Device Associated Infections Surveillance: CLABSI, CAUTI, and Ventilator Associated Events (VAE)

ACH IP Course, 2022

Infection Prevention Training for ACH
Healthcare-Associated Infections Program
Center for Health Care Quality California
Department of Public Health

Objectives –Central Line Associated Blood Stream Infections (CLABSI)

- Review CLABSI surveillance definitions
- Discuss importance of accurate data collection
- Demonstrate how to report CLABSI events summary data in NHSN
- Discuss NHSN data analysis and feedback to staff

CLABSI Surveillance for Prevention

1. Perform surveillance for CLABSI using NHSN standardized definitions and methods
2. Compare SIR or rate over time to assess prevention progress
3. Monitor CLABSI incidence over time using the standardized infection ratio (SIR) metric

(See Introduction to NHSN slides)

CLABSI Surveillance Key Terms

- Lab confirmed bloodstream infection (**LCBI**)
  - Blood culture positive for a pathogen
- **Commensal**
  - Organism not usually considered pathogenic
  - Include (but not limited to)
    - Diphtheroids
    - *Propionibacterium* spp.
    - coagulase-negative staphylococci
    - viridans group streptococci
    - *Aerococcus* spp.
    - *Micrococcus* spp.

NHSN Patient Safety Manual: Chapter 4, pp 4-10, NHSN organism list (PDF)
(www.cdc.gov/nhsn/pdfs/pscmanual/4psc_clabscurrent.pdf)

CLABSI Surveillance

- To be considered a CLABSI, a **central line** must be
  - In place for >2 days on the date of the event (date device placed = day one)

AND

  - Still in place on day of event -or- in place on the day prior to the event
- The CLABSI **event date** is defined as the day the first element used to meet the surveillance definition occurs within the seven-day infection window period

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Present on Admission

- An infection is considered **Present on Admission (POA)** if:
  - The date of event of the occurs on the day of admission to an inpatient location (calendar day 1), the 2 days before admission, and the calendar day after admission.

Hospital Day	Date of Event Assignment for RIT	Classification
2 days before admit	Hospital Day 1	POA
1 day before admit	Hospital Day 1	
1	Hospital Day 1	
2	Hospital Day 2	
3	Hospital Day 3	HAI
4	Hospital Day 4	
5	Hospital Day 5	

CLABSI Surveillance Definition

LCBI 1

Patient of any age

- ❑ has a recognized pathogen cultured from one or more blood cultures
  and
- ❑ Organism cultured from blood is not related to an infection at another site

LCBI 2*

Patient of any age

- ❑ has common skin commensals cultured from 2 or more blood cultures drawn on separate occasions
  and

has at least one of the following signs and symptoms

- ❑ Fever <38°C>, chills, or hypotension

and

- ❑ Signs and symptoms and (+) lab results are not related to an infection at another site

LCBI 3*

Patient of <1year of age

- ❑ has common skin commensals cultured from 2 or more blood cultures drawn on separate occasions

and

has at least one of the following signs and symptoms

- ❑ Fever (>38°C), hypothermia (36C core), apnea, or bradycardia

and

- ❑ Signs and symptoms and (+) lab results are not related to an infection at another site

*All criteria within 7 day infection window period
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Mucosal Barrier Injury (MCBI) BSI

- More specific BSI definition for oncology patients
- BSI resulting when intestinal organisms from compromised intestinal wall mix into the bloodstream
- Occurs in post allogeneic hematopoietic transplant or severely neutropenic patients
- MCBI SIR is calculated separately from CLABSI SIR

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CLABSI Infection Criteria

Diagnostic Test for Possible CLABSI	Localized Sign or Symptoms for Possible CLABSI (ONLY used with 2 blood commensals)
• Positive blood culture with a pathogen OR- • 2 positive blood cultures with common commensals	• Fever • Chills • Hypotension

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CLABSI due to Common Commensal Organisms

- Two blood cultures have been collected on the same or consecutive days
  - One positive culture may be due to poor skin prep prior to lab draw (skin contaminant)
  - Two matching positive cultures of the same commensal, meeting criteria, are considered a true pathogen

Example: Blood cultures positive for common commensal organism (e.g., S. epi) collected on Mon-Tues meets LCBI 2; cultures collected on Mon-Wed are too far apart

CLABSI Infection Window Period

- Defined as the 7-days during which all site-specific infection criteria must be met
- Includes the day the **first** positive blood culture was obtained, 3 calendar days before and 3 calendar days after

Infection Window Period:	3 days before first positive diagnostic test			FIRST POSITIVE DIAGNOSTIC TEST	3 days after first positive diagnostic test		
Example:	Mar 7	Mar 8	Mar 9	Mar 10	Mar 11	Mar 12	Mar 13

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CLABSI Event Date

- The date of event is the date the first element is used to meet the definition for the first time
- May or may not be the positive blood culture date

CLABSI Location Attribution

- A CLABSI is attributed to the location of the patient on the day of event
  - Defined as the date that the **first** element used to meet the LCBI criterion occurred
- If the date of event for a CLABSI is the day of transfer or discharge, or the next day, the infection is attributed to the transferring location
- Attribute CLABSI to correct location for accurate SIR calculations. Each location has different risk adjustments in NHSN

CLABSI Cannot Re-Occur in the Same Patient within a 14-Day Timeframe

- The date of the CLABSI event is considered day 1
- A new CLABSI is not reported until 14 days have elapsed
- If a new pathogen is identified in the blood within the 14 day timeframe, it should be added to the CLABSI already reported
  - Refer to the CLABSI protocol for more details

Secondary BSI Attribution

- The period in which a positive blood culture must be collected to be considered a secondary BSI to a primary site of infection:
  - Includes the 7-day infection window combined with the 14-day repeat infection timeframe, or 14-17 days depending on the date of the event
  - A positive blood culture collected outside this 14-17 date range cannot be considered a secondary BSI to the primary infection
- A primary BSI (CLABSI) cannot have a secondary BSI

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Secondary BSI Attribution -2

- A secondary BSI may be attributed to a primary site of infection if one of the following is true:
  1. The blood culture pathogen **matches** an organism also cultured in the primary infection site

     OR

  2. A positive blood culture is an element used to meet the primary site infection definition
- See the Secondary BSI Guide (Table B1) of the CLABSI protocol for more details

Secondary BSI Attribution -3

NHSN Infections that include a positive blood culture as an element in the primary site definition:

- Bone-Osteomyelitis
- Burn
- Disc space infection
- Endocarditis
- GI tract infection
- Intra-abdominal infection
- Joint
- Meningitis
- Other infection-reproductive tract
- Pneumonia
- Spinal abscess
- Omphalitis
- Urinary System Infection

NHSN Patient Safety Module: Chapter 4, Secondary BSI Guide, pp 4-27, Table B1(PDF) (www.cdc.gov/nhsn/pdfs/pcsmanual/pcsmanual_current.pdf)

Pathogen Assignment

- If a new blood pathogen is identified within the 14-day repeat infection timeframe, it should be added to the already reported CLABSI as an additional pathogen
- Do not report it as a new CLABSI
- Pathogens excluded from specific infection definitions (e.g. yeast for UTI and PNEU) are also excluded from being considered secondary bloodstream infections
  - Example: Yeast in the blood and urine would be reported as a CLABSI, as yeast is excluded from the UTI definition
- Refer to the NHSN protocol for more details on pathogen assignment and secondary BSI

Pathogens Associated with CLABSI

- *Coagulase-negative Staphylococci* 16%
- *Staphylococcus aureus* 13%
- *Klebsiella (pneumoniae/oxytoca)* 8%
- *Enterococcus faecalis* 8%
- *Candida albicans* 7%
- *Escherichia coli* 5%
- Candida spp 5%

NHSN Antimicrobial Resistance Report: Distribution of all Pathogens Reported by HAI Type, Appendix to Table 4, 2011-2014 (www.cdc.gov/nhsn/xls/reportdatatables/2014-appendix-pathogens.xlsx)

How do I Apply the CLABSI Surveillance Definitions?

Let’s look at some examples…

NHSN HAI and POA Worksheet Generator

Based on the information you provided:

Admit Date: Tue Jan 01 2019

The event is: **HAI**

Date of Event: Fri Jan 04 2019

Infection Window Period: Tue Jan 01 2019 - Mon Jan 07 2019

Repeat Infection Timeframe (RIT): Fri Jan 04 2019 - Thu Jan 17 2019

Event Type: BSI

www.cdc.gov/nhsn

Admit date: 1/1/2019

Hospital Day/Date	First Diagnostic Test	Infection Window Period (*)	Date of Event	Repeat Infection Timeframe (*)
1. - 1/1/2019 - Admit Date			-	
2. - 1/2/2019			-	
3. - 1/3/2019			-	
4. - 1/4/2019	✓	✓	- HAI	
5. - 1/5/2019			-	
6. - 1/6/2019			-	
7. - 1/7/2019			-	
8. - 1/8/2019			-	
9. - 1/9/2019				
10. - 1/10/2019				
11. - 1/11/2019				
12. - 1/12/2019				
13. - 1/13/2019				
14. - 1/14/2019				
15. - 1/15/2019				
16. - 1/16/2019				
17. - 1/17/2019				

- Enter 3 data points into Worksheet Generator:
  - Date of Admission
  - Date of first diagnostic test
  - Event type
- NHSN Generates a worksheet for you to enter additional data
- You must determine if the HAI definition is met

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

BSI Event Date

Hospital Day/Date	First Diagnostic Test	Infection Window Period (*)	Date of Event	Repeat Infection Timeframe (*)
12/30/2018			-	
12/31/2018			-	
1. - 1/1/2019 - Admit Date			-	
2. - 1/2/2019	✓	BC + Staph aureus	- POA	
3. - 1/3/2019			-	
4. - 1/4/2019			-	
5. - 1/5/2019			-	
6. - 1/6/2019			-	
7. - 1/7/2019			-	
8. - 1/8/2019				
9. - 1/9/2019				
10. - 1/10/2019				
11. - 1/11/2019				
12. - 1/12/2019			-	
13. - 1/13/2019			-	
14. - 1/14/2019			-	
15. - 1/15/2019			-	

Automatically populates HAI or POA on date of event

BSI: POA
Date of Event: date of the first diagnostic test
Pathogen: Staph A

CLABSI Event Date

Hospital Day/Date	First Diagnostic Test	Infection Window Period (*)	Date of Event	Repeat Infection Timeframe (*)	Secondary BSI Attribution Period (*)
1. - 1/1/2019 - Admit Date		☐ Central line inserted	-		
2. - 1/2/2019		☐	-		
3. - 1/3/2019		☑ Fever 38.8	- HAI		
4. - 1/4/2019	✓	☑ BC + Staph epi			
5. - 1/5/2019		☐ BC + Staph epi	-		
6. - 1/6/2019		☐	-		
7. - 1/7/2019		☐	-		
8. - 1/8/2019			-		
9. - 1/9/2019			-		
10. - 1/10/2019			-		
11. - 1/11/2019			-		
12. - 1/12/2019			-		
13. - 1/13/2019			-		
14. - 1/14/2019			-		
15. - 1/15/2019			-		
16. - 1/16/2019			-		

Remember:
The date of event is the date the first element is used to meet the definition for the first time

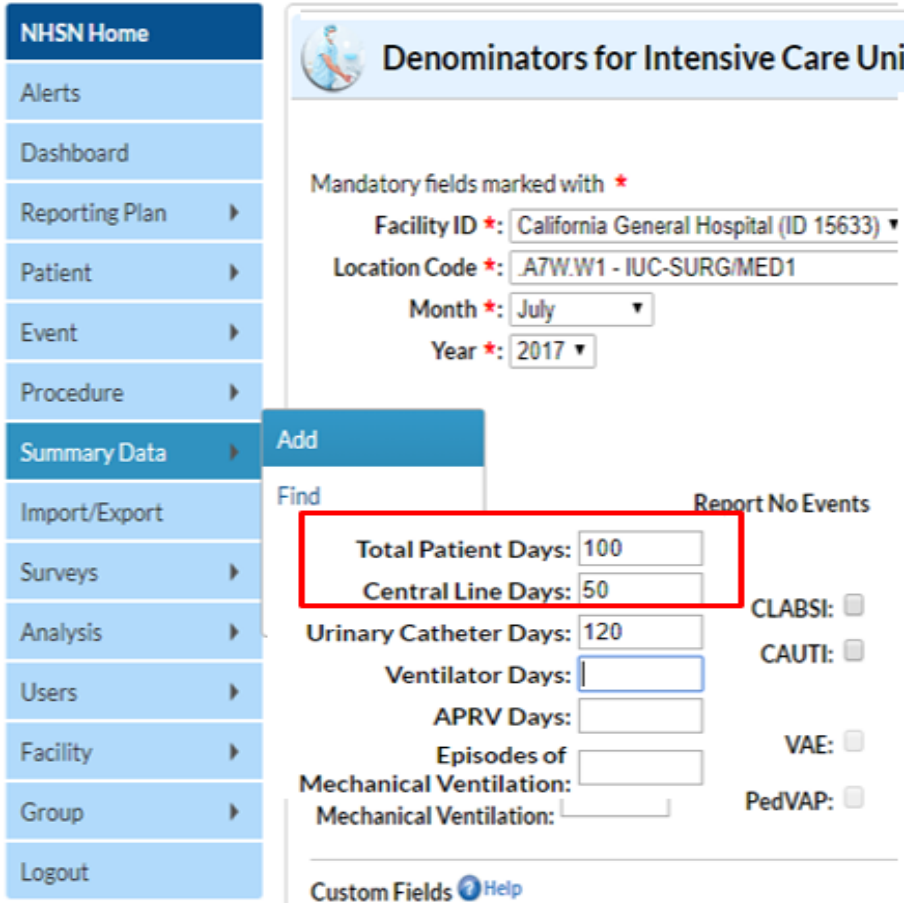
Primary and Secondary Examples

Hospital Day/Date	First Diagnostic Test	Infection Window Period (*)	Date of Event	Repeat Infection Timeframe (*)	Secondary BSI Attribution Period (*)
1. - 1/1/2019 - Admit Date					
2. - 1/2/2019					
3. - 1/3/2019		Dysuria	HAI		
4. - 1/4/2019	✓	Urine culture >100,000cfu/ml E. faecalis			
5. - 1/5/2019					
6. - 1/6/2019					
7. - 1/7/2019					
8. - 1/8/2019					
9. - 1/9/2019					
10. - 1/10/2019					
11. - 1/11/2019		Blood culture E. faecalis/Yeast			Blood Culture E. faecalis/Yeast
12. - 1/12/2019					
13. - 1/13/2019					
14. - 1/14/2019					
15. - 1/15/2019					
16. - 1/16/2019					

UTI & Secondary BSI
DOE= 1/3/19
Pathogen: E. faecalis

Primary BSI
DOE = 1/11/19
Pathogen: Yeast

Add Monthly CLABSI Summary Data to NHSN

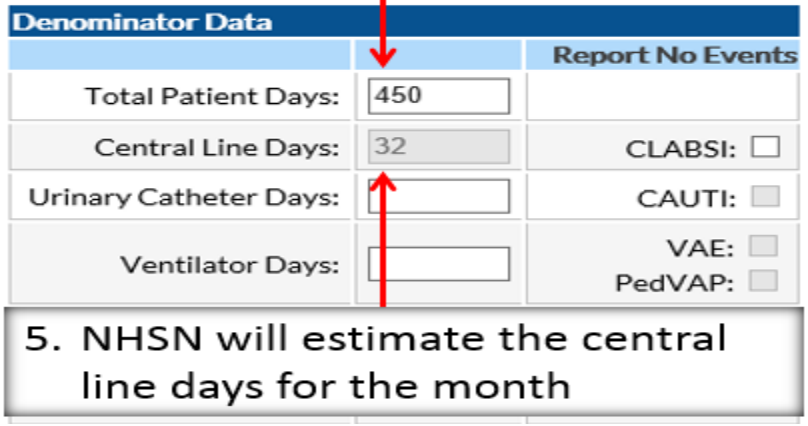


- Enter monthly denominator data for each patient location
  - Patient days
  - Central line days

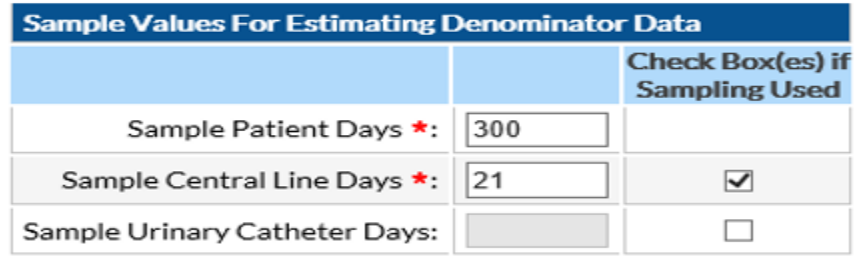
Optional: Denominator Data Sampling

How to sample: Count the number of the location patient days and the number of central lines on a designated day each week. Not on Saturday or Sunday. Add those numbers for the month and enter here.

1. Enter Monthly patient days for this location based on daily collection



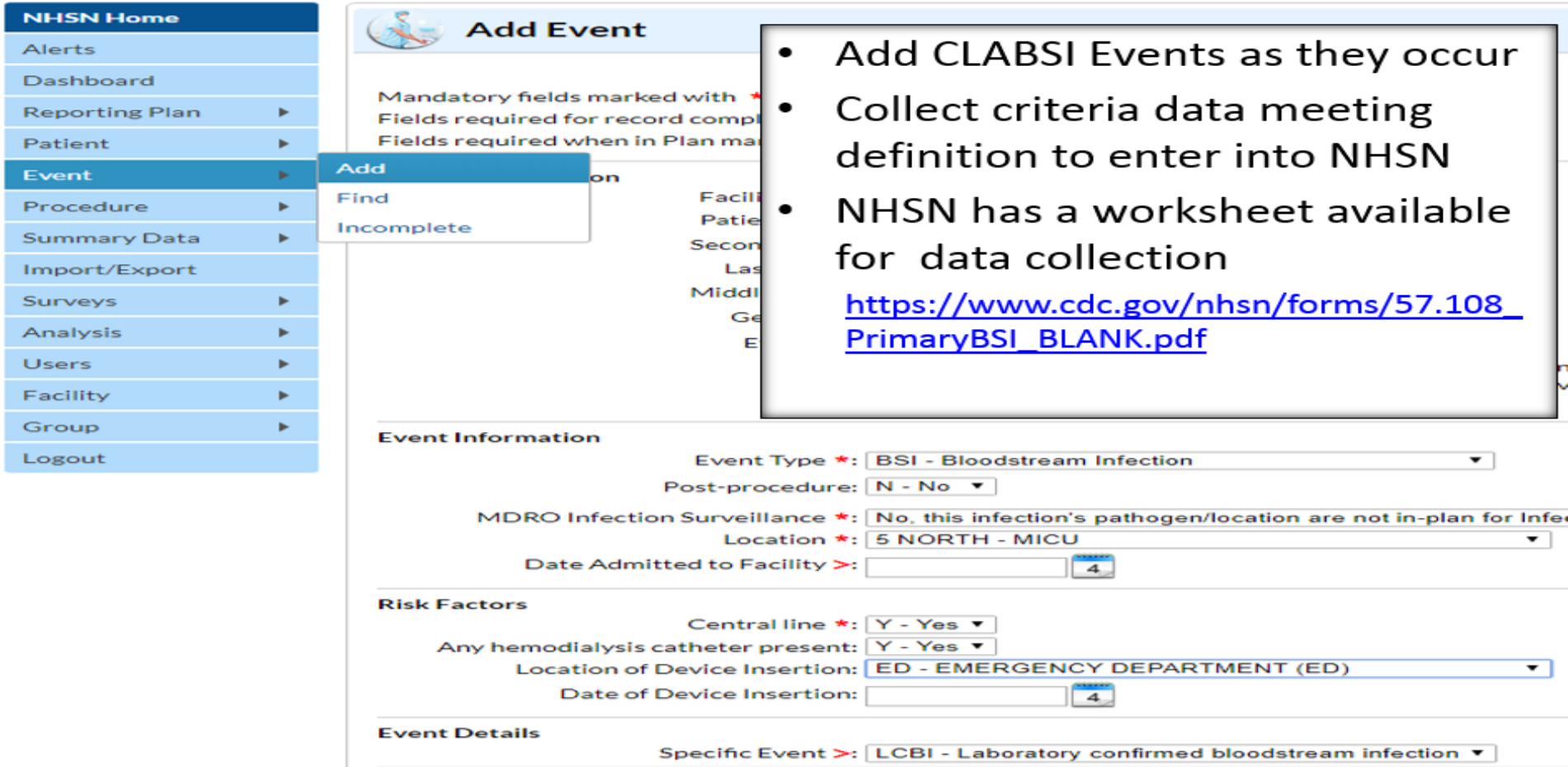
5. NHSN will estimate the central line days for the month



2. Check Box if sampling is used
3. Enter sampled total patient-days
4. Enter sampled total central line days

Note: Sampling may not be used for NICU or specialty care areas/oncology

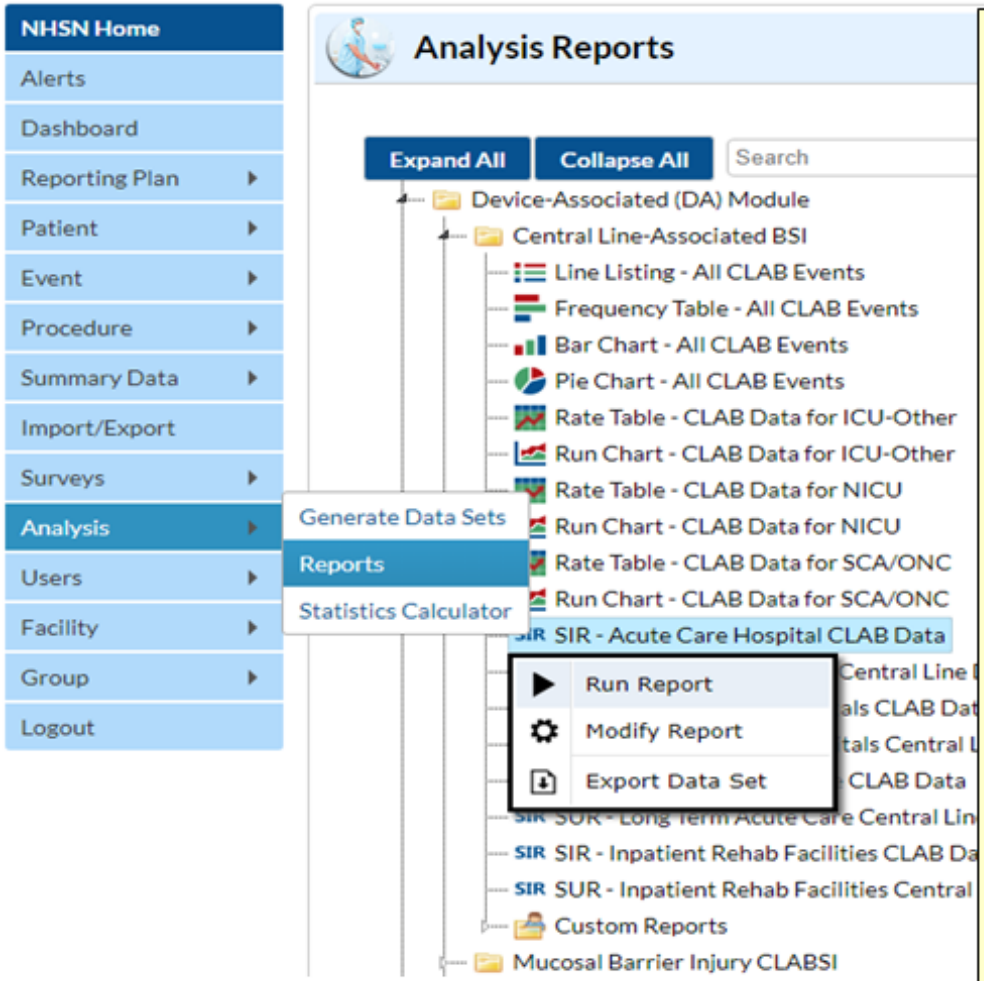
Add CLABSI Event to NHSN



- Add CLABSI Events as they occur
- Collect criteria data meeting definition to enter into NHSN
- NHSN has a worksheet available for data collection

  https://www.cdc.gov/nhsn/forms/57.108_PrimaryBSI_BLANK.pdf

NHSN CLABSI Analysis Reports



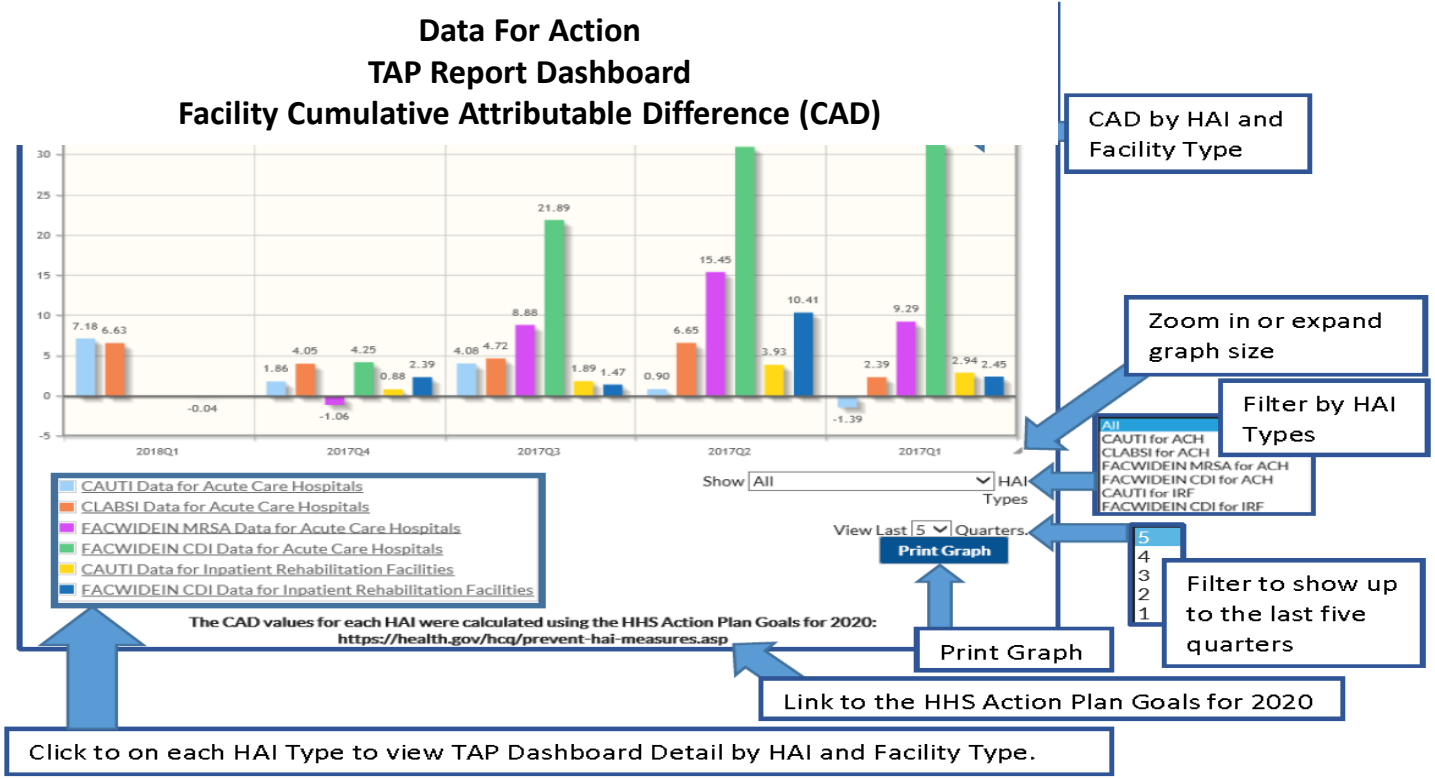
- Generate data set prior to creating a report
- Choose report according to need
  - SIR report- Your incidence compared to expected incidence
  - TAP report – Number of events that needed to be prevented to reach targeted goal –
    - which locations are priority

NHSN Targeted Assessment for Prevention (TAP) Report

- Identifies the **number of infections that needed to be prevented** to reach targeted goal - Cumulative Attributable Difference(CAD)
  - Lists results high-to-low by location
  - Assists in deciding where to focus infection prevention resources

	LOCATION									
facCAD	locRank	location	loccdc	infCount	numcldays	locDUR	locCAD	locSIR	SIRtest	numPathBSI
27.44	1	MICU-G	IN:ACUTE:CC:M	11	4117	50	8.68	2.37	SIG	16 (2, 6, 0, 6, 0, 0)
	2	SICU	IN:ACUTE:CC:S	8	4135	55	5.67	1.72		9 (5, 1, 1, 1, 0, 1)
	3	5-NORTH	IN:ACUTE:WARD:MS	5	1158	14	4.44	4.43	SIG	8 (0, 4, 0, 1, 1, 0)
	4	6S	IN:ACUTE:WARD:MS	4	1101	10	3.46	3.73	SIG	4 (1, 0, 2, 0, 0, 1)
	5	4S	IN:ACUTE:WARD:TEL	3	571	8	2.72	.		3 (0, 0, 1, 0, 0, 0)
	6	PCU	IN:ACUTE:STEP	2	685	25	1.65	.		2 (0, 2, 0, 0, 0, 0)
	7	G5	IN:ACUTE:WARD:MS	2	820	10	1.60	.		2 (1, 0, 1, 0, 0, 0)
	8	CVU	IN:ACUTE:STEP	1	532	15	0.73	.		1 (0, 0, 0, 0, 0, 1)
	9	LD	IN:ACUTE:WARD:LD	0	0	0	0.00	.		

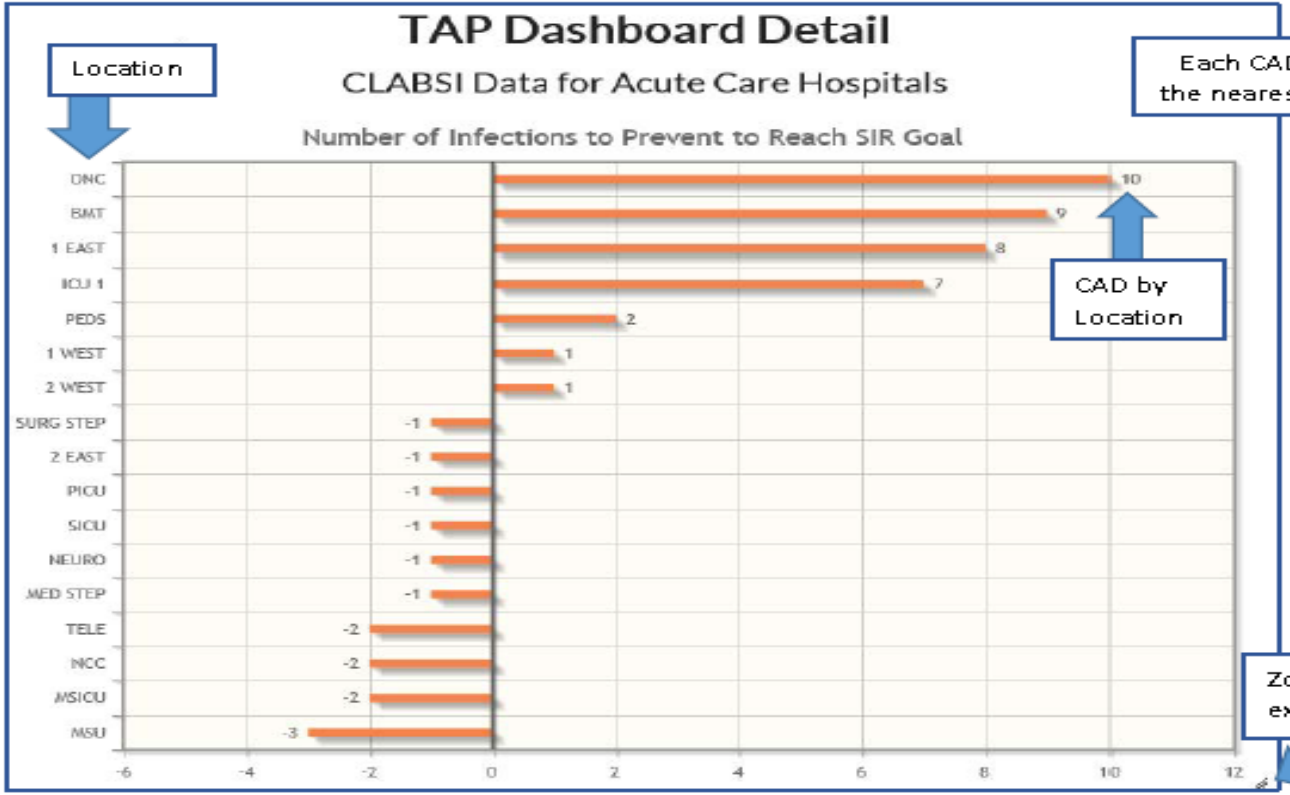
Targeted Assessment for Prevention (TAP) Reports



TAP Report Quick Reference Guide (PDF)
(www.cdc.gov/nhsn/pdfs/ps-analysis-resources/ref-guide/tap-dashboard-qrg-508.pdf)

California Department of PublicHealth

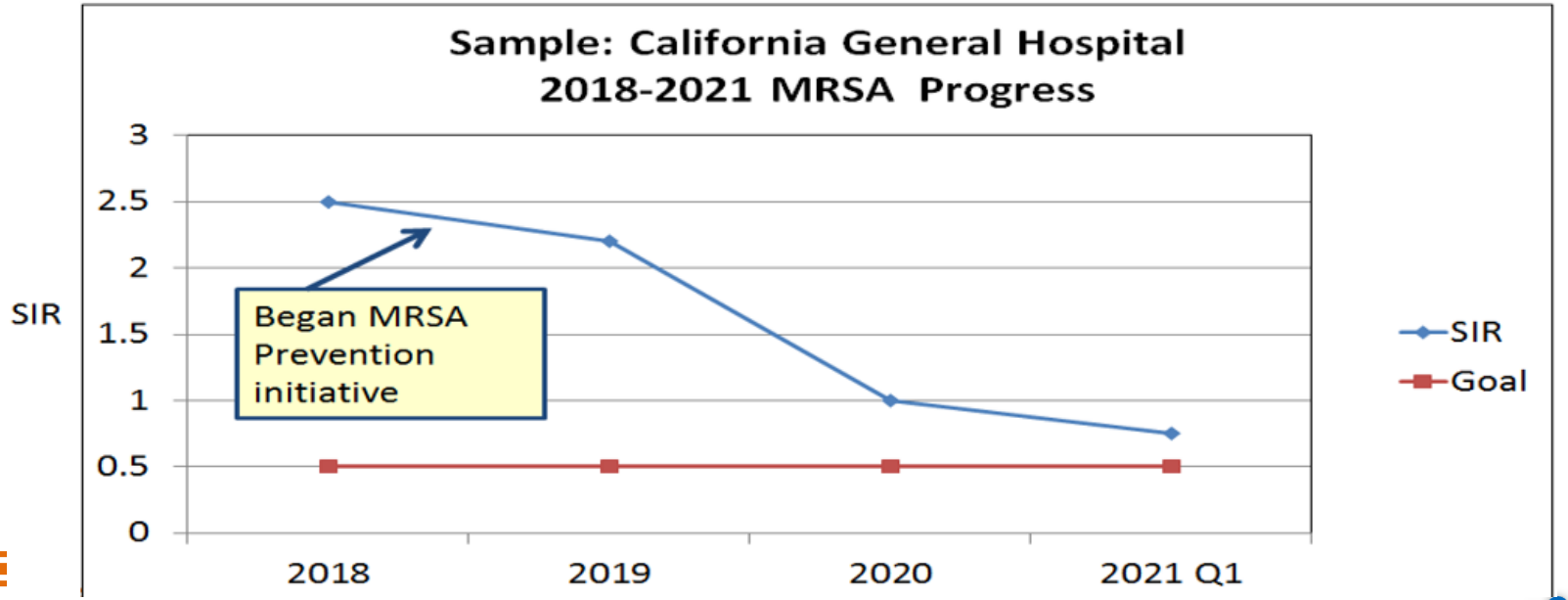
TAP Dashboard Detail - Locations



Use the TAP report to prioritize prevention efforts to the locations in need!

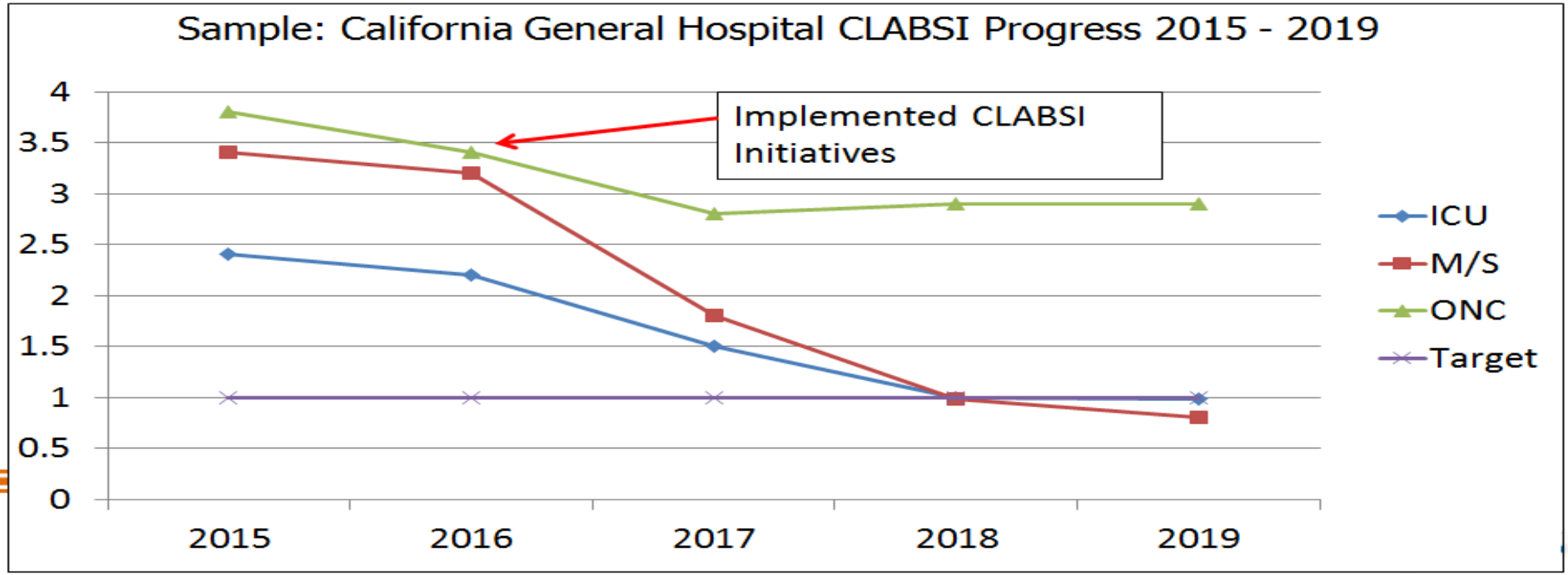
Track Progress Over Time

- Feedback results to staff
- Celebrate successes!



Measure CLABSI Prevention Progress

- Feedback results to your staff and leadership
- Changes in CLABSI incidence should be visible over time
- In the example, we can see ONC needed additional interventions



CLABSI Surveillance Summary

- Consistent use of standard surveillance methods and CLABSI definitions are essential for accurate case finding
- Capturing complete and accurate data is necessary for precise CLABSI SIR calculation
- Perform surveillance and feedback CLABSI SIR with adherence monitoring results to all units and leadership

Catheter-Associated Urinary Tract Infection (CAUTI) Surveillance

ACH IP Course, 2021

Basics of Infection Prevention
Healthcare-Associated Infections Program
Center for Health Care Quality
California Department of Public Health

Objectives – Catheter Associated Urinary Tract Infections (CAUTI)

- Review CAUTI surveillance definitions
- Discuss importance of accurate data collection
- Demonstrate how to report CAUTI data in NHSN
- Discuss NHSN data analysis and feedback to staff

Clinical vs Surveillance Definitions

Clinical criteria used by physicians for patient care and management may differ from surveillance criteria

- Clinical
  - Patient centered
  - Used for therapeutic decisions
- Surveillance
  - Population based
  - Applied exactly the same way each time

CAUTI Surveillance Definitions

UTI may or may not be associated with use of a urinary catheter (CAUTI vs. UTI)

For CAUTI:
Catheter must be in place
>2 days (Day 1 = day of insertion)

And

Catheter still present

Or

Catheter removed day of or day prior to when UTI criteria met

CAUTI Surveillance Definitions- 2

- NHSN infection window period
  - Seven days during which all site-specific infection criteria must be met
- Criteria for CAUTI include specific clinical symptoms and positive urine culture, and sometimes positive blood culture
- Includes the day the **first** positive diagnostic test (urine culture or blood culture for CAUTI) was obtained, 3 calendar days before and 3 calendar days after

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CAUTI Infection Window Period
Acute Care Hospitals

- For CAUTI, the first diagnostic test will be either a positive urine or blood culture

Infection Window Period:	3 days before first positive diagnostic test			FIRST POSITIVE DIAGNOSTIC TEST	3 days after first positive diagnostic test		
Example:	Mar 7	Mar 8	Mar 9	Mar 10	Mar 11	Mar 12	Mar 13

CAUTI Infection Criteria- Acute Care Hospitals

Diagnostic Test for Possible CAUTI	Localized Sign or Symptom Examples for Possible CAUTI
• Positive urine or blood culture	• Suprapubic tenderness • Costovertebral angle pain • Urgency • Frequency • Dysuria • Fever

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CAUTI Cannot Re-Occur in the Same Patient Within a 14-Day Period

No new CAUTI can be reported within a 14-day repeat infection timeframe (RIT)

- The date of the CAUTI event is considered day 1
- A new CAUTI is not reported until 14 days have elapsed
- If a new pathogen is identified in the urine within the 14-day period it should be added to the CAUTI already reported
- Refer to the NHSN CAUTI protocol for more details

CAUTI Location Attribution

- Attribute CAUTI to the inpatient location where the patient was assigned on the date of infection event
- If all elements of CAUTI are present on the date of transfer or discharge, or the next day, the CAUTI is attributed to the transferring/discharging location

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Symptomatic CAUTI Surveillance Definition

Symptomatic CAUTI requires the patient to have both clinical and microbiologic findings within a 7-day window period

- **Refer to written definitions frequently when performing UTI surveillance**
- Urine culture must grow no more than two species of organisms, at least one of which is bacteria of $\geq 10^5$ CFU/ml

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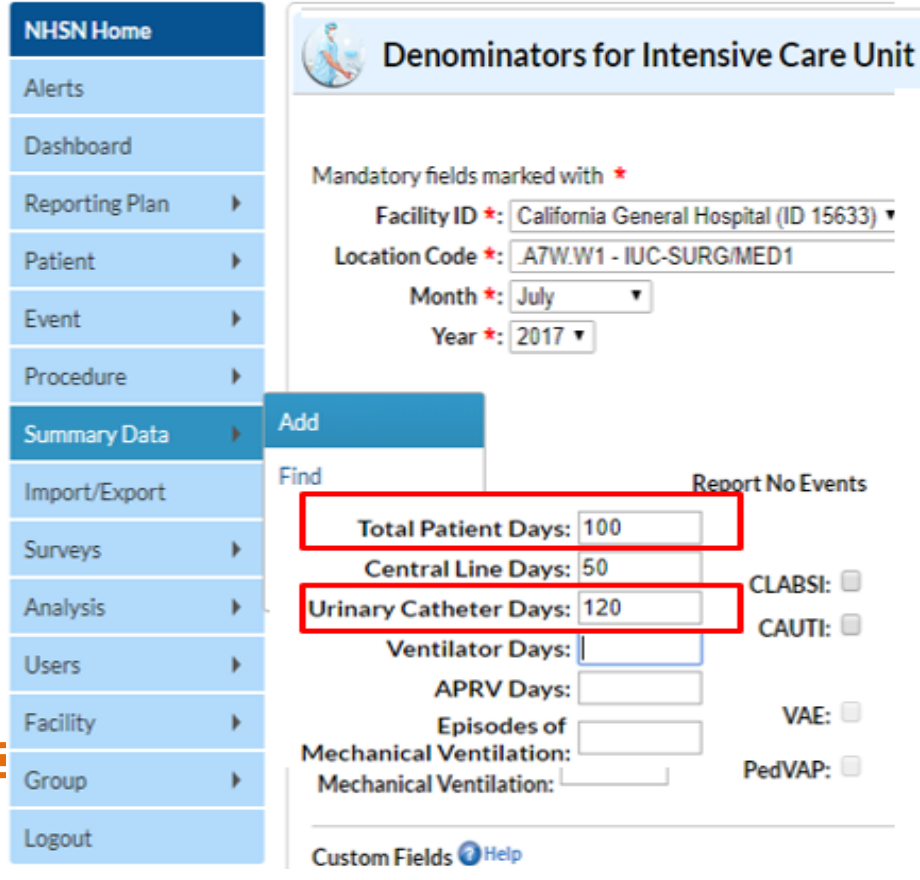
Asymptomatic CAUTI with Bacteremia Surveillance Definition

Asymptomatic UTI with Bacteremia (ABUTI) requires the following **three** criteria within a 7-day window period:

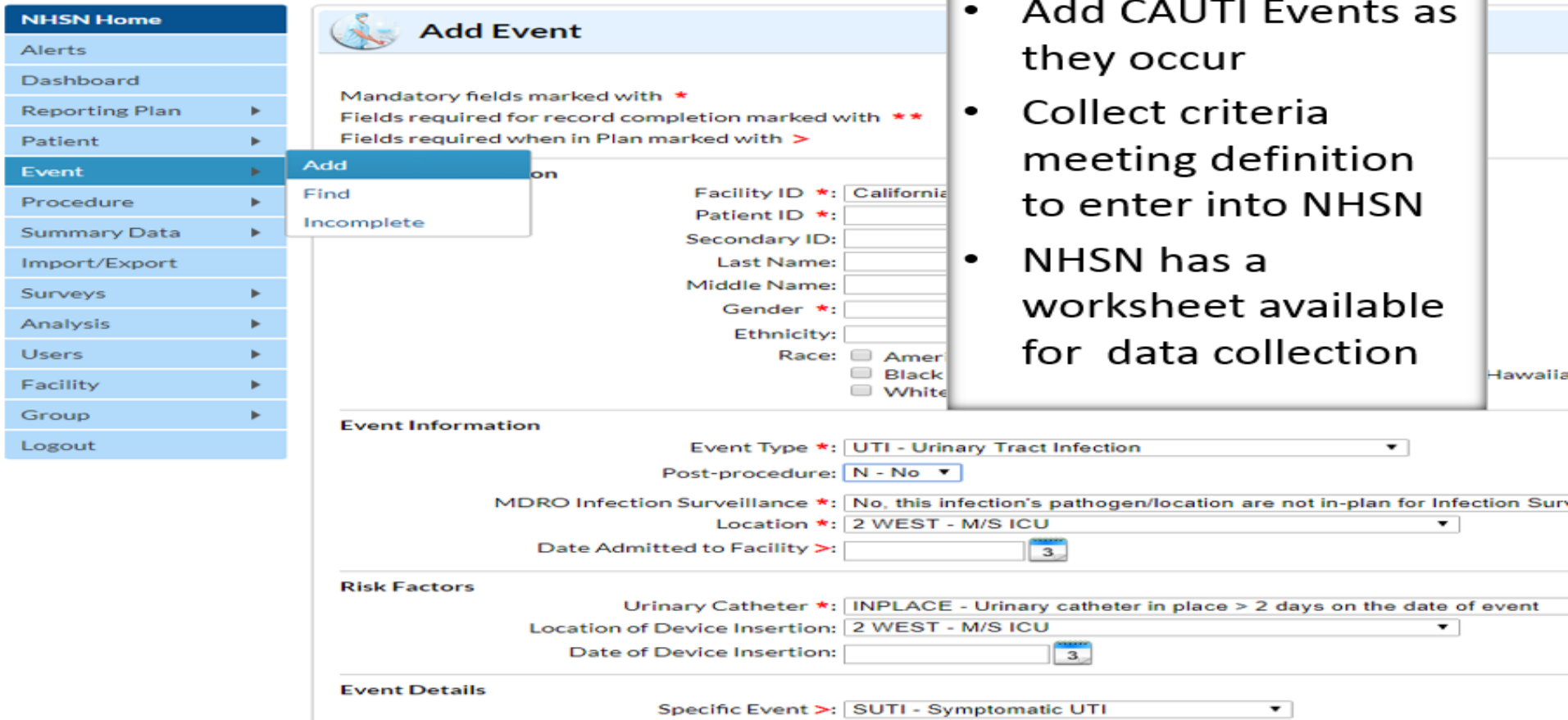
1. Urine culture with no more than two species of organisms, at least one of which is a bacteria of $>10^5$ CFU/ml
2. Positive blood culture with at least one matching bacteria to the urine **or** 2 positive blood cultures with common commensal bacteria and a matching common commensal in the urine
3. No clinical signs or symptoms of CAUTI

Report Monthly CAUTI Summary Data to NHSN



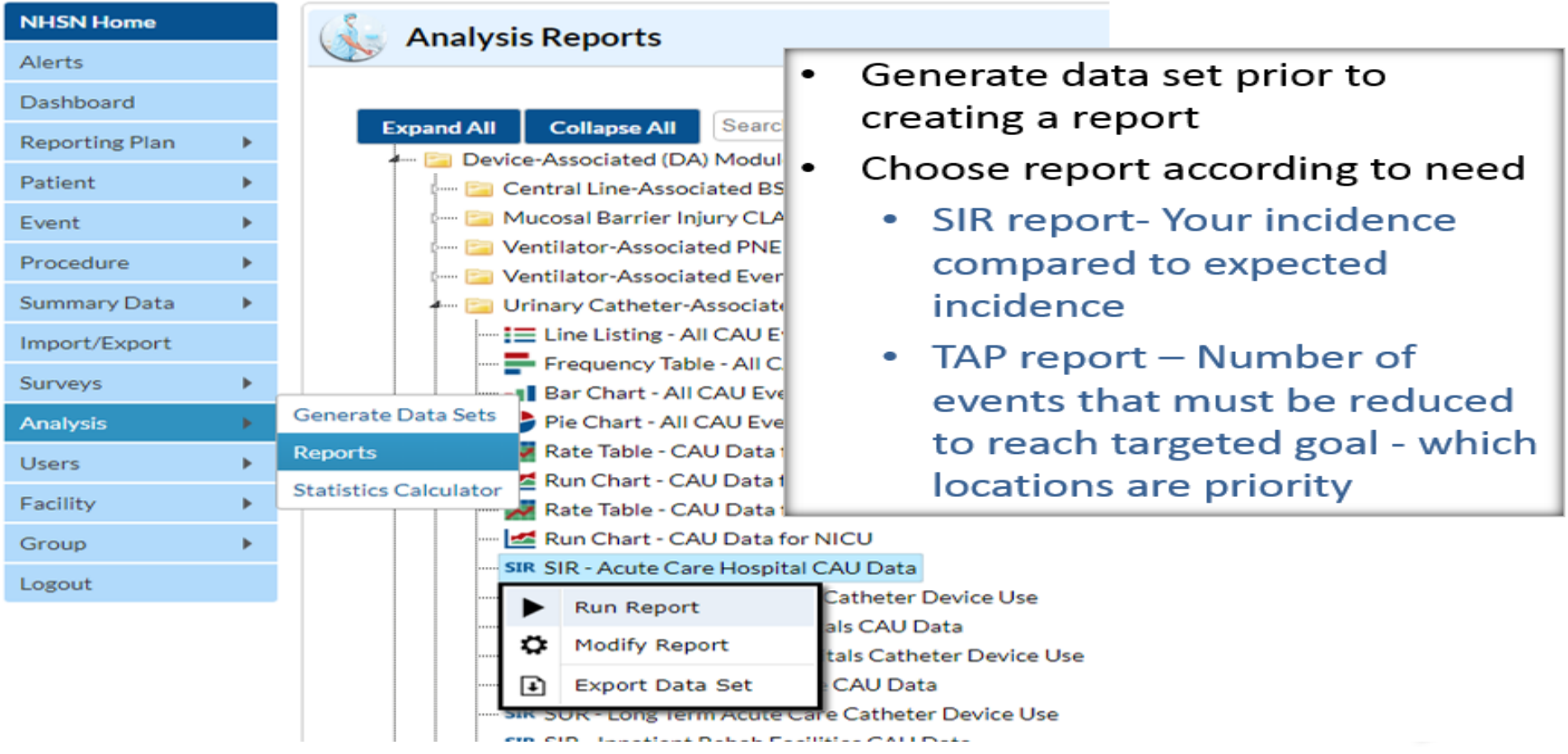
- Enter monthly denominator data for each patient location
  - Patient days
  - Urinary catheter days

Report CAUTI Event to NHSN



- Add CAUTI Events as they occur
- Collect criteria meeting definition to enter into NHSN
- NHSN has a worksheet available for data collection

NHSN CAUTI Analysis Reports



- Generate data set prior to creating a report
- Choose report according to need
  - SIR report- Your incidence compared to expected incidence
  - TAP report – Number of events that must be reduced to reach targeted goal - which locations are priority

NHSN CAUTI SIR Report

summaryYH	infCount	numPred	numucathdays	SIR	SIR_pval	sir95ci
2017H1	5	9.689	9541	0.516	0.1155	0.189, 1.144

Facility SIR

loccdc	summaryYH	infCount	numPred	numucathdays	SIR	SIR_pval	sir95ci
IN:ACUTE:CC:CT	2017H1	0	0.980	959	.	.	
IN:ACUTE:CC:MS	2017H1	1	2.966	2904	0.337	0.2557	0.017, 1.663
IN:ACUTE:STEP	2017H1	1	0.918	802	.	.	
IN:ACUTE:WARD:M	2017H1	0	1.390	1372	0.000	0.2492	, 2.156
IN:ACUTE:WARD:MS	2017H1	0	1.392	1526	0.000	0.2485	, 2.152
IN:ACUTE:WARD:ONC_HONC	2017H1	1	0.525	402	.	.	
IN:ACUTE:WARD:S	2017H1	2	0.714	782	.	.	
IN:ACUTE:WARD:TEL	2017H1	0	0.804	794	.	.	

SIR by Location

loccdc	summaryYH	numucathdays	numPredDDays	SUR	SUR_pval	SUR95CI
IN:ACUTE:CC:CT	2017H1	959	1,060.626	0.904	0.0016	0.848, 0.963
IN:ACUTE:CC:MS	2017H1	2904	3,276.933	0.886	0.0000	0.854, 0.919
IN:ACUTE:STEP	2017H1	802	759.748	1.056	0.1318	0.984, 1.131
IN:ACUTE:WARD:M	2017H1	1372	1,766.447	0.777	0.0000	0.736, 0.819
IN:ACUTE:WARD:MS	2017H1	1526	1,662.447	0.918	0.0007	0.873, 0.965
IN:ACUTE:WARD:ONC_HONC	2017H1	402	404.483	0.994	0.9280	0.900, 1.095
IN:ACUTE:WARD:S	2017H1	782	1,173.094	0.667	0.0000	0.621, 0.715
IN:ACUTE:WARD:TEL	2017H1	794	1,300.469	0.611	0.0000	0.569, 0.654

SUR by Location

California Department of PublicHealth

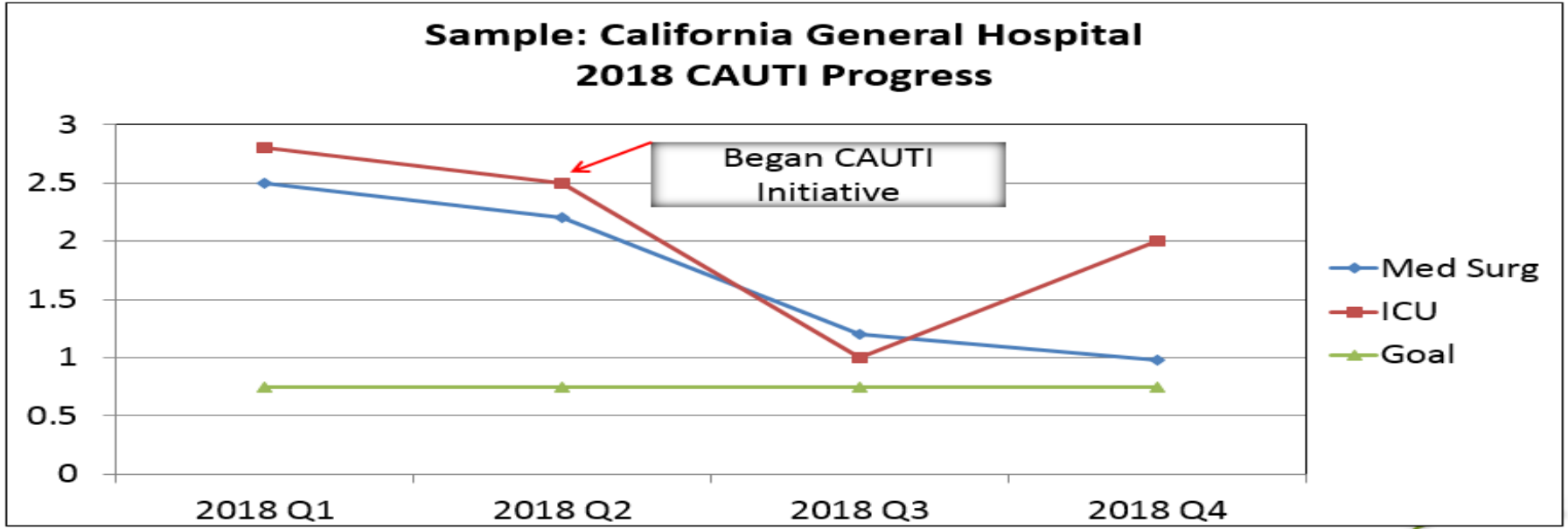
CAUTI TAP Report

	LOCATION							
Facility CAD	Location Rank	Location	CDC Location	Events	Central Line Days	DUR %	CAD	SIR
1.96	1	6E ONC	IN:ACUTE:WARD:ONC_HONC	3	1883	62	2.00	1.50
	2	CCU	IN:ACUTE:CC:CT	2	1082	64	1.46	1.84
	3	5 MED	IN:ACUTE:WARD:M	2	3199	26	0.61	0.72
	4	ICU	IN:ACUTE:CC:MS	1	2207	42	-0.11	0.45
	5	ICCU	IN:ACUTE:STEP	0	700	24	-0.32	.
	6	CMU NEW	IN:ACUTE:WARD:TEL	0	1178	16	-0.51	0.00
	7	6S 6W	IN:ACUTE:WARD:S	0	1245	24	-0.54	0.00
	8	4 M/S	IN:ACUTE:WARD:MS	0	1434	15	-0.62	0.00

Prioritize locations with highest cumulative attributable difference (CAD) – the number of infections we would have needed to prevent to reach goal

Track Progress Over Time

- Feedback results to your staff and leadership
- Changes in CAUTI incidence should be visible over time
- In the example, we can see ICU needed additional interventions



References and Resources

- Gould CV, Umscheid CA, Agarwal RK, Kuntz G, Pegues DA, and HICPAC. Guideline for Prevention of Catheter-associated Urinary Tract Infections 2009 (www.cdc.gov/hicpac/pdf/CAUTI/CAUTIguideline2009final.pdf)
- IHI Program to Prevent CAUTI (www.ihi.org/topics/CAUTI/Pages/default.aspx)
- APIC Preventing CAUTI: A patient-centered approach ,2012 (PDF) (apic.org/Resource_/TinyMceFileManager/epublications/CAUTI_feature_PS_fall_12.pdf)
- IDSA Guidelines , *Clin Infect Dis* 50:625-63, 2010
- SHEA/IDSA Compendium, *ICHE*, 35:464-479, 2014
- National Quality Forum (NQF) Safe Practices for Better Healthcare,2010

CAUTI Surveillance Summary

- Consistent use of standard surveillance methods and CAUTI definitions are essential for accurate case finding
- Capturing complete and accurate data is necessary for precise CAUTI SIR calculation
- Perform surveillance and feedback CAUTI SIR with adherence monitoring results to all units and leadership

Pneumonia and Ventilator-Associated Event Surveillance

ACH IP Course, 2021

Basics of Infection Prevention
Healthcare-Associated Infections Program
Center for Health Care Quality
California Department of Public Health

Objectives – Ventilator-Associated Events (VAE)

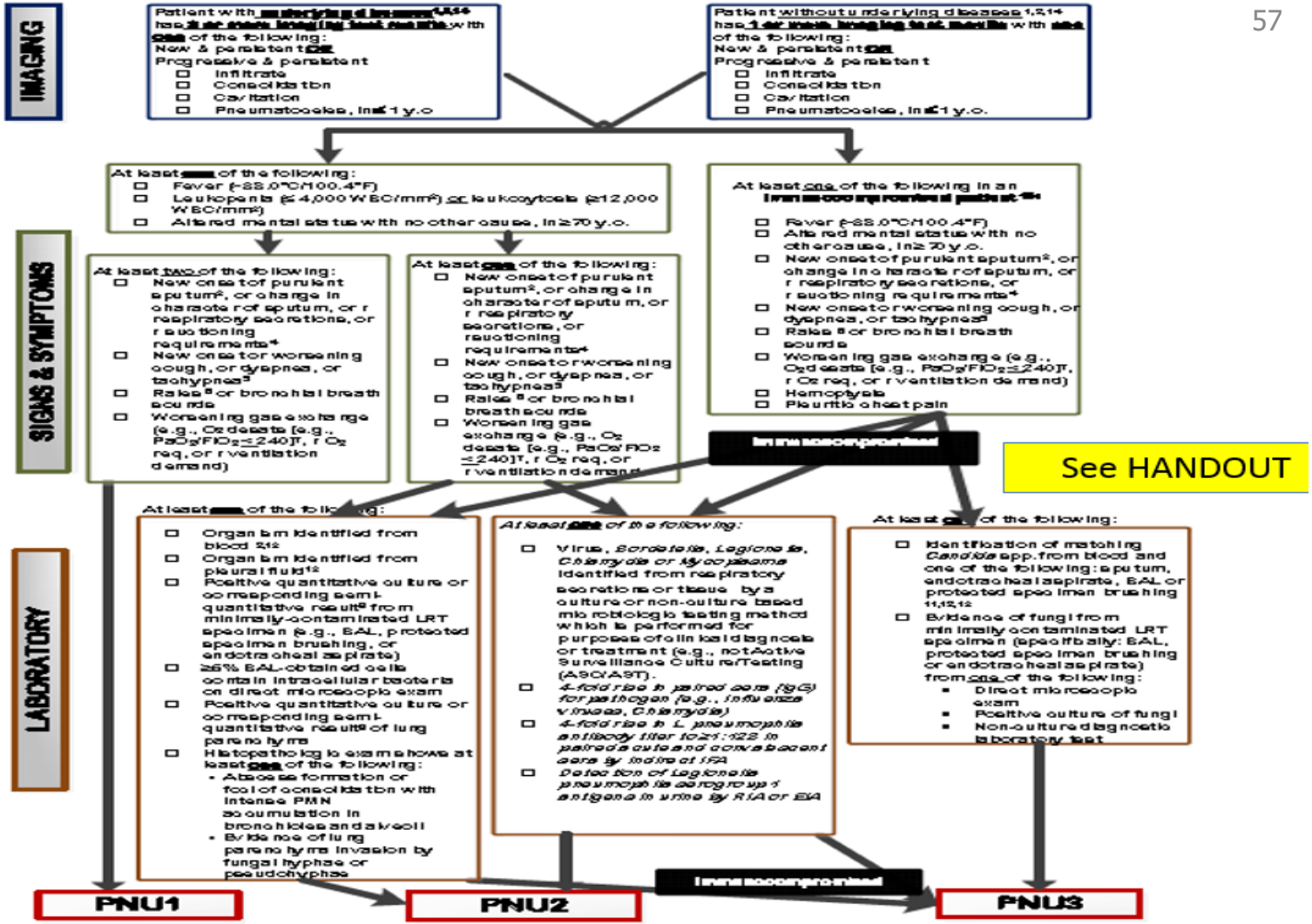
- Describe surveillance definitions for pneumonia (PNEU), ventilator associated events (VAE), and possible ventilator associated pneumonia (PVAP)
- Demonstrate how to use the NHSN VAE Calculator
- Review importance of feedback of HAI results to staff

Pneumonia (PNEU) Surveillance Definition

- NHSN PNEU definition is used for non-ventilated patients only
- Surveillance definition can be met by 3 different criteria using combinations of imaging, signs/ symptoms of infection, and laboratory results
  - Clinically defined pneumonia (PNU1)
  - Pneumonia with specific laboratory findings (PNU2)
  - Pneumonia in immuno-compromised patients (PNU3)

NHSN Patient Safety Module: Chapter 6

NHSN Patient Safety Module: Chapter 6



See HANDOUT

Pneumonia (PNEU 2) with Secondary BSI

- Used frequently for CLABSI surveillance to determine if BSI is primary or secondary to pneumonia
  - Candida and other yeast are not considered causative pathogens of pneumonia

NHSN Patient Safety Module: Chapter 6

Identifying Ventilator-Associated Events (VAE) and Possible Pneumonia (PVAP)

- Follow NHSN surveillance protocols
- Work with ICU and respiratory therapy staff to develop alerting process
- Monitor ventilated patient for
  - Positive cultures
  - Changes in WBC
  - Patient temperature chart/log
  - Pharmacy reports of antimicrobial use
  - Change in respiratory secretions

Defining VAE and PVAP

- Pneumonia definition is subjective and complex
- Surveillance definition algorithm detects a broad range of conditions/complications that occur in mechanically ventilated patients
- Ventilator-associated event (VAE) defines
  - Ventilator-associated conditions (VAC)
  - Infection-related ventilator-associated complications (IVAC)
  - Possible ventilator-associated pneumonia (PVAP)

Applying VAE and Pneumonia Surveillance Definitions

- VAE definition is used for all ventilated patients in adult locations regardless of age (excludes high frequency ventilated and extracorporeal life support patients)
  - IVAC is an infection-related VAE
  - IVAC/PVAP is pneumonia that occurs in patients intubated and on mechanical ventilation
- VAP/PNEU definition is used for pediatric locations
  - Includes pediatric locations (e.g., PICU)
  - Excludes NICU

VAE/PVAP Surveillance Definition

- Patient must be ventilated >2 calendar days
- Patient must have ≥3 calendar days of stability or improvement of oxygenation followed by ≥2 calendar days of worsening oxygenation
- Earliest date of event for VAE is mechanical ventilation day 3 (first day of worsening oxygenation)
- First possible day that VAC criteria can be fulfilled is mechanical ventilation day 4
- For VAE surveillance, PEEP values between 0 - 5 cmH2O will be considered equivalent

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Ventilator Associated Event (VAE)

- Daily minimum PEEP and FiO_2 values are defined as the lowest value set on the ventilator during a calendar day (and maintained for at least 1 hour)
  - If there is no value documented to have been maintained for at least 1 hour, the daily minimum value is the lowest value set on the ventilator during the calendar day
- VAE optional denominator – episodes of mechanical ventilation (EMV)
  - An episode of mechanical ventilation is a period of days during which the patient was mechanically ventilated for some portion of each consecutive day

NHSN Patient Safety Module: Chapter 10

VAC Criteria

- 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
- The baseline period is defined as the 2 calendar days immediately preceding the first day of increased daily minimum PEEP or FiO_2

AND

- After the period of stability – At least 1 of the following 2 criteria sustained for ≥2 calendar days:
  - ❑ 1. Increase in daily minimum FiO_2 of≥ 20 points over the daily minimum FiO_2 in the baseline period
  - ❑ 2. Increase in daily minimum PEEP of ≥3 cmH_2O

IVAC Criteria

- Meets VAE criteria for VAC

AND

- On or after calendar day 3 on ventilator and within 2 calendar days before or after onset worsening oxygenation:
  - BOTH of the following 2 criteria are met:
    - ❑ 1. Temp >38°C or <36°C
      OR
      WBC>12,000 cells/mm^3 or <4,000 cells/mm^3
    - ❑ 2. A new antimicrobial agent(s) is started, and is continued for >4 calendar days

PVAP Criteria

- Meets VAE criteria for IVAC
- On or after calendar day 3 on ventilator and within 2 calendar days before or after onset of worsening oxygenation:

  One of the following three criteria is met:

  - ❑ 1. Positive culture (see list) without requirement for purulent respiratory secretions*
  - ❑ 2. Purulent respiratory secretions plus specified positive respiratory culture*
  - ❑ 3. Positive pleural culture, lung histopathology, or diagnostic test for Legionella, or specified virus*

*Consult VAE protocol for organism exclusions

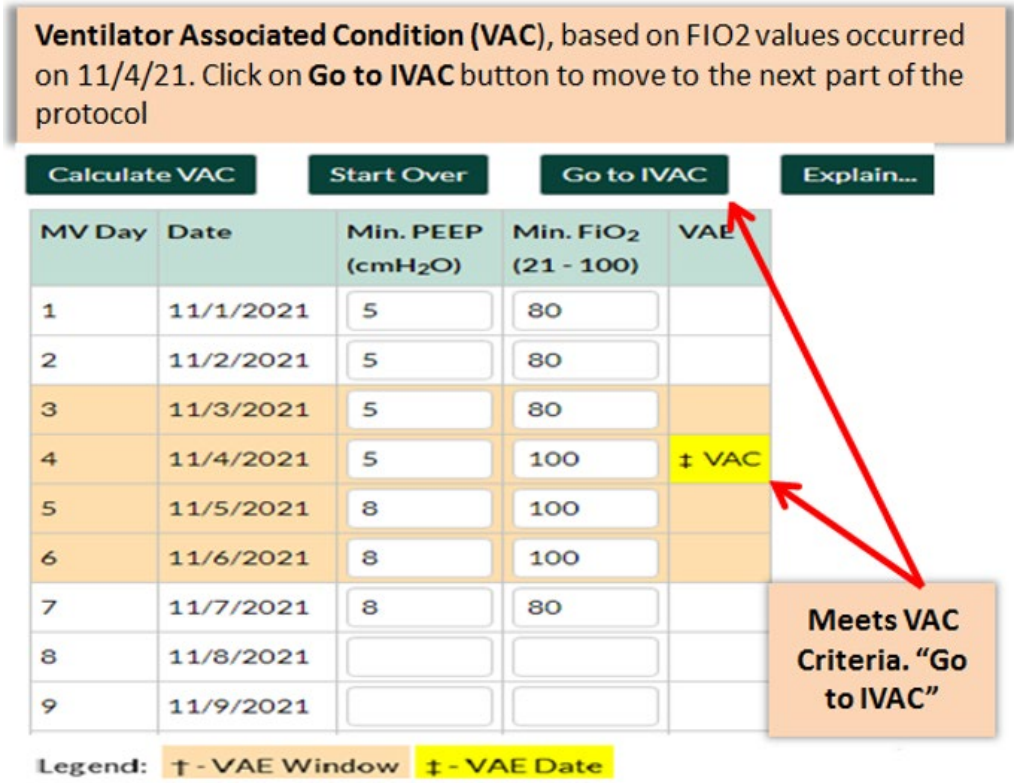
NHSN Patient Safety Module: Chapter 10

NHSN VAE Calculator Version 8.1

1. Enter ventilator data, follow instructions

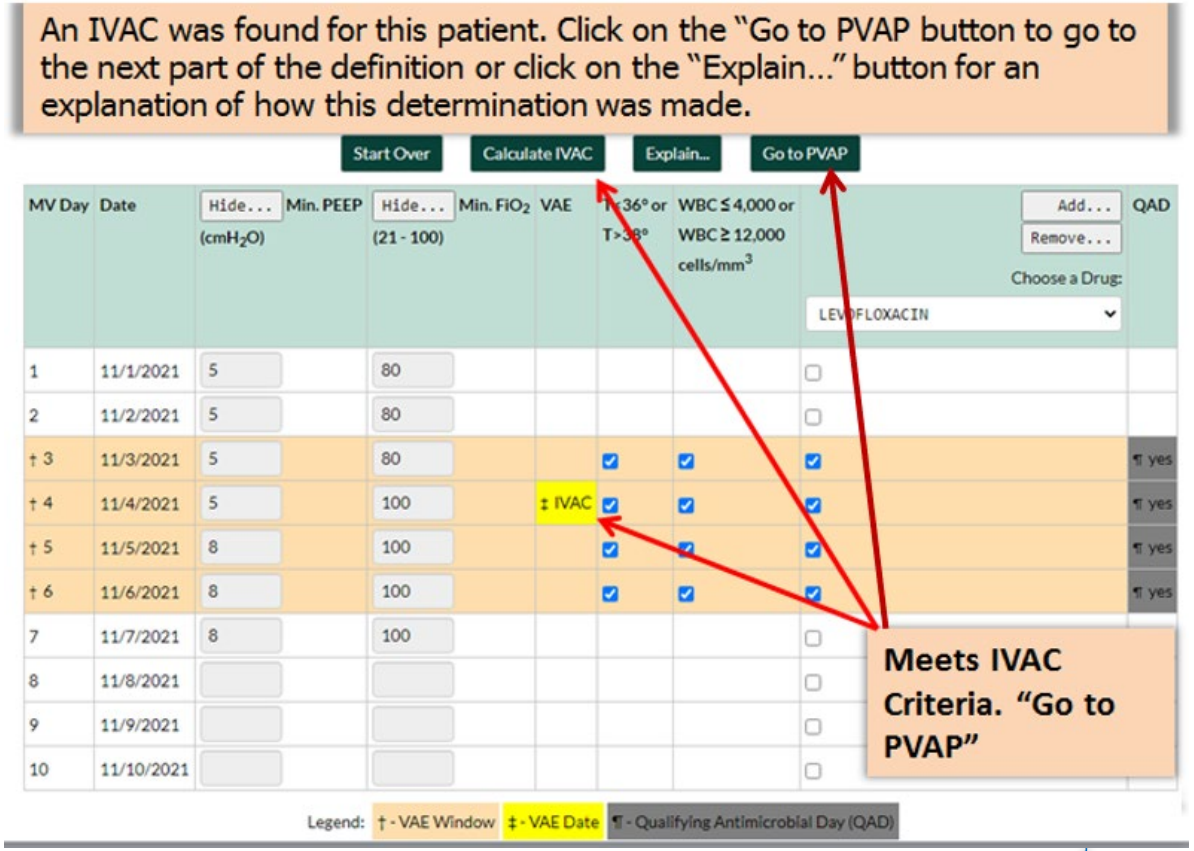
[VAE Calculator](www.cdc.gov/nhsn/vae-calculator/index.html)

(www.cdc.gov/nhsn/vae-calculator/index.html)



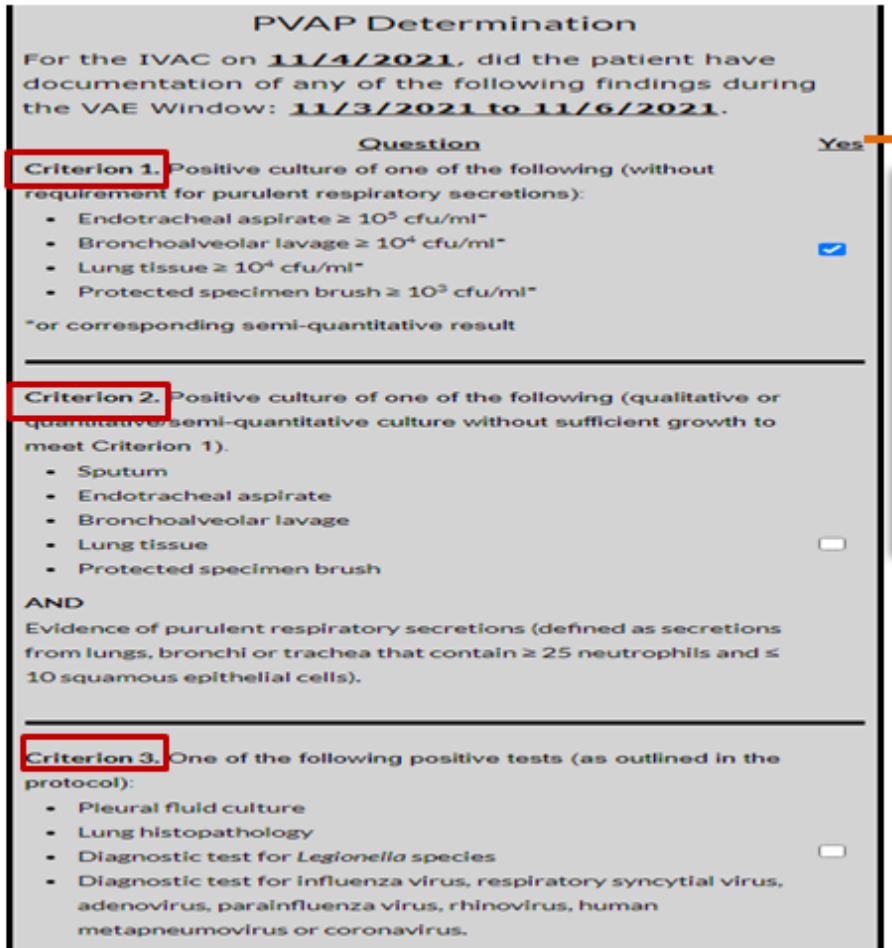
NHSN VAE Calculator Version 8.1

2. Enter temperature, WBC count, antibiotics
3. Click "Calculate IVAC"



NHSN PVAP

1. Check criteria in table, then "Calculate PVAP"



PVAP Determination

For the IVAC on **11/4/2021**, did the patient have documentation of any of the following findings during the VAE Window: **11/3/2021 to 11/6/2021**.

Question	Yes
Criterion 1. Positive culture of one of the following (without requirement for purulent respiratory secretions): • Endotracheal aspirate ≥ 10^5 cfu/ml* • Bronchoalveolar lavage ≥ 10^4 cfu/ml* • Lung tissue ≥ 10^4 cfu/ml* • Protected specimen brush ≥ 10^3 cfu/ml* *or corresponding semi-quantitative result	☑
Criterion 2. Positive culture of one of the following (qualitative or quantitative/semi-quantitative culture without sufficient growth to meet Criterion 1). • Sputum • Endotracheal aspirate • Bronchoalveolar lavage • Lung tissue • Protected specimen brush **AND** Evidence of purulent respiratory secretions (defined as secretions from lungs, bronchi or trachea that contain ≥ 25 neutrophils and ≤ 10 squamous epithelial cells).	☐
Criterion 3. One of the following positive tests (as outlined in the protocol): • Pleural fluid culture • Lung histopathology • Diagnostic test for *Legionella* species • Diagnostic test for influenza virus, respiratory syncytial virus, adenovirus, parainfluenza virus, rhinovirus, human metapneumovirus or coronavirus.	☐

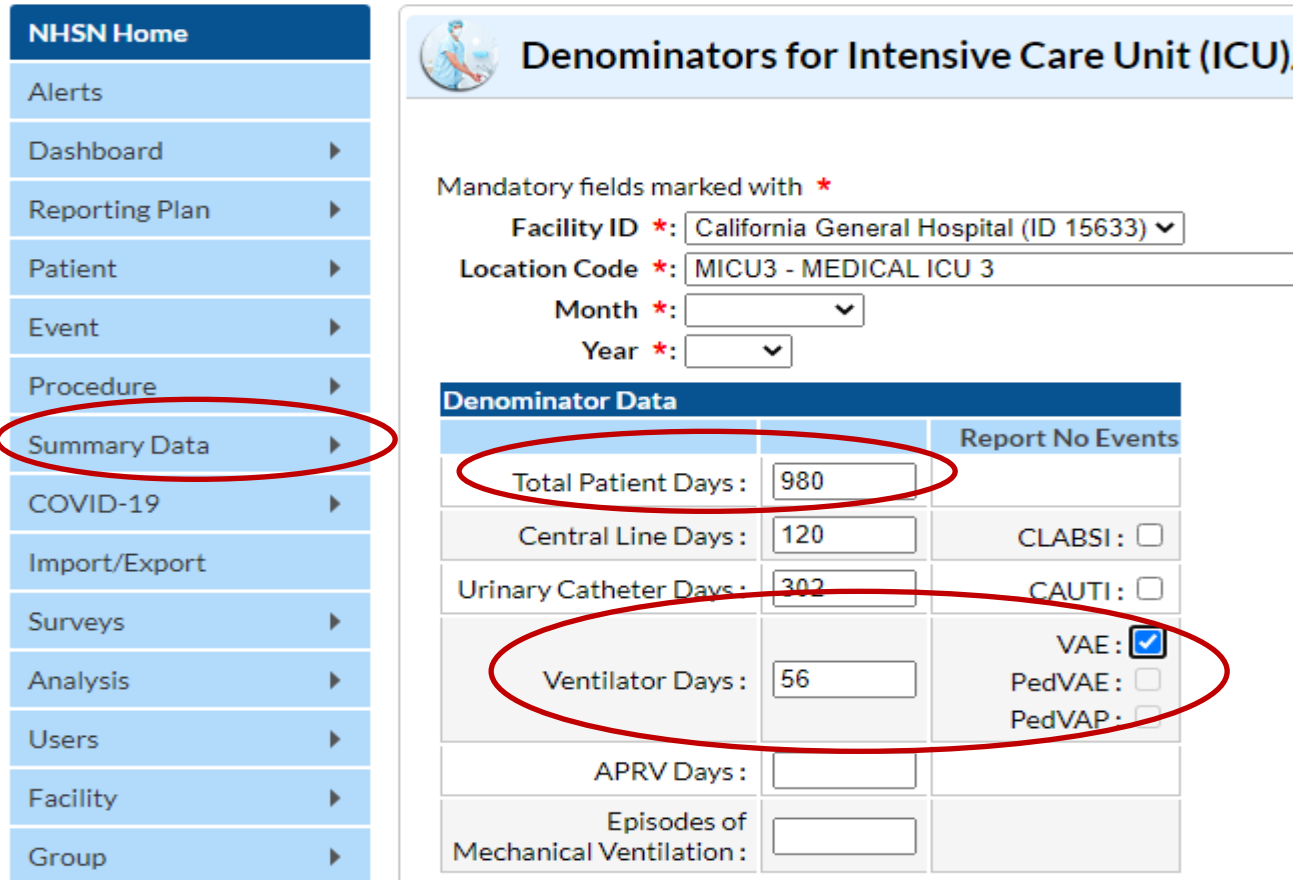
Calculate PVAP | Close

2. Result:
   - After calculating PVAP, a pop up will appear verifying the type of event.
   - Select "Explain" for information on the criteria used

The event on 11/4/2021 conforms to a Possible Ventilator-Associated Pneumonia (PVAP) definition. For a discussion of why, click on the Explain button.

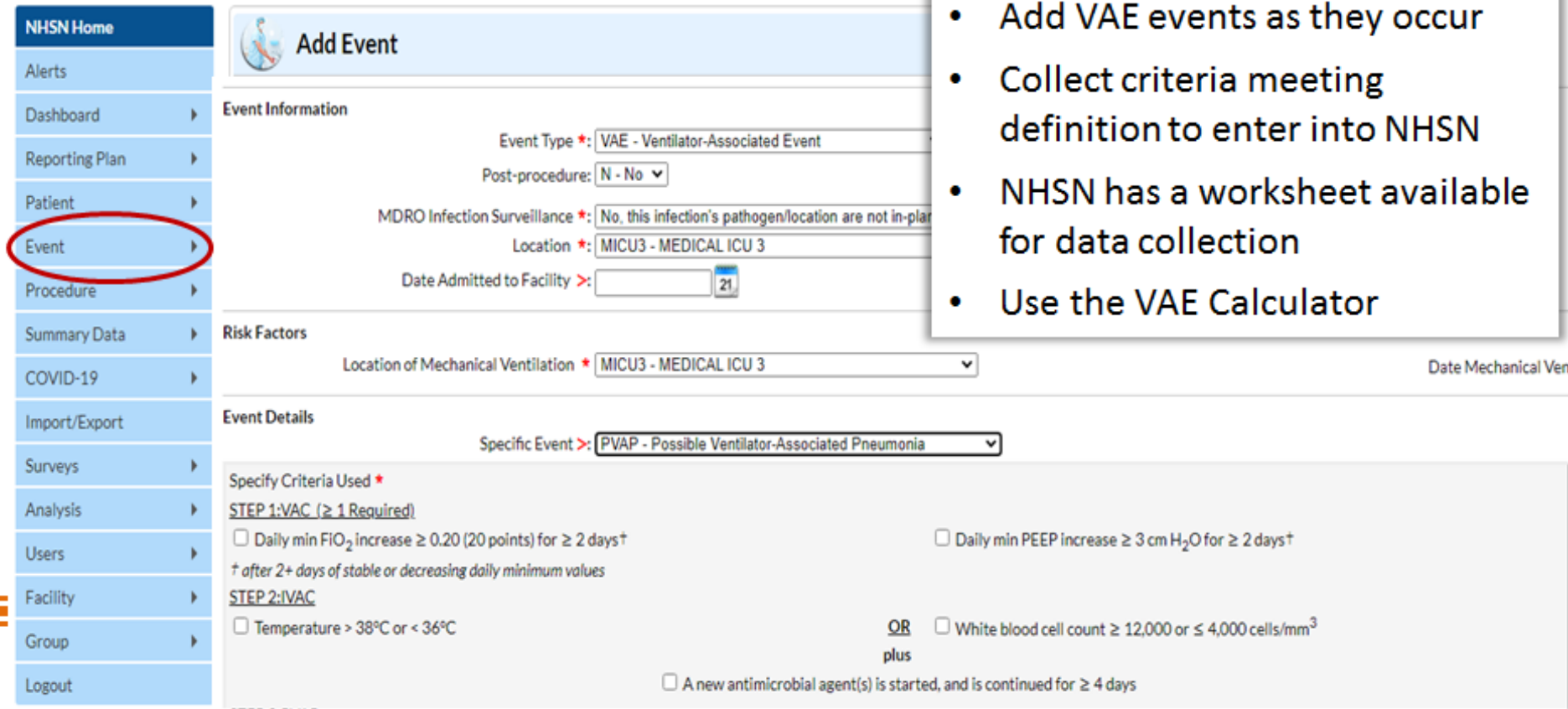
Close

Report Monthly VAE Summary Data



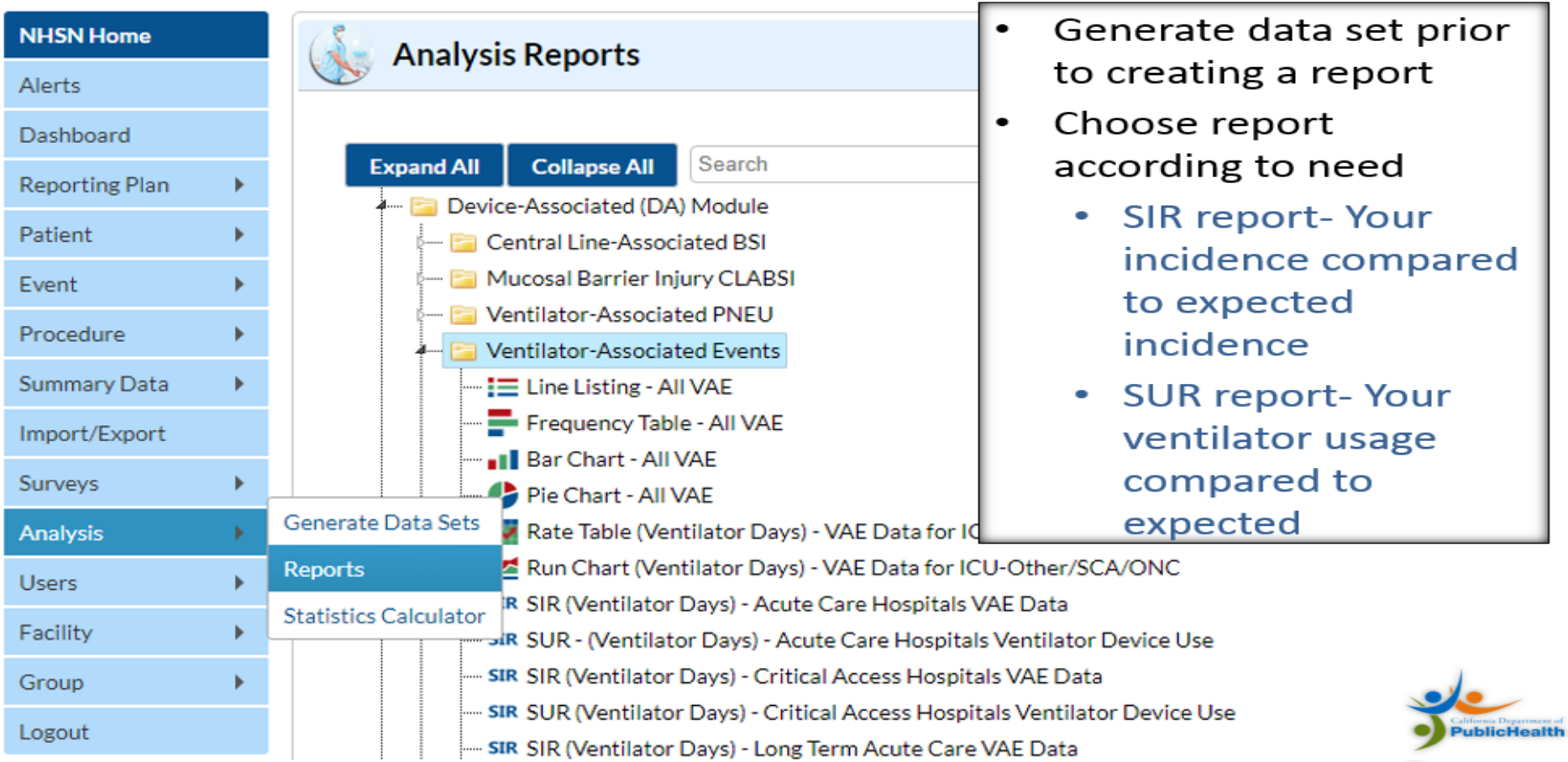
- Enter monthly denominator data for each patient location
  - Patient days
  - Ventilator days

Enter VAE Event



- Add VAE events as they occur
- Collect criteria meeting definition to enter into NHSN
- NHSN has a worksheet available for data collection
- Use the VAE Calculator

NHSN VAE Analysis



- Generate data set prior to creating a report
- Choose report according to need
  - SIR report- Your incidence compared to expected incidence
  - SUR report- Your ventilator usage compared to expected

Feedback VAE Results

- Share VAE SIR and SUR progress results with
  - ICU staff
  - Respiratory Therapists
  - ICU Committee
  - Infection Control Committee
  - Leadership
- Analysis of your data helps identify areas for further education and prevention activities

Pneumonia Surveillance Summary

- Surveillance for pneumonia and VAP challenging
- VAE definitions reduce variability
  - Used only in adult locations
- Consistent use of standard surveillance methods and PNEU/VAE/VAP definitions are essential for accurate case finding
- Analysis and feedback of VAE/VAP data is necessary to review progress in VAE/VAP reduction

References for VAP Prevention and Bundles

- Institute for Healthcare Improvement (IHI)
  (www.ihi.org/resources/Pages/Tools/HowtoGuidePreventVAP.aspx)
- SHEA Compendium: Strategies to Prevent Ventilator-Associated Pneumonia in Acute Care Hospitals: 2014 Update
  (www.shea-online.org/index.php/practice-resources/priority- topics/compendium-of-strategies-to-prevent-hais)

References and Resources

- Coffin, S, et al. (2008). Strategies to Prevent Ventilator-Associated Pneumonia in Acute Care Hospitals. *Infect Control Hosp Epidemiol* ,29:S31-S40.
- Greene LR, Sposato K, Farber MR, Fulton TM, Garcia RA. (2009). Guide to the Elimination of Ventilator – Associated Pneumonia. Washington, D.C.: APIC.
- Greene LR, Sposato K, Farber MR, Fulton TM, Garcia RA. (2009) Guide to the Elimination of Ventilator – Associated Pneumonia, APIC.
- Hidron AI, et.al., (2008) *Infect Control Hosp Epidemiol,* 29:996-1011
- NHSN Patient Safety Module: Chapter 6 (PNEU/VAP) (PDF) (www.cdc.gov/nhsn/PDFs/pscManual/6pscVAPcurrent.pdf)
- NHSN Patient Safety Module: Chapter 10 VAE (PDF) (www.cdc.gov/nhsn/PDFs/pscManual/10-VAE_FINAL.pdf)

Questions?

For more information,

please contact

HAIProgram@cdph.ca.gov

Include “ACH IP Basics Course” in the subject line

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