Device-Associated Infections

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OBJECTIVES

- ✓ Describe a central line-associated bloodstream infection (CLABSI) using NHSN/CDC criteria
- ✓ Describe a catheter-associated urinary tract infection (CAUTI) using NHSN/CDC criteria
- ✓ Describe a ventilator-associated event (VAE) using NHSN/CDC criteria
- ✓ Detail best practices for the prevention of CLABSI, CAUTI and VAE

NHSN CHAP 2 SURVEILLANCE DEFINITIONS

- Infection Window Period (IWP): the 7 days during which all site-specific infection criteria must be met.

← INFECTION WINDOW PERIOD →						
3	DAYS	BEFORE	First Positive Diagnostic Test	3	DAYS	AFTER

- Date of event (DOE): the date the <u>first</u> element used to meet a site-specific infection criterion occurs for the <u>first</u> time within the seven-day IWP. DOE is used to determine:
  - If an event is HAI or POA
  - Location of attribution
  - Device association
  - Day 1 of the Repeat Infection Timeframe

NHSN CHAP 2 SURVEILLANCE DEFINITIONS

- Repeat Infection Timeframe (RIT): a 14-day timeframe during which no new infections of the same type are reported.
  - Applies to both POA and HAI determinations.
  - Date of event is Day 1
  - If criteria for the same type of infection are met and the date of event is within the 14-day RIT, a new event is not identified or reported.
  - Additional pathogens recovered during RIT from same type of infection are added to the event.

NHSN TRAINING

https://www.cdc.gov/nhsn/training/patient-safety-component/index.html

PSC Overview

Training Videos

General NHSN Definitions for 2019 – May 2019

- YouTube Link [Video – 52 min]
- Slideset [PDF – 5 MB]

Quick Learns

Determining Healthcare Association or Present on Admission Infections and Other Rules – July 2017

- YouTube Link [Video – 16 min]

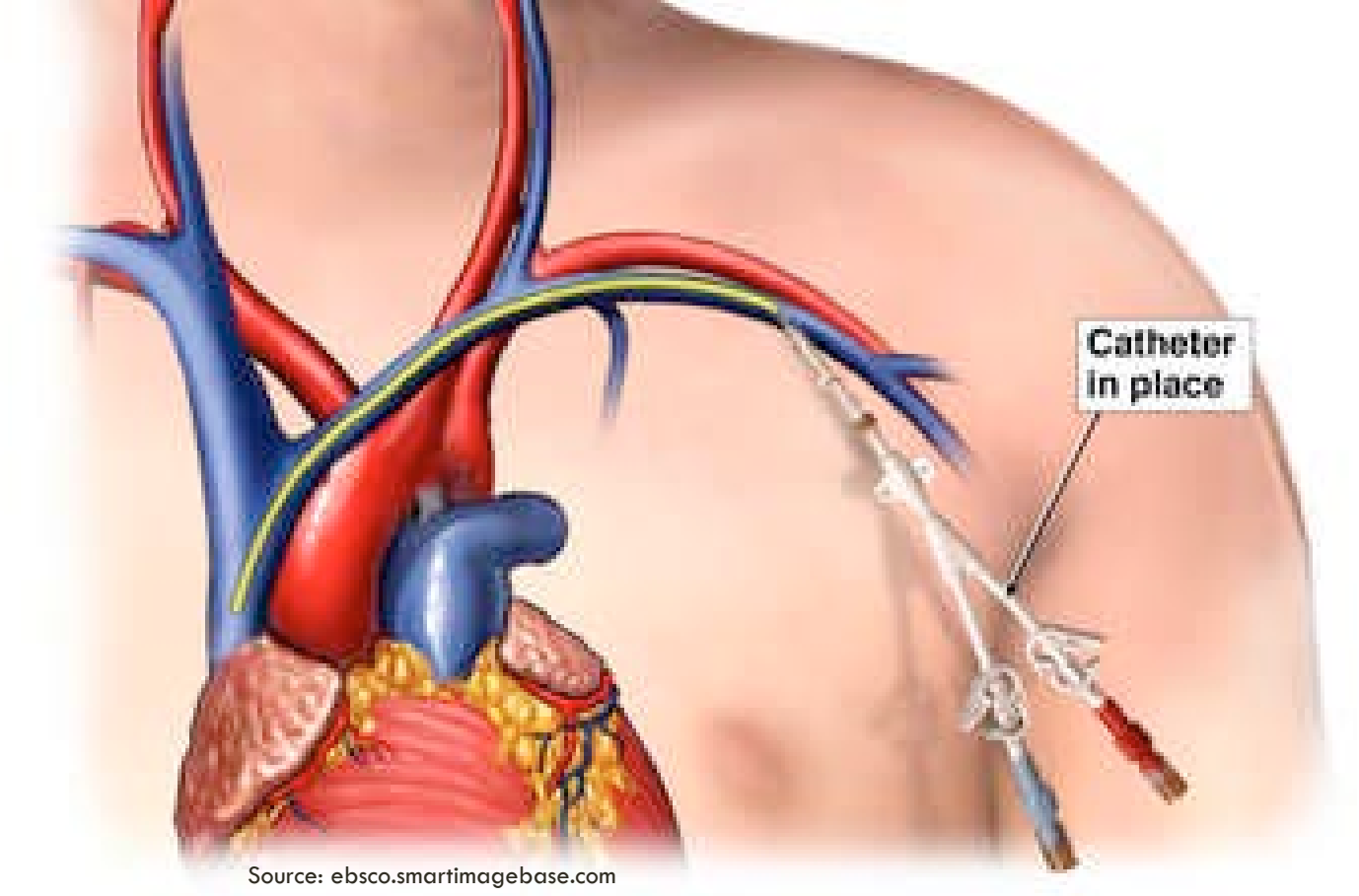
CLABSI: THE PROBLEM

- 46% decrease in CLABSIs across U.S. hospitals from 2008-2013[1]
- Central line-associated bloodstream infections (CLABSIs) result annually in:
  - 84, 551 to 203, 916 preventable infections
  - 10,426 to 25,145 preventable deaths
  - $1.7 to $21.4 billion avoidable costs[2]

[1]CDC National and State Healthcare-Associated Infections Progress Report, published October 2018, available at http://www.cdc.gov/hai/data/portal/progress-report.html

[2]Umscheid CA, Mitchell MD et al. Estimating the proportion of reasonably preventable hospital-acquired infections and associated mortality and costs. *Infect Control Hosp Epidemiol*. 2011 Feb;32(2):101-114.

Source: iStock

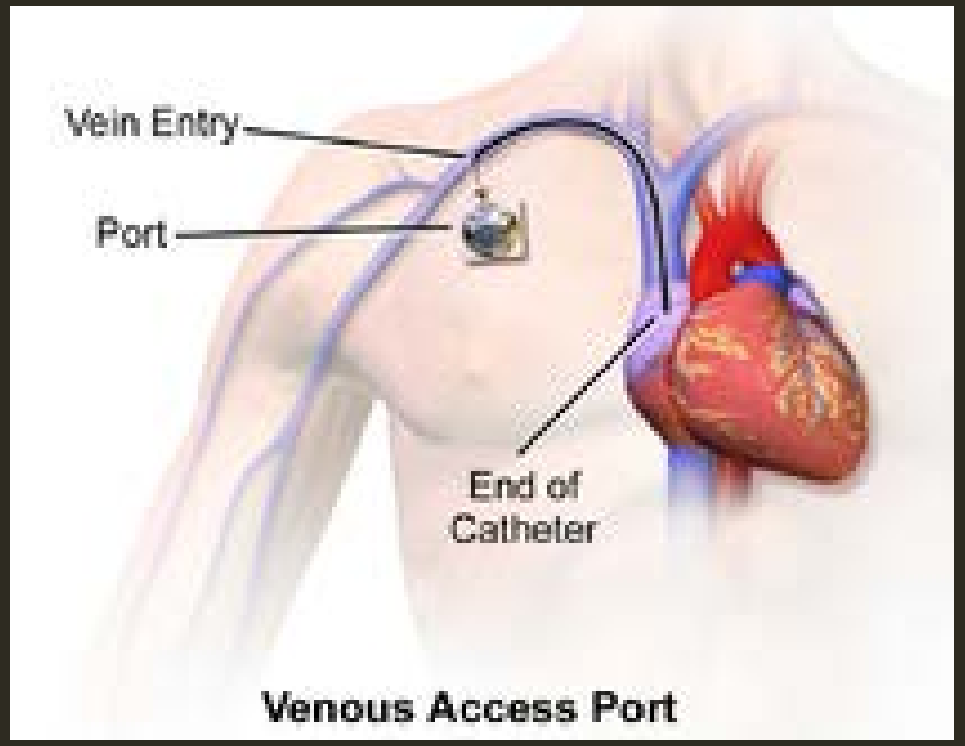


Source: ebsco.smartimagebase.com

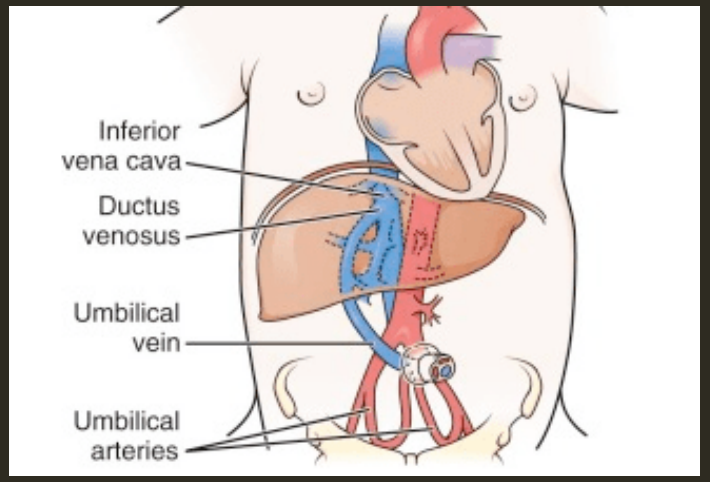
WHAT IS A CENTRAL LINE?

Intravascular catheter that terminates at or close to the heart or in one of the major vessels which is used for infusion, withdrawal of blood, or hemodynamic monitoring

- Aorta
- Pulmonary artery
- Superior vena cava
- Inferior vena cava
- Brachiocephalic veins
- Internal jugular veins
- Subclavian veins
- External iliac veins
- Common iliac veins
- Femoral veins
- In neonates, the umbilical artery/vein



Source: Wikipedia

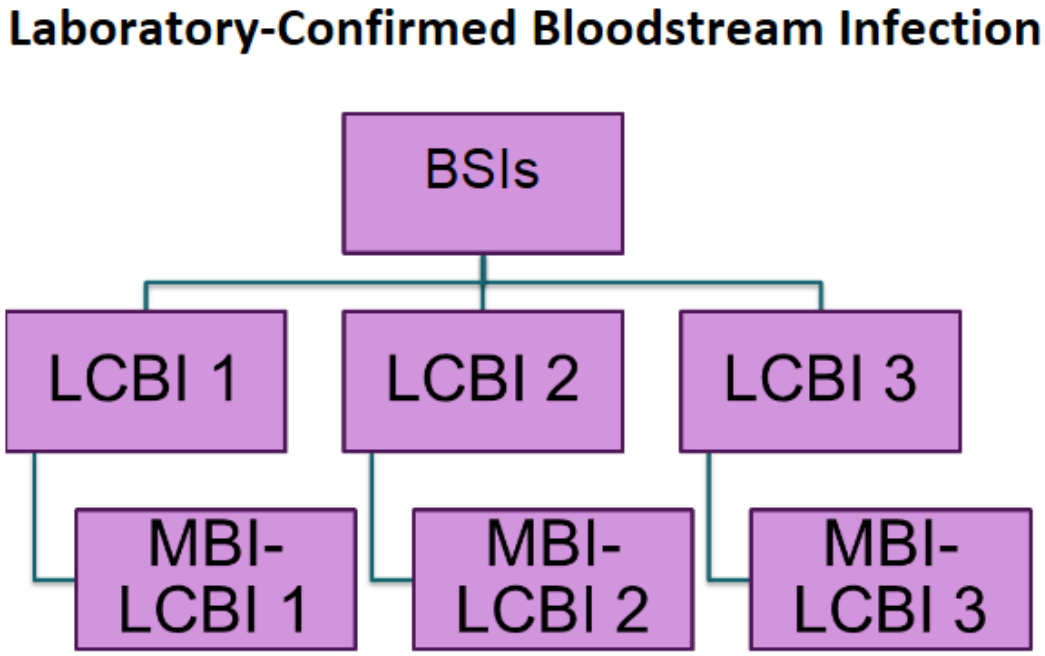


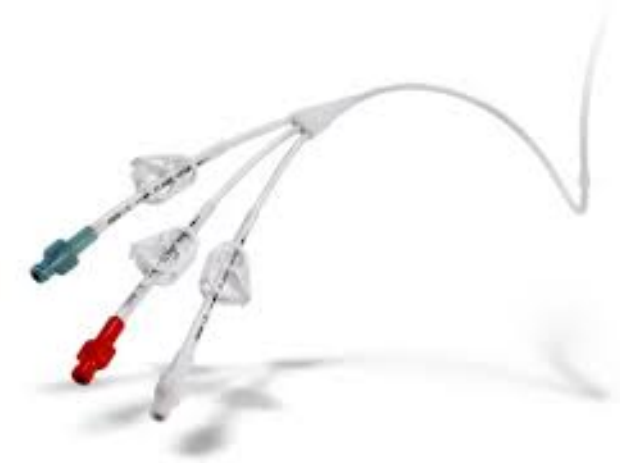
Source: Brown University Blogs

TYPES OF CENTRAL LINES

- Temporary/Non-tunneled
- Permanent/Tunneled
- Umbilical catheter

➢ Eligible central line: a central line that has been in place for >2 consecutive calendar days following the **first access** of the central line, in an inpatient location, during the current admission





Source: The Joint Commission

LABORATORY-CONFIRMED BLOODSTREAM INFECTIONS (LCBI) OR PRIMARY BSIS

LCBI CRITERION 1

Patient of any age has a recognized bacteria or fungal pathogen not included on the NHSN common commensal list, identified from one or more blood specimens obtained by a culture or non-culture based microbiologic testing method

AND

Organism(s) identified in the blood is not related to an infection at another site

LCBI CRITERION 2

Patient of any age has at least ***one*** of the following signs or symptoms: fever (>38.0^{0}C), chills, or hypotension

AND

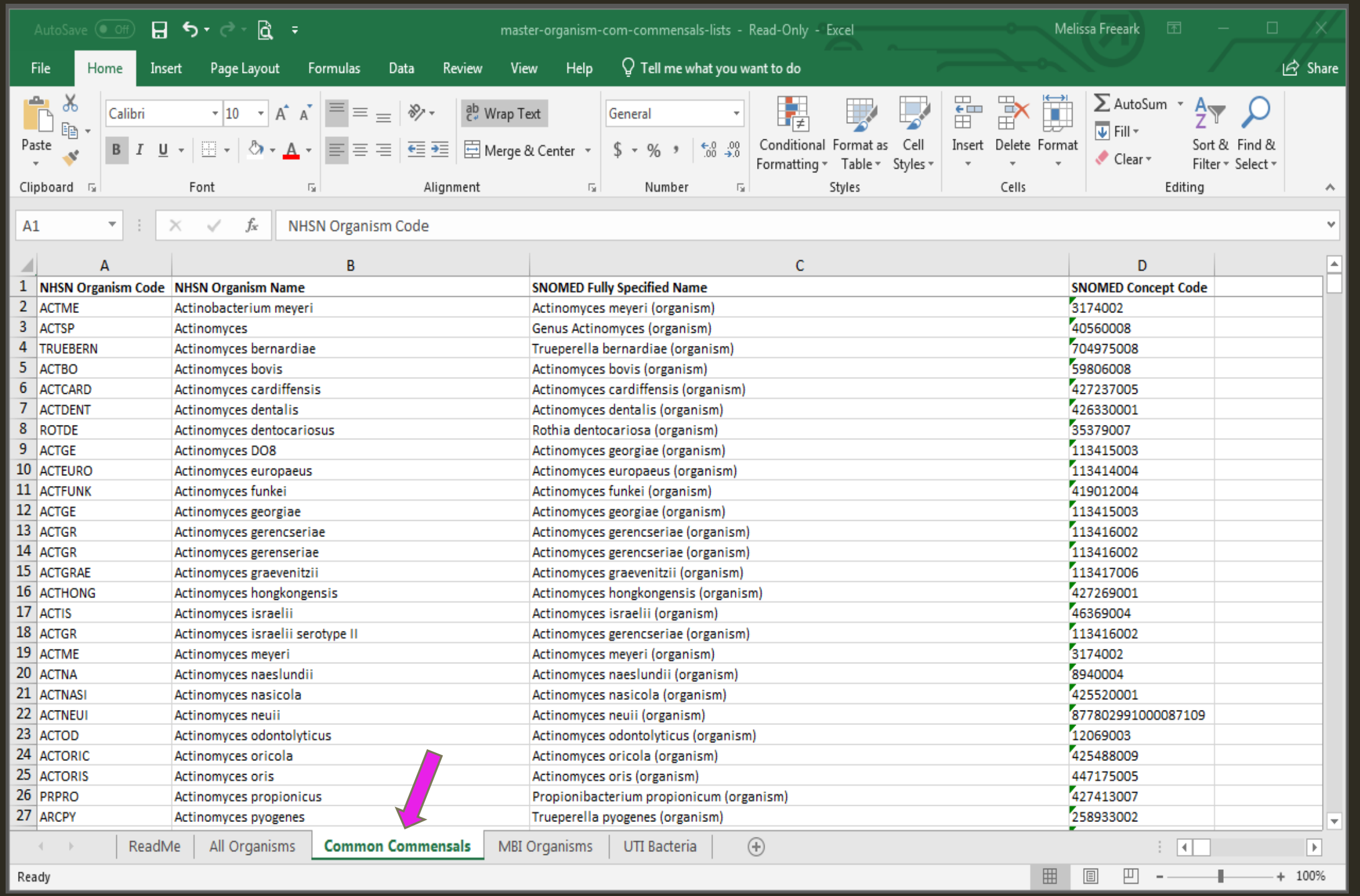
Organism(s) identified in blood is not related to an infection at another site

AND

The same NHSN common commensal is identified by a culture or non-culture based microbiological testing method, from two or more blood specimens collected on separate occasions

NHSN

MASTER ORGANISMS COMMON COMMENSAL LIST



master-organism-com-commensals-lists - Read-Only - Excel

NHSN Organism Code	NHSN Organism Name	SNOMED Fully Specified Name	SNOMED Concept Code
ACTME	Actinobacterium meyeri	Actinomyces meyeri (organism)	3174002
ACTSP	Actinomyces	Genus Actinomyces (organism)	40560008
TRUEBERN	Actinomyces bernardiae	Trueperella bernardiae (organism)	704975008
ACTBO	Actinomyces bovis	Actinomyces bovis (organism)	59806008
ACTCARD	Actinomyces cardiffensis	Actinomyces cardiffensis (organism)	427237005
ACTDENT	Actinomyces dentalis	Actinomyces dentalis (organism)	426330001
ROTDE	Actinomyces dentocariosus	Rothia dentocariosa (organism)	35379007
ACTGE	Actinomyces DO8	Actinomyces georgiae (organism)	113415003
ACTEURO	Actinomyces europaeus	Actinomyces europaeus (organism)	113414004
ACTFUNK	Actinomyces funkei	Actinomyces funkei (organism)	419012004
ACTGE	Actinomyces georgiae	Actinomyces georgiae (organism)	113415003
ACTGR	Actinomyces gerencseriae	Actinomyces gerencseriae (organism)	113416002
ACTGR	Actinomyces gerenseriae	Actinomyces gerencseriae (organism)	113416002
ACTGRAE	Actinomyces graevenitzii	Actinomyces graevenitzii (organism)	113417006
ACTHONG	Actinomyces hongkongensis	Actinomyces hongkongensis (organism)	427269001
ACTIS	Actinomyces israelii	Actinomyces israelii (organism)	46369004
ACTGR	Actinomyces israelii serotype II	Actinomyces gerencseriae (organism)	113416002
ACTME	Actinomyces meyeri	Actinomyces meyeri (organism)	3174002
ACTNA	Actinomyces naeslundii	Actinomyces naeslundii (organism)	8940004
ACTNASI	Actinomyces nasicola	Actinomyces nasicola (organism)	425520001
ACTNEUI	Actinomyces neuii	Actinomyces neuii (organism)	877802991000087109
ACTOD	Actinomyces odontolyticus	Actinomyces odontolyticus (organism)	12069003
ACTORIC	Actinomyces oricola	Actinomyces oricola (organism)	425488009
ACTORIS	Actinomyces oris	Actinomyces oris (organism)	447175005
PRPRO	Actinomyces propionicus	Propionibacterium propionicum (organism)	427413007
ARCPY	Actinomyces pyogenes	Trueperella pyogenes (organism)	258933002

LCBI CRITERION 3

Source: CDC

Patient ≤1 year of age has at least ***one*** of the following signs or symptoms:

fever (>38.0^{0}C), hypothermia (<36.0^{0}C), apnea or bradycardia

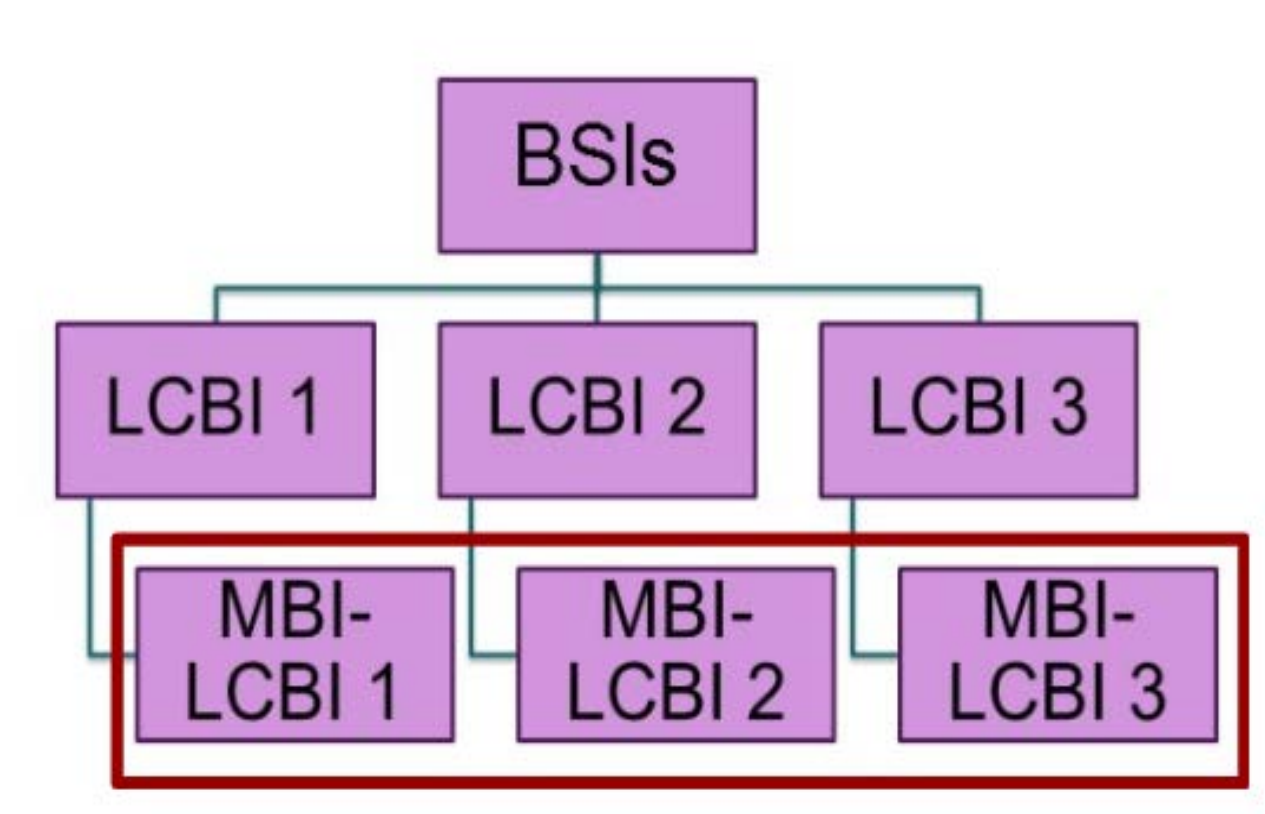
AND

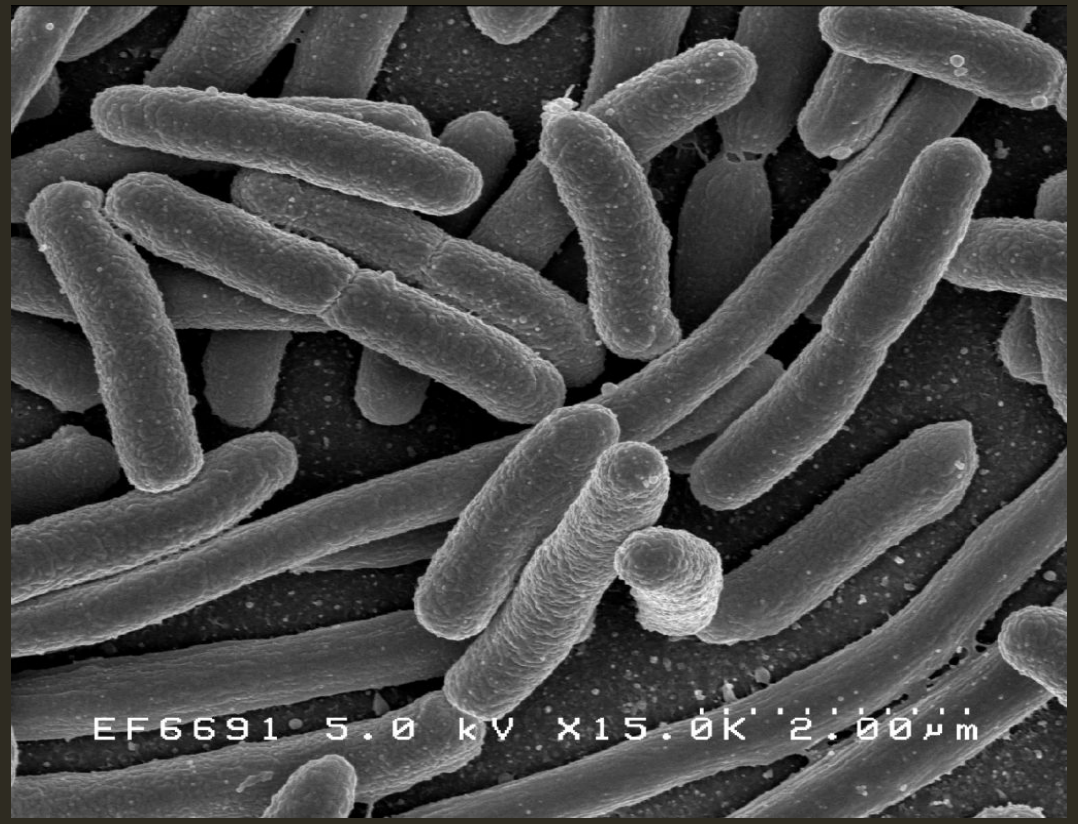
Organism(s) identified in blood is not related to an infection at another site

AND

The same NHSN common commensal is identified by a culture or non-culture based microbiological testing method, from two or more blood specimens collected on separate occasions

MUCOSAL BARRIER INJURY LABORATORY-CONFIRMED BLOODSTREAM INFECTION





Source: Wikipedia

MBI-LCBI CRITERIA

MBI-LCBI 1	MBI-LCBI 2	MBI-LCBI 3
Patient of **any age** fully meets LCBI 1 criteria	Patient of **any age** fully meets LCBI 2 criteria	Patient **≤1 year of age** fully meets LCBI 3 criteria
with at least **one** blood specimen	with at least **two** blood specimens	
identified by culture or non-culture based microbiologic testing method		
with **ONLY intestinal organisms** from the NHSN MBI organism list*	with **ONLY Viridans Group *Streptococcus*** or ***Rothia spp.*** but no other organisms	

AND

Patient meets at least *one* of the following:

1. Is an allogeneic hematopoietic stem cell transplant recipient within the past year with one of the following documented during same hospitalization as positive blood specimen:
   a. Grade III or IV gastrointestinal graft versus host disease [GI GVHD]
   b. ≥1-liter diarrhea in a 24-hour period (or ≥20 mL/kg in a 24-hour period for patients <18 years of age) with onset on or within the 7 calendar days before the date the positive blood specimen was collected.
2. Is neutropenic, defined as at least two separate days with ANC† and/or WBC values <500 cells/mm^3 collected within a 7-day time period which includes the collection date of the positive blood specimen, the 3 calendar days before and the 3 calendar days after (See Table 6).

MBI-LCBI CRITERIA

MBI-LCBI 1	MBI-LCBI 2	MBI-LCBI 3
Patient of **any age** fully meets LCBI 1 criteria	Patient of **any age** fully meets LCBI 2 criteria	Patient **≤1 year of age** fully meets LCBI 3 criteria
with at least **one** blood specimen	with at least **two** blood specimens	
identified by culture or non-culture based microbiologic testing method		
with **ONLY intestinal organisms** from the NHSN MBI organism list*	with **ONLY Viridans Group *Streptococcus*** or ***Rothia spp.*** but no other organisms	

AND

Patient meets at least *one* of the following:

1. Is an allogeneic hematopoietic stem cell transplant recipient within the past year with one of the following documented during same hospitalization as positive blood specimen:
   a. Grade III or IV gastrointestinal graft versus host disease [GI GVHD]
   b. ≥1-liter diarrhea in a 24-hour period (or ≥20 mL/kg in a 24-hour period for patients <18 years of age) with onset on or within the 7 calendar days before the date the positive blood specimen was collected.
2. Is neutropenic, defined as at least two separate days with ANC† and/or WBC values <500 cells/mm^3 collected within a 7-day time period which includes the collection date of the positive blood specimen, the 3 calendar days before and the 3 calendar days after (See Table 6).

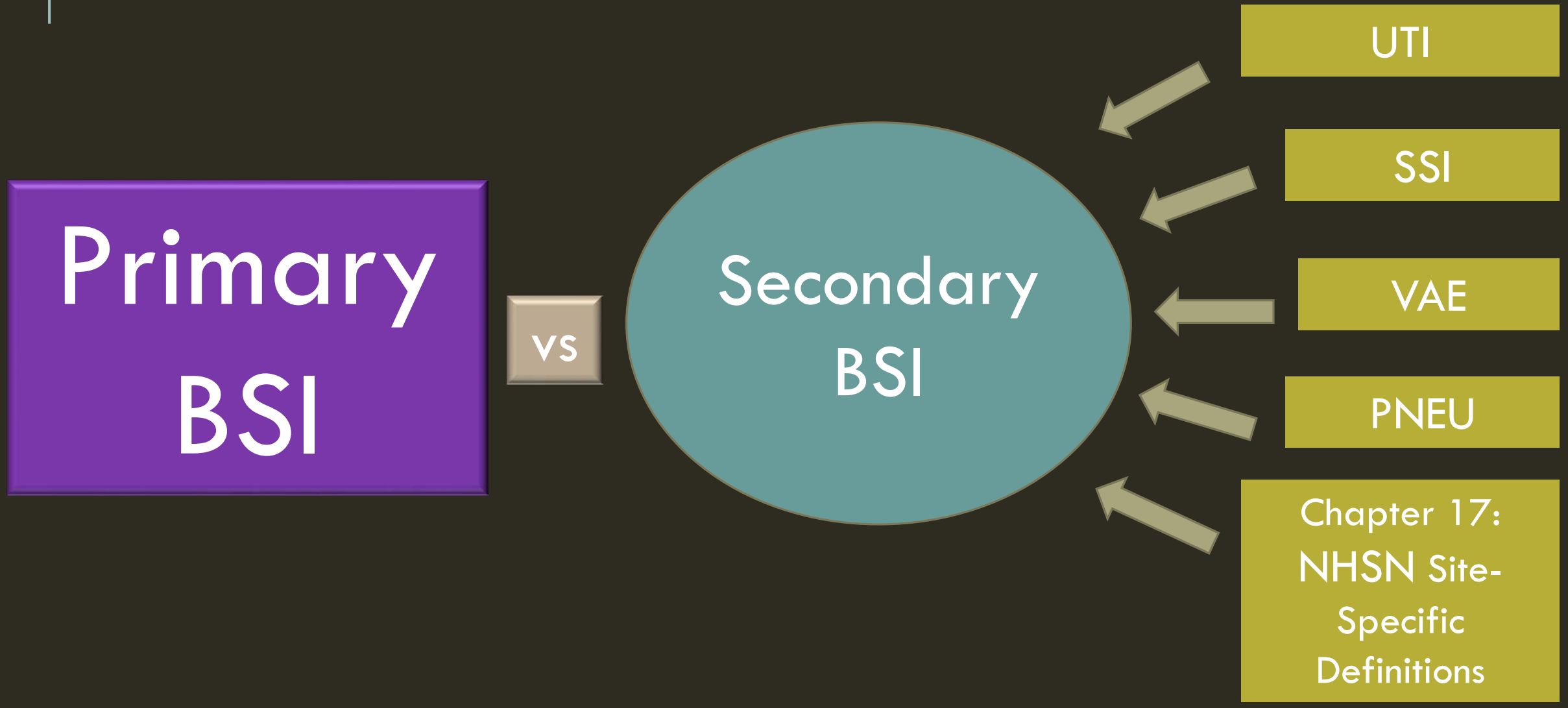
APPENDIX A: PARTIAL LIST OF MBI-LCBI ORGANISMS

Appendix A: Partial List of MBI-LCBI Organisms

Abiotrophia	*Escherichia (E)*	*Pantoea (+E)*
Alistipes	*Eubacterium*	*Parabacteroides*
Alloscardovia	*Ewingella (E)*	*Peptostreptococcus*
Anaerobiospirillum	*Faecalibacterium*	*Pichia*
Anaerococcus	*Filifactor*	*Porphyromonas*
Anaerorhabdus	*Finegoldia*	*Prevotella*
Arcobacter	*Flavonifractor*	*Proteus (E)*
Atopobium	*Fusobacterium*	*Providencia (E)*
Averyella (+E)	*Gemella*	*Pseudoflavonifractor*
Bacteroides	*Geotrichum*	*Pseudoramibacter*
Bifidobacterium	*Granulicatella*	*Rahnella (E)*
Bilophila	*Hafnia (E)*	*Raoultella (+E)*
Blautia	*Helcococcus*	*Rothia*
Buttiauxella (E)	*Helicobacter*	*Ruminococcus*
Campylobacter	*Klebsiella (E)*	*Saccharomyces*
Candida	*Kluyvera (E)*	*Sarcina*
Capnocytophaga	*Kluyveromyces*	*Serratia (E)*
CDC Enteric Group 58 (+E)	*Lactobacillus*	*Shigella (E)*
Cedecea (E)	*Leclercia (E)*	*Slackia*
Citrobacter (E)	*Leminorella (E)*	*Streptococcus (VGS subset)*
Clostridium	*Leptotrichia*	*Tannerella*
Collinsella	*Leuconostoc*	*Tatumella (E)*
Cronobacter (+E)	*Megamonas*	*Tetragenococcus*
Dialister	*Megasphaera*	*Tissierella*
Dichelobacter	*Mitsuokella*	*Trabulsiella (E)*
Edwardsiella (E)	*Moellerella (E)*	*Veillonella*
Eggerthella	*Mogibacterium*	*Weissella*
Eggerthia	*Morganella (E)*	*Yersinia (E)*
Enterobacter (E)	*Obesumbacterium (+E)*	*Yokenella (E)*
Enterococcus	*Odoribacter*	

E = Family Enterobacteriaceae

PRIMARY VS SECONDARY BSIS



SECONDARY BSI

Must meet one of the CDC/NHSN site-specific definitions (Chapter 17, UTI, PNEU or SSI)

AND

One of the following scenarios must be met:

At least one organism from the blood specimen matches an organism identified from the site-specific specimen that is used as an element to meet the NHSN site-specific infection criterion AND the blood specimen is collected during the secondary BSI attribution period (infection window period + repeat infection timeframe).

OR

An organism identified in the blood specimen is an element that is used to meet the NHSN site-specific infection criterion, and therefore is collected during the site-specific infection window period.

SCENARIO 1: (+) Blood specimen must contain at least one matching organism to the site-specific specimen

Table B1: Secondary BSI Guide: List of all NHSN primary site-specific definitions available for making secondary BSI determinations using Scenario 1 or Scenario 2

Scenario 1	Scenario 2
A positive blood specimen must contain at least **one eligible matching organism** to the site-specific specimen	Positive blood specimen must be an **element** of the **site-specific definition**
And the blood specimen is collected in the site-specific **secondary BSI attribution period**	**And** blood specimen is collected in the site-specific **infection window period**
And an eligible organism **identified from the site-specific specimen** is used as an element to meet the site-specific definition	And an eligible organism **identified in a blood specimen** is used as an element to meet the site-specific definition

Site	Criterion
ABUTI	ABUTI
BONE	1
BRST	1
CARD	1
CIRC	2 or 3
CONJ	1
DECU	1
DISC	1
EAR	1, 3, 5 or 7,
EMET	1
ENDO	1
EYE	1
GE	2a
GIT	2a, 2b (only yeast)
IAB	1 or 3a
IC	1
JNT	1
LUNG	1
MED	1
MEN	1
ORAL	1 or 3a
OREP	1
PJI	1
PNEU	2 or 3
SA	1
SINU	1
SSI	SI, DI or OS
SKIN	2a
ST	1
UMB	1a
UR	1a or 3a
USI	1
SUTI	1a, 1b or 2
VASC *only as SSI*	1
VCUF	3

Site	Criterion
BONE	3a
BURN	1
DISC	3a
ENDO	4a, 4b, 5a or 5b (specific organisms) 6e or 7e plus other criteria as listed
GIT	1b or 2c
IAB	2b or 3b
JNT	3c
MEN	2c or 3c
OREP	3a
PNEU	2 or 3
SA	3a
UMB	1b
USI	3b or 4b

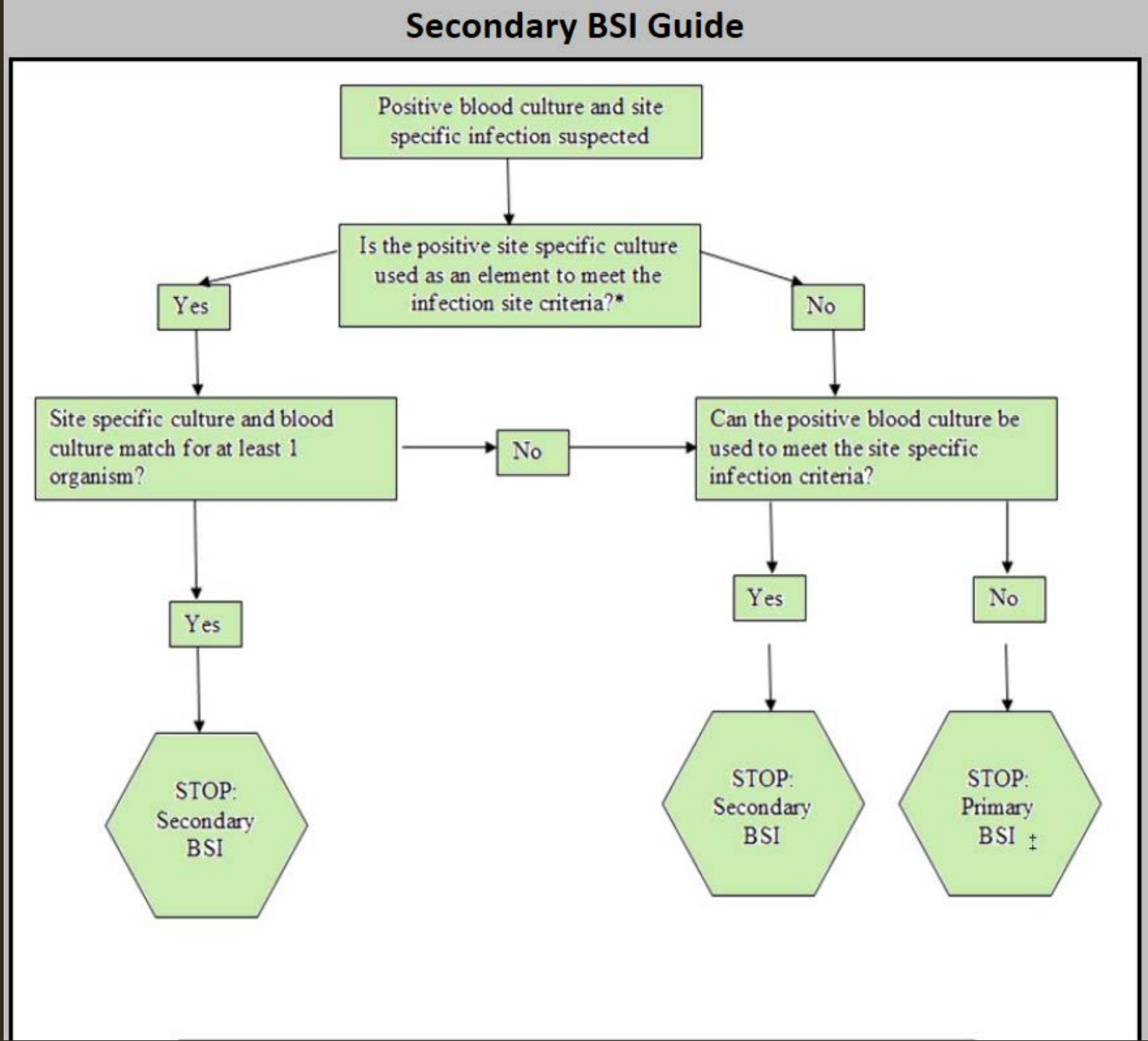
SCENARIO 2: (+) Blood specimen is an element of the site-specific definition

NHSN CHAP 2 SURVEILLANCE DEFINITIONS

- Secondary BSI Attribution Period (SBAP): the period in which a blood specimen must be collected for a secondary bloodstream infection to be attributed to a primary site of infection.

INFECTION WINDOW PERIOD	+	REPEAT INFECTION TIMEFRAME
←14-17 DAYS →		

SECONDARY BSI GUIDE



https://nhsn.cdc.gov/nhsntraining/calculator/workgen.html

Admit date: 9/1/2019

Hospital Day/Date	First Diagnostic Test	Infection Window Period (*)	Date of Event	Repeat Infection Timeframe (*)
3. - 9/3/2019		☐	-	
4. - 9/4/2019		☐	-	
5. - 9/5/2019		☐	-	
6. - 9/6/2019	✔	☑	- HAI	
7. - 9/7/2019		☐	-	
8. - 9/8/2019		☐	-	
9. - 9/9/2019		☑	-	
10. - 9/10/2019			-	
11. - 9/11/2019			-	
12. - 9/12/2019			-	
13. - 9/13/2019			-	
14. - 9/14/2019			-	
15. - 9/15/2019			-	
16. - 9/16/2019			-	
17. - 9/17/2019			-	
18. - 9/18/2019			-	
19. - 9/19/2019			-	

Start Over... Back... Print Friendly Window... Generate Table...

RISK FACTORS FOR CLABSI

- Heavy microbial colonization of insertion site
- Femoral or internal jugular access site
- Multiple CVCs
- Mulitlumen CVCs
- Parenteral nutrition
- Lack of maximal sterile barriers for insertion
- Prolonged hospitalization before CVC insertion

The Joint Commission. *Preventing Central Line-Associated Bloodstream Infections: useful Tools, An International Perspective*. Nov 20, 2013. Accessed Oct 11, 2019. http://www.jointcommission.org/CLABSIToolkit

STRATEGIES TO PREVENT CLABSI

Hand hygiene

Use full barrier precautions during central venous catheter insertion

Use chlorhexidine for skin preparation

Avoid using the femoral vein for catheter in adult patients

Disinfect the hub each and every time

Remove unnecessary catheters

Appendix 3. Guidelines to Prevent Central Line-Associated Blood Stream Infections. Content last reviewed March 2018. Agency for Healthcare Research and Quality, Rockville, MD. https://www.ahrq.gov/hai/clabsi-tools/appendix-3.html

CENTRAL LINE INSERTION PRACTICES (CLIP) ADHERENCE MONITORING

- Hand hygiene by inserters
- Use of maximal sterile barriers during insertion
  - Sterile gloves
  - Sterile gown
  - Cap
  - Mask worn
  - Large sterile drape
- Proper use of a skin antiseptic prior to insertion
- Time to allow the skin antiseptic to dry before catheter insertion

O'Grady, NP., Alexander, M., Burns, LA., Dellinger, EP., Garland, J., Heard, SO., Maki, DG., et al. "Guidelines for the Prevention of Intravascular Catheter-related Infections". *Clinical Infectious Diseases* 52 (a): (2011): 1087-99.

Source: Medical News Today

CAUTI: THE PROBLEM

Source: 123rf.com

Research suggests CAUTIs are highly preventable and that perhaps as many as 50 to 70 percent of these episodes can be prevented[1-2]

Since 2008, CMS will no longer reimburse costs associated with hospital-acquired CAUTI[3]

Each day the indwelling urinary catheter remains, a patient has a 3%-7% increased risk of acquiring a catheter-associated urinary tract infection (CAUTI)[4-5]

[1]Meddings J, Rogers MA, Macy M, et al. Systematic review and meta-analysis: reminder systems to reduce catheter-associated urinary tract infections and urinary catheter use in hospitalized patients. Clin Infec Dis. 2010 Sep 1;51(5):550-60. PMID: 20673003

[2]Umscheid CA, Mitchell MD, Doshi JA, et al. Estimating the proportion of healthcare-associated infections that are reasonably preventable and the related mortality and costs. Infect Control Hosp Epidemiol. 2011;32(2):101-14. PMID: 21460463

[3]Wald HL, Kramer AM. Nonpayment for harms resulting from medical care: catheter-associated urinary tract infections. JAMA. 2007 Dec 19;298(23):2782-2784. PMID: 18165672.

[4]McGuckin M. The patient survival guide: 8 simple solutions to prevent hospital and healthcare-associated infections. New York, NY: Demos Medical Publishing; 2012

[5]Lo E, Nicolle LE, Coffin SE, Gould C, Maragakis LL, Meddings J, et al. Strategies to prevent catheter-associated urinary tract infections in acute care hospitals: 2014 update. *Infection Control and Hospital Epidemiology* 2014;35:464-79.

WHAT IS AN INDWELLING URINARY CATHETER?

A drainage tube that is inserted into the urinary bladder through the urethra, is left in place, and is connected to a drainage bag.

WHAT COUNTS?	WHAT DOESN'T?
FOLEY CATHETERS	CONDOM CATHETERS
INDWELLING CATHETERS USED FOR CONTINUOUS OR INTERMITTENT IRRIGATION	STRAIGHT CATHETERS/IN-AND-OUT CATHETERS
FOLEY CATHETER PLUS	NEPHROSOTOMY TUBES
	ILEOCONDUITS
	SUPRAPUBIC CATHETERS

CATHETER-ASSOCIATED UTI (CAUTI)

A urinary tract infection (UTI) is defined using :

- Symptomatic Urinary Tract Infection (SUTI) criteria
- Asymptomatic Bacteremic UTI (ABUTI) criteria
- Urinary System Infection (USI) criteria

❖UTI is considered a primary site of infection
→ cannot be secondary to another site

Source: medicalnewstoday.com

CAUTI DEFINITION

A UTI where an indwelling urinary catheter was in place for >2 calendar days on the date of event, with device placement being Day 1

AND

an indwelling urinary catheter was in place on the date of event or the day before. If an indwelling urinary catheter was in place for more than 2 consecutive days in an inpatient location and then removed, the date of event for the UTI must be the day of device discontinuation or the next day for the UTI to be catheter-associated.

Excluded organisms:

- Any *Candida* species and "yeast" not otherwise specified
- Mold
- Dimorphic fungi
- Parasites

SYMPTOMATIC UTI (SUTI) 1A: CAUTI

Patient must meet 1, 2, and 3 below:

1. Patient had an indwelling urinary catheter that had been in place for more than 2 consecutive days in an inpatient location on the date of event AND was either:

- Present for any portion of the calendar day on the date of event OR
- Removed the day before the date of event

2. Patient has at least one of the following signs or symptoms:

- Fever (>38.0°C)*, suprapubic tenderness, costovertebral angle pain or tenderness, urinary urgency^{+}, urinary frequency^{+}, dysuria^{+}

3. Patient has a urine culture with no more than two species of organisms identified, at least one of which is a bacterium of $\geq 10^5$ CFU/ml. All elements of the SUTI criterion must occur during the IWP.

*Reminder: To use fever in a patient >65 years of age, the ICU needs to be in place for more than 2 consecutive days in an inpatient location on date of event and is either still in place OR was removed the day before the DOE.

SYMPTOMATIC UTI (SUTI) 1B: NON-CAUTI

Patient must meet 1, 2, and 3 below:

1. One of the following is true:
   - Patient has an indwelling urinary catheter but it has/had not been in place for >2 calendar days in an inpatient location on the date of event **OR**
   - Patient did not have an indwelling urinary catheter in place on the date of event nor the day before the event

2. Patient has at least **one** of the following signs and symptoms:
   - Fever (>38.0C) in a patient ≤65 years of age
   - Suprapubic tenderness
   - Costovertebral angel pain or tenderness
   - Urinary frequency
   - Urinary urgency
   - Dysuria

3. Patient has a urine culture with no more than 2 species of organisms identified, at least one of which is a bacterium of $\geq 10^5$CFU/mL. All elements of the SUTI criterion must occur during the IWP.

SUTI 2: CAUTI OR NON-CAUTI

Patient must meet 1, 2, and 3 below:

1. Patient ≤1 year of age* (with or without an indwelling urinary catheter)
2. Patient has at least one of the following signs or symptoms:
   - Fever (>38.0C), lethargy, hypothermia, vomiting, apnea, suprapubic tenderness, bradycardia
3. Patient has a urine culture with no more than 2 species of organisms identified, at least one of which is a bacterium of $\geq 10^5$CFU/mL. All elements of the SUTI criterion must occur during the IWP.

Source: CDC

*If patient had an IUC in place for more than 2 consecutive days in an inpatient location and the IUC was in place on the DOE or the previous day the CAUTI criteria is met.

ASYMPTOMATIC BACTEREMIC UTI (ABUTI)

Patient must meet 1, 2, and 3:

1. Patient with or without an indwelling urinary catheter has no signs or symptoms of SUTI 1 or 2 according to age (Patients >65 years of age with a non-catheter associated ABUTI **may** have a fever and still meet the ABUTI criterion).

2. Patient has a urine culture with no more than two species of organisms identified, at least one of which is a bacterium of $>10^5$ CFU/mL

3. Patient has organism identified from blood specimen with at least one matching bacterium to a bacterium identified in the urine specimen, or meets LCBI criterion 2 (without fever) and matching common commensal(s) in the urine. All elements of the ABUTI criterion must occur during the IPW.

USING THE SECONDARY BSI GUIDE

ABUTI

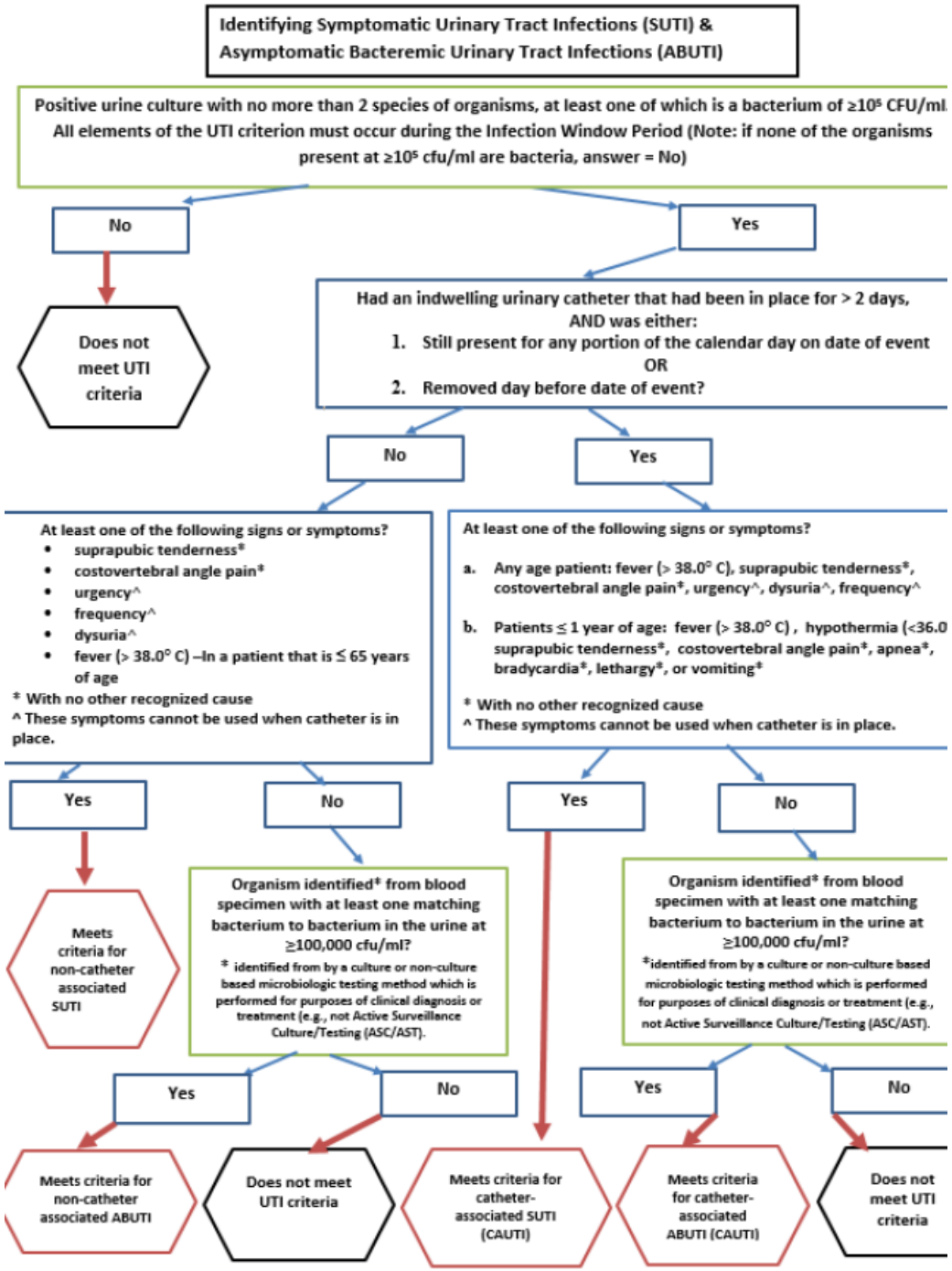
SUTI 1A
SUTI 1B
SUTI 2

Table B1: Secondary BSI Guide: List of all NHSN primary site-specific definitions available for making secondary BSI determinations using Scenario 1 or Scenario 2

Scenario 1	Scenario 2
A positive blood specimen must contain at least **one eligible matching organism** to the site-specific specimen	Positive blood specimen must be an **element** of the **site-specific definition**
And the blood specimen is collected in the site-specific **secondary BSI attribution period**	**And** blood specimen is collected in the site-specific **infection window period**
And an eligible organism **identified from the site-specific specimen** is used as an element to meet the site-specific definition	And an eligible organism **identified in a blood specimen** is used as an element to meet the site-specific definition

Site	Criterion
ABUTI	ABUTI
BONE	1
BRST	1
CARD	1
CIRC	2 or 3
CONJ	1
DECU	1
DISC	1
EAR	1, 3, 5 or 7
EMET	1
ENDO	1
EYE	1
GE	2a
GIT	2a, 2b (only yeast)
IAB	1 or 3a
IC	1
JNT	1
LUNG	1
MED	1
MEN	1
ORAL	1 or 3a
OREP	1
PJI	1
PNEU	2 or 3
SA	1
SINU	1
SSI	SI, DI or OS
SKIN	2a
ST	1
UMB	1a
UR	1a or 3a
USI	1
SUTI	1a, 1b or 2
VASC *only as SSI*	1
VCUF	3

Site	Criterion
BONE	3a
BURN	1
DISC	3a
ENDO	4a, 4b, 5a or 5b (specific organisms) 6e or 7e plus other criteria as listed
GIT	1b or 2c
IAB	2b or 3b
JNT	3c
MEN	2c or 3c
OREP	3a
PNEU	2 or 3
SA	3a
UMB	1b
USI	3b or 4b



IDENTIFYING SUTI AND ABUTI FLOWCHART

HTTPS://WWW.CDC.GOV/NHSN/PDFS/PSCMANUAL/7PSCCAUTICURRENT.PDF

NHSN CHAP 2 SURVEILLANCE DEFINITIONS

- Transfer Rule: if the date of event is on the date of transfer or discharge, or the next day, the infection is attributed to the transferring/discharging location.

DATE	PATIENT LOCATION	LOCATION OF ATTRIBUTION
MARCH 22	5 EAST	
MARCH 23	5 EAST ICU	
MARCH 24 (DATE OF EVENT)	ICU	*5 EAST- CAUTI
MARCH 25	ICU	

CAUTI PREVENTION

- Insert catheters only for appropriate indications and leave in place only as long as needed
  - Acute urinary retention or bladder outlet obstruction
  - Accurate urinary output measurements for critically ill patients
  - Perioperative use for selected surgical procedures
  - To assist in healing of open sacral or perineal wounds in incontinent patients
  - Patient requires prolonged immobilization
  - Improve comfort care for end of life care
- Consider non-invasive alternatives
- Insertion technique
- Nurse-driven removal protocol

Carolyn V. Gould, MD, MSCR; Craig A. Umscheid, MD, MSCE; Rajender K. Agarwal, MD, MPH; Gretchen Kuntz, MSW, MSLIS; David A. Pegues, MD; and the Healthcare Infection Control Practices Advisory Committee (HICPAC); *Guideline for Prevention of Catheter-Associated Urinary Tract Infections 2009*; http://www.cdc.gov/infectioncontrol/guidelines/cauti

CAUTI PREVENTION: MAINTENANCE OF THE CATHETER

Catheter maintenance

- Securement device
- Maintaining closed drainage system
- Maintain obstructed urine flow
- Keep collection bag below level of the bladder

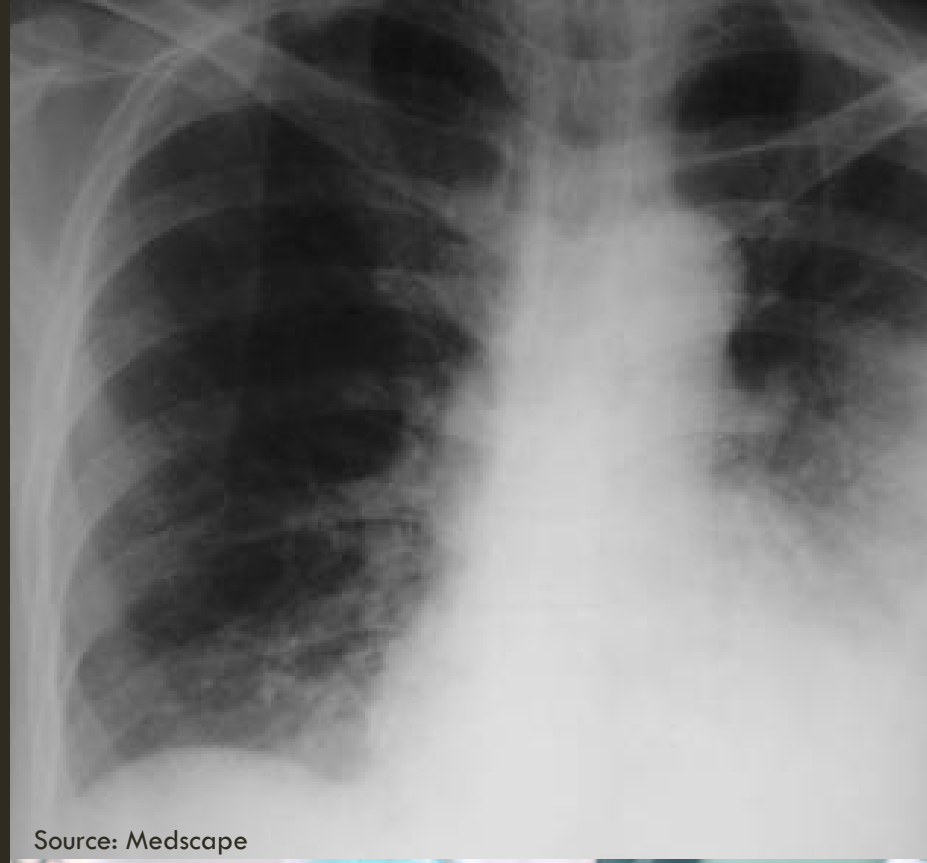
Patient hygiene

Hand hygiene

Carolyn V. Gould, MD, MSCR; Craig A. Umscheid, MD, MSCE; Rajender K. Agarwal, MD, MPH; Gretchen Kuntz, MSW, MSLIS; David A. Pegues, MD; and the Healthcare Infection Control Practices Advisory Committee (HICPAC); *Guideline for Prevention of Catheter-Associated Urinary Tract Infections 2009*; http://www.cdc.gov/infectioncontrol/guidelines/cauti

VENTILATOR-ASSOCIATED EVENTS

- 5-10% of mechanically ventilated patients develop a ventilator-associated event (VAE)[1-2]
- Historically, VAP was considered one of the most lethal HAIs with a 35% mortality rate for vented patients[3-4]



Source: Medscape

Source: RT: For Decision Makers in Respiratory Care

[1]Klompas M, Khan Y, Kleinman K, et al. Multicenter evaluation of a novel surveillance paradigm for complications of mechanical ventilation. *PLoS ONE* 2011 Mar 22;6(3):e18062. PMID 21445364

[2]Klein Klouwenberg PM, van Mourik MS, Ong DS, et al. Electronic implementation of a novel surveillance paradigm for ventilator-associated events: feasibility and validation. *Am J Respir Crit Care Med* 2014 Apr 15;189(8):947-55. PMID: 24498886.

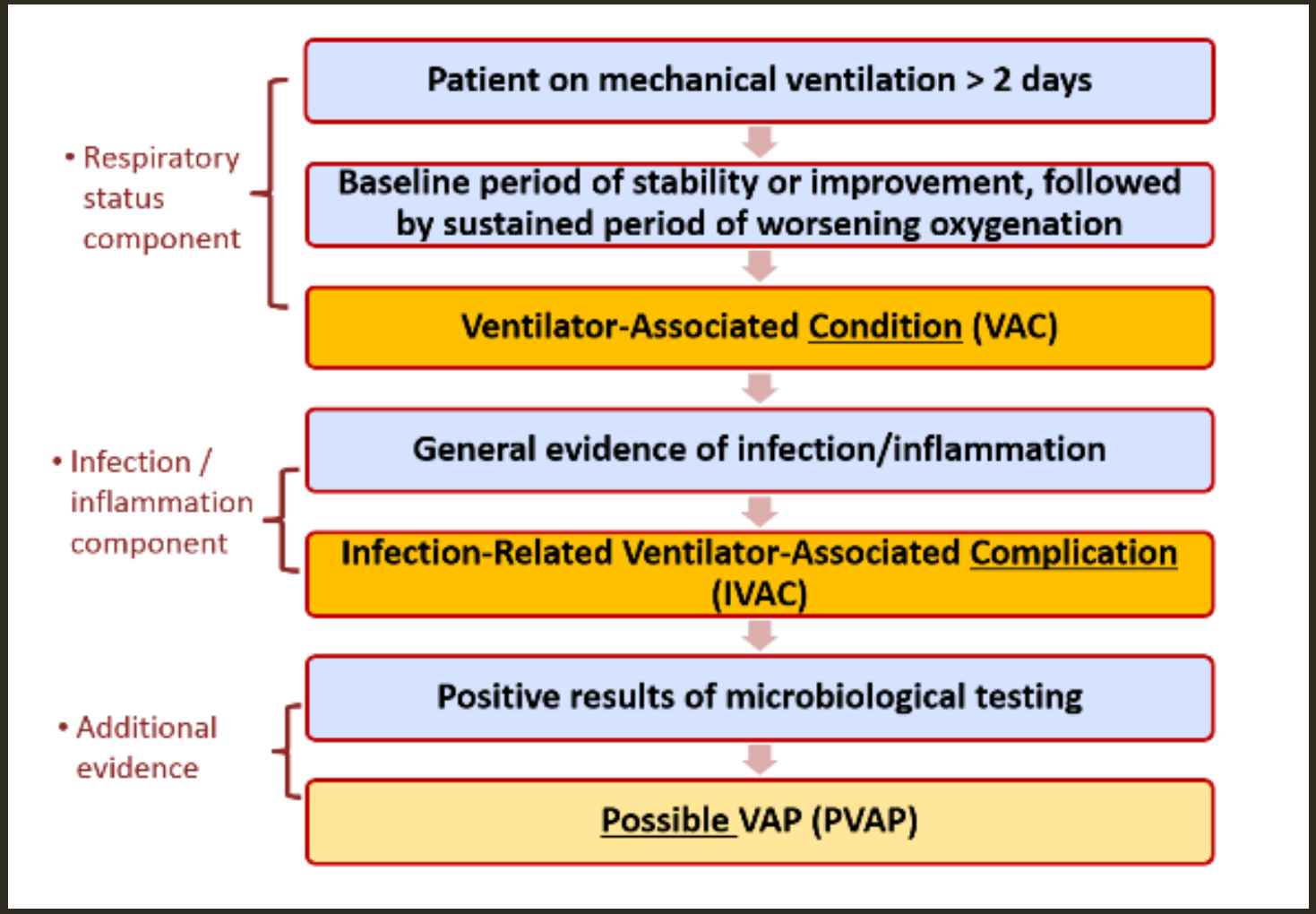
[3]Safdar N, Dezfullian C, Collard HR, et al. Clinical and economic consequences of ventilator-associated pneumonia: a systematic review. *Crit Care Med* 2005; 33(10):2184-93. PMID: 16215368.

[4]Wunsch H, Linde-Zwirble WT, Angus DC, et al. The epidemiology of mechanical ventilation use in the United States. *Crit Care Med* 2010; 38(10):1947-53. PMID: 20639743.

VENTILATOR-ASSOCIATED EVENTS (VAE)

Combination of objective criteria that identify:

- A deterioration in respiratory status after a period of stability or improvement on the ventilator (VAC)
- Evidence of infection or inflammation (IVAC)
- Laboratory evidence of respiratory infection (PVAP)



VENTILATOR-ASSOCIATED EVENT: IMPORTANT DEFINITIONS

- Must be mechanically ventilated at least 4 consecutive days to meet criteria
  - Day of intubation and initiation of mechanical ventilation is Day 1

- Daily minimum PEEP and FiO2
  - Lowest setting during a calendar day that was maintained for greater than 1 HOUR

- PEEP values between 0 ccH20 and 5 cmH20 will be considered equivalent.

ESTABLISHING A BASELINE PERIOD OF STABILITY

Establish a baseline period of stability on the ventilator

- The 2 calendar days immediately preceding the first day of increased daily minimum PEEP or FiO2 and must be characterized by $\geq$ 2 calendar days of stable or decreasing minimum FiO2 or PEEP values

On ventilator	On ventilator	On ventilator	On ventilator
Stable/improving	Stable/improving	Worsening oxygenation	Worsening oxygenation

VENTILATOR-ASSOCIATED CONDITION (VAC)

After a period of stability or improvement on the ventilator, the patient has at least one of the following indicators of worsening oxygenation:

1. Increase in the **daily minimum** FiO2 of ≥ 0.20 (20 points) over the daily minimum of the first day in the baseline period, sustained for ≥ 2 calendar days

OR

2. Increase in the **daily minimum** PEEP of ≥3 cmH_2O over the daily minimum PEEP of the first day in the baseline period, sustained for ≥ 2 calendar days

VENTILATOR-ASSOCIATED EVENT: EXAMPLE

Mechanical Vent Day	Daily Minimum PEEP	Daily Minimum FiO2	VAE
1	0 (5)	1.00 (100%)	
2	0 (5)	0.50 (50%)	
3	5	0.50 (50%)	
4	5	0.50 (50%)	
5	8	0.50 (50%)	VAC
6	8	0.50 (50%)	

INFECTION-RELATED VENTILATOR-ASSOCIATED COMPLICATION (IVAC)

On or after calendar day 3 of mechanical ventilation and within 2 calendar days before or after the onset of worsening oxygenation, the patient meets both of the following criteria:

1) Temperature > 38 °C or < 36°C, **OR** white blood cell count ≥ 12,000 cells/mm3 or ≤ 4,000 cells/mm3.

AND

2) A new antimicrobial agent(s) (see Appendix for eligible antimicrobial agents) is started, and is continued for ≥ 4 calendar days.

POSSIBLE VAP (PVAP)- CRITERION 1

On or after calendar day 3 of mechanical ventilation and within 2 calendar days before or after the onset of worsening oxygenation, ONE of the following criteria is met (taking into account organism exclusions specified in the protocol):

Criterion 1: Positive culture of one of the following specimens, meeting quantitative or semi-quantitative thresholds, as outlined in protocol, without requirement for purulent respiratory secretions:

- Endotracheal aspirate, $\geq 10^5$ CFU/ml or corresponding semi-quantitative result
- Bronchoalveolar lavage, $\geq 10^4$ CFU/ml or corresponding semi-quantitative result
- Lung tissue, $\geq 10^4$ CFU/g or corresponding semi-quantitative result
- Protected specimen brush, $\geq 10^3$ CFU/mL or corresponding semi-quantitative result

*C*andida* species or yeast not otherwise specified; coagulase-negative *Staphylococcus* species; and *Enterococcus* species, when identified from sputum, endotracheal aspirate, bronchoalveolar lavage, or protected specimen brush specimens. These organisms can be reported as PVAP pathogens if identified from lung tissue or pleural fluid specimens.

POSSIBLE VAP (PVAP)- CRITERION 2

Criterion 2: Purulent respiratory secretions (defined as secretions from the lungs, bronchi, or trachea that contain $\geq$ 25 neutrophils and $\leq$ 10 squamous epithelial cells per low power field [lpf, x100]) PLUS organism identified from one of the following specimens (to include qualitative culture, or quantitative/semi-quantitative culture without sufficient growth to meet criterion #1):

- Sputum
- Endotracheal aspirate
- Bronchoalveolar lavage
- Lung tissue
- Protected specimen brush

*If the laboratory reports semi-quantitative results, those results must correspond to the quantitative thresholds.

POSSIBLE VAP (PVAP)- CRITERION 3

Criterion 3: One of the following positive tests:

- Organism identified from pleural fluid culture (where specimen was obtained during thoracentesis or initial placement of chest tube and NOT from an indwelling chest tube)
- Lung histopathology, defined as: 1) abscess formation or foci of consolidation with intense neutrophil accumulation in bronchioles and alveoli; 2) evidence of lung parenchyma invasion by fungi (hyphae, pseudohyphae or yeast forms); 3) evidence of infection with the viral pathogens listed below based on results of immunohistochemical assays, cytology, or microscopy performed on lung tissue
- Diagnostic test for *Legionella* species
- Diagnostic test on respiratory secretions for influenza virus, respiratory syncytial virus, adenovirus, parainfluenza virus, rhinovirus, human metapneumovirus, coronavirus

VAE SURVEILLANCE ALGORITHM

Figure 1: Ventilator-Associated Events (VAE) Surveillance Algorithm

Patient has a baseline period of stability or improvement on the ventilator, defined by ≥ 2 calendar days of stable or decreasing daily minimum* FiO_2 or PEEP values. The baseline period is defined as the 2 calendar days immediately preceding the first day of increased daily minimum PEEP or FiO_2.

*Daily minimum defined by lowest value of FiO_2 or PEEP during a calendar day that is maintained for > 1 hour.

After a period of stability or improvement on the ventilator, the patient has at least one of the following indicators of worsening oxygenation:

1) Increase in daily minimum* FiO_2 of ≥ 0.20 (20 points) over the daily minimum FiO_2 of the first day in the baseline period, sustained for ≥ 2 calendar days.
2) Increase in daily minimum* PEEP values of ≥ 3 cmH_2O over the daily minimum PEEP of the first day in the baseline period†, sustained for ≥ 2 calendar days.

Ventilator-Associated Condition (VAC)

On or after calendar day 3 of mechanical ventilation and within 2 calendar days before or after the onset of worsening oxygenation, the patient meets both of the following criteria:

1) Temperature > 38 °C or < 36°C, **OR** white blood cell count ≥ 12,000 cells/mm^3 or ≤ 4,000 cells/mm^3.

AND

2) A new antimicrobial agent(s) (see Appendix for eligible antimicrobial agents) is started, and is continued for ≥ 4 qualifying antimicrobial days (QAD).

Infection-related Ventilator-Associated Complication (IVAC)

On or after calendar day 3 of mechanical ventilation and within 2 calendar days before or after the onset of worsening oxygenation, ONE of the following criteria is met (**taking into account organism exclusions specified in the protocol**):

1) Criterion 1: Positive culture of one of the following specimens, meeting quantitative or semi-quantitative thresholds as outlined in protocol, without requirement for purulent respiratory secretions:
   - Endotracheal aspirate, ≥ 10^5 CFU/ml or corresponding semi-quantitative result
   - Bronchoalveolar lavage, ≥ 10^4 CFU/ml or corresponding semi-quantitative result
   - Lung tissue, ≥ 10^4 CFU/g or corresponding semi-quantitative result
   - Protected specimen brush, ≥ 10^3 CFU/ml or corresponding semi-quantitative result
2) Criterion 2: Purulent respiratory secretions (defined as secretions from the lungs, bronchi, or trachea that contain ≥25 neutrophils and ≤10 squamous epithelial cells per low power field [lpf, x100])† PLUS organism identified from one of the following specimens (to include qualitative culture, or quantitative/semi-quantitative culture without sufficient growth to meet criterion #1):
   - Sputum
   - Endotracheal aspirate
   - Bronchoalveolar lavage
   - Lung tissue
   - Protected specimen brush

   † If the laboratory reports semi-quantitative results, those results must correspond to the quantitative thresholds. See additional instructions for using the purulent respiratory secretions criterion in the VAE Protocol.
3) Criterion 3: One of the following positive tests:
   - Organism identified from pleural fluid (where specimen was obtained during thoracentesis or initial placement of chest tube and NOT from an indwelling chest tube)
   - Lung histopathology, defined as: 1) abscess formation or foci of consolidation with intense neutrophil accumulation in bronchioles and alveoli; 2) evidence of lung parenchyma invasion by fungi (hyphae, pseudohyphae or yeast forms); 3) evidence of infection with the viral pathogens listed below based on results of immunohistochemical assays, cytology, or microscopy performed on lung tissue
   - Diagnostic test for *Legionella* species
   - Diagnostic test on respiratory secretions for influenza virus, respiratory syncytial virus, adenovirus, parainfluenza virus, rhinovirus, human metapneumovirus, coronavirus

Possible Ventilator-Associated Pneumonia (PVAP)

NHSN VAE CALCULATOR

https://nhsn.cdc.gov/VAECalculator/vaecalc_v6.html

NHSN Ventilator-Associated Event (VAE) Calculator Ver. 6.0

A Ventilator-Associated Condition (VAC) based on PEEP values occurred on 9/4/2019

Click on the Go To IVAC button to move to the next part of the protocol or click on the "Explain" button to see how this determination was made.

Calculate VAC | Start Over | Go to IVAC | Explain...

MV Day	Date	Min. PEEP (cmH_2O)	Min. FiO_2 (21 - 100)	VAE
1	9/1/2019	5	21	
2	9/2/2019	5	21	
3	9/3/2019	5	21	
4	9/4/2019	8	21	‡ VAC
5	9/5/2019	8	21	
6	9/6/2019			
7	9/7/2019			

Explanation:

X

The two days preceding 9/4/2019 are the baseline period of stability or improvement followed by a sustained period (≥ 2 days) of worsening oxygenation.

OK

(Hint: this box is movable by dragging with your mouse. If you move it to one side and leave it open, the explanation will automatically update itself as things change.)

VENTILATOR ASSOCIATED PNEUMONIA (VAP) PREVENTION

Source: Canadian Patient Safety Institute

Minimize exposure to mechanical ventilation

- Use noninvasive positive pressure ventilation in select populations
- Vent weaning protocols (minimize duration)

Elevate the head of bed to 30°-45°

Daily sedation vacation

Coordinated subglottic suctioning

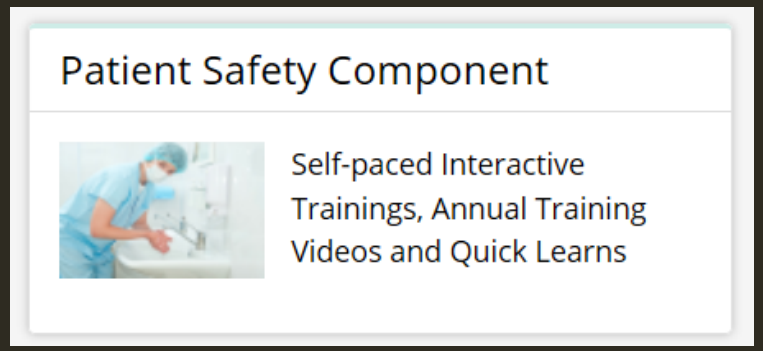
Oral care

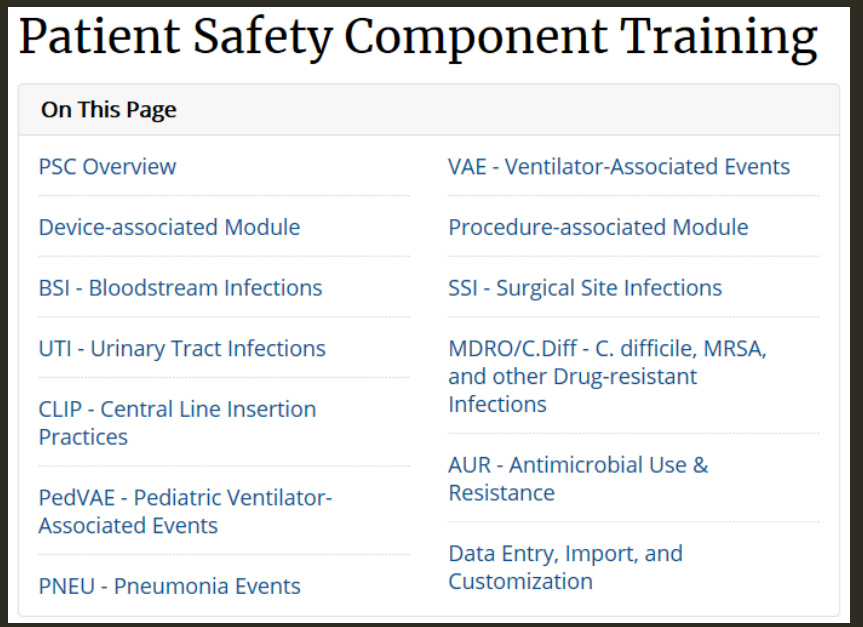
Peptic ulcer disease prophylaxis

Deep vein thrombosis prophylaxis

Facilitate early mobilization

Klompas, M., Branson, R., Eichenwald, E., Greene, L., Howell, M., Lee, G., . . . Berenholtz, S. (2014). Strategies to Prevent Ventilator-Associated Pneumonia in Acute Care Hospitals: 2014 Update. *Infection Control and Hospital Epidemiology, 35*(8), 915-936. doi:10.1086/677144





NHSN TRAINING

https://www.cdc.gov/nhsn/training/patient-safety-component/index.html

EXISTING GUIDELINES AND RECOMMENDATIONS

The Healthcare Infection Control Practices Advisory Committee (HICPAC), Centers for Disease Control and Prevention

The Institute for Healthcare Improvement

The Agency for Healthcare Research and Quality

The Joint Commission

APIC

WEEKLY DEVICE ROUNDS IN CRITICAL CARE

- CENTRAL LINES
  - Status of the dressing
  - Location of insertion
  - Date of last dressing change
  - Dated IV bags and tubing
  - Daily CHG bath

- URINARY CATHETERS
  - Indication
  - Consideration of an alternative
  - Securement device
  - Drainage bag below bladder
  - Recent perineal/meatal care

RESOURCES

Appendix 3. Guidelines to Prevent Central Line-Associated Blood Stream Infections. Content last reviewed March 2018. Agency for Healthcare Research and Quality, Rockville, MD. https://www.ahrq.gov/hai/clabsi-tools/appendix-3.html

Toolkit for Reducing CAUTI in Hospitals. Content last reviewed March 2018. Agency for Healthcare Research and Quality, Rockville, MD. https://www.ahrq.gov/hai/tools/cauti-hospitals/index.html

Toolkit To Improve Safety for Mechanically Ventilated Patients. Content last reviewed August 2017. Agency for Healthcare Research and Quality, Rockville, MD. https://www.ahrq.gov/hai/tools/mvp/index.html

Marschall, J., Mermel, L., Fakih, M., Hadaway, L., Kallen, A., O'Grady, N., . . . Yokoe, D. (2014). Strategies to Prevent Central Line–Associated Bloodstream Infections in Acute Care Hospitals: 2014 Update. *Infection Control and Hospital Epidemiology, 35*(7), 753-771. doi:10.1086/676533

Klompas, M., Branson, R., Eichenwald, E., Greene, L., Howell, M., Lee, G., . . . Berenholtz, S. (2014). Strategies to Prevent Ventilator-Associated Pneumonia in Acute Care Hospitals: 2014 Update. *Infection Control and Hospital Epidemiology, 35*(8), 915-936. doi:10.1086/677144

National Healthcare Safety Network (NHSN), Patient Safety Component Manual. https://www.cdc.gov/nhsn/pdfs/pscmanual/pcsmanual_current.pdf

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