabled if a skin commensal was reported in Section II of the BSI Event Form, see Flow diagram 5.2 and Appendix 2)
V. Antimicrobial treatment for suspected blood stream infection
VI. Presence of a CVC
VII. Source of infection

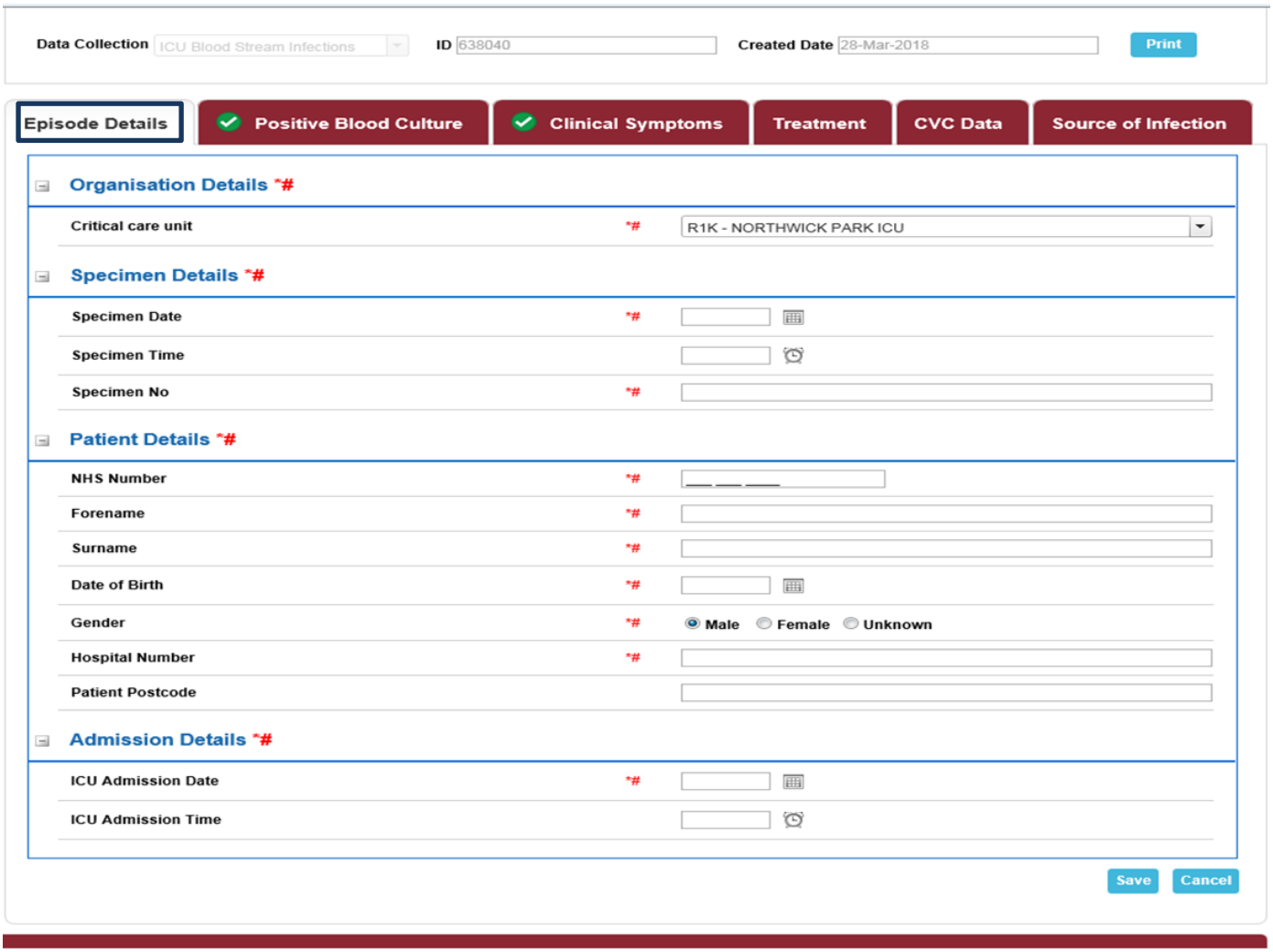
NOTE: one Event Form per episode should be entered. The episode length is defined as a 7 day period for each organism cultured and for combinations of organisms. For further information, please see section 5.2.

5.8 Patient/Specimen

The information completed in this section captures vital patient demographics and specimen details (Figure 5.4) to allow the patient to be uniquely identified for de-duplication purposes, linkage to existing datasets and epidemiological analyses. In addition, some of the fields may be useful locally to identify patients.

All data entered must be saved.

Figure 5.3: Episode Details Section



Details of each field are included in Table 5.1.

This section must be completed prior to the record being saved as it is used to generate the case and a unique ID number on the system.

Table 5.1: Fields in Section 1: 'Patient/Specimen' details

Field	Completion	Used for case definitions?	Field Type	Rationale	Comment
Patient details					
NHS No. (NHS number)	Mandatory	×	Numeric	Allows: unique identification of patients to identify multiple episodes; linkage to other datasets to obtain further patient information and case mix adjustment	**If this is unknown at the time of data collection, please enter all 9s (i.e. 9999999999).** Please update with the correct NHS number as soon as this information is known. Only valid NHS numbers can be used for the purposes of de-duplication and data linkage.
DoB (Date of birth)	Mandatory	✓	Calendar date picker	In combination with other dates such as specimen date and ICU admission date, the patient's age at the time of specimen collection or at the time of admission to an ICU can be calculated for analysis. Allows: linkage to other datasets to obtain further patient information and case mix adjustment	Can either use the calendar date picker or you can enter a valid date in the format DD/MM/YYYY. The date cannot be greater than today's date and it cannot be after the specimen date or ICU admission date **If DoB is unknown, please enter:** **01/01/1900.**
First name	Mandatory	×	Free text	Allows: linkage to other datasets to obtain further patient information and case mix adjustment. May be useful locally to identify patients	**If this is unknown at the time of data entry please enter "Unknown".** Please update with the correct first name as soon as this information is known.

Field	Completion	Used for case definitions?	Field Type	Rationale	Comment
Surname	Mandatory	×	Free text	Allows: linkage to other datasets to obtain further patient information and case mix adjustment. May be useful locally to identify patients	**If this is unknown at the time of data entry please enter "Unknown".** Please update with the correct first name as soon as this information is known
Gender	Mandatory	×	Tab selection options	Used for epidemiological reports and analysis. May be useful locally to identify patients	Please select "Male" or "Female".
Hospital No. (Hospital number)	Mandatory	×	Free text (may contain either/both letters and numbers)	Allows: unique identification of patients to identify multiple episodes; linkage to other datasets to obtain further patient information and case mix adjustment. May be useful locally to identify patients	**If this is unknown at the time of data collection please enter "Unknown".** Please update with the correct Hospital number as soon as this information is known.
ICU Admission Date	Mandatory	✓	Calendar date picker	Used with 'Specimen Date' to calculate period from admission to positive specimen collection	Can either use the calendar date pick or you can enter a valid date in the format DD/MM/YYYY. The date must be greater than or equal to date of birth and less than or equal to specimen date. This should be the initial admission to this ICU, where the end of an ICU admission is when a patient has died, admitted to a different ward in the hospital (not including discharges for tests or operations when the patient will

Field	Completion	Used for case definitions?	Field Type	Rationale	Comment
					then be admitted straight back to the same ICU) or been discharged to the home team or transferred to a different ICU.
ICU Admission Time	Optional	✓	Clock time picker	This will be used in combination with 'Specimen Date' to calculate period from admission to positive specimen collection more accurately. Where 'ICU Admission Time' is not available 'ICU Admission Date' will be used on its own	Can either use the clock pick or you can enter a valid time in the format HH:MMMM using the 12 hour clock (AM and PM).
Patient Postcode	Optional	✗	Free text	Used to map patients to geographical areas, such as NHS Region for the purposes of analysis	For neonates please enter the mother's usual residential postcode
Specimen details					
Specimen Date	Mandatory	✓	Calendar date picker	In combination with 'Date of Birth' and 'ICU Admission Date' this is used to calculate age at specimen collection and to calculate the period between ICU admission and positive specimen collection	Enter a valid date in the format DD/MM/YYYY. It must be greater than or equal to the 'DoB' and greater than or equal to the 'ICU Admission Date'
Specimen Time	Optional	✓	Clock time picker	This will be used in combination with 'Specimen Date' to calculate period between ICU admission and positive specimen collection	Can either use the clock pick or you can enter a valid time in the format HH:MMMM using the 12 hour clock (AM and PM).

Field	Completion	Used for case definitions?	Field Type	Rationale	Comment
				more accurately. Where ‘Specimen Time’ is not available ‘Specimen Date’ will be used on its own	If the time taken is not known the time received in the laboratory may be entered
Specimen No. (Specimen number)	Mandatory	✗	Free text (may contain either/both letters or numbers)	Allows: unique identification of patient specimens for use in the lab and to link back to patient	Enter a valid specimen number.

Field	Completion	Used for case definitions?	Field Type	Rationale	Comment
Organism 1	Mandatory	✓	Drop down menu	Used in epidemiological analysis to identify predominant organisms responsible for BSIs in ICUs	An organism must be selected from the drop down list. **NOTE:** To activate the drop down menu start typing the organism name in the field, ALL organisms containing the characters entered will be shown in a drop down list. Then click on the relevant organism.
Organism 2, 3, 4	Optional	✗	Drop down menu	Also used in epidemiological analysis to identify predominant organisms responsible for BSIs in ICUs and to identify polymicrobial infections	Only to be completed in the event of a polymicrobial infection within the same blood culture set taken; if not detected within the same blood culture set it should be reported as a different episode on a different case capture form and will be provided a different ICU DCS ID number. Up to three additional organisms can be entered, one per field. **NOTE:** To activate the drop down menu start typing the organism name in the field, ALL organisms containing the characters entered will be shown in a drop down list. Then click on the relevant organism.

5.9 Clinical symptoms

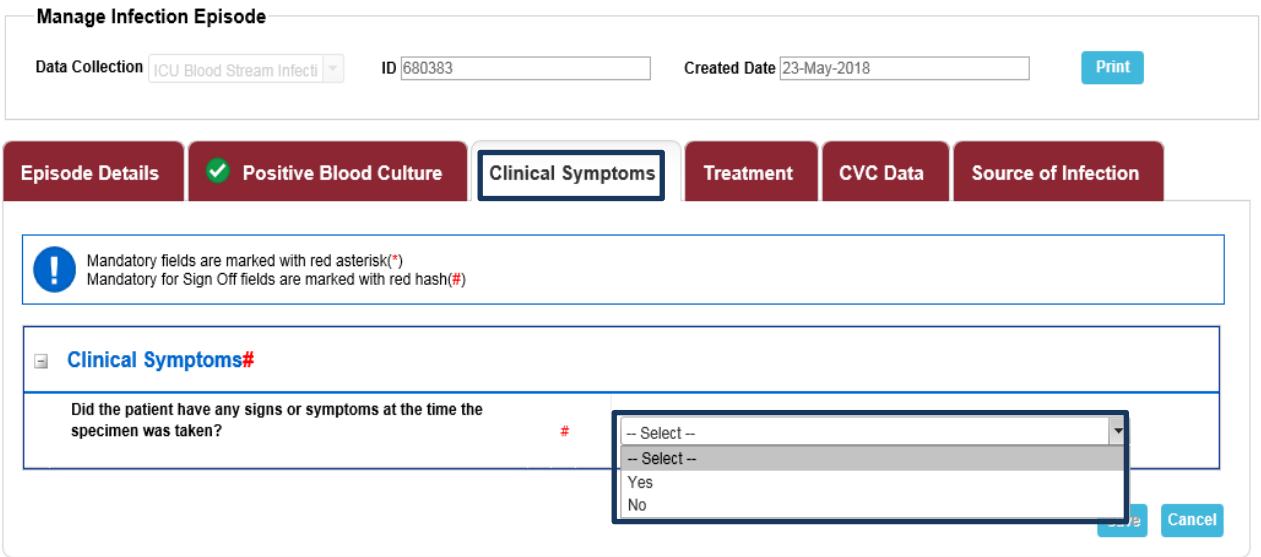
The clinical signs and symptoms should be entered at the time of the first positive blood culture for an episode only.

The information entered allows the data to be categorised according to different definitions of BSI. Sub-sections for adults (patients aged ≥13 years), Figure 5.6; paediatrics (patients aged > 28 days and < 13 years), Figure 5.7; and neonates (patients aged ≤28 days or patient of any age in a neonatal ICU), Figure 5.8 are available. Please select the appropriate section depending on the patient's age (or in some cases, the unit where they are being managed e.g. neonates > 28 days but managed on a neonatal unit; adults ≥13 years but managed on a paediatric unit).

As many signs and symptoms as necessary can be selected. If the patient had no symptoms then please select "Patient has no signs/symptoms".

At least one sign or symptom or "Patient has no signs/ symptoms" must be selected for the Event Form to be ready for submission (Figure 5.5).

Figure 5.4: Clinical Symptoms Section



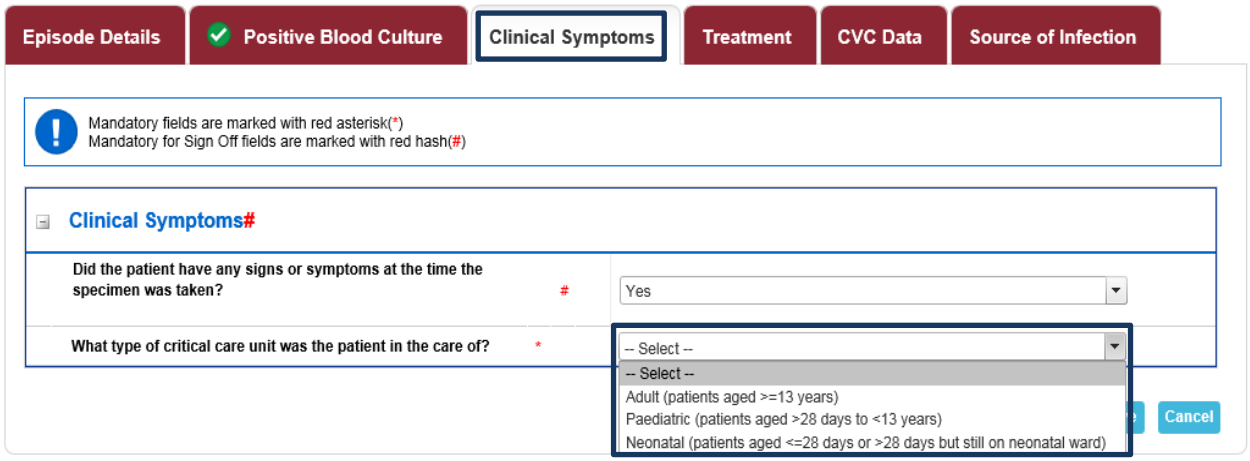

Episode Details
Positive Blood Culture
Clinical Symptoms
Treatment
CVC Data
Source of Infection
Mandatory fields are marked with red asterisk(*)
Mandatory for Sign Off fields are marked with red hash(#)
Clinical Symptoms#
Did the patient have any signs or symptoms at the time the specimen was taken?
#
Yes
What type of critical care unit was the patient in the care of?
*
-- Select --
-- Select --
Adult (patients aged >=13 years)
Paediatric (patients aged >28 days to <13 years)
Neonatal (patients aged <=28 days or >28 days but still on neonatal ward)
Cancel

Figure 5.5: Clinical Symptoms Adults

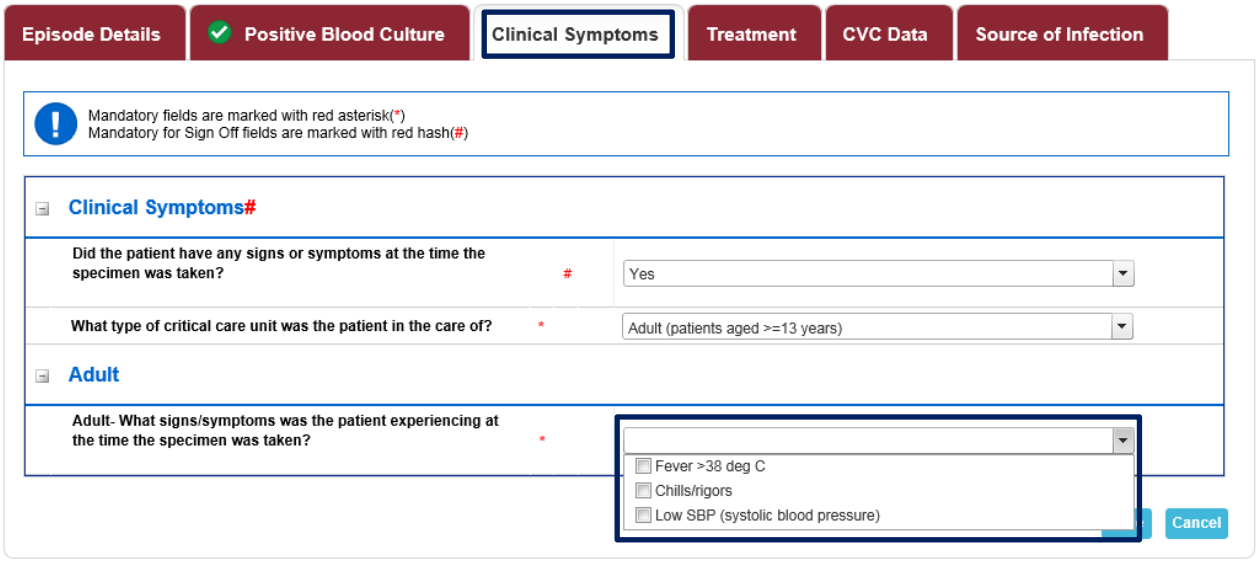


Figure 5.6: Clinical Symptoms Paediatrics

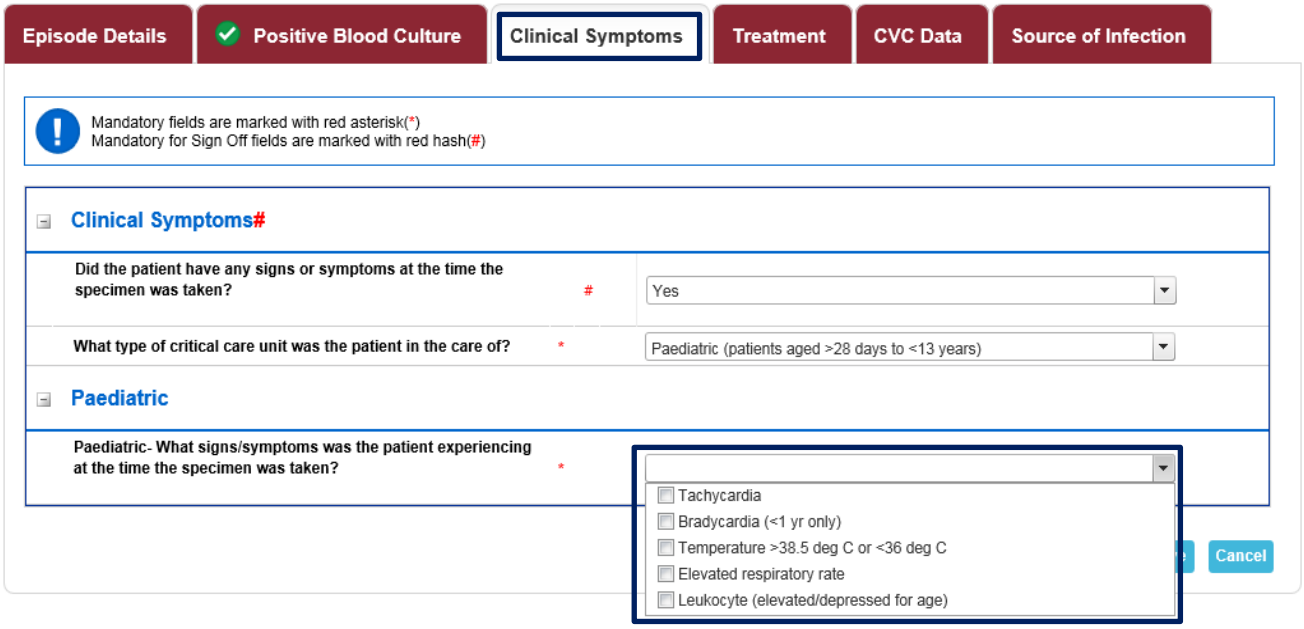
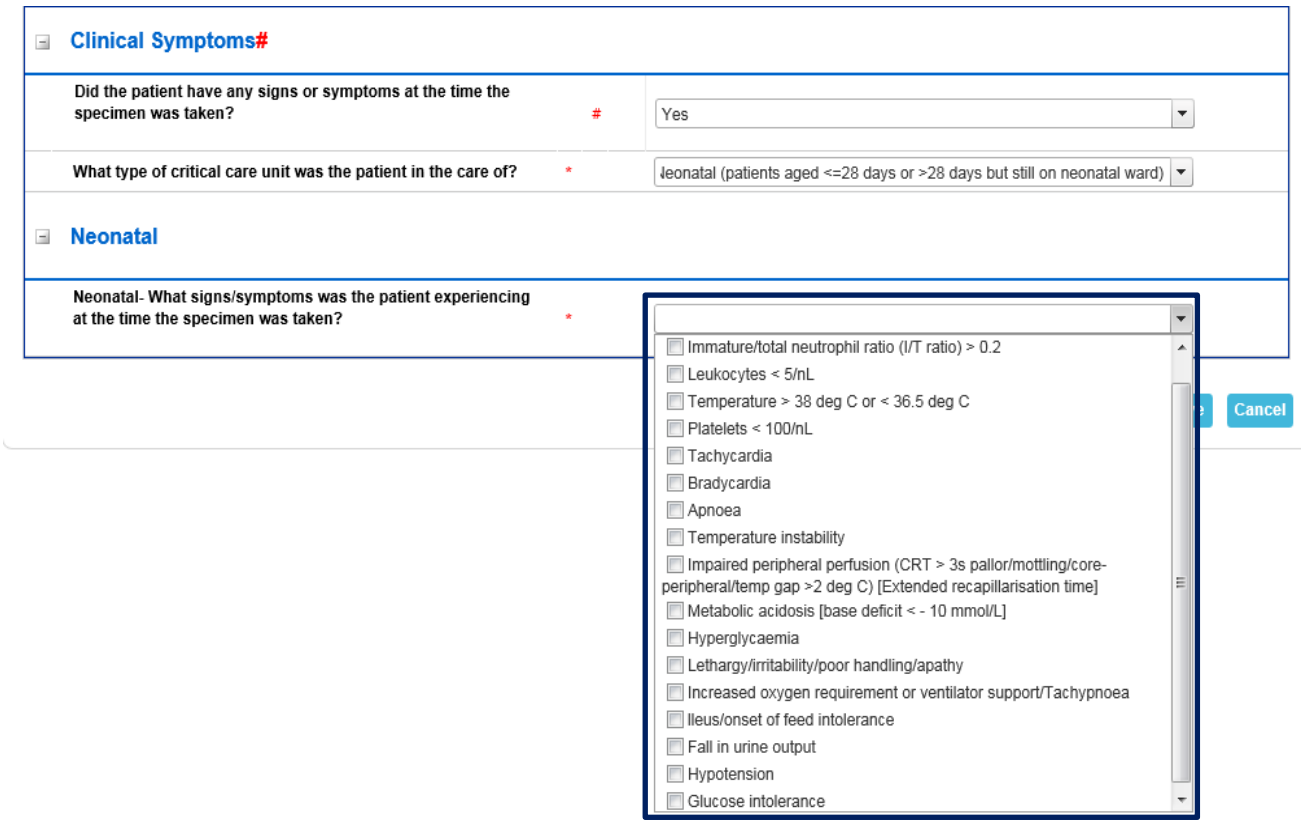


Figure 5.7: Clinical Symptoms Neonatal



Details of each field are included in Table 5.2.

Various fields from this section must be completed prior to the record being flagged as ready for monthly filing. As per section 5.6.2 and Appendix 3, only when all BSIs in a month are flagged as ready for monthly filing, will you be able to submit the data for the period.

All data entered must be saved.

Table 5.2: Fields in Section 2: 'Clinical Symptoms' details

Field	Completion	Used for case definitions?	Field Type	Rationale	Comment
Clinical signs and symptoms (Adults)					
Fever > 38°C	Optional	✓	Tick box	Identifies if the patient had any signs or symptoms at the time of specimen collection	Select if appropriate at the time of specimen collection
Chills / rigors	Optional	✓	Tick box	Identifies if the patient had any signs or symptoms at the time of specimen collection	Select if appropriate at the time of specimen collection
Low SBP (systolic blood pressure)	Optional	✓	Tick box	Identifies if the patient had any signs or symptoms at the time of specimen collection	Select if appropriate at the time of specimen collection
Clinical signs and symptoms (Paediatrics)					
Tachycardia	Optional	✓	Tick box	Identifies if the patient had any signs or symptoms at the time of specimen collection	Select if appropriate at the time of specimen collection
Bradycardia (<1 year)	Optional	✓	Tick box	Identifies if the patient had any signs or symptoms at the time of specimen collection	Select if appropriate at the time of specimen collection **This field is only relevant if the patient is <1 year of age.**
Temperature >38°C or <36°C	Optional	✓	Tick box	Identifies if the patient had any signs or symptoms at the time of specimen collection	Select if appropriate at the time of specimen collection
Elevated respiratory rate	Optional	✓	Tick box	Identifies if the patient had any signs or symptoms at the time of specimen collection	Select if appropriate at the time of specimen collection
Leukocyte (elevated/depressed for age)	Optional	✓	Tick box	Identifies if the patient had any signs or symptoms at the time of specimen collection	Select if appropriate at the time of specimen collection. Enter a value (n/l) if selected

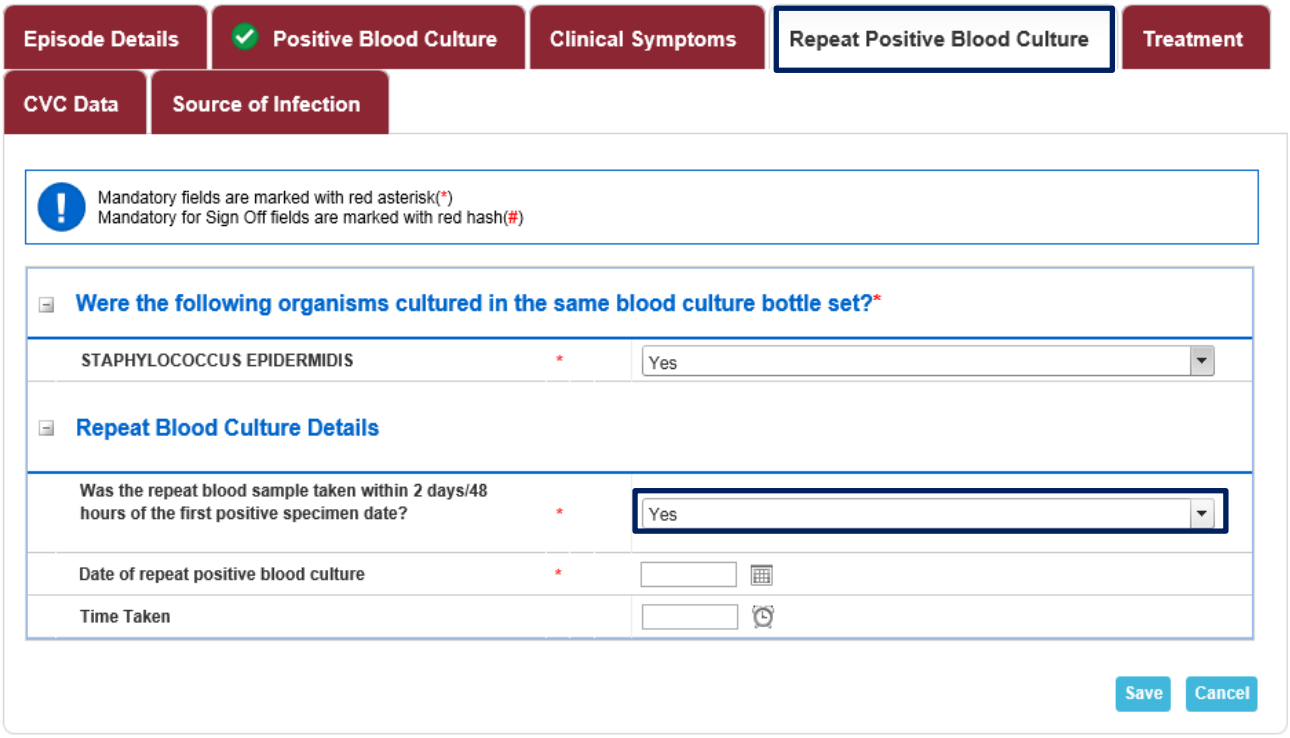
Field	Completion	Used for case definitions?	Field Type	Rationale	Comment
Clinical signs and symptoms (Neonates)					
C-reactive protein >2.0 mg/dL	Optional	✓	Tick box	Identifies if the patient had any signs or symptoms at the time of specimen collection	Select if appropriate at the time of specimen collection
Immature/total neutrophil ratio (I/T ratio) >0.2	Optional	✓	Tick box	Identifies if the patient had any signs or symptoms at the time of specimen collection	Select if appropriate at the time of specimen collection
Leukocytes <5/nL	Optional	✓	Tick box	Identifies if the patient had any signs or symptoms at the time of specimen collection	Select if appropriate at the time of specimen collection
Temperature >38°C or <36.5°C	Optional	✓	Tick box	Identifies if the patient had any signs or symptoms at the time of specimen collection	Select if appropriate at the time of specimen collection
Platelets <100/nL	Optional	✓	Tick box	Identifies if the patient had any signs or symptoms at the time of specimen collection	Select if appropriate at the time of specimen collection
Tachycardia	Optional	✓	Tick box	Identifies if the patient had any signs or symptoms at the time of specimen collection	Select if appropriate at the time of specimen collection
Bradycardia	Optional	✓	Tick box	Identifies if the patient had any signs or symptoms at the time of specimen collection	Select if appropriate at the time of specimen collection
Apnoea	Optional	✓	Tick box	Identifies if the patient had any signs or symptoms at the time of specimen collection	Select if appropriate at the time of specimen collection
Temperature instability	Optional	✓	Tick box	Identifies if the patient had any signs or symptoms at the time of specimen collection	Select if appropriate at the time of specimen collection

Field	Completion	Used for case definitions?	Field Type	Rationale	Comment
Impaired peripheral perfusion (CRT >3s pallor /mottling /core-peripheral /temp gap >2^{o}C) [Extended recapillarisation time]	Optional	✓	Tick box	Identifies if the patient had any signs or symptoms at the time of specimen collection	Select if appropriate at the time of specimen collection
Metabolic acidosis [base deficit ≤ minus 10mmol/L]	Optional	✓	Tick box	Identifies if the patient had any signs or symptoms at the time of specimen collection	Select if appropriate at the time of specimen collection
Hyperglycaemia	Optional	✓	Tick box	Identifies if the patient had any signs or symptoms at the time of specimen collection	Select if appropriate at the time of specimen collection
Lethargy /irritability /poor handling /apathy	Optional	✓	Tick box	Identifies if the patient had any signs or symptoms at the time of specimen collection	Select if appropriate at the time of specimen collection
Increased oxygen requirement or ventilator support/Tachypnoea	Optional	✓	Tick box	Identifies if the patient had any signs or symptoms at the time of specimen collection	Select if appropriate at the time of specimen collection
Ileus/onset of feed intolerance	Optional	✓	Tick box	Identifies if the patient had any signs or symptoms at the time of specimen collection	Select if appropriate at the time of specimen collection
Fall in urine output	Optional	✓	Tick box	Identifies if the patient had any signs or symptoms at the time of specimen collection	Select if appropriate at the time of specimen collection
Hypotension	Optional	✓	Tick box	Identifies if the patient had any signs or symptoms at the time of specimen collection	Select if appropriate at the time of specimen collection
Glucose intolerance	Optional	✓	Tick box	Identifies if the patient had any signs or symptoms at the time of specimen collection	Select if appropriate at the time of specimen collection

5.10 Repeat positive blood culture

Only enter details of a repeat positive blood culture, if the same skin commensal is identified by blood culture and the specimen date of the repeat blood culture is ≤ 2 days from the first specimen (Figure 5.8, section 5.2). This information allows calculation of rates of BSIs due to skin commensal organisms.

Figure 5.8: Repeat Positive Blood Culture



Details of each field are included in Table 5.3.

To update this tab retrospectively the patient must be located using the 'Search' function (see "*Case Capture BSI Event User Guide*" under the section 'Help' on the ICU DCS). If no repeat positive blood culture has been taken for a skin commensal, "No" should be selected. If a repeat blood culture was taken, but nothing was cultured "Taken, nothing cultured" should be selected – this option will activate the "Date taken" and "Time taken" fields (Table 5.3).

NOTE: This section will only be triggered if the first organism entered into the Patient/specimen section is a skin commensal.

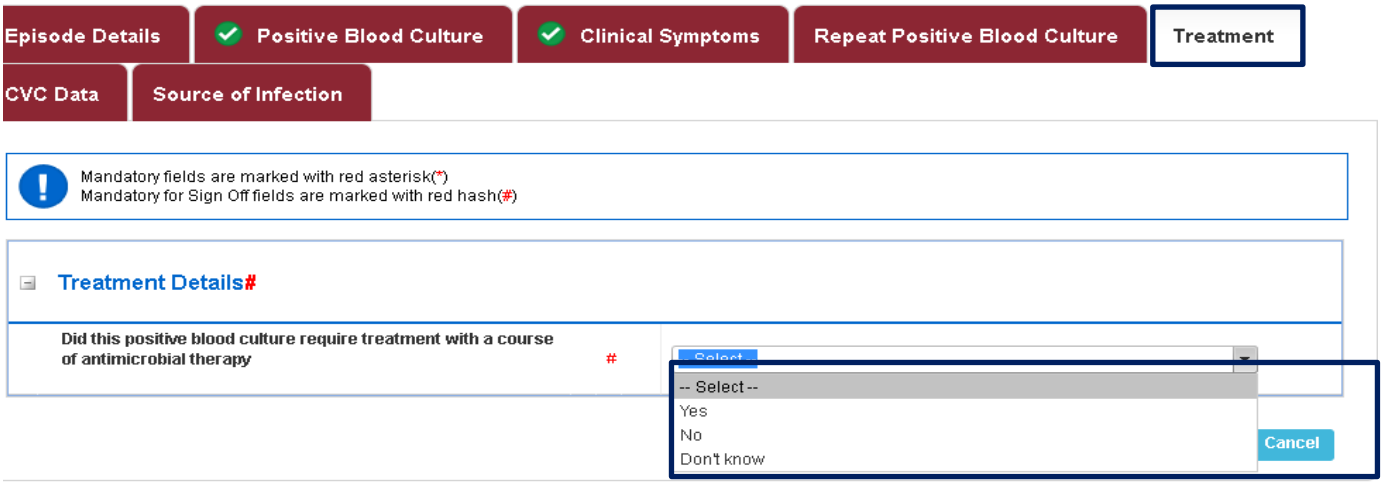
Table 5.3: Fields in Section 3: 'Repeat positive blood culture' details

Field	Completion	Used for case definitions	Field Type	Rationale	Comment
Organism	Mandatory if triggered	✓	Drop down list	Used in analysis to identify predominant organisms responsible for BSIs in ICUs	Select "Yes or No" in order to confirm the Organism name, as stated on the left-hand side.
Date taken	Mandatory if triggered	✓	Calendar date picker	Used to check if the repeat blood culture is **within 2 days** of the first blood culture, as part of the case definitions	Can either use the calendar date picker or you can enter a valid date in the format DD/MM/YYYY. The date cannot be greater than today's date and it must be after the first specimen date and 'ICU Admission Date' but must be within 2 days of the first specimen date If 'Date taken' is unknown, please enter: 01/01/1900.
Time taken	Optional	×	Tick box	This will be used in combination with 'Date taken' to calculate period between ICU admission and positive specimen collection more accurately. Where 'Time taken' is not available 'Date taken' will be used on its own.	Enter a valid time in the format HH:MM using the 12 hour clock (AM or PM).

5.11 Treatment

Information on treatment given at any time to treat the blood stream infection should be entered into this section. It is not limited to treatment provided at the time of the specimen collection or when culture results were received (Figure 5.9).

Figure 5.9: Treatment



Details of each field are included in Table 5.4.

This section must be completed prior to the record being flagged as ready for monthly filing. As per section 5.6.2 and Appendix 3, only when all BSI in a month are flagged as ready for monthly filing, will you be able to submit the data for the period.

All data entered must be saved.

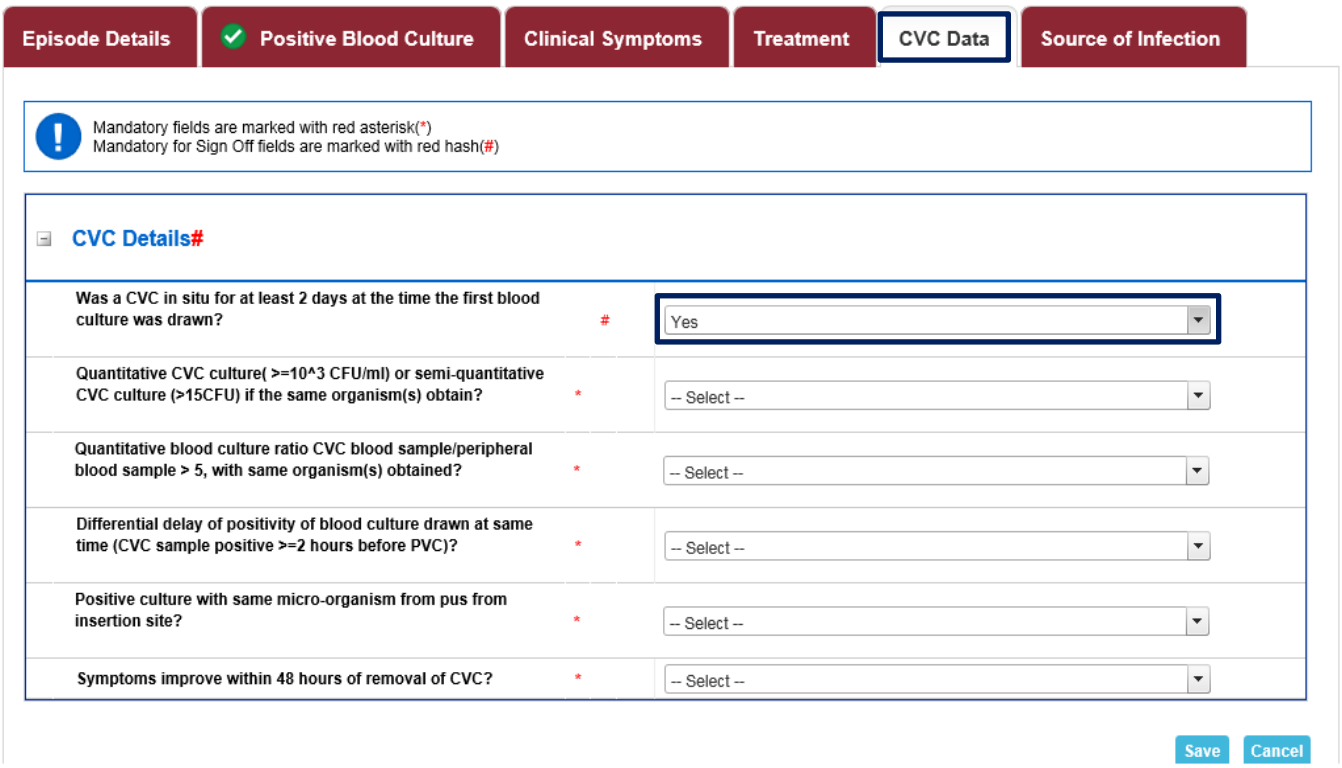
Table 5.4: Fields in Section 4: 'Treatment' details

Field	Completion	Used for case definitions	Field Type	Rationale	Comment
Did this positive blood culture require treatment with a course of antimicrobial therapy?	Mandatory	✓	Tab selection options	Determines whether the positive blood culture was deemed to be clinically significant	"Yes" or "No" or" Don't Know" must be selected

5.12 CVC Data

CVC data should be entered at the time of the first positive blood culture only for each episode (Figure 5.10). A CVC is defined as a vascular catheter that ends close to, or in, the great vessels (femoral, subclavian, jugular, aorta etc). CVCs can be short- or long-term. Common names (not exclusive) are PICC, CVC, portocath, tesio, hickman etc.

Figure 5.10: CVC data



Details of each field are included in Table 5.5.

This section must be completed prior to the record being flagged as ready for monthly filing. As per section 5.6.2 and Appendix 3, only when all BSI in a month are flagged as ready for monthly filing, will you be able to submit the data for the period.

All data entered must be saved.

Table 5.5: Fields in Section 5: 'CVC Data' details

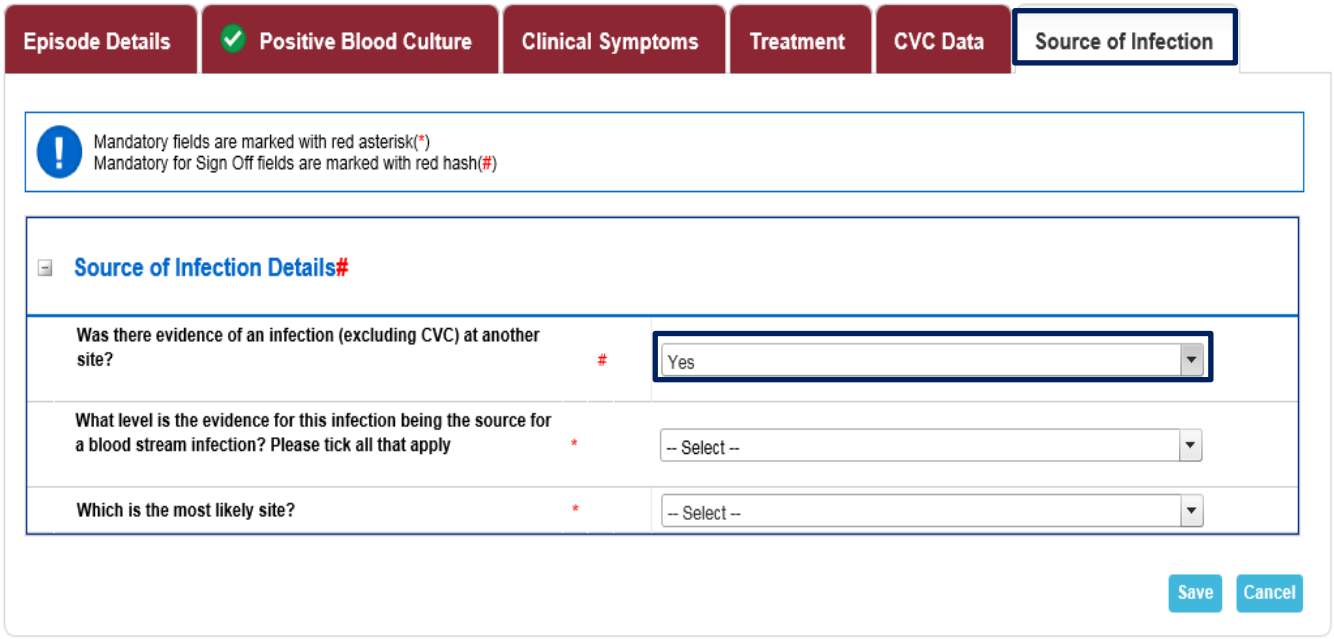
Field	Completion	Used for case definitions	Field Type	Rationale	Comment
Was a CVC in situ for at least 2 days at the time the first blood culture was drawn?	Mandatory	✓	Tab selection options	Determines the presence of a CVC at time the positive BC was taken	"Yes" or "No" must be selected
If no, was a CVC removed the day before the first blood culture was drawn?	Mandatory if triggered (Only mandatory if CVC not in situ for at least 2 days at the time the first blood culture was drawn)	✓	Tab selection options	Determines if a CVC was in place immediately prior to the BC	If the answer to the previous question is "No" then this question must be completed as "Yes" or "No".
If the answer to either of the above is "Yes", answer all of the following questions:					
Quantitative CVC culture ≥10^3 CFU/ml or semi-quantitative CVC culture >15 CFU?	Mandatory if triggered (Only mandatory if CVC in situ for at least 2 days or removed the day before the first blood culture was drawn)	✓	Tab selection options	Provides laboratory confirmation of CR-BSI	"Yes" or "No" must be selected. If the analysis is not available at your unit please select "N/A"
Quantitative blood culture ratio CVC blood sample/peripheral blood sample >5?	Mandatory if triggered (Only mandatory if CVC in situ for at least 2 days or removed the day before the first blood culture was drawn)	✓	Tab selection options	Provides laboratory confirmation of CR-BSI	"Yes" or "No" must be selected. If the analysis is not available at your unit please select "N/A"

Field	Completion	Used for case definitions	Field Type	Rationale	Comment
Differential delay of positivity of blood culture drawn at same time (CVC sample positive ≥ 2 hours before PVC)?	Mandatory if triggered (Only mandatory if CVC in situ for at least 2 days or removed the day before the first blood culture was drawn)	✓	Tab selection options	Provides laboratory confirmation of CR-BSI	"Yes" or "No" must be selected. If the analysis is not available at your unit please select "N/A"
Positive culture with the same micro-organism from pus from insertion site?	Mandatory if triggered (Only mandatory if CVC in situ for at least 2 days or removed the day before the first blood culture was drawn)	✓	Tab selection options	Provides laboratory confirmation of CR-BSI	"Yes" or "No" must be selected. If the analysis is not available at your unit please select "N/A"
Symptoms improve within 48 hours of removal of CVC?	Mandatory if triggered (Only mandatory if CVC in situ for at least 2 days or removed the day before the first blood culture was drawn)	✓	Tab selection options	Provides clinical confirmation of CR-BSI	"Yes" or "No" must be selected. If the analysis is not available at your unit please select "N/A"

5.13 Source of infection

Source of infection information should be entered for the time of the first positive blood culture only for each episode (Figure 5.11). The information required to complete this field may take time to establish and can be entered retrospectively (see chapter 8: sections 8.1 and section 8.2 to view and update these fields retrospectively).

Figure 5.11: Source of Infection



Answer “Yes” to Question 1 triggers related questions.

Details of each field are included in Table 5.6.

Various fields from this section must be completed prior to the record being flagged as ready for monthly filing. As per section 5.6.2 and Appendix 3, only when all BSIs in a month are flagged as ready for monthly filing, will you be able to submit the data for the period.

All data entered must be saved.

Table 5.6: Fields in Section 6: 'Source of infection' details

Field	Completion	Used for case definitions	Field Type	Rationale	Comment
Was there evidence of a secondary infection (excluding CVC) at another site?	Mandatory	✓	Tab selection options	Determines whether the BSI was related to an infection at another site.	"Yes", "No" or "No data available" must be entered. Only consider organisms identified ≤ 7 days of the first positive blood culture. **Note:** This is to determine if the BSI is secondary to any pre-existing infection.
If yes, what level is the evidence for the infection? Please tick all that apply (At least one of the following three options must be selected):					
Microbiologically confirmed (same organism, at different site)	Optional, if triggered* (*one of the three options needs to be selected)	✓	Tick box	Determines whether the infection was microbiologically confirmed	Select if appropriate for the time of specimen collection. Only consider organisms identified ≤ 7 days of the first positive blood culture
Clinical syndrome	Optional, if triggered* (*one of the three options needs to be selected)	×	Tick box	Determines whether the infection was syndrome related	Select if appropriate for the time of specimen collection Only consider organisms identified ≤ 7 days of the first positive blood culture
Radiological or other diagnostic procedure	Optional, if triggered* (*one of the three options needs to be selected)	×	Tick box	Determines whether the infection was confirmed diagnostically	Select if appropriate for the time of specimen collection. Only consider organisms identified ≤ 7 days of the first positive blood culture

Field	Completion	Used for case definitions	Field Type	Rationale	Comment
Which is the most likely site? (One of the following sites must be selected)					
Pulmonary	Optional, if triggered* (*one of the nine sites needs to be selected)	×	Tab selection option	Allows description of underlying foci of infection for non-CVC-BSI	One option only must be selected
Skin / soft tissue	Optional, if triggered* (*one of the nine sites needs to be selected)	×	Tab selection options	Allows description of underlying foci of infection for non-CVC-BSI	One option only must be selected
Genito-urinary	Optional, if triggered* (*one of the nine sites needs to be selected)	×	Tab selection option	Allows description of underlying foci of infection for non-CVC-BSI	One option only must be selected
Bone / joint	Optional, if triggered* (*one of the nine sites needs to be selected)	×	Tab selection options	Allows description of underlying foci of infection for non-CVC-BSI	One option only must be selected
Digestive (incl. liver)	Optional, if triggered* (*one of the nine sites needs to be selected)	×	Tab selection option	Allows description of underlying foci of infection for non-CVC-BSI	One option only must be selected

Field	Completion	Used for case definitions	Field Type	Rationale	Comment
Central Nervous System	Optional, if triggered* (*one of the nine sites needs to be selected)	×	Tab selection options	Allows description of underlying foci of infection for non-CVC-BSI	One option only must be selected
Surgical Site Infection	Optional, if triggered* (*one of the nine sites needs to be selected)	×	Tab selection options	Allows description of underlying foci of infection for non-CVC-BSI	One option only must be selected
Cardio-vascular System	Optional, if triggered* (*one of the nine sites needs to be selected)	×	Tab selection option	Allows description of underlying foci of infection for non-CVC-BSI	One option only must be selected
Other	Optional, if triggered* (*one of the nine sites needs to be selected)	×	Tab selection options	Allows description of underlying foci of infection for non-CVC-BSI	If this option is selected the site must be specified in the free text field
Other, please specify	Mandatory if triggered	×	Free text	Allows description of underlying foci of infection for non-CVC-BSI	If “Other” option is selected, a free text field allowing you to specify what the other source of infection is will be triggered. This is mandatory if triggered.

6. Denominator data

Denominator information for each unit is collected to allow rates of BSI and CVC-related BSI to be calculated.

6.1 Denominator data flows

Denominator data can be submitted to the ICU DCS in one of three ways. However, the only mandatory information required by the surveillance programme are the following monthly totals:

- Total number of patients in the unit (defined as the total number of occupied bed days for each unit per month)
- Total number of patients in the unit for >2 nights[1] (defined as the total number of occupied bed days for each unit per month, restricted to patients in the unit >2 nights)
- Of the patients in the unit for >2 nights[1], the number with ≥1 CVC (defined as the total number of CVC days for the unit for the month, restricted to include patients in the unit for >2[1] nights with at least 1 CVC in place (NB. if a patient has multiple CVCs on one day, this only counts as 1 CVC day))
- Total number of blood culture sets taken

Users can choose to submit this information to the ICU DCS in three different ways:

- **'Month By Day' (Optional):**
  - Entering daily totals summed over all of the beds on the unit (unit-level, daily basis)
  - To be completed at the same time every day (preferable at midnight)
  - Automatically calculated based on entry via 'Daily Bed Census', but can be manually added
  - Tool available for the system to aggregate the daily unit values to create the 'Monthly Denominator Summary'

- **'Monthly Denominator Summary' (Mandatory):**
  - Entering the aggregate totals summed over all of the beds on the unit for the full month (i.e. monthly at unit level)

[1] Please note that an admission to an ICU is defined as the period from when a patient is first admitted to the ICU and leaves the ICU either due to death, transfer to a different ICU or discharge to the home team or to another part of the hospital (excluding for tests, procedures or operations when the patient will be immediately readmitted to the ICU after the test/procedure/operation concludes). Please count whether a patient has been in the ICU >2 nights from the first date of an admission and not from the date a patient was returned to the ICU after a test/procedure/operation.

- To be completed at the end of every month
- Or can be calculated using the “Populate Monthly Denominator” functionality within the ‘Daily Bed Census’ or ‘Month By Day’ tools on the ICU DCS

Please note, that you are not expected to manually enter denominator data for all three denominator data entry tools. The minimum requirement is the ‘Monthly Denominator Summary’, this can be manually entered or the optional ‘Month By Day’ collection, can be used to populate the ‘Monthly Denominator Summary’ data.

The following pages describe the denominator data items in more detail including the rationale for their collection.

To help with data collection, forms for up to a 30-bed unit and up to a 75-bed unit have been provided for the ‘Daily Bed Census’, and an additional form for the ‘Month By Day’ denominator collection have been provided in Appendix 4.

6.2 ‘ICU Daily Census’ tool (formerly ‘Month by Days’)

The ‘ICU Daily Census’ is an optional denominator tool. Data submitted using this tool will allow for device-specific denominators (i.e. CVC-days) to be used when calculating infection rates.

In addition, the data submitted through the ‘ICU Daily Census’ automatically populates the mandatory ‘Monthly Denominator Summary’, at the end of each month.

NOTE: The system will calculate an average aggregated value when using this tool, if not all of the days in a month-period have had values for the ‘ICU Daily Census’. This means that if not all of the days have entered values, the system can still use the data available to produce ‘Monthly Summary’ values.

The census of all beds should be carried out at the same time every day; ideally at midnight. See Table 6.1 for details of the fields collected.

All data entered must be saved.

Figure 6.1: 'ICU Daily Census' tool; used to populate 'Monthly Denominator Summary'

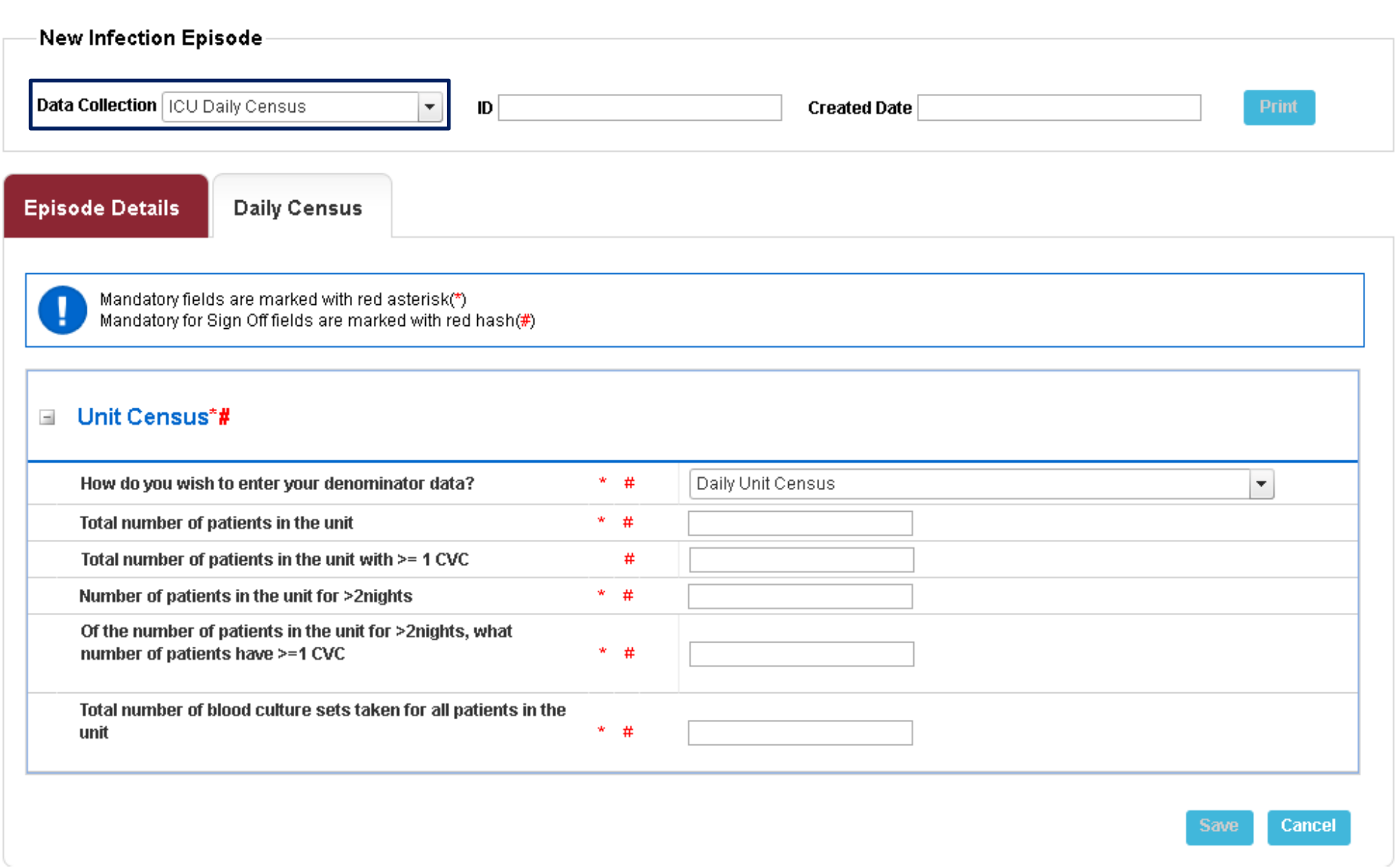


Table 6.1: Fields in the optional 'ICU Daily Census' tool

Field	Completion	Field Type	Rationale	Comment
A. Total number of occupied bed-days for unit	Optional	Numeric	Used to calculate total number of patient days per month	Sum of patient bed days for that day
B. Total number of patients in the unit with >=1 CVC	Optional	Numeric	Used to calculate total number of CVC days in the unit per month	Sum of CVC days for all patients for that day
C. Number of occupied overnight bed-days for unit, restricted to only include occupied overnight bed-days when patient has been in the unit >2 nights	Optional	Numeric	Used to calculate the total number of patient days in the unit for >2 nights per month	Sum of patient bed days over a month, for patients in unit for over 2 nights, for that day
D. Number of CVC-days, restricted to only include CVC-days when patient has been in the unit for >2 nights (1 CVC day is 1 patient-day where patient has ≥1 CVC)	Optional	Numeric	Used to calculate the total number of patient days in the unit for >2 nights with at least one CVC	Sum of CVC days, for patients staying>2 nights in the unit, for that day
E. Total number of blood culture sets taken for all patients?	Optional	Numeric	Used to calculate total number of positive blood cultures	Sum of all blood culture sets taken for that day

6.3 ‘Monthly Denominator Summary’

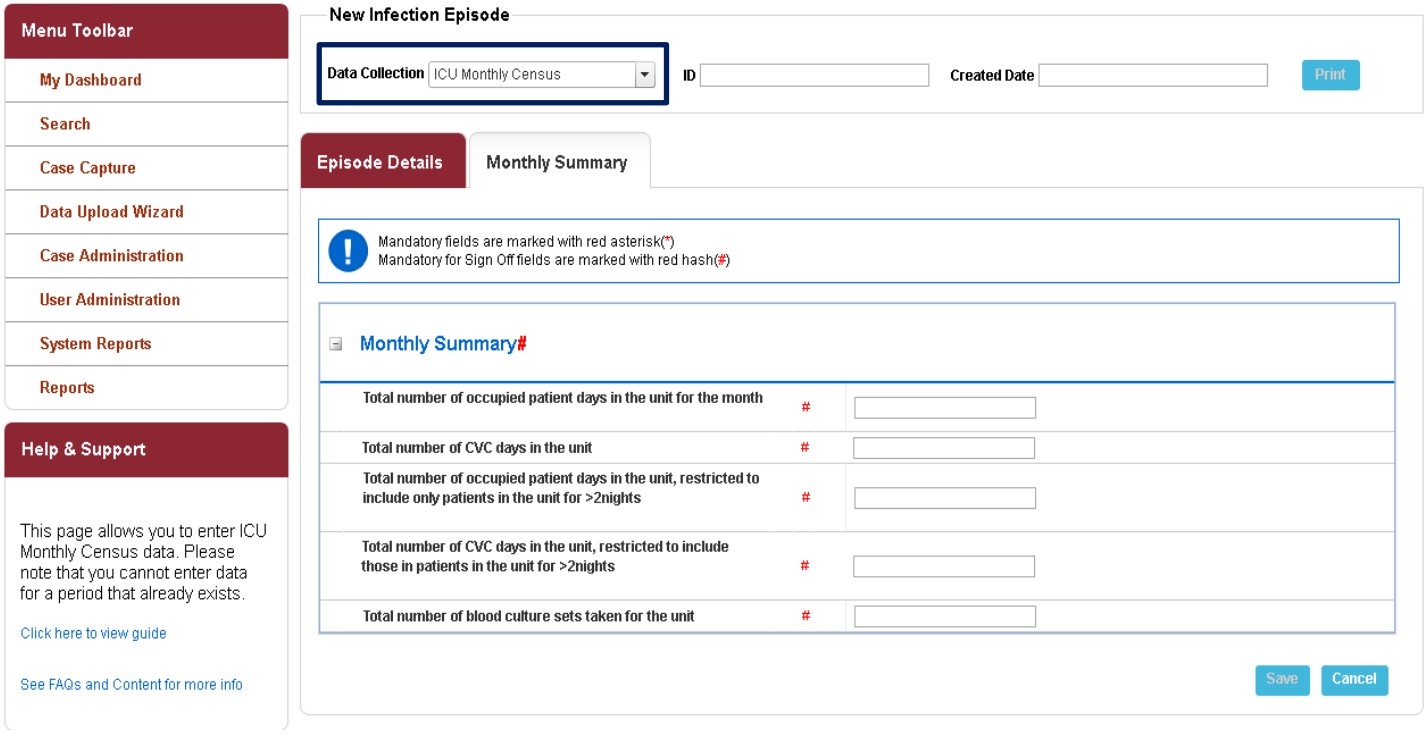
The ‘Monthly Denominator Summary’ is a mandatory denominator tool.

Data submitted through the ‘ICU Daily Census’ tool can be used to populate the mandatory ‘Monthly Denominator Summary’ at the end of each month. Alternatively, the ‘Monthly Denominator Summary’ can be entered manually by the user once the month of interest has elapsed.

See Table 6.2 for details of the fields collected.

All data entered must be saved.

Figure 6.3: 'Monthly Denominator Summary' tool



NOTE: If data is already entered onto the 'Monthly Denominator Summary' section, this may have been calculated by the system due to the user having used the 'ICU Daily Census' tool. Any updates or changes made to the data on the 'Monthly Denominator Summary' section will need to be saved. This saved data will not overwrite the lower level of denominator data (i.e. data entered via the 'ICU Daily Unit Census' tool), only the aggregated values calculated by the system when a user has chosen to use to populate the monthly denominator features from the 'ICU Daily Unit Census' tool.

Table 6.2: Fields in the mandatory 'Monthly Denominator Summary' tool

Field	Completion	Field Type	Rationale	Comment
A. Total number of occupied bed-days for unit	Optional	Numeric	Used to calculate total number of patient days per month	Sum of patient bed days for that month
B. Total number of patients in the unit with ≥1 CVC	Optional	Numeric	Used to calculate total number of CVC days in the unit per month	Sum of CVC days for all patients for that day
C. Number of CVC-days, restricted to only include CVC-days when patient has been in the unit for >2 nights (1 CVC day is 1 patient-day where patient has ≥1 CVC)	Optional	Numeric	Used to calculate the total number of patient days in the unit for >2 nights with at least one CVC	Sum of CVC days, for patients staying>2 nights in the unit, for that day
D. Number of occupied overnight bed-days for unit, restricted to only include occupied overnight bed-days when patient has been in the unit >2 nights	Optional	Numeric	Used to calculate the total number of patient days in the unit for >2 nights per month	Sum of patient bed days over a month, for patients in unit for over 2 nights, for that day
E. Total number of blood culture sets taken for all patients?	Optional	Numeric	Used to calculate total number of positive blood cultures	Sum of all blood culture sets taken for that day

7. Dashboard

7.1 Introduction

There are up to three report dashboards available to users depending on their permissions and access to the system. The dashboards provide an overview of data on the system to direct user's workflow and highlight outstanding actions. The available dashboards are:

- Summary (summary of cases entered onto the system, data completeness, sign off and Post Infection Review (PIR);
- Benchmarking (allows users to compare their organisation against other organisations in terms of rates and counts of reported cases);
- Data Quality (completeness of data entry of cases on the system).

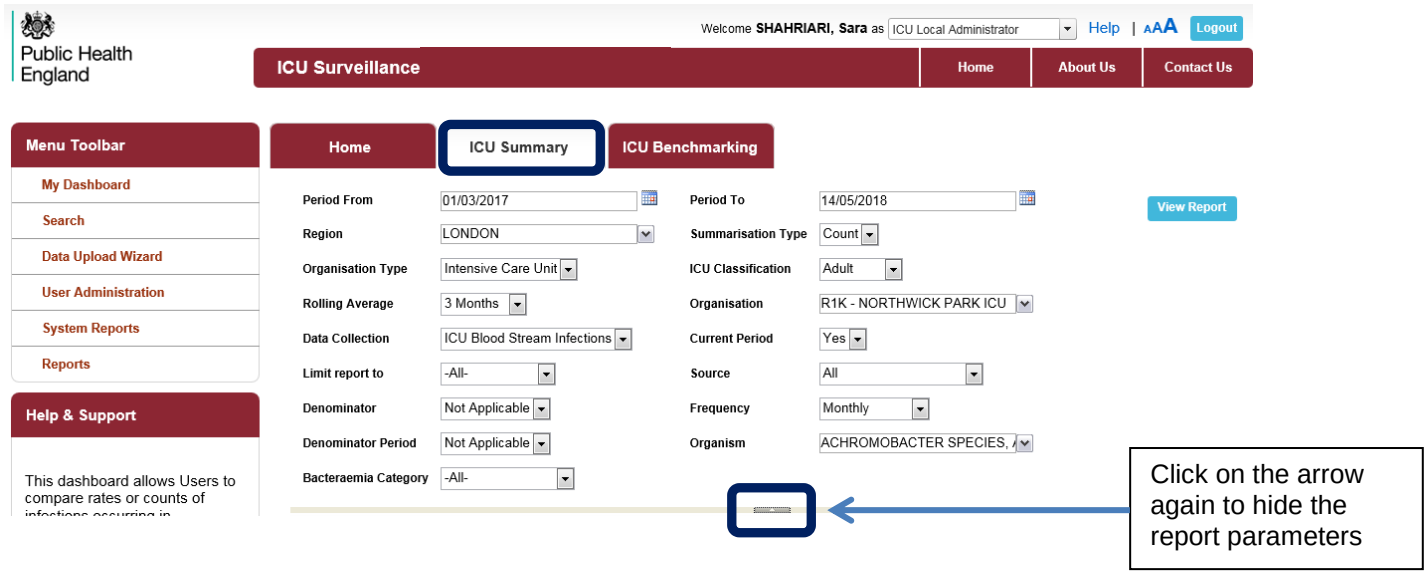
7.2 Summary Dashboard

The Summary Dashboard has up to five elements, access to which is determined by user permissions. When first landing on the Summary Dashboard a report, based on pre-set default parameters. To view and modify the parameters (see Figure 7.1) click on the small down arrow towards the top of the screen. The parameters can be hidden by clicking this arrow again.

7.3 Benchmarking Dashboard

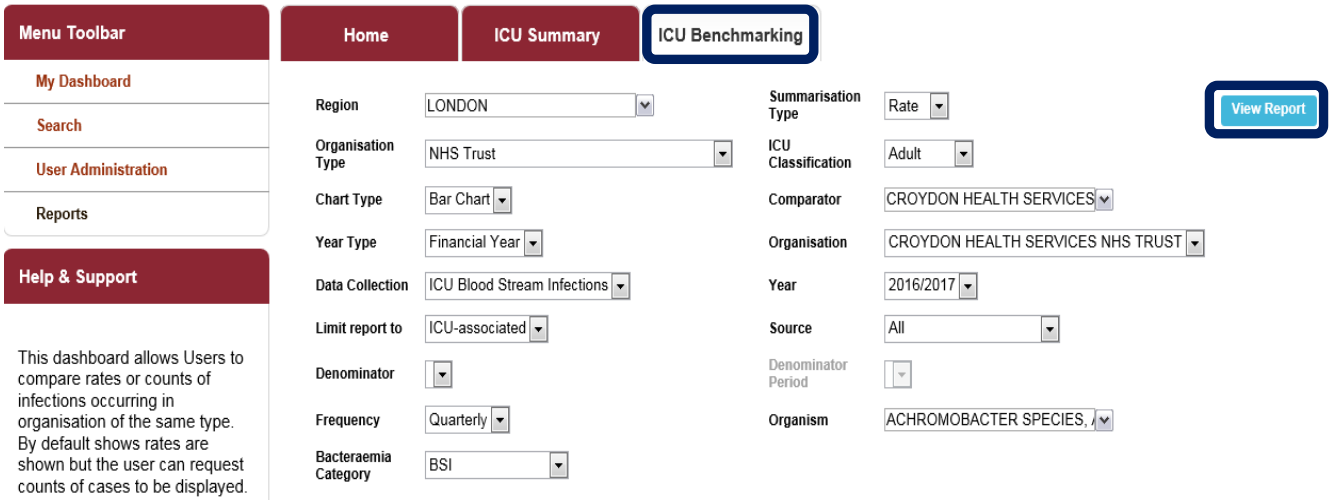
The benchmarking dashboard allows users to compare a specific organisation (for example an NHS acute Trust) against a selection of other user-specified Trusts. This report can display both counts and rates for the selected time period. The default is for this report to display rates because count data does not take into account the size of the organisations being compared. We therefore recommend running this report using a rate (**NB:** although useful for benchmarking, calculated rates should still be interpreted with caution as they are unadjusted for such factors as age, gender, case mix etc.)

Figure 7.1: Accessing the Summary Dashboard Report Parameters Screen



For further information of the functionality of the different elements of the 'Dashboard', see the Dashboard User Guides on the ICU DCS 'Help' screen.

Figure 7.2: Accessing the Benchmarking Dashboard Report Parameters Screen



8. Viewing, updating and deleting BSI event data

All BSI event data entered onto the ICU DCS can be viewed, updated or deleted. For further information on BSI events please refer to the "*Case Capture BSI Event User Guide*" under the section 'Help' on the ICU DCS.

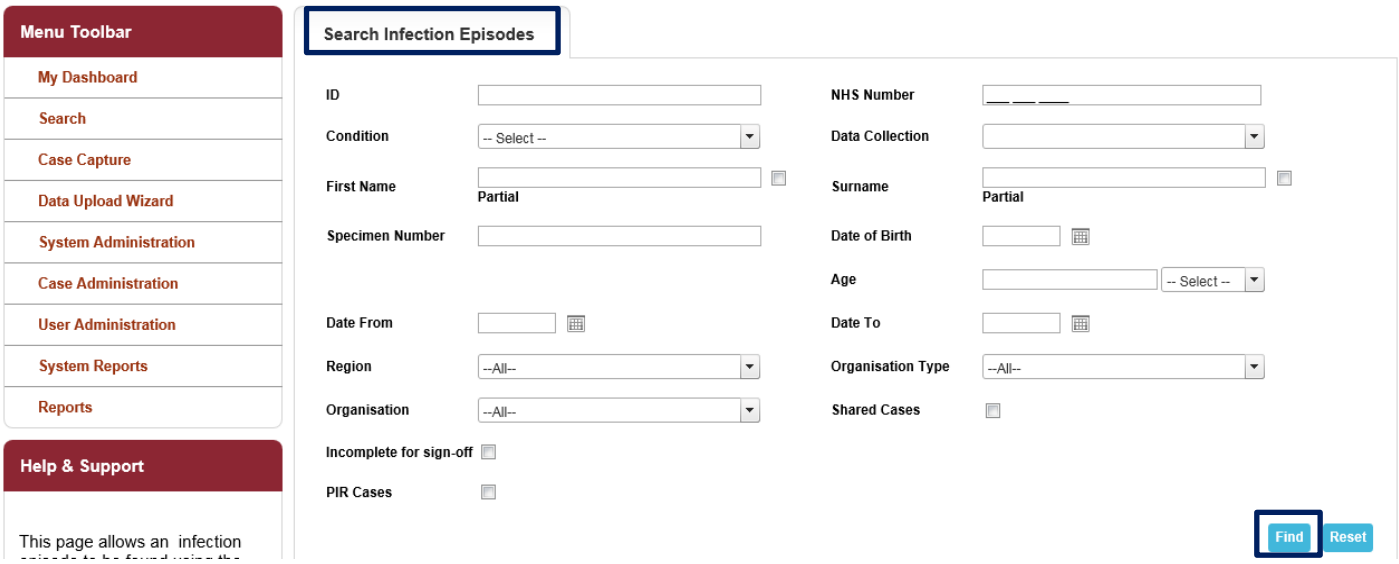
8.1 Viewing a case(s)

BSI event data can be viewed and updated by:

- Select "Search" from the side banner
- This will redirect you to the "Search" screen
- In the search screen (Figure 8.1) enter as much information as required to find the case(s) of interest, and click 'Find'.
- Cases can be amended by clicking on the Case ID.

Additionally, cases can be deleted via the search screen (see section 8.2 and "*Delete BSI User Guide"* under the section 'Help' on the ICU DCS).

Figure 8.1: Viewing a case(s) via the 'Search' tool



8.2 Updating a case

To update a specific case, data entry users must click on the hyperlink of the case ID for the relevant case. Users will be redirected to the six sections of the case capture flow. All data can be updated as required and saved. For further details please refer to the "*Case Capture BSI Event User Guide"* under the section 'Help' of the ICU DCS.

NOTE: Cases in a period which have not been signed off can be edited. If the case you wish to update is not within a signed off period, the case can be accessed and amended by using the 'Search' tool. Once a period is locked, cases within this period cannot be amended or deleted, unless requested. Individuals will need to contact ICCQIP via the surveillance inbox (ICCQIP.surveillance@phe.gov.uk) requesting the period to be unlocked. Please refer to the "*Sign-Off Userguide*" for more information.

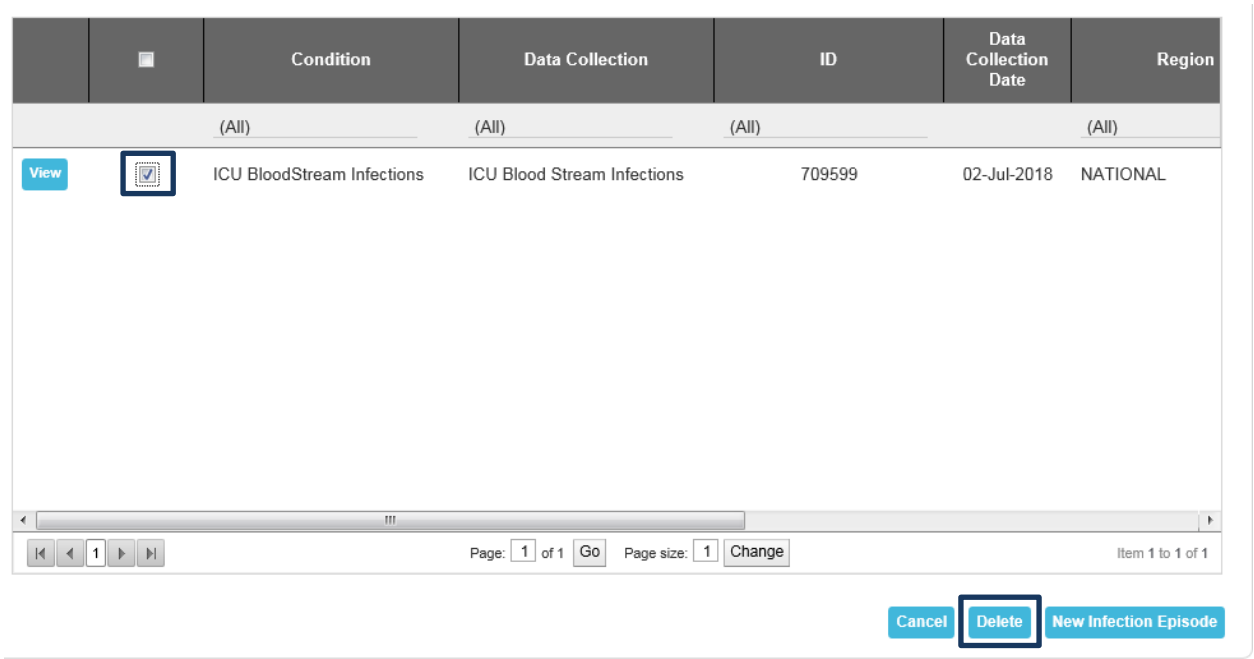
8.3 Deleting a case

All BSI cases entered onto the ICU DCS can be deleted. However locked cases/periods must be unlocked by the PHE ICU Surveillance team first. This can only be done by contacting PHE at ICCQIP.surveillance@phe.gov.uk. The reason for deleting a case must be due to case being entered by error and should be specified. The period will only be unlocked for 24 hours for the cases to be deleted. To delete a specific case:

- Select 'Search' from the side banner
- This will redirect you to the 'Search' screen (Figure 8.1)
- In the search screen enter as much information as required to find the case(s) of interest
- Please refer to the "*Search User Guide"* under the 'Help' section of the ICU DCS for further details regarding 'Search' fields
- Press 'Find' to search records matching the search criteria
- The returned results show a list of the records fulfilling the "Search" criteria on screen
- Individual cases can be deleted by selecting the tick box next to the case ID (Figure 8.2)
- A delete confirmation box will appear below the searched results.
    - To delete the case select "Yes"
    - To cancel the delete select "No"

NOTE: Once a selected case has been deleted it cannot be retrieved.

Figure 8.2: Deleting a case



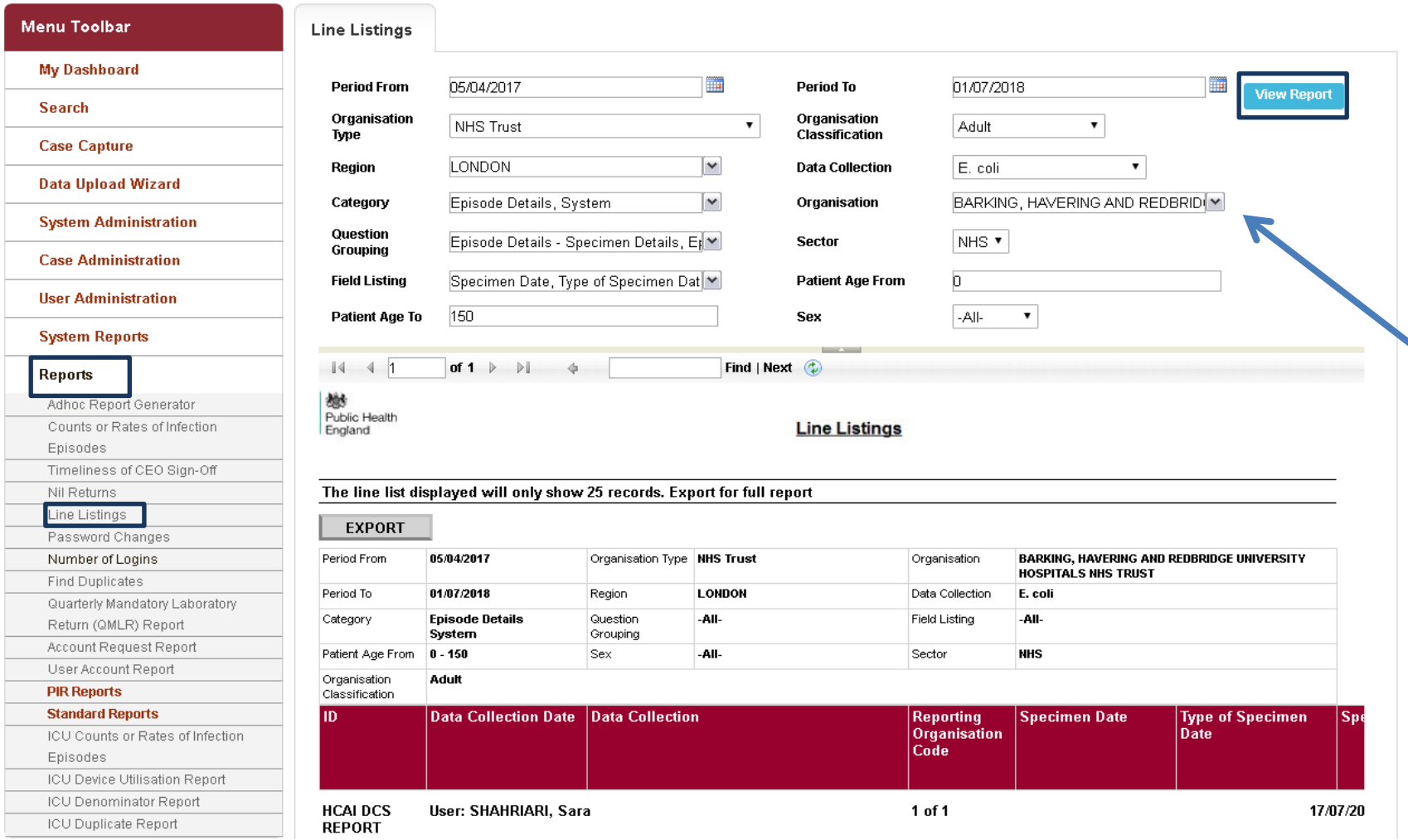
8.4 Running a line list report

BSI event data can also be viewed as a line list report (Figure 8.3). This allows the user to view all cases, or filter them by various parameters including “Period From” and “Period To”, “Patient Age From” and “Patient Age To” and “Sex” as well as other parameters.

‘Reports – Line Listings’ is used to find the case(s) of interest. As much information as required can be entered to find the case(s) of interest. “Unit” and “Period From” are mandatory fields (“Period From” and “Period To” represents either the date the positive specimen was collected or admission date to the ICU – select as required). The “Period From” and “Period To” fields are pre-completed with default values, these dates can be changed as required.

Case(s) can be viewed on screen in a list of the records matching the search criteria or exported to a .csv file. The .csv export will show all entered information for each case but the on screen summary is just a preview of key fields to allow the user to identify if the correct case(s) have been returned. The .csv export can be saved locally for analysis etc. This .csv file contains PII, please adhere to local policies regarding where sensitive information can be saved. For further information, please refer to *“Line Listings Report User Guide”* under the section ‘Help’ on the ICU DCS.

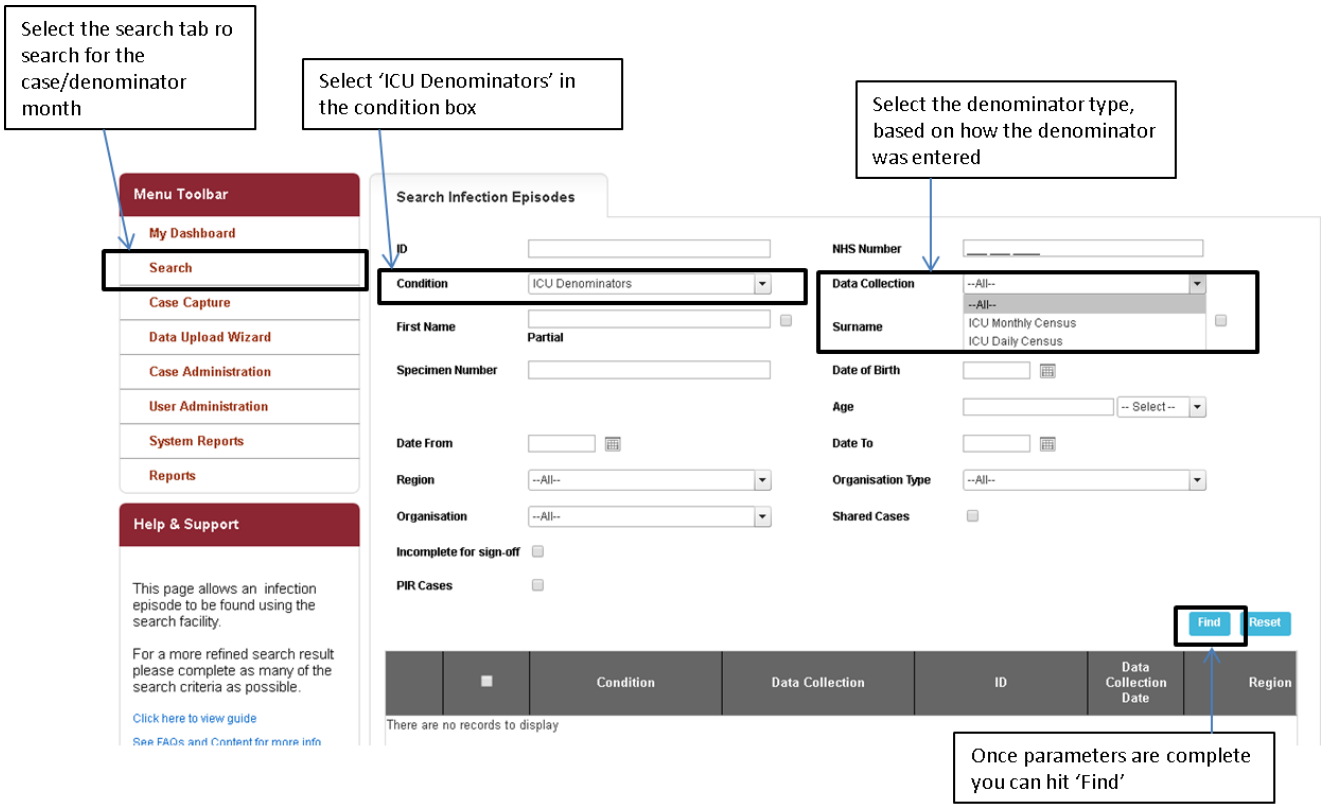
Figure 8.3: Running a line list



9. Viewing and updating denominator data

The Denominator options can be accessed via the 'Case Capture' tab on the Dashboard screen followed by selecting the type of denominator in the drop down box (Figure 9.1).

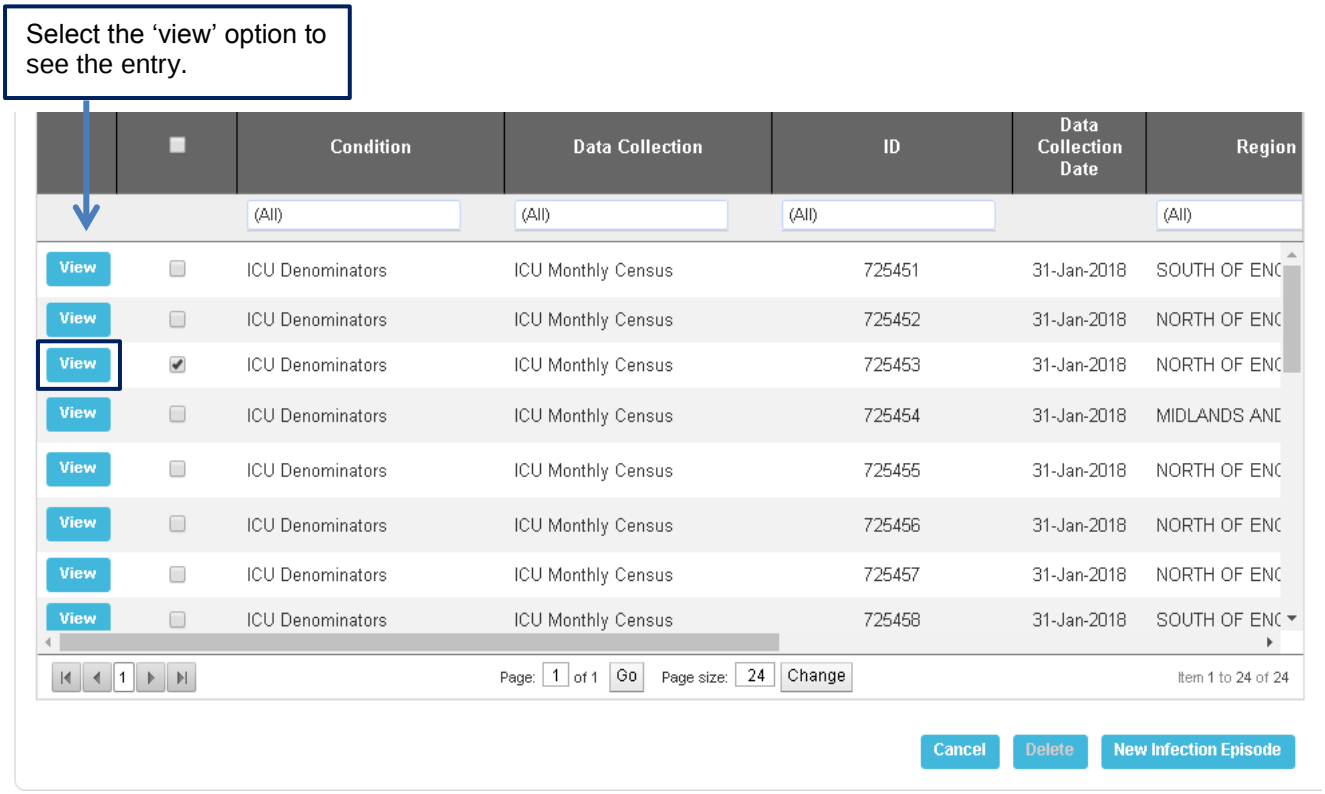
Figure 9.1: Viewing options for denominator data



Denominator data can be viewed but not updated via the "Reports" drop down menu ('ICU Denominator Report'). This will enable users to run a denominator line listing report and export the information as a .csv file. For further information see section 9.3 (Running a Denominator Line Listing).

More parameters can be entered to narrow your search. All the cases meeting this search criteria will be bought up. This case can then be amended or deleted.
To amend a case you would need to click the 'view' option next to the case, Figure 9.2.

Figure 9.2: Amending a denominator entry

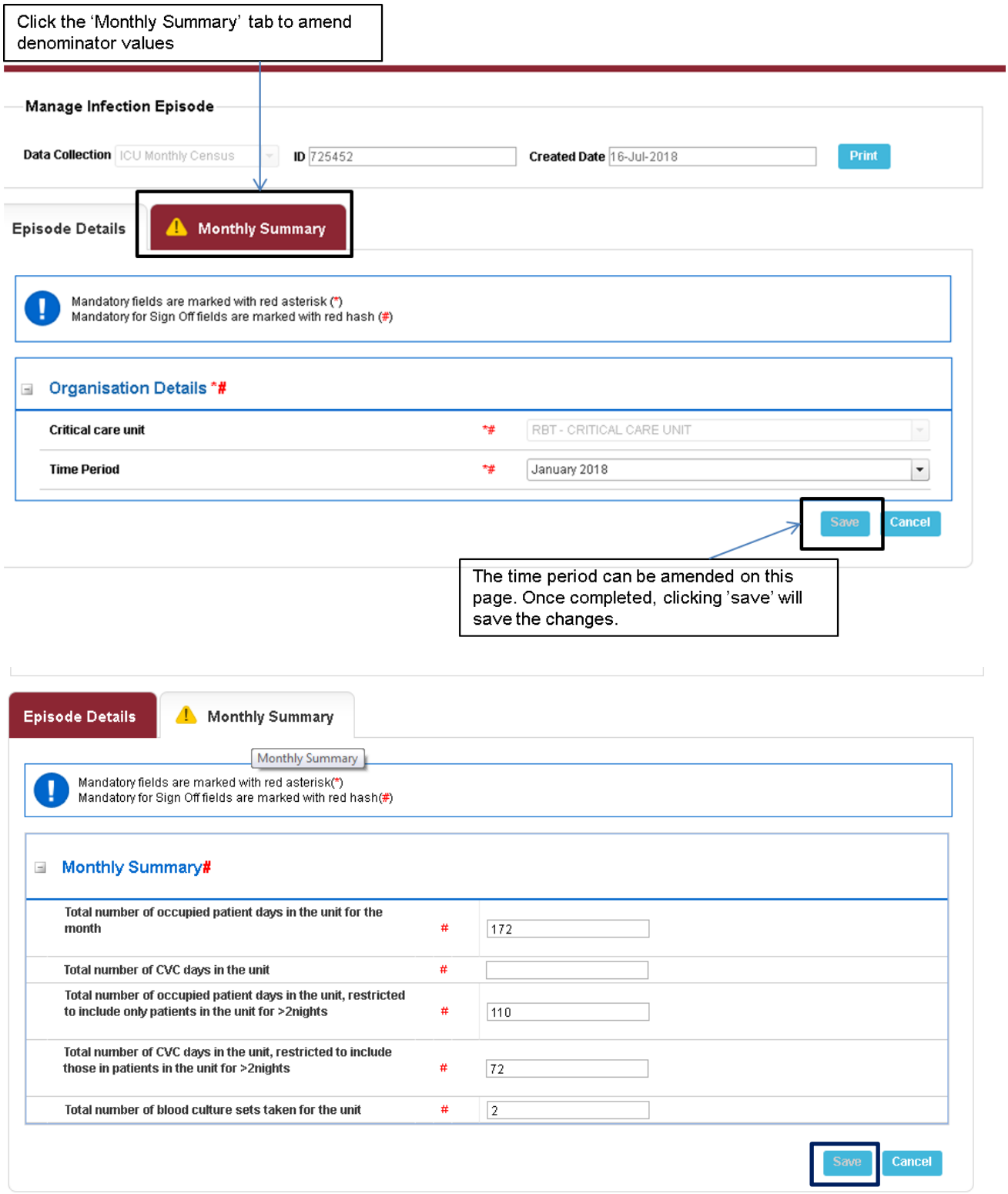


9.1 Viewing and updating 'Monthly Denominator Summary'

If amending the raw denominator data, select 'Case Capture' → 'Enter a Case'. Once the Monthly Summary tab is selected, the page will redirect you to the denominator page (NB: Completing the *Organisation Details* will allow for Monthly Summary selection). The fields can then be amended and re-saved with the new values, Figure 9.3.

To update the 'Monthly Denominator Summary' data, the fields can be edited and will then need to be saved. This will overwrite any existing data which has been used to populate these fields.

Figure 9.3: Amending Monthly Summary denominator data



9.2 Viewing and updating monthly denominator summary using Daily Census

The 'Monthly Denominator Summary' can be populated using the Daily Unit Census which can be accessed in a similar way to the Monthly Census from the 'Case Capture – Enter a Case' option from the Menu Toolbar (Figure 9.2). To view and/or update a specific day or month, the relevant day/month can be selected from the 'Search' option (Figure 9.4) via the relevant denominator tool. This will redirect users to the selected denominator tools.

It is important to note that if the 'Monthly Denominator Summary' has been entered for a given month and the 'Daily Unit Census' tool are used to populate the monthly denominator, the monthly denominator aggregate data already saved in the ICU DCS will be overwritten with the 'Daily Bed Census' data (Figure 9.5).

All updated data must be saved.

Figure 9.4: Search ICU Daily Census

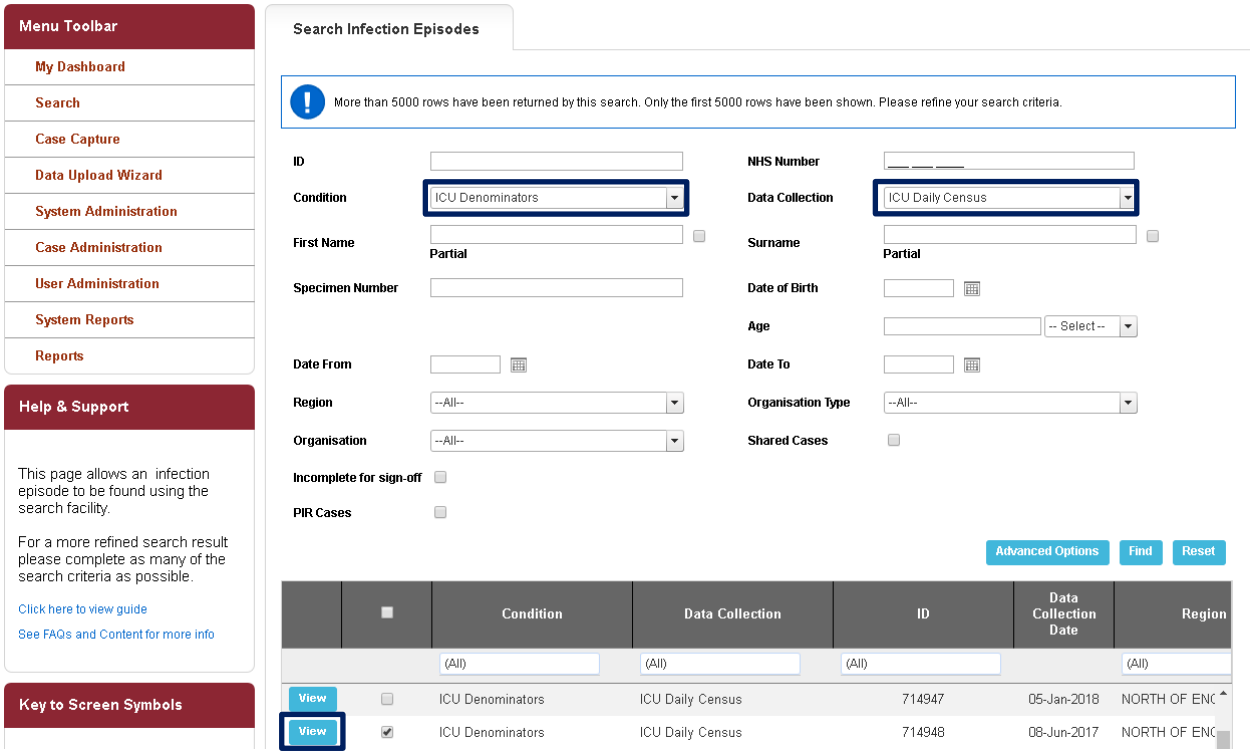
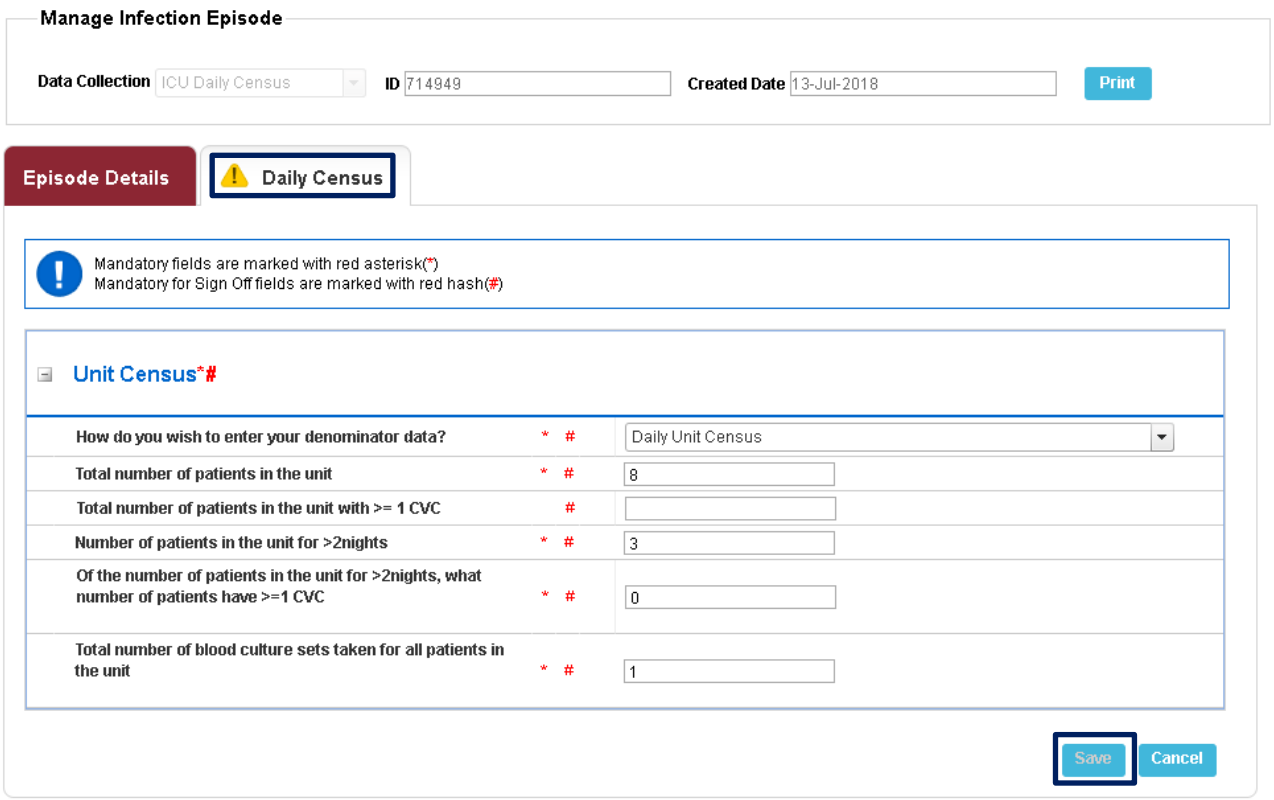


Figure 9.5: Amending Daily Unit Census data

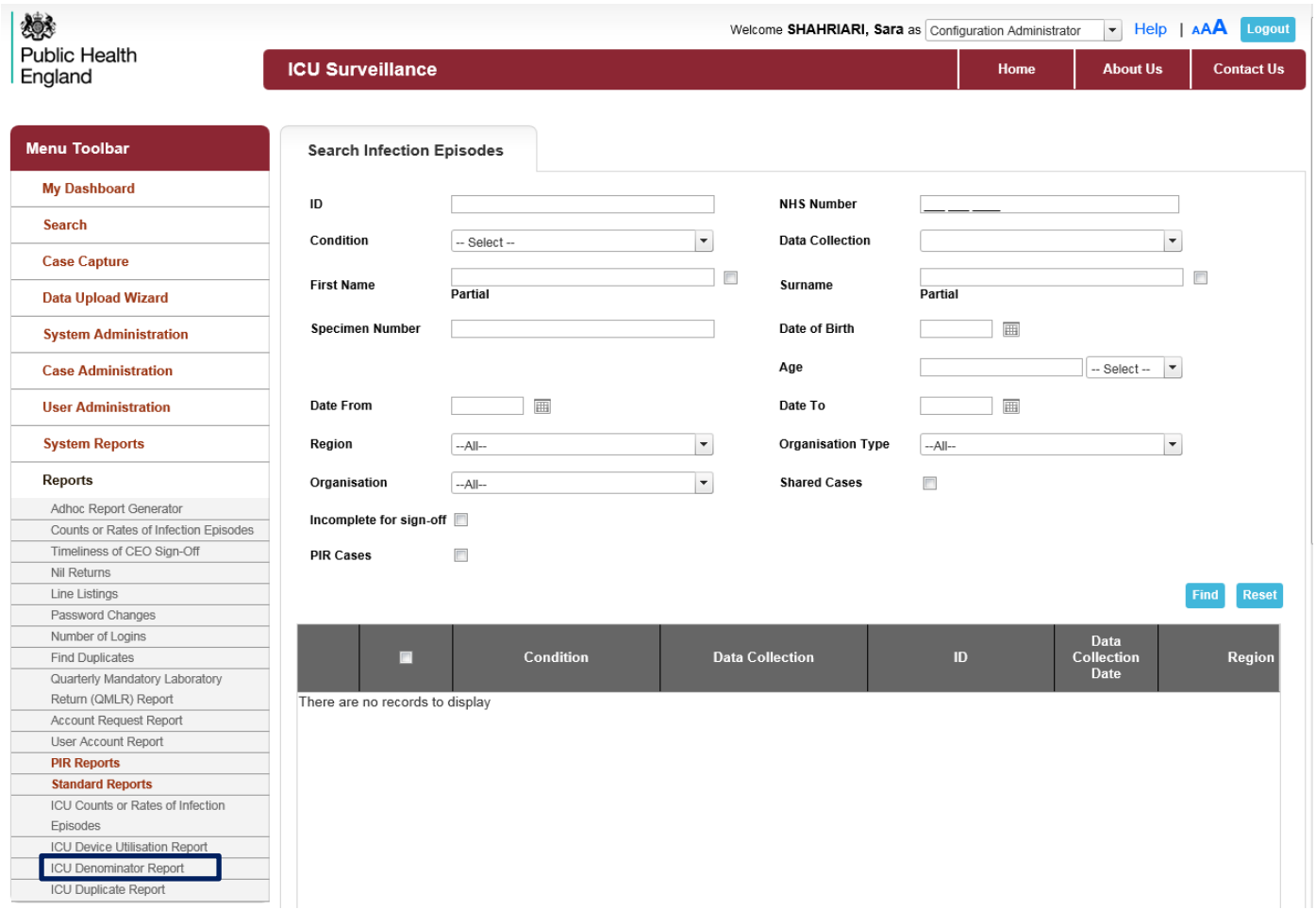


9.3 Running a denominator line listing report

Denominator data can be extracted and exported as a line list report. A denominator line list report will allow you to view multiple month/time periods by denominator type.

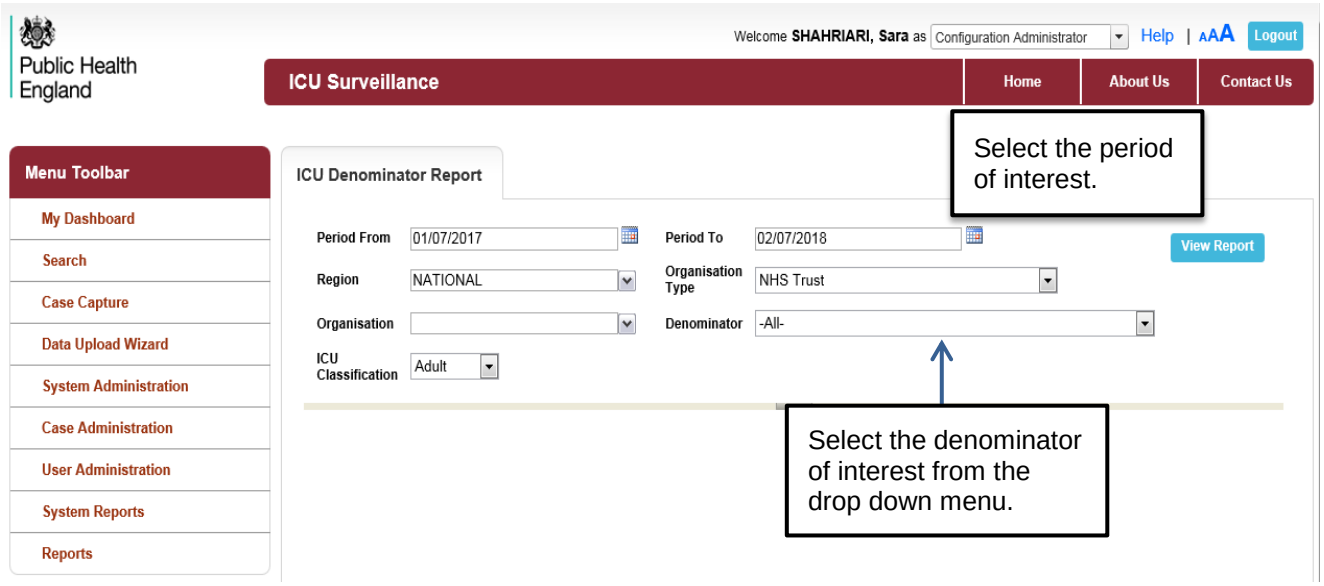
- Select ‘Reports’ from the Menu Toolbar (Figure 9.6)
- Select ‘ICU Denominator Report’ from the drop down menu

Figure 9.6: ICU Denominator Report



This will redirect users to the ‘ICU Denominator Report’ screen (Figure 9.7)

Figure 9.7: Denominator line listing screen



Users must select the relevant unit(s), enter the period of interest ('Period From' and 'Period To') and select the denominator type for export. The data can be exported directly to a .csv file. The .csv file will show denominator information for the selected unit(s) between the selected dates. The .csv export can be saved locally for analysis etc.

This .csv file does not contain PII.

10. Sign-off

10.1 Signing-off tool

This functionality allows cases in periods to be signed off and verified as completed and accurate. Cases should be locked by an authorised senior member of the team. Only individuals with the sign-off authority for ICCQIP are able to sign-off on cases and periods. Once data for a quarter has been added to the system it should be verified and signed off 1.5 months after the end of the respective quarter, for example, data for October 2018 to December 2018 should be checked, verified and signed-off by 15 February 2019.

Once a period is locked, cases within this period cannot be amended or deleted, unless requested. Individuals will need to contact ICCQIP via the surveillance inbox (ICCQIP.surveillance@phe.gov.uk) requesting the period to be unlocked. Cases with known errors or entered in error should be requested for amendment or deletion only. Once unlocked, changes must be made by 5pm the following working day, as the period will be re-locked at this point.

Cases/periods must be signed-off a month at a time and must be done in chronological order, e.g. Jan-17 cannot be signed off unless all previous months are signed off. Cases can only be locked if all mandatory fields for sign-off (#) are complete.

Cases should be checked for completeness and accuracy by a senior member of the team before being signed off.

Details on how to sign-off cases can be seen in Figure 10.1.

10.2 Sign-off episode screen

To access the sign-off screen, you must have sign-off rights, and the ‘ICU Signoff’ role must be selected from the top-right toolbar.

The Sign-Off Episode Screen can be accessed by clicking on ‘Case Capture’ in the Menu Toolbar and then selecting the ‘Sign-Off Cases’ link (Figure 10.1).

Select the appropriate parameters, and click ‘Search’ to view unsigned cases (Figure 10.2). If you would like to see all cases for that period, untick the box titled ‘Unsigned Only’.

Figure 10.1: How to sign-off a case

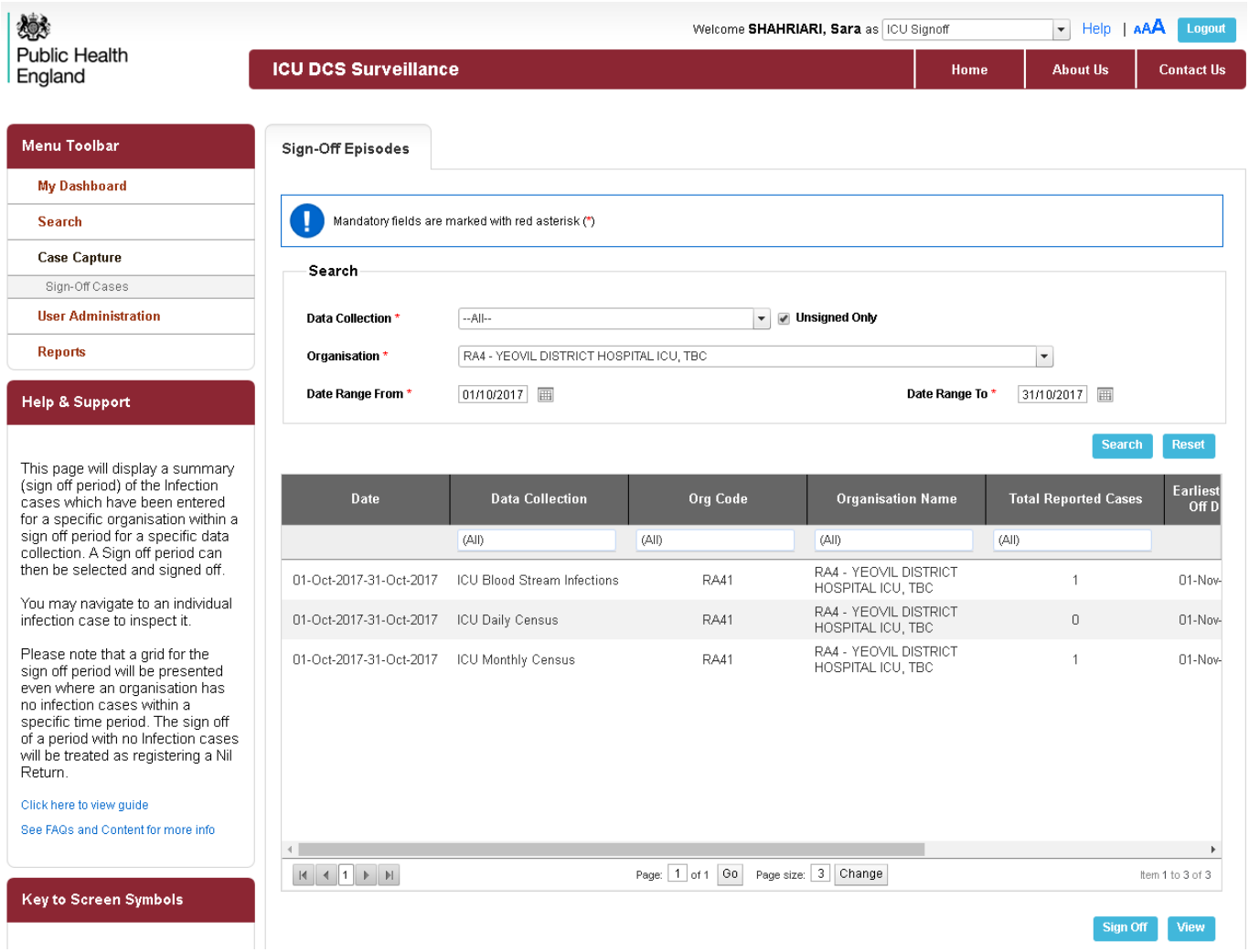
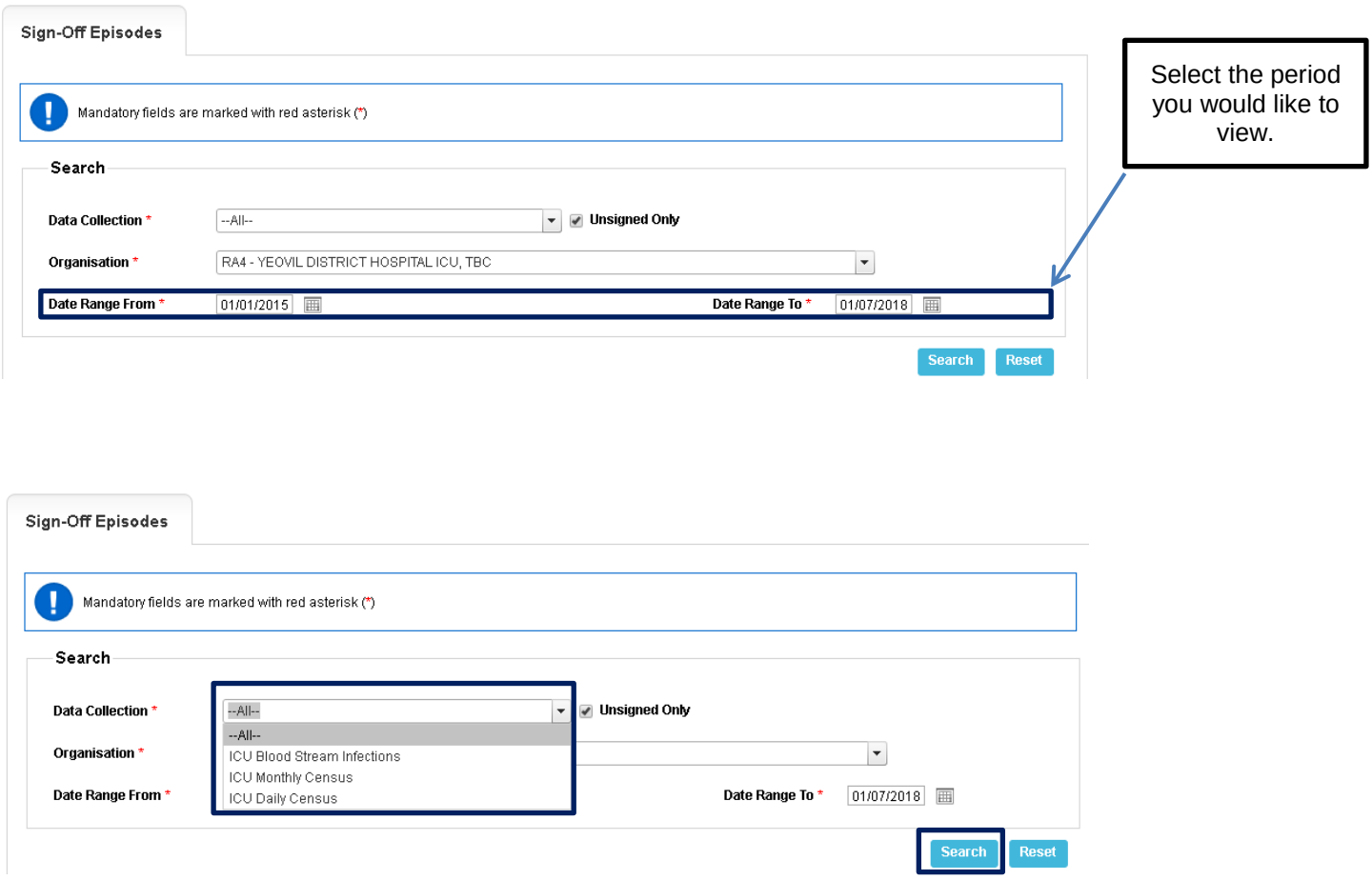


Figure 10.2: Sign-off episodes parameters



In order to sign-off, select the relevant period (tick the box in the 'Sign-Off' column) and click on the 'Sign Off' link (Figure 10.3). Please be aware that you must sign-off previous periods prior to signing off the current period (Figure 10.4).

Figure 10.3: Selecting periods to sign-off

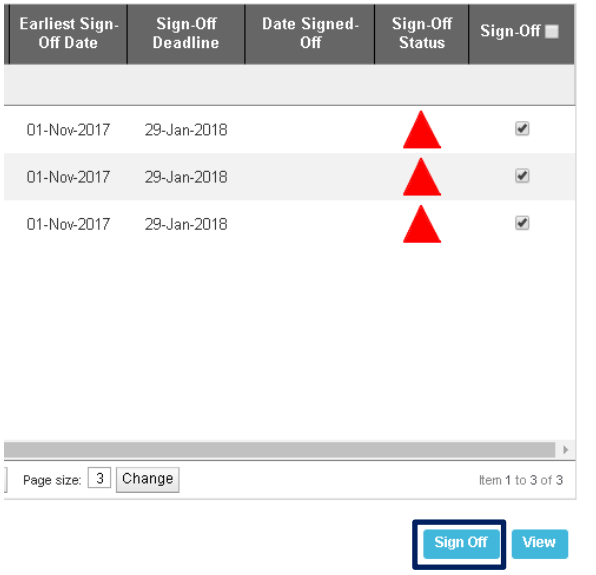
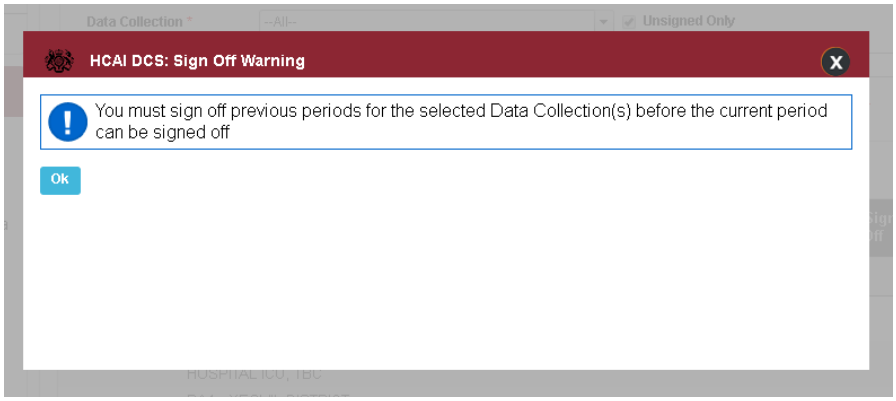


Figure 10.4: Sign-off warning



11. Plans for data analysis

11.1 Summary of data outputs

Initial analyses of the study will include assessment of data quality as well as a description of the reported data.

11.2 Data quality

Data quality will be determined by the level of completion of key patient details. This includes a valid NHS number, date of birth, gender, first name and surname.

11.3 Reported data

Reported data will include number of:

- BSIs reported
- Number of BSIs reported conforming to CDC and ECDC case definitions
- Symptomatic and asymptomatic BSIs
- Polymicrobial infections
- ICU-associated BSIs
- Catheter associated BSIs
- Catheter related BSIs
- Positive BCs that require treatment with a course of antimicrobial therapy

11.4 Data outputs

The ICU DCS for the sentinel surveillance scheme will allow users to run line listing reports, which will provide the number of BSIs, between specified specimen dates or ICU admission dates, and monthly denominators.

Further outputs, produced by Public Health England offline, include:

1. Number of BSIs (total and ICU-acquired)

    - By patient age and gender
    - By reporting unit
    - By source
    - By CR-BSI and CA-BSI
    - By species
    - Species by source
    - Time from admission in ICU to BSI (days)

2. Rates of BSI

    - Overall rate of BSI by selected time period
    - By reporting unit and selected time period
    - All BSIs by patient days (total and >2 nights in ICU) and selected time period
    - ICU-associated BSI by patient days and selected time period
    - ICU-associated CR-BSI and CA-BSI by catheter-days and selected time period

3. Device utilisation rate

    - Proportion of patient days with CVC – for patient in ICU > 2 nights

12. Confidentiality and data sharing

The seven Caldicott principles are upheld across Public Health England (PHE). These are:

1. Justify the purpose(s) of using confidential information
2. Don't use patient-identifiable information unless it is absolutely necessary
3. Use the minimum necessary patient-identifiable information
4. Access to patient-identifiable information should be on a strict need-to-know basis
5. Everyone with access to patient-identifiable information must understand his or her responsibilities
6. Understand and comply with the law
7. The duty to share information can be as important as the duty to protect patient confidentiality

Collection of patient data for ICU surveillance falls within PHE's approval under Section 251 of the NHS Act 2006 to process patient identifiable information for the purposes of infectious disease surveillance. This allows organisations to disclose identifiable patient information to PHE without the explicit consent of the patient concerned while remaining within the confines of the Data Protection Act.

From April 2013, applications to access patient information without explicit consent will be processed by the Health Research Authority (HRA) Confidentiality Advisory Group (for research applications) and the Secretary of State for Health (for non-research applications), replacing the former National Information Governance Board process.

For more information, including the Register of approved applications under Section 251 visit: http://www.hra.nhs.uk/about-the-hra/our-committees/section-251/cag-advice-and-approval-decisions/
Patient identifiable information (PII) is entered for each positive blood culture to allow identification of patients and linkage to other datasets. No patient level data, whether it is PII or not, is available to users unless they have appropriate permissions to view this information.

13. Access to the ICU DCS

The system is only available on the NHS N3 network.

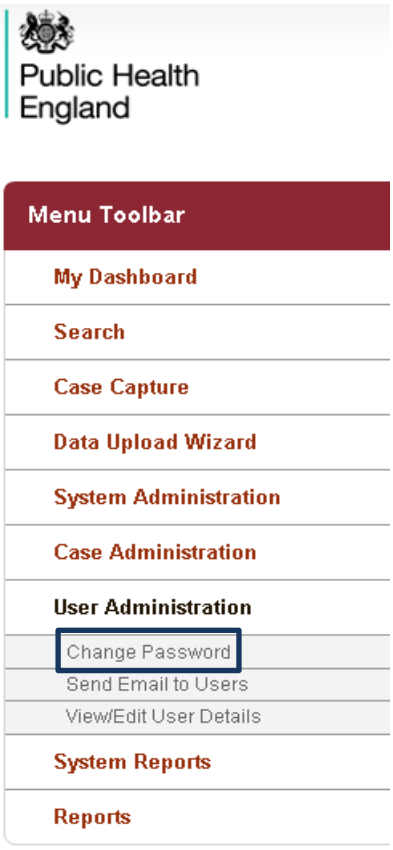
Access to the system is strictly controlled and users are required to have a valid username and password to log onto the system. Each username and password is unique and issued to an individual allowing them specific access to the data held on the system.

It is the individual's responsibility to ensure that the login details are kept securely. Passwords are not held by PHE or other members of ICCQIP.

Passwords can be reset on the ICU DCS by clicking on the 'User Administration' tool on the Menu Toolbar and selecting 'Change Password' from the drop down menu (Figure 13.1).

Please note: currently, the system is compatible with Internet Explorer 9, 10 and 11 (IE9, IE10, IE11), Internet Explorer Edge, Google Chrome and Mozilla Firefox.

Figure 13.1: Reset password



It is important to note PHE will only be authorising Local Administrators for access to the ICU DCS. No one from a Trust can be authorised until the Local Administrator(s) has been authorised for that Trust.

Local Administrators will be responsible for:

- Authorising or rejecting user account requests from users at the organisation where you are the Local Administrator
- Managing all user accounts at the organisation where you are the Local Administrator, including de-activating, and suspending user accounts when staff leave employment at the organisation where you are the Local Administrator

A summary of roles and permissions can be found in Table 13.1 below.

Table 13.1: User access and permissions to study ICU DCS

User	Data Entry	Line listings
Data Entry	Yes for their own organisation	Yes only for positive BCs reported in their organisation and monthly denominator summary data
Local Administrator	Yes for their own organisation	Yes only for positive BCs reported in their organisation and monthly denominator summary data
PHE National	No	Yes for all BCs and denominator summaries reported nationally

13.1 User Administration

Once a user has requested/created an account, the account settings can be managed under the "User Administration" tab on the left hand side. Users can change their passwords by clicking on "Change Password" (see Figure 13.1 and "*Self Account Management User Guide"* under the section 'Help' of the ICU DCS).

Please note: Units for your NHS Trust need to be added by the software developer prior to participation in the surveillance programme.
If these need amending or if you need more units added please contact:
ICCQIP.surveillance@phe.gov.uk

13.2 Data linkage and data sharing

A limited number of staff have special permission granted by the former National Information Governance Board for Health and Social Care (NIGB) on behalf of the Secretary of State to access PII for linkage to other health databases. Any PII data used for such purposes are stored securely and not shared with others.

14. Reference list

(1) Health Protection Agency. English National Point Prevalence Survey on Healthcare-associated Infections and Antimicrobial Use, 2011. 2012.

(2) Eber MR, Laxminarayan R, Perencevich EN, Malani A. Clinical and economic outcomes attributable to health care-associated sepsis and pneumonia. Arch Intern Med 2010 Feb 22;170(4):347-53.

(3) Johnson AP, Davies J, Guy R, Abernethy J, Sheridan E, Pearson A, et al. Mandatory surveillance of methicillin-resistant Staphylococcus aureus (MRSA) bacteraemia in England: the first 10 years. J Antimicrob Chemother 2012 Apr;67(4):802-9.

(4) Bion J, Richardson A, Hibbert P, Beer J, Abrusci T, McCutcheon M, et al. 'Matching Michigan': a 2-year stepped interventional programme to minimise central venous catheter-blood stream infections in intensive care units in England. BMJ Qual Saf 2013 Feb;22(2):110-23.

(5) Pronovost P, Needham D, Berenholtz S, Sinopoli D, Chu H, Cosgrove S, et al. An intervention to decrease catheter-related bloodstream infections in the ICU. N Engl J Med 2006 Dec 28;355(26):2725-32.

(6) Dixon-Woods M, Leslie M, Tarrant C, Bion J. Explaining Matching Michigan: an ethnographic study of a patient safety program. Implement Sci 2013;8:70.

(7) The Faculty of Intensive Care Medicine. Critical Eye. 2013. Report No.: Issue 4.

15. Appendix 1: Case Definitions

Definitions are based on the Centers for Disease Control and Prevention (CDC) and European Centre for Disease Prevention and Control (ECDC) definitions.

15.1 Bloodstream infection (BSI)

Table 15.1: Criteria for case definitions for bloodstream infections in adults and paediatrics

Adults (≥13 years)	Paediatrics (<13yrs)
Meets one of the following criteria:	***Meets one of the following criteria:***
a) A recognised pathogen from at least one blood culture	**a)** A recognised pathogen from at least one blood culture
OR	**OR**
b) A common skin microorganism* from 2 blood cultures drawn on separate occasions and taken within a 48hr period **AND** The patient has at least ONE symptom of fever >38^{o}C, chills or hypotension	**b)** A common skin microorganism* from 2 blood cultures drawn on separate occasions and taken within a 48hr period **AND** The patient has at least TWO symptoms of paediatric SIRS[2]: tachycardia, bradycardia (<1yr), temperature >38.5^{o}C <36^{o}C, elevated respiratory rate, leukocytes (elevated/depressed for age), leukocyte count (if leucocyte is selected)

*coagulase-negative staphylococci, Micrococcus sp., Propionibacterium acnes, Bacillus sp., Corynebacterium sp. Etc.

[1] The presence of at least TWO of the following four criteria (ONE of which must be abnormal temperature or leukocyte count):

- Tachycardia defined as a mean heart rate >2SD above normal for age in the absence of external stimulus, chronotropic drugs or painful stimuli
- For children <1 year old bradycardia defined as a mean heart rate <10th percentile for age in the absence of external vagal stimuli, beta blocker drugs or congenital heart disease
- Core temperature of >38.5 or <36 degrees Celsius
- Mean respiratory rate >2SD above normal for age or mechanical ventilation for an acute process not related to underlying neuromuscular disease or receipt of general anaesthesia
- Leukocyte count elevated or depressed for age (not secondary to chemotherapy induced leukopenia) or >10% immature neutrophils

Table 15.2: Criteria for case definitions for bloodstream infections in neonates

Neonates (<28 days)
Meets one of the following criteria:
a) A recognised pathogen from at least one blood culture **OR** **b)** A common skin microorganism* is cultured from blood AND Patient has ONE of: C-reactive protein >2.0 mg/dL immature/total neutrophil ratio (I/T ratio) >0.2 leukocytes <5/nL platelets <100/nL
AND
At least TWO of: temperature >38°C or <36.5°C or temperature instability tachycardia or bradycardia apnoea extended recapillarisation time metabolic acidosis hyperglycaemia other sign of BSI such as apathy

Table 15.3: Criteria for Neonatal Data Analysis Unit Definition

Neonates (<28 days): Neonatal Data Analysis Unit Definition[3]
Meets one of the following criteria:
a) A recognised pathogen from at least one blood culture
OR
b) Growth of mixed organisms or skin commensals* **AND** Three or more predefined clinical signs: • Increase in apnoea or bradycardia • Temperature instability • Impaired peripheral perfusion (CRT > 3s pallor/mottling/core-peripheral temp gap >2^{o}C) • Metabolic acidosis/base deficit < -10mmol/L • Lethargy/irritability/poor handling • Increased oxygen requirement or ventilator support • Ileus/onset of feed intolerance • Fall in urine output • Hypotension • Glucose intolerance

**Aerococcus Sp., Bacillus sp. other, Corynebacterium sp., Coagulase-negative staphylococci not specified, Coagulase-negative staphylococci other, Micrococcus sp., Propionibacterium sp., Staphylococcus Epidermidis, Staphylococcus Haemolyticus, Streptocuccus (Viridans group)*
Lower values for heart rate, leukocyte count and systolic BP = 5th percentile; upper values for heart & respiratory rate, leukocyte count = 95th percentile

[3] NDAU Definitions for catheter association BSI accessed 15th April 2016: https://www1.imperial.ac.uk/resources/99F3B656-C321-4881-8E24-EA1F4355B276/definitionforcabsiv3.pdf

Table 15.4: Age specific vital signs and laboratory variables

Age Group	Heart Rate		Respiratory Rate	Leukocyte count	Systolic BP
	Tachycardia	Bradycardia	Breaths/min	Leukocytes x 103/mm	Mm Hg
0 days – 1 week	>180	<100	>50	>34	<65
1 week – 1 month	>180	<100	>40	>19.5 or <5	<75
1 month – 1 year	>180	<90	>34	>17.5 or <5	<100
2 – 5 years	>140	NA	>22	>15.5 or <5	<94
6 – 12 years	>130	NA	>18	>13.5 or <4.5	<105
13 – 18 years	>110	NA	>14	>11 or <4.5	<117

15.1.1 Symptomatic bacteraemia

- Patient has BSI that meets the adult, paediatric or neonatal definition
- **OR** has evidence of infection at another site (excluding CVC)
- **OR** is being treated for a BSI

15.1.2 Asymptomatic bacteraemia (contaminants)

- Patient has recognised pathogen or common skin commensals from 1 or 2 positive cultures

AND

- No signs or symptoms (or insufficient to meet case definitions)
- No treatment for the positive BSI

15.1.3 ICU-associated bacteraemia

- Date of positive blood culture > 2 days after date of ICU admission (where the date of ICU admission is day 1)

15.1.4 Central venous catheter-bloodstream infection (CVC-BSI)

a) Catheter-associated BSI (CABSI)

Table 15.5: Criteria for defining catheter-associated BSI (CABSI)

Meets ALL of the following criteria:
a) One of the criteria for bloodstream infection
AND
b) The presence of at least one central venous catheters at the time of the positive blood culture, or CVC removed within 48 hrs before positive blood cultures
AND
c) 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

b) Catheter-related BSI (CRBSI)

Table 15.6: Criteria for defining catheter-related BSI (CRBSI)

Meets ALL of the following criteria:
a) One of the criteria for bloodstream infection
AND
b) The presence of at least one central venous catheters at the time of the positive blood culture **or** CVC removed within 48 hrs before positive blood cultures
AND
c) At least <u>one</u> of the following where the same culture was identified: I) quantitative CVC culture $\geq 10^3$ CFU/ml or semi-quantitative CVC culture > 15 CFU II) quantitative blood culture ratio CVC blood sample/peripheral blood sample> 5 III) differential delay of positivity of blood cultures: CVC blood sample culture positive 2 hours or more before peripheral blood culture (blood samples drawn at the same time) IV) positive culture with the same micro-organism from pus from insertion site V) symptoms improve within 48hr of removal of CVC

15.1.5 ICU-associated BSI

A case will be defined as being ICU-associated if the patient has been in the ICU for >2 nights (or 48 hours, if the date and time of both ICU admission and ICU specimen were provided) after ICU admission when the positive blood culture sample was taken.

16. Appendix 2: Organism code list

Table 16.1: List of Recognised pathogen organisms and codes

CODE	LABEL	Is a Skin Commensal?
ACHSPP	ACHROMOBACTER SPECIES	
ACIBAU	ACINETOBACTER BAUMANNII	
ACICAL	ACINETOBACTER CALCOACETICUS	
ACIHAE	ACINETOBACTER HAEMOLYTICUS	
ACILWO	ACINETOBACTER LWOFFI	
ACINSP	ACINETOBACTER SP., NOT SPECIFIED	
ACIOTH	ACINETOBACTER SP., OTHER	
ACTSPP	ACTINOMYCES SPECIES	
1090	AEROCOCCUS SPECIES	Yes
AEMSPP	AEROMONAS SPECIES	
AGRSPP	AGROBACTERIUM SPECIES	
ALCSPP	ALCALIGENES SPECIES	
ANANSP	ANAEROBES, NOT SPECIFIED	
ANAOTH	OTHER ANAEROBES	
ASPFUM	ASPERGILLUS FUMIGATUS	
ASPNIG	ASPERGILLUS NIGER	
ASPNSP	ASPERGILLUS SP., NOT SPECIFIED	
ASPOTH	ASPERGILLUS SP., OTHER	
1142	BACILLUS ANTHRACIS	
BACSPP	BACILLUS SPECIES, OTHER	Yes
BATFRA	BACTEROIDES FRAGILIS	
BATNSP	BACTEROIDES SPECIES, NOT SPECIFIED	
BATOTH	BACTEROIDES SP., OTHER	
BCTNSP	OTHER BACTERIA, NOT SPECIFIED	
BCTOTH	OTHER BACTERIA	
BURCEP	BURKHOLDERIA CEPACIA	
2330	BURKHOLDERIA SPECIES	
CAMSPP	CAMPYLOBACTER SPECIES	
CANALB	CANDIDA ALBICANS	
CANGLA	CANDIDA GLABRATA	
CANNSP	CANDIDA SP., NOT SPECIFIED	
CANOTH	CANDIDA SP., OTHER	
CANPAR	CANDIDA PARAPSILOSIS	
CANTRO	CANDIDA TROPICALIS	

CODE	LABEL	Is a Skin Commensal?
CHLSPP	CHLAMYDIA SPECIES	
CITDIV	CITROBACTER KOSERI (EX. DIVERSUS)	
CITFRE	CITROBACTER FREUNDII	
CITNSP	CITROBACTER SP., NOT SPECIFIED	
CITOTH	CITROBACTER SP., OTHER	
CLODIF	CLOSTRIDIUM DIFFICILE	
CLOOTH	CLOSTRIDIUM OTHER	
CORSPP	CORYNEBACTERIUM SPECIES	Yes
ENBAER	ENTEROBACTER AEROGENES	
ENBAGG	ENTEROBACTER AGGLOMERANS	
ENBCLO	ENTEROBACTER CLOACAE	
ENBGER	ENTEROBACTER GERGOVIAE	
ENBNSP	ENTEROBACTER SP., NOT SPECIFIED	
ENBOTH	ENTEROBACTER SP., OTHER	
ENBSAK	ENTEROBACTER SAKAZAKII	
ENCFAE	ENTEROCOCCUS FAECALIS	
ENCFAI	ENTEROCOCCUS FAECIUM	
ENCNSP	ENTEROCOCCUS SP., NOT SPECIFIED	
ENCOTH	ENTEROCOCCUS SP., OTHER	
ESCCOL	ESCHERICHIA COLI	
ETBNSP	ENTEROBACTERIACEAE, NOT SPECIFIED	
ETBOTH	ENTEROBACTERIACEAE, OTHER	
FILOTH	FILAMENTS OTHER	
FLASPP	FLAVOBACTERIUM SPECIES	
FUNNSP	FUNGI, NOT SPECIFIED	
FUNOTH	FUNGI OTHER	
GARSPP	GARDNERELLA SPECIES	
GNBOTH	OTHER GRAM- BACILLI, NON ENTEROBACTERIACIAEA	
GNCNSP	GRAM NEGATIVE COCCI, NOT SPECIFIED	
GNCOTH	GRAM NEGATIVE COCCI, OTHER	
GPBNSP	GRAM POSITIVE BACILLI, NOT SPECIFIED	
GPBOTH	GRAM POSITIVE BACILLI, OTHER	
GPCNSP	GRAM POSITIVE COCCI, NOT SPECIFIED	
GPCOTH	GRAM POSITIVE COCCI, OTHER	
HAEINF	HAEMOPHILUS INFLUENZAE	
HAENSP	HAEMOPHILUS SP., NOT SPECIFIED	
HAEOTH	HAEMOPHILUS SP., OTHER	
HAEPAI	HAEMOPHILUS PARAINFLUENZAE	
HAFSPP	HAFNIA SPECIES	

CODE	LABEL	Is a Skin Commensal?
HELPYL	HELICOBACTER PYLORI	
KLENSP	KLEBSIELLA SP., NOT SPECIFIED	
KLEOTH	KLEBSIELLA SP., OTHER	
KLEOXY	KLEBSIELLA OXYTOCA	
KLEPNE	KLEBSIELLA PNEUMONIAE	
LACSPP	LACTOBACILLUS SPECIES	
LEGSPP	LEGIONELLA SPECIES	
LISMON	LISTERIA MONOCYTOGENES	
1960	MICROCOCCUS SPECIES	Yes
MOGSPP	MORGANELLA SPECIES	
MORCAT	MORAXELLA CATHARRALIS	
MORNSP	MORAXELLA SP., NOT SPECIFIED	
MOROTH	MORAXELLA SP., OTHER	
MYCATY	MYCOBACTERIUM, ATYPICAL	
MYCTUB	MYCOBACTERIUM TUBERCULOSIS COMPLEX	
MYPSPP	MYCOPLASMA SPECIES	
NEIMEN	NEISSERIA MENINGITIDIS	
NEINSP	NEISSERIA SP., NOT SPECIFIED	
NEIOTH	NEISSERIA SP., OTHER	
NOCSPP	NOCARDIA SPECIES	
PAROTH	OTHER PARASITES	
PASSPP	PASTEURELLA SPECIES	
PRESPP	PREVOTELLA SPECIES	
PROSPP	PROPIONIBACTERIUM SPECIES	Yes
PRTMIR	PROTEUS MIRABILIS	
PRTNSP	PROTEUS SP., NOT SPECIFIED	
PRTOTH	PROTEUS SP., OTHER	
PRTVUL	PROTEUS VULGARIS	
PRVSPP	PROVIDENCIA SPECIES	
PSEAER	PSEUDOMONAS AERUGINOSA	
PSENSP	PSEUDOMONADACEAE FAMILY, NOT SPECIFIED	
PSEOTH	PSEUDOMONADACEAE FAMILY, OTHER	
SALENT	SALMONELLA ENTERITIDIS	
SALNSP	SALMONELLA SP., NOT SPECIFIED	
SALOTH	SALMONELLA SP., OTHER	
SALTYM	SALMONELLA TYPHIMURIUM	
SALTYP	SALMONELLA TYPHI OR PARATYPHI	
SERLIQ	SERRATIA LIQUEFACIENS	
SERMAR	SERRATIA MARCESCENS	
SERNSP	SERRATIA SP., NOT SPECIFIED	

CODE	LABEL	Is a Skin Commensal?
SEROTH	SERRATIA SP., OTHER	
SHISPP	SHIGELLA SPECIES	
STAAUR	STAPHYLOCOCCUS AUREUS	
STACNS	COAGULASE-NEGATIVE STAFYLOCOCCI, NOT SPECIFIED	Yes
STAEPI	STAPHYLOCOCCUS EPIDERMIDIS	Yes
STAHAE	STAPHYLOCOCCUS HAEMOLYTICUS	Yes
2440.0007	STAPHYLOCOCCUS SP., OTHER	
STAOTH	COAGULASE-NEGATIVE STAFYLOCOCCI, OTHER	Yes
STEMAL	STENOTROPHOMONAS MALTOPHILIA	
2549	STREPTOCOCCUS (VIRIDANS GROUP)	Yes
STRAGA	STREPTOCOCCUS AGALACTIAE (B)	
STRHCG	OTHER HAEMOL. STREPTOCOCCAE (C, G)	
STRNSP	STREPTOCOCCUS SP., NOT SPECIFIED	
STROTH	STREPTOCOCCUS SP., OTHER	
STRPNE	STREPTOCOCCUS PNEUMONIAE	
STRPYO	STREPTOCOCCUS PYOGENES (A)	
YEAOTH	YEASTS, OTHER	
YERSPP	YERSINIA SPECIES	

17. Appendix 3: Mandatory fields required for period submission/sign-off and optional fields

Mandatory fields include:

Patient details:

- NHS number
- Date of birth
- Patient first name
- Patient surname
- Gender
- Hospital number
- ICU admission date

Specimen details:

- Specimen date
- Specimen number
- Organism(s) cultured (”Organism 1” is the minimum entry required)

Fields required for period submission/monthly filing include:

All mandatory fields mentioned above

Clinical Symptoms:

- At least one sign or symptom or “Patient has no signs/symptoms” must be selected

Repeat Positive Blood Culture (only if skin commensal indicated from first specimen taken):

- Response to “Was a repeat blood culture taken?”

Treatment:

- Response to “Did this positive blood culture require treatment with a course of antimicrobial therapy?”

CVC Data:

- Responses to “Was a CVC in situ for at least 2 days at the time the first blood culture was drawn?”

- Response to “If no, was a CVC removed the day before the first blood culture was drawn?” if “No” selected for first question
- If yes to either of the above:
    - Response to “Quantitative CVC culture >=103 CFU/ml or semi-quantitative CVC culture > 15CFU?”
    - Response to “Quantitative blood culture ratio CVC blood sample/peripheral blood sample > 5?”
    - Response to “Differential delay of positivity of blood culture drawn at same time (CVC sample positive ≥ 2 hours before PVC)?”
    - Response to “Positive culture with same micro-organism from pus from insertion site?”
    - Response to “Symptoms improve within 48 hours of removal of CVC?”

Source of Infection:

- Response to “Was there evidence of a secondary infection (excluding CVC) at another site?”
- If “Yes” then “what level is the evidence for the secondary infection?” and “Which is the most likely site?”

Optional fields include:

Patient details:

- ICU Admission Time
- Patient postcode

Specimen details:

- Specimen Time
- Organism 2
- Organism 3
- Organism 4

Repeat Positive Blood Culture:

- If “Yes” is selected “Time taken” and Organism 2,3,4 becomes optional
- If “Taken, nothing cultured” is selected “Time taken” becomes optional

18. Appendix 4: Denominator forms to aid with data collection

The following four pages provide denominator forms for the daily bed census and daily unit census (‘Month By Day’), which you can print in order to help with data collection.

The first form can be used to help with the daily bed census, for a unit with up to 30 beds, this is one page long. To print just this page, please print page 90 only.

The second form is also to aid with the daily bed census, for a large unit (up to 75 beds). This form is two pages long and to print these, please print pages 91-92 only.

The final form can be used to help the collection of data for the daily unit census; ‘Month By Day’. This form I one page long, to print only this form, please ask your printer to print page 93 only.

Daily Bed Census Sheet (up to 30 beds/unit)

Use to capture the information required to complete the Daily Census Denominator Sheet

Date:

	A	B	C	D	E
Bed No.	**Patient**	**Has this patient been in ICU for>2nights**	**Does this patient have one or more CVC**	**Blood culture sets sent TODAY**	**Blood culture sets positive TODAY**
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
TOTAL FOR THE DAY					

Column totals:

Column A: No. patients in unit today

Column B: If Column A = Y, No. of patients in unit today that have been in unit for > 2 nights

Column C: If Column B = Y, No. of patients with CVC who have been in unit >2nights

Column D: Total number of blood cultures sets sent to lab today from the bed

Column E: Total number of blood culture positive sets received today for the bed

Daily Bed Census Sheet (up to 75 beds/unit)

Use to capture the information required to complete the Daily Census Denominator Sheet

Date:

	A	B	C	D	E
Bed No.	**Patient**	**Has this patient been in ICU for>2nights**	**Does this patient have one or more CVC**	**Blood culture sets sent TODAY**	**Blood culture sets positive TODAY**
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					

	A	B	C	D	E
Bed No.	**Patient**	**Has this patient been in ICU for>2nights**	**Does this patient have one or more CVC**	**Blood culture sets sent TODAY**	**Blood culture sets positive TODAY**
41					
42					
43					
44					
45					
46					
47					
48					
49					
50					
51					
52					
53					
54					
55					
56					
57					
58					
59					
60					
61					
62					
63					
64					
65					
66					
67					
68					
69					
70					
71					
72					
73					
74					
75					
DAILY TOTAL					

Column totals:

Column A: No. patients in unit today

Column B: If Column A = Y, No. of patients in unit today that have been in unit for > 2 nights

Column C: If Column B = Y, No. of patients with CVC who have been in unit >2nights

Column D: Total number of blood cultures sets sent to lab today from the bed

Column E: Total number of blood culture positive sets received today for the bed

Daily census sheet – Denominator data

Use to capture denominator data for number of patient-days and number of catheter-days at risk. Complete each **column for each day of month;** use totals to calculate the denominators for the monthly totals, or as an aid for month by day (unit census) denominator.

Year: **Month:**

	A	B	C	D	E
Day	**Total no. patients in unit**	**No. patients in unit with one or more CVCs**	**No. of patients in unit for >2nights**	**No. patients in unit >2nights with one or more CVCs***	**No. blood culture sets sent**
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
TOTAL FOR MONTH					

CVC = central vascular device

*Measures appropriate denominator for ICU-acquired bloodstream infection which are those that occur >48hr after admission to the unit.

A
B
C
D
E

Day

Total no. patients in unit