Surveillance for Bloodstream Infections (BSIs)

May,2023

Objectives

- **At the end of this session, participants will be able to:**
  - Describe key terms and case definitions used in BSI surveillance
  - Complete BSI infection and denominator reporting forms
  - Conduct basic analysis of BSI surveillance data
  - Correctly apply case definition to identify BSI cases

BSI Surveillance –
Key Terms and Case Definition

BSI surveillance

- **This surveillance system tracks <u>laboratory confirmed BSIs</u>**
  - Hospitals participating in surveillance must have laboratories that are able to perform blood cultures
  - Hospital microbiology laboratories should be able to identify pathogens to the species level

- **Laboratory confirmed BSIs that meet case reporting criteria are divided into one of three categories:**
  - Central line-associated BSI (CLABSI)
  - Primary BSI, not central line-associated
  - Secondary BSI

Types of laboratory confirmed BSIs

- **BSIs can be caused by**
  - recognized pathogens or
  - common commensals

- **Recognized pathogens:**
  - Pathogens known to cause BSI, for example
    - *Staphylococcus aureus*
    - *Klebsiella pneumoniae*
    - *Pseudomonas aeruginosa*

Types of laboratory confirmed BSIs

- **Common commensals:**
  - An organism which can commonly exist on body surfaces without causing disease
  - May be referred to as a "contaminant" when isolated in blood cultures
    - Can cause true BSIs when isolated from patients with significant healthcare exposure or found in repeated positive blood cultures
  - Examples of common commensals include
    - *Aerococcus* species
    - *Propionibacterium* species
    - Coagulase-negative *Staphylococcus*
  - If an organism is not explicitly included on the common commensal list maintained by CDC, then it is a recognized pathogen

*BSI protocol Appendix 1 includes incomplete lists of common commensals and recognized pathogens. Master list of common commensals is maintained by CDC at http://www.cdc.gov/nhsn/xls/master-organism-com-commensals-lists.xlsx

Types of laboratory confirmed BSIs

- **Recognized pathogens and common commensals are treated differently in BSI surveillance**

Recognized pathogen BSI:

A single positive blood culture with a recognized pathogen

Common commensal BSI:

- Two or more positive blood cultures with the same commensal

&

- At least one sign or symptom compatible with a BSI

Common commensal BSIs – matching blood cultures

- **Matching blood cultures must be collected at the same time, at different times on the same day, or on consecutive days:**
  - *S. mitis* from a peripheral blood draw collected on 20 Oct matches *S. mitis* from blood drawn from a central line on 20 Oct
  - *S. mitis* from blood drawn from a central line at 6 AM on 20 Oct matches *S. mitis* from a peripheral blood draw collected at 8 PM on 20 Oct
  - *S. mitis* from a peripheral blood draw collected on 20 Oct matches *S. mitis* from a peripheral blood draw collected on 21 Oct
  - *S. mitis* from a peripheral blood draw collected on 20 Oct **DOES NOT match** *S. mitis* from a peripheral blood draw collected on 22 Oct
    - Blood cultures must be collected on the same day or consecutive days

Common commensal BSIs – matching blood cultures

- **Blood samples taken at the same time**
  - Ideally, should be taken from different sites using separate sterile needle and syringe
  - If taken from the same site, separate needle and syringe should be used with site disinfection between draws

- **Blood samples taken at different times**
  - Remember - must be collected on the same day or consecutive days

- **One or both blood specimens may be from a central line**
  - If both specimens are taken from a central line they can be drawn from the same lumen or different lumens (lumen disinfection)

Are these matching blood cultures?

- **A patient has a blood specimen drawn from his central line at 7 AM on 10 November, and a separate blood specimen drawn from his central line at 9 PM on 10 November. Both specimens grow *Micrococcus sp*.**

- **A patient's blood specimen collected on 15 November grows *Streptococcus mitis*. Additional blood specimens are collected between 16 and 18 November, which show no growth. A blood specimen collected on 19 June grows *S. mitis*.**

Are these matching blood cultures?

- **A patient has a blood specimen drawn from his central line at 7 AM on 10 November, and a separate blood specimen drawn from his central line at 9 PM on 10 November. Both specimens grow *Micrococcus sp*.**
  - YES (same organism from two cultures collected on the same day)

- **A patient's blood specimen collected on 15 November grows *Streptococcus mitis*. Additional blood specimens are collected between 16 and 18 June, which show no growth. A blood specimen collected on 19 June grows *S. mitis*.**
  - NO (same organism from two cultures, but not drawn on same/ consecutive days)

Common commensal BSIs – signs and symptoms

- **Recall that BSIs with common commensals require matching blood cultures and at least one clinical sign or symptom**
- **Signs and symptoms used in the BSI case definition are:**

Patients > 12 months of age

At least one of the following:

- **Fever** (>38°C core)
- **Hypotension**

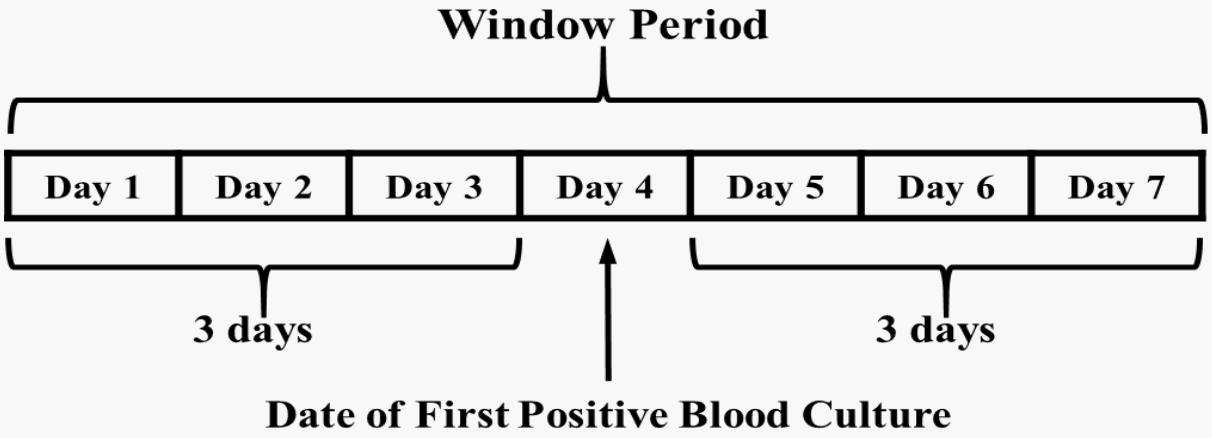
Infants (≤ 12 months of age)

At least one of the following:

- **Fever** (>38°C core)
- **Hypothermia** (<36°C core)
- **Hypotension**
- **Apnea**
- **Bradycardia**

Key terms – BSI surveillance

- **Window Period**
  - The BSI case definition must be met within a 7 day time frame known as the “window period”
  - Includes the date the first positive blood culture is **collected**, the three calendar days before, and the three calendar days after



Setting the window period

- **The microbiology lab calls you on 19 June to report that a blood culture collected from a patient in the ICU on 17 June is growing *S. mitis*.**

- **What is the window period for this potential BSI?**

Setting the window period

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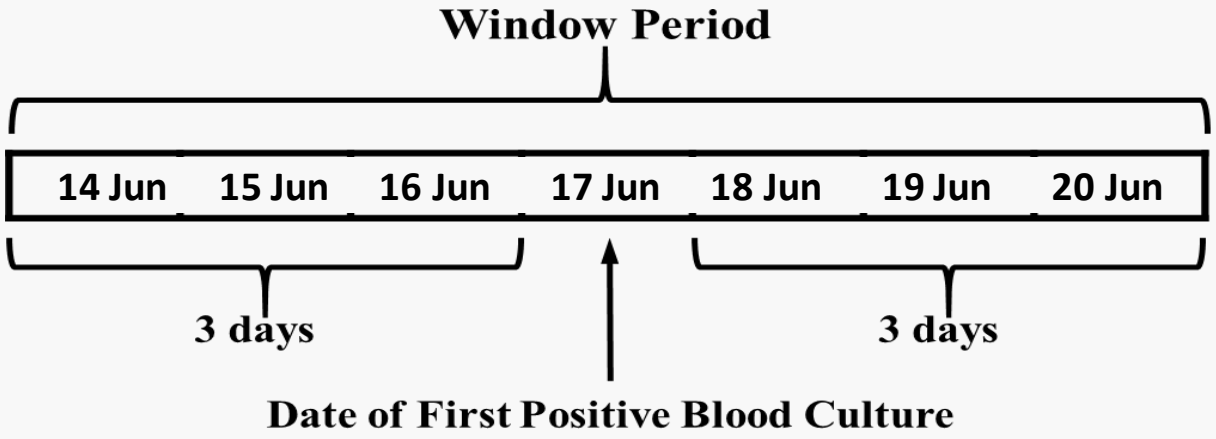


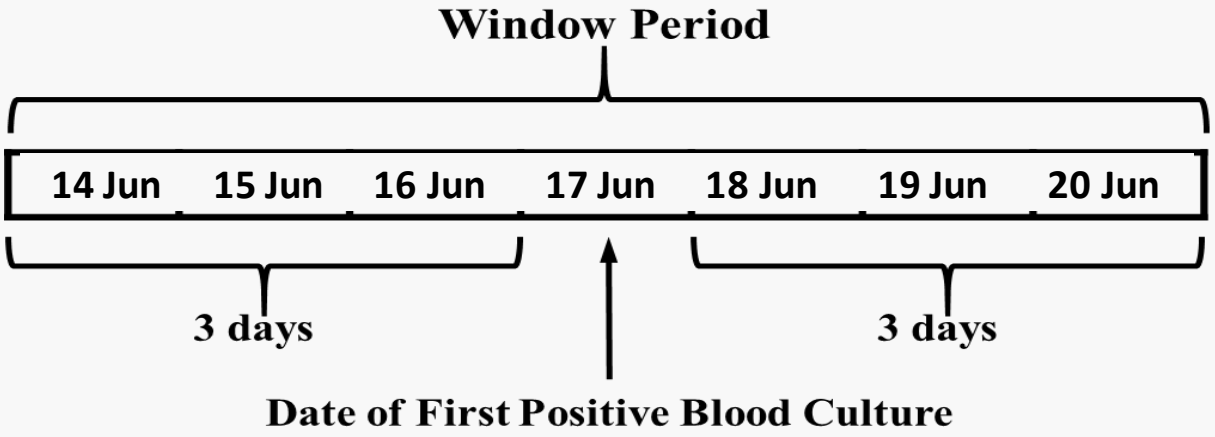
Key terms – BSI surveillance

- **Date of event**
  - The date when the first element used to meet the BSI case definition occurs for the first time within the window period
    - For BSIs with a recognized pathogen, this will be the date of first blood culture collection
    - For BSIs with a common commensal, this will be the date of first blood culture collection OR date of first sign/symptom from the case definition

Determining the date of event

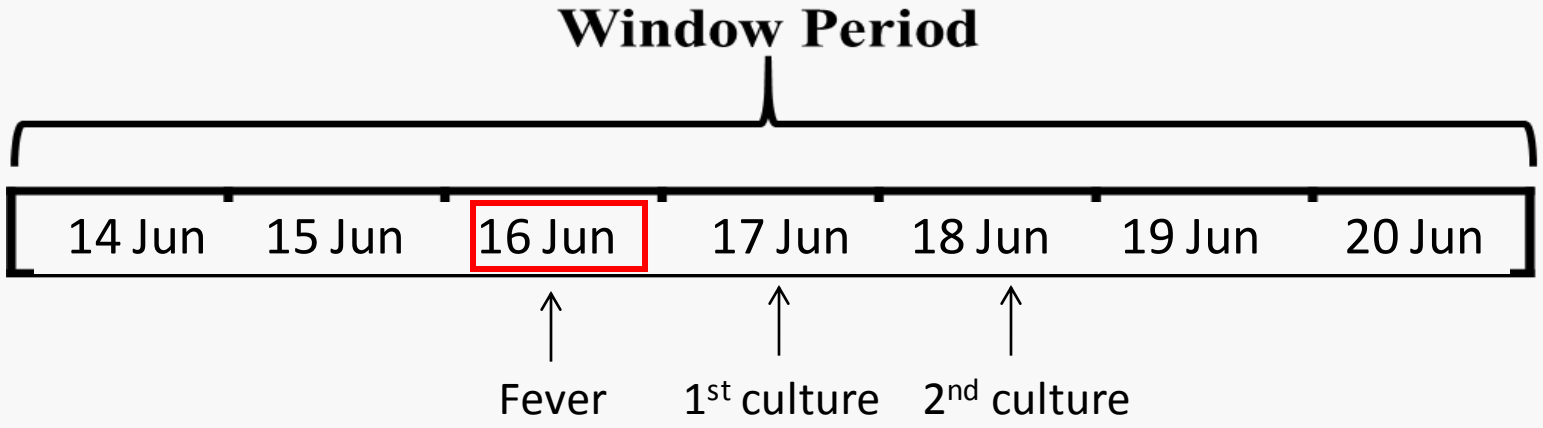
The microbiology lab calls you on 19 June to report that a blood culture collected from a patient in the ICU on 17 June is growing *S. mitis.*

- You review the chart of the patient with *S. mitis* from the previous example and find that the patient had a second blood culture with *S. mitis* on 18 June. The patient developed a fever on 16 June. The patient meets the BSI case definition. What is the date of event for this BSI?



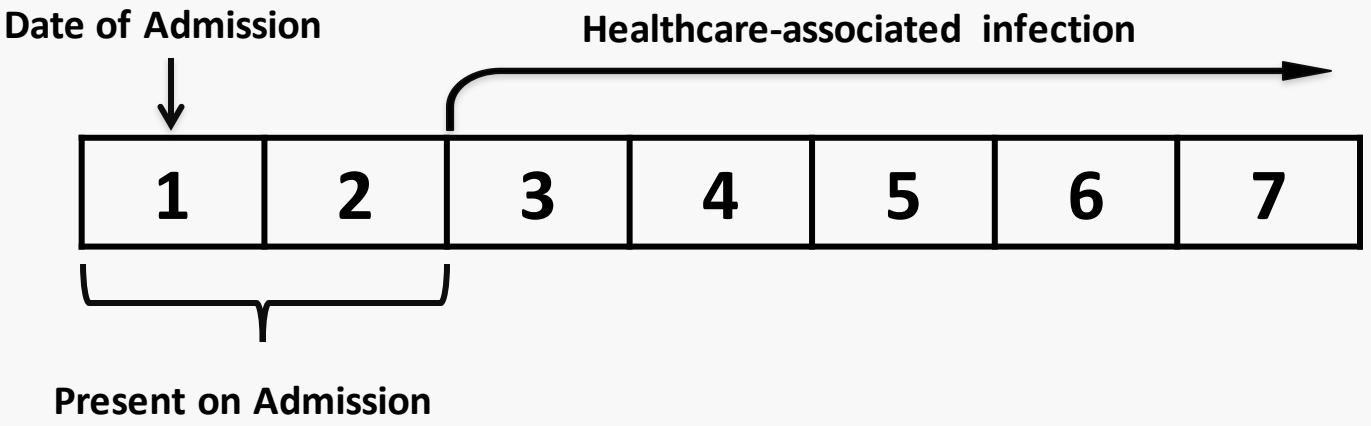
Determining the date of event

- You review the chart of the patient with *S. mitis* from the previous example and find that the patient had a second blood culture with *S. mitis* on 18 June. The patient developed a fever on 16 June. The patient meets the BSI case definition. What is the date of event for this BSI?



Key terms – BSI surveillance

- **Healthcare-associated infection (HAI)**
  - Date of event >2 calendar days after date of hospital admission
  - Date of hospital admission = Day 1
- **Present on admission (POA)**
  - Date of event occurs ≤ 2 calendar days after hospital admission



Key terms – BSI surveillance

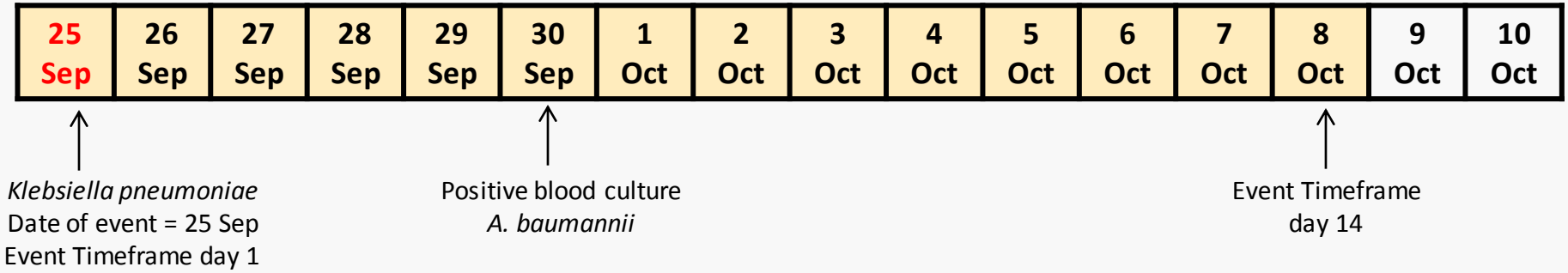
- **Surveillance protocol includes a rule to separate primary HAI events for the same patient**

- **Event Timeframe**

  - 14-day timeframe during which a primary BSI is considered to be ongoing and no new BSIs can be reported for the patient
  - Date of event = day 1 of the Event Timeframe
  - Organisms identified from blood cultures taken during the Event Timeframe are added to the case report form of the initial BSI

Key terms – BSI surveillance

- **Example – primary BSI with date of event of 25 September:**
  - Date of event is Day 1 of Event Timeframe
  - Event Timeframe = 25 Sept to 8 Oct (14 days)



  - No new BSIs for this patient can be reported between 25 Sept and 8 Oct
  - *A. baumanii* from blood collected on 30 Sept is not a new BSI per surveillance rules
    - Organism/susceptibility data for *A. baumannii* is added to the 25 Sept BSI case report form

BSI Surveillance – Inclusion Criteria

- **Recall that inclusion criteria have been developed to confirm that a BSI is healthcare associated and attributable to an ICU participating in surveillance**

- **BSIs meeting ALL of the following must be reported:**
  - Date of event does not occur within the Event Timeframe of a previously identified primary BSI
  - Date of event >2 calendar days from surveillance unit admission, with date of surveillance unit admission as Day 1

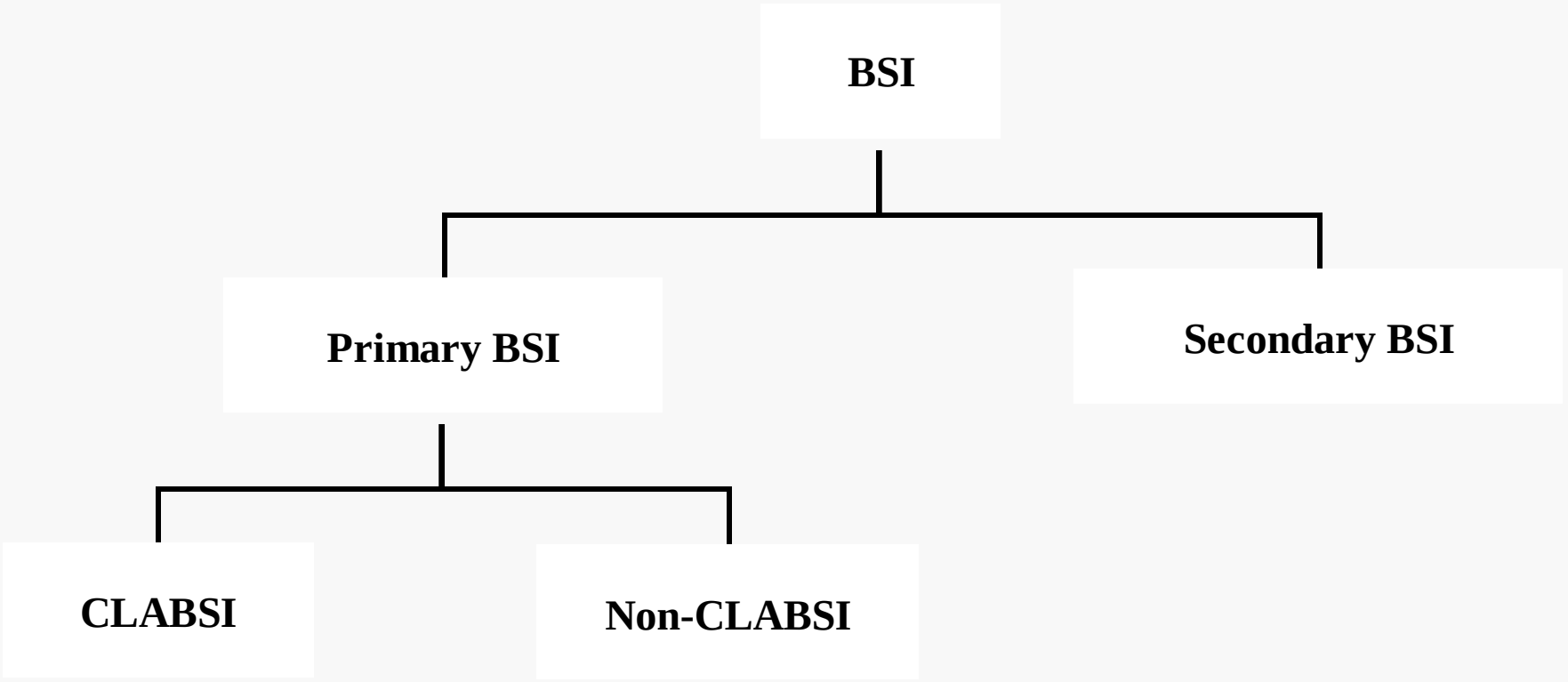
- **If the BSI does not meet ALL of the above, it is not reported**

BSI surveillance – additional definitions

- **A case report form is completed for <u>all BSIs</u> that meet the inclusion criteria**
  - Report BSIs in all patients, not just patients with central lines!

- **BSIs are classified into one of three categories**
  - BSIs may be considered a primary infection in the bloodstream ("primary BSI")
  - Primary BSIs can be further classified by association with a central line
    - Central line-associated bloodstream infection (CLABSI)
    - Primary BSI, not central line-associated
  - BSIs may also be disseminated from an infection at another body site ("secondary BSI")

BSI categories



Additional definitions – Secondary BSI

- **BSIs may be disseminated from an infection at another body site ("secondary BSIs")**

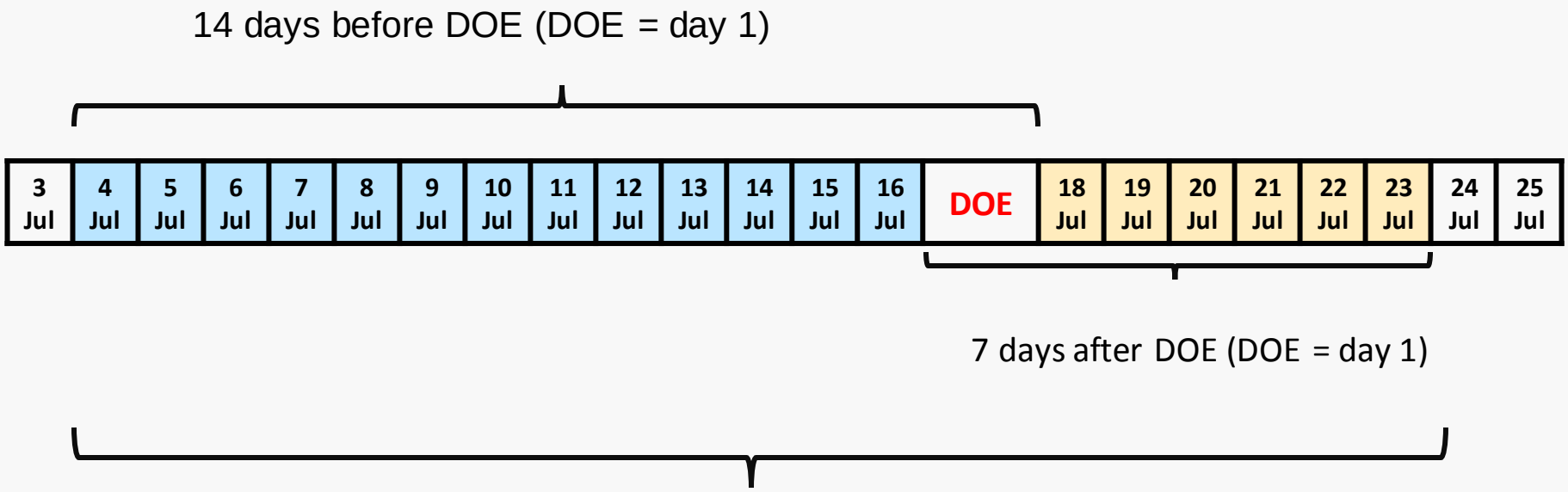
- **Secondary BSI = a BSI with a <u>matching positive culture</u> taken from another body site (urine, Tracheal aspirate, etc.) within the <u>Secondary BSI Attribution Period</u>**

Additional definitions – Secondary BSI

- **Secondary BSI Attribution Period (SBAP)**
  - Timeframe that includes the **14 calendar days before** the date of event **and the 7 days after** the date of event (where the date of event = Day 1)

- **Rationale**
  - 14 calendar days before:
    - Primary HAI that leads to secondary BSI likely occurs first – need to extend the SBAP back from the blood culture long enough to be clinically relevant
  - 7 days after:
    - Many labs take ~2 days to provide confirmation of positive blood culture – allows time for microbiological investigation of potential primary sites of infection

Additional definitions – Secondary BSI



Secondary BSI attribution period = 4 – 23 July

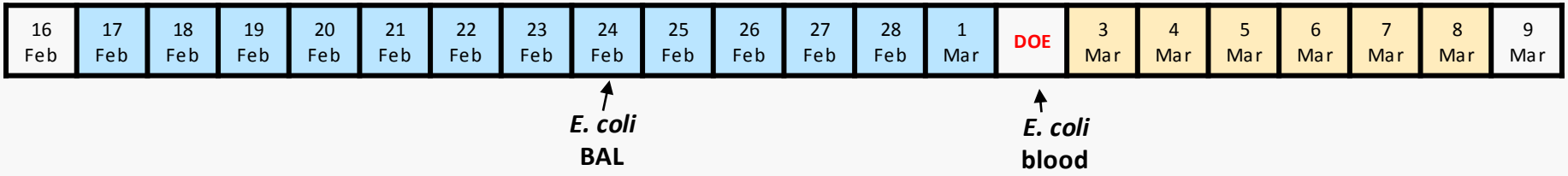
A BSI is classified as a Secondary BSI if matching organism is identified in cultures from any other body site during the 20 day SBAP

Scenario: Secondary BSI Attribution Period

- You identify a BSI caused by *E. coli* in a patient in your ICU with date of event of 2 March. When you review the patient's chart, you find that a BAL specimen collected on 24 Feb also grew *E. coli*.
- Is this classified as a secondary BSI?

Scenario: Secondary BSI Attribution Period

- You identify a BSI caused by *E. coli* in a patient in your ICU with date of event of 2 March. When you review the patient's chart, you find that a BAL specimen collected on 24 Feb also grew *E. coli*. Is this classified as a secondary BSI?



In this scenario, the secondary BSI attribution period runs from 17 Feb to 8 Mar.

A BAL culture that matches the blood culture was collected during the secondary BSI attribution period. **This BSI is classified as a secondary BSI**.

Secondary BSIs and Event Timeframe

- A patient is admitted to your ICU on 1 Sept. A central line is placed on 3 Sept.

- Blood cultures collected from this patient on 17 Sept grow *K. pneumoniae*. You review the patient's history and find that a BAL culture collected on 7 Sept also grew *K. pneumoniae.*
  - Due to the matching cultures, this episode is classified as a secondary BSI - the BSI is secondary to a primary respiratory infection.

- This patient spikes a fever on 26 Sept. Blood cultures are collected that day and grow *S. aureus*.

- How do you think the *S. aureus* blood culture should be treated?

Example 4: Applying the Secondary BSI Attribution Period

Surveillance Unit Day	Clinical / Laboratory Criteria	Window Period	Event Timeframe	Secondary BSI Attribution Period
3				
4				
5				
6				
7	(+) BAL culture *Klebsiella pneumoniae*			Matching (+) culture from other body site
8				
9				
10				
11				
12				
13				
14				
15				
16				
17	(+) blood culture *Klebsiella pneumoniae*	1st (+) blood culture	Secondary BSI. Event Timeframe is not created.	
18				
19				
20				
21				
22				
23				
24				
25				
26	(+) blood culture *S. aureus*			

Secondary BSIs and Event Timeframe

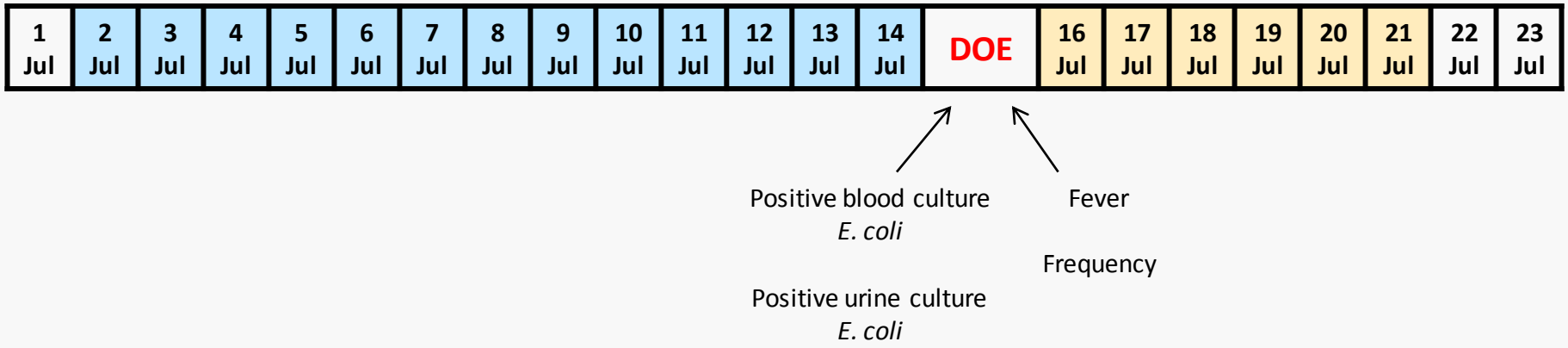
- Recall that an Event Timeframe is created to separate HAI events in the same person
- A secondary BSI is associated with a primary HAI at another body site
- The Event Timeframe applies to the primary HAI, not the secondary BSI
- Event Timeframe is created for primary BSIs, but is not created for secondary BSIs

Scenario: Secondary BSIs and Event Timeframe

- A patient is admitted to your ICU on 10 Jul. Urinary catheter and central line are placed on 12 Jul. On 15 Jul, the patient develops a fever and urinary frequency. Urine and blood specimens are collected that day and sent for culture. Both urine and blood cultures grow *E. coli* (urine at $>10^5$ CFU/mL). The patient is treated with antibiotics and symptoms resolve. On 23 Jul, the patient again develops fever. Blood cultures are drawn and grow *E. faecalis.*

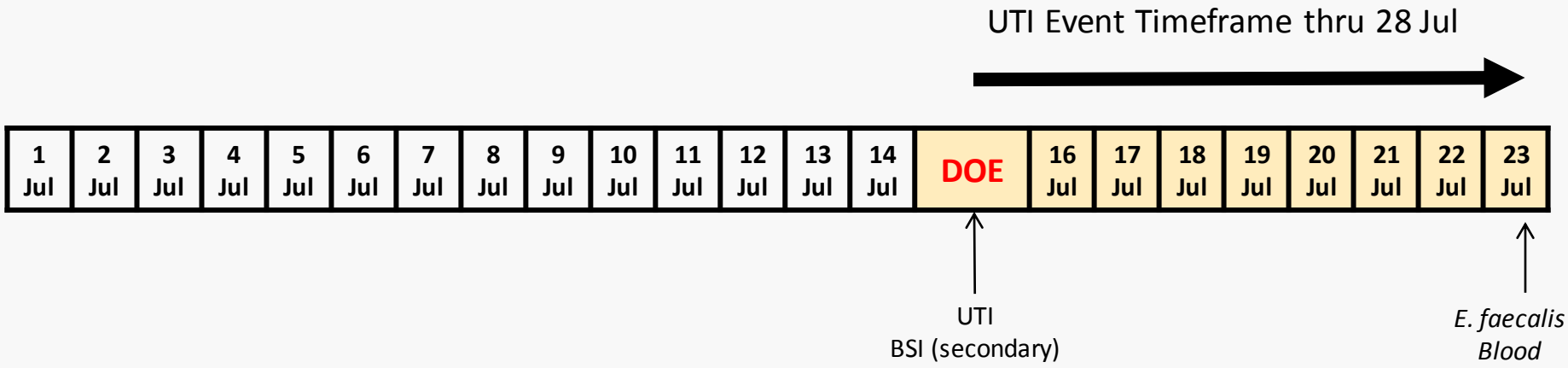
- What would your surveillance team report?

Scenario: Secondary BSIs and Event Timeframe



- Patient meets UTI case definition (culture plus symptoms) – create CRF. UTI is primary infection
- Patient meets BSI case definition (recognized pathogen) – create CRF. BSI is secondary to primary UTI.

Scenario: Secondary BSIs and Event Timeframe



- Event Timeframe is created for UTI, since UTI is primary HAI. No UTIs can be reported for this patient through 28 July.
- No Event Timeframe is created for BSI, since the BSI was associated with the primary UTI. Investigate *E. faecalis* as possible new BSI.

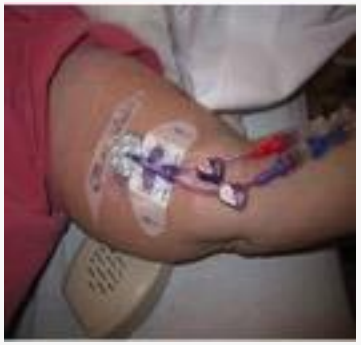
Additional definitions – Primary BSI

- A BSI that does not have a matching positive culture taken from another body site during the Secondary BSI Attribution Period is classified as a primary BSI

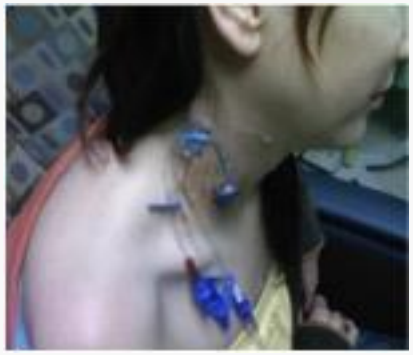
- Primary BSIs can be further classified into central line-associated BSIs (CLABSI) or primary BSIs not associated with central lines

Additional definitions – central line associated BSI

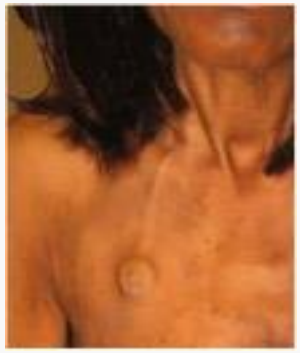
- **Central line:**
  - An intravascular catheter that terminates at or near the heart in one of the great vessels* and is used for infusion, blood draws, or monitoring
    - Neither the insertion site nor type of device alone can be used to determine if the line is a central line
    - The site where the device terminates is what determines central line status
  - Can be temporary (e.g. PICC line) or permanent (e.g. tunneled dialysis catheter). BSI surveillance in this network only tracks temporary lines.



PICC



Non-tunneled catheter



Port-a-cath

*Great vessels for the purpose of reporting central line status are found in the BSI surveillance protocol

Additional definitions – central line associated BSI

- **A central line-associated BSI (CLABSI) is defined as a primary BSI that meets one of the following criteria:**
  - A central line has been in place for >2 calendar days on the date of event, with day of central line insertion being Day 1

    OR
  - A central line was in place for >2 calendar days but had been removed on the date of event or the day before the date of event

Additional definitions – central line associated BSI

- **Example – central line in place for >2 calendar days on the date of event**

20 May	21 May	22 May (DOE)	23 May	24 May
Central line placed (day 1)	Central line day 2	Positive MRSA blood collected	Central line day 4	Central line day 5

Central line has been in place for 3 calendar days on the date of event

- **Example – central line in place for >2 calendar days but removed on the date of event or the day before the date of event**

20 Jun	21 Jun (DOE)	22 Jun	23 Jun	24 Jun
Central line removed (day 9)	Positive MRSA blood collected			New central line placed

Central line was in place for 9 days but removed the day before date of event

Identifying CLABSIs

- Case report form does not directly ask for the surveillance team to determine if the BSI was a CLABSI

- Surveillance team should report all BSIs that meet case definition and inclusion criteria

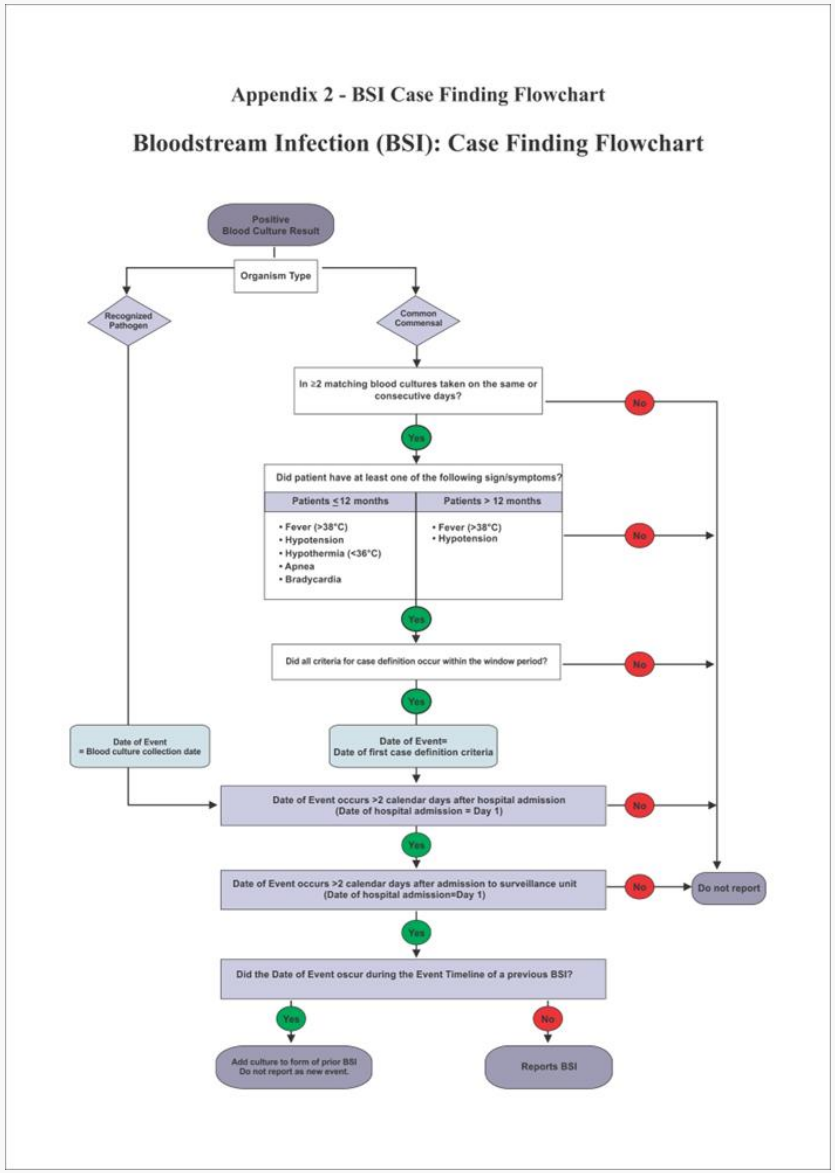
- CRF asks about history of central line use for each case. Data system determines whether or not the case is a CLABSI or primary, non-CLABSI based on the answers to these questions.

BSI Surveillance – Case Finding

Implementing BSI surveillance: case finding

- **Work with Microbiology lab to get regular positive blood culture data**
  - Check blood culture log book each day
  - Receive daily report of all positive blood cultures from ICUs
- **Work with ICU clinical staff to evaluate all patients for potential BSI**
  - Identify patients with BSI symptoms who have not been cultured
  - Assess need for cultures of other body sites to find source of BSI
- **Query a variety of data sources**
  - Medical records
  - Laboratory records
  - Conversations with clinical staff

BSI case finding flowchart (BSI module, appendix 2)



BSI case investigation worksheet

Bloodstream Infection (BSI) – Case Investigation Worksheet and Table

For all positive blood cultures:

1. Record collection date of blood culture: _____/_____/_____ Continue to Question 2.
2. Select type of organism in positive blood culture:

   ☐ Recognized Pathogen. If selected, then date of event = collection date of positive culture. Skip to Question 4.
   ☐ Common Commensal. If selected, continue to Question 3.

3. For common commensals only,

   3a. Did the common commensal have a matching blood culture collected on the same or consecutive day?
   ☐ Yes. If selected, record the result on the case investigation table and continue to Question 3b.
   ☐ No. If selected, the case definition is not met. **Do not report this episode**.

   3b. Did the patient have at least one of the following signs or symptoms during the window period?
   ☐ Yes. If selected, record the signs/symptoms on the case investigation table and continue to Question 3c.
   ☐ No. If selected, the case definition is not met. **Do not report this episode.**

BSI Case Investigation Table

Hospital Admission Date: ____/____/_____ ICU Admission Date: _____/____/_____

Date	First Positive Culture Record information for first positive blood culture on the line with the X.	Window Period Record matching commensal culture and symptoms.	Date of Event (DOE) Indicate DOE with an X.	Secondary BSI Attribution Period Record positive cultures from other body sites collected during the 14 days before DOE and the 7 days after DOE. DOE = Day 1.	Event Timeframe Record positive cultures from blood cultures collected during the 14 days after the DOE. DOE = Day 1.	Central Line? (Y/N)

BSI Worksheet

BSI Case Investigation Table

Hospital Admission Date: ____/____/_____ ICU Admission Date: _____/____/_____

Date	**First Positive Culture** Record information for first positive blood culture on the line with the X.	**Window Period** Record matching commensal culture and symptoms.	**Date of Event (DOE)** Indicate DOE with an X.	**Secondary BSI Attribution Period** Record positive cultures from other body sites collected during the 14 days before DOE and the 7 days after DOE. DOE = Day 1.	**Event Timeframe** Record positive cultures from blood cultures collected during the 14 days after the DOE. DOE = Day 1.	**Central Line?** (Y/N)
	X					

BSI Surveillance – Case Report Form

BSI case report form

Surveillance unit Number _____

Case ID: _____

Case Type _____

Patient Name _____

Medical record Number: _____

Hospital Name:

Sex: □ Male □ Female	Date of Birth (DD/MM/YYYY): __ /__ /__ Age (Years): ____ □ Age/DOB (Unknown)	Birth weight: _____grams (NICU only)

Date of hospital admission: ____ /_____ /_____ Date of admission to surveillance unit: ____ /_____ /_____

Location prior to hospital admission: □ Home / Community □ Another hospital □ Unknown

Linked Case ID **(autogenerated)** do not fill on Hard copy. **Only to be filled on software**

- **Instructions for completing CRF – BSI module, appendix 4**

- **Initial section of CRF captures demographic data**
  - Birth weight only required for cases identified in NICU (if hospital is doing surveillance in NICUs)
  - Use medical record or other sources of information to determine where patient was located before hospital admission, if possible
  - Ensure that dates of hospital admission and admission to the surveillance unit are accurately captured

BSI case report form

1. BSI Details	
Type of laboratory-confirmed BSI	□ Recognized Pathogen □ Common Commensal (from ≥ 2 blood cultures)
Date of event *(dd/mm/yyyy)*:	_____/_____/_____
Fill out culture results in Section 5, Organisms and Antibiotic Susceptibility	

- **Section 1 of CRF captures BSI information**
  - Record the date of event – recall that this is the date when the first criteria used to meet the case definition occurred
    - If first criteria met is a positive blood culture, then use date of **specimen collection** as date of event
  - Tick the box for the type of organism being reported
  - Details on the organism(s) isolated from blood and their antibiotic susceptibilities will be collected later in the CRF

BSI case report form

2. Invasive Devices: Central Lines	
Did the patient have a central line in place at any time on • The date of event **or** • The day before the date of event?	□ Yes □ No*(skip to 3, Infections at Other Body Sites)*
If **YES,** was the central line in place for >2 calendar days?	□ Yes □ No*(skip to 3, Infections at Other Body Sites)*
What was the last date before the date of event that the patient did not have a Central Lines in place at any time during the calender day?	----/-----/------- DD/MM/YYYY
How many times was the Central line changed during this period?	
If **YES,** type(s) of central line(s) in place *(check all that apply)*	□ Non-tunneled short-term catheter (e.g., double or triple lumen) □ Peripherally inserted central catheter (PICC) □ Port-a-cath □ Hemodialysis catheter □ Tunneled catheter □ Umbilical catheter □ Other, specify: _____
Location(s) of central line(s) in place *(check all that apply)*	□ Jugular □ Brachial □ Subclavian □ Umbilical □ Femoral □ Other, specify: _____

- **Section 2 of CRF records details of the patient's central line(s):**
  - Was the line in place on the date of event or the day before?
  - Was the line in place for at least 2 calendar days?
  - Type and site of all central lines

BSI case report form

3. Infections at Other Body Sites			
Was a positive, matching culture obtained from another body site(s) during the Secondary BSI Attribution Period?	□ Yes □ No *(skip to 4, Outcome)* □ Unknown		
If **YES**, specify specimen(s) collected, date(s) of culture, and organism(s).	Specimen Collected	Date of Collection	Organism
	1.		
	2.		
	3.		

- **Section 3 of CRF tracks positive cultures at other body sites**
  - Record all positive cultures from other body sites collected during the Secondary BSI Attribution Period that match the organism reported in the patient's blood culture

BSI case report form

4. Outcome		
Patient status at end of 14 days after DOE (Where DOE = Day 1)	□ Still in surveillance unit □ Transferred to other hospital □ Transferred to other ward/unit within the hospital □ Discharged □ LAMA □ Died □ Unknown	Date of discharge, transfer, or death: ____ /_____ /_____
Patient outcome at end of hospitalization	□ Discharged □ Transferred to other hospital □ LAMA □ Died □ Unknown	Date of discharge, transfer, or death: ____ /_____ /_____

- **Section 4 of CRF tracks patient outcomes**
  - Indicate the status of the patient at the end of 14 days after the date of event (where the date of event = day 1)
    - If a patient is still in the surveillance unit at the end of this time period, tick that box
  - Indicate the status of the patient at the end of their hospitalization and record date of discharge, transfer, or death
    - Small minority of cases might require long period of tracking

BSI case report form

5. Organisms and Antibiotic Susceptibility				
Date of sample collection	**Organism**	**Drugs**		
_____	*Staphylococcus epidermidis*	**OX** S I R N **VANC** S I R N **OTHER DRUG 5** S I R N	**CEFOX** S I R N **OTHER DRUG 1** S I R N	**METH** S I R N **OTHE** S I R N
_____	*Staphylococcus haemolyticus*	**OX** S I R N **VANC** S I R N	**CEFOX** S I R N **OTHER DRUG 1** S I R N	**METH** S I R N **OTHE** S I R N

- **Section 5 of CRF is used to report the organisms in the patient's blood culture(s) and their susceptibility results**
  - Common organisms that cause BSIs are listed in the table
  - Record the collection date in front of the organism name
  - If the organism is not in the list, record its name and specimen collection date in the "Other Organisms" section at the end of the table

BSI case report form – blood cultures

_____	*Staphylococcus aureus*	**CIPRO/LEVO/MOXI** S I R N	**CLIND** S I R N
		OX/CEFOX/METH S I R N	**RIF** S I R N

Drug Codes:

AMK = amikacin	CEFTRX = ceftriaxone
AMP = ampicillin	CEFUR= cefuroxime
AMPSUL = ampicillin/sulbactam	CTET= cefotetan
AMXCLV = amoxicillin/clavulanic acid	CIPRO = ciprofloxacin
ANID = anidulafungin	CLIND = clindamycin
AZT = aztreonam	COL = colistin

Result Codes

S = Susceptible I = Intermediate R = Resistant NS = Non-susceptible S-DD = Susceptible-dose dependent N = Not tested

- **Section 5 of CRF is used to report the organisms in the patient's blood culture(s) and their susceptibility results**
  - For each organism reported on the CRF, record the results of its antimicrobial susceptibility testing
  - Antimicrobials and results are shown as codes; list of codes is provided at the end of the form
  - Antimicrobials not tested in testing panel should be recorded as "N"

BSI Surveillance – Denominator Data Collection and Reporting

BSI surveillance – denominator data

- **Two denominators are collected each day in BSI surveillance**
  - **Central line days:**
    - Number of patients in the ICU with at least one central line in place
    - If a patient has more than one central line in place, only count one central line day
    - If a patient has a central line with multiple lumens, only count one central line day
  - **Patient days:**
    - Total number of patients in the ICU
    - Should be collected at the same time as central line days

Collecting denominator data

- **Denominator data should be collected at the same time every day**
  - Even on weekends or holidays
  - Denominators should only reflect the patients present in the surveillance unit at the time of collection
  - Data collection can be done by surveillance staff or clinical staff working in the surveillance unit
- **Each surveillance location should have its own denominator data collection form**
  - Denominator counts are recorded on the form for each day
  - Daily counts are added up at the end of each month and the form is given to the hospital surveillance team
  - A new denominator data collection form is started in each surveillance unit on the first day of each month

Denominator data collection form

Hospital Name:		Surveillance Unit Number:	Month:	Year:
Date	**Number of Patients**	Number of patients with ≥1 **central line**	Number of patients with **urinary catheter**
1			
2			
3			
4			
5			

- **Form included in generic HAI module protocol as Appendix 2**
- **Denominators for both BSI and UTI are included on the same form for easier data collection**

Collecting denominator data - neonatal ICUs

- **If surveillance is done in neonatal ICUs, denominator data can be stratified by birth weight categories in order to calculate more specific BSI rates**
  - Lower birth weight = increased risk
- **If this is not feasible, denominator data can be collected without birth weight using the adult/pediatric ICU form**

Hospital Name:		Location:		Month:		*Year:			
Birth Weight Categories									
Date	**A = ≤750 g**		**B = 751-1000 g**		**C =1001-1500 g**		**D = 1501-2500 g**		**E= >2500 g**	
	Pt	CL	Pt	CL	Pt	CL	Pt	CL	Pt	CL
1										
2										
3										

Counting daily denominators

- The charge nurse in your 5 bed surgical ICU is responsible for collecting BSI denominator data. She collects the denominator data every day at 10:00 AM. How many central line days and patient days should she report for the day summarized below?

Bed Number	Patient Information
1	Patient has been in the ICU for 3 days and has a femoral and jugular central line.
2	This bed is empty until a patient is transferred from the operating room at 3 PM. The patient has a subclavian central line.
3	Patient has been in the ICU for 2 days and has a peripherally inserted central catheter (PICC).
4	Patient has been in the ICU for 10 days and had his femoral central line removed yesterday.
5	The patient in this bed was discharged at 8 AM and did not have any central lines.

Counting daily denominators

Bed Number	Patient Information	Patient Day?	Central Line Day?
1	Patient has been in the ICU for 3 days and has a **femoral and jugular** central line.	Yes	Yes
2	This bed is **empty until a patient is transferred from the operating room at 3 PM**. The patient has a subclavian central line.	No	No
3	Patient has been in the ICU for 2 days and **has a peripherally inserted central catheter** (PICC).	Yes	Yes
4	Patient has been in the ICU for 10 days and had his **femoral central line removed yesterday**.	Yes	No
5	The patient in this bed was **discharged at 8 AM** and did not have any central lines.	No	No
		Total = 3	**Total = 2**

- Only include patients present in the unit at the time of the count
- Patients with multiple temporary central lines only count as one central line day

BSI Surveillance – Data Analysis and Feedback

BSI surveillance – analysis metrics

- **Several metrics can be calculated as part of BSI surveillance**

- **BSI rates (use patient days as denominator):**
  - Total BSI rate = number of BSIs per 1,000 patient days
  - Primary BSI rate = number of primary BSIs per 1,000 patient days

- **CLABSI rates (use central line days as denominator):**
  - CLABSI rate = number of CLABSIs per 1,000 central line days

- **Central line use:**
  - Device utilization ratio (DUR) = proportion of patient days that are also central line days

Analysis example – CLABSI data

Unit	Number of CLABSIs
Medical ICU	3
Surgical ICU	4
Pediatric ICU	9

- Your diligent surveillance team has finished their first month of surveillance! The number of CLABSIs that were identified in each unit is displayed in the table above.

- What do you think of this data? Does it suggest a problem?

CLABSI data after one month of surveillance

Unit	Number of CLABSIs	Number of Beds in Unit	Number of Central Line Days
Medical ICU	3	10	200
Surgical ICU	4	10	275
Pediatric ICU	9	30	800

- **The pediatric unit had the highest number of CLABSIs – but it also is much larger than the medical and surgical ICUs**

- **Before we can think about potential areas of concern, we need to look at CLABSI rates**

CLABSI incidence rates

$$CLABSI\ incidence = \frac{\#\ of\ reported\ CLABSIs}{\#\ of\ central\ line\ days}\ x\ 1000$$

Unit	Number of CLABSIs	Number of Central Line Days	CLABSI Rate Calculation	CLABSI Rate per 1,000 CL Days
Medical ICU	3	200	(3/200) x 1000	15.0
Surgical ICU	4	275	(4/275) x 1000	14.5
Pediatric ICU	9	800	(9/800) x 1000	11.3

CLABSI data after one month of surveillance

Unit	Number of CLABSIs	Number of Central Line Days	CLABSI Rate per 1,000 CL Days
Medical ICU	3	200	15.0
Surgical ICU	4	275	14.5
Pediatric ICU	9	800	11.3

- **Units that have high rates of central line usage are more likely to have higher CLABSI rates**
- **Removing unnecessary central lines can lead to reductions in CLABSI rates**
- **Device utilization rate (DUR) can be used to assess central line usage**

Device utilization ratio for central lines

$$DUR = \frac{\text{\# of central line days}}{\text{\# of patient days}}$$

Unit	Number of CLABSIs	Number of CL Days	CLABSI Rate per 1,000 CL Days	Number of Patient Days	Device Utilization Ratio
Medical ICU	3	200	15.0	290	200/290 = 0.689
Surgical ICU	4	275	14.5	295	275/295 = 0.932
Pediatric ICU	9	800	11.3	847	800/847 = 0.945

Device utilization ratio for central lines

Unit	Number of CLABSIs	Number of CL Days	CLABSI Rate per 1,000 CL Days	Number of Patient Days	Device Utilization Ratio
Medical ICU	3	200	15.0	290	200/290 = 0.689
Surgical ICU	4	275	14.5	295	275/295 = 0.932
Pediatric ICU	9	800	11.3	847	800/847 = 0.945

- **DUR can be multiplied by 100 and expressed as a percent**
  - For pediatric ICU, DUR = 0.945 = 94.5%
  - Interpretation: 94.5% of patient days in the pediatric ICU were also central line days

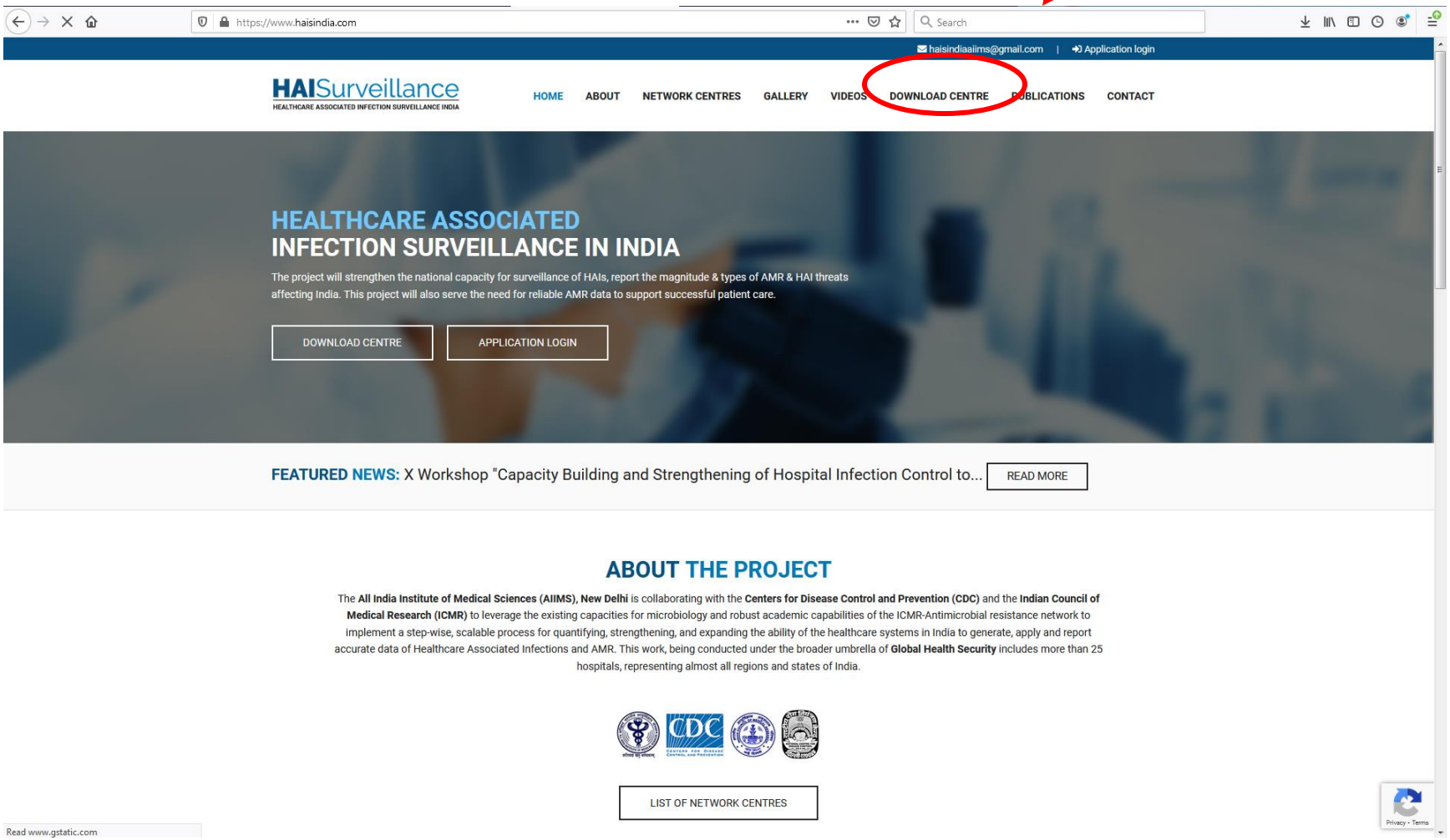
- **Maximum DUR = 1.00 (100%)**

Surveillance data and CLABSI prevention

Unit	Number of CLABSIs	Number of CL Days	CLABSI Rate per 1,000 CL Days	Number of Patient Days	Device Utilization Ratio
Medical ICU	3	200	15.0	290	200/290 = 0.689
Surgical ICU	4	275	14.5	295	275/295 = 0.932
Pediatric ICU	9	800	11.3	847	800/847 = 0.945

- **How can these metrics inform CLABSI prevention efforts?**
  - Surgical ICU – has a high CLABSI rate and a high DUR. Consider an intervention to focus on unnecessary central lines?
  - Pediatric ICU – has the lowest CLABSI rate but the highest DUR. Maybe removing unnecessary central lines can drive rates even lower?
  - Medical ICU – has the highest CLABSI rate but lowest DUR. Maybe other factors are influencing the rate? Insertion/maintenance practices?

Case Scenarios
www.haisindia.com



BSI Worksheet

BSI Case Investigation Table

Hospital Admission Date: ___/___/____ ICU Admission Date: ____/____/____

Date	**First Positive Culture** Record information for first positive blood culture on the line with the X.	**Window Period** Record matching commensal culture and symptoms.	**Date of Event (DOE)** Indicate DOE with an X.	**Secondary BSI Attribution Period** Record positive cultures from other body sites collected during the 14 days before DOE and the 7 days after DOE. DOE = Day 1.	**Event Timeframe** Record positive cultures from blood cultures collected during the 14 days after the DOE. DOE = Day 1.	**Central Line?** (Y/N)
	X					