Use and Application of the Ventilator Associated Event (VAE) Protocol – Part 2 Case Scenarios

Tara Millson, DNP, RN, CIC

Cindy Gross, MT, SM (ASCP), CIC

Protocol and Validation Team

National Healthcare Safety Network

March 27, 2019

VAE - Case Study 1

A 59-year old male is seen in the ER on 1/27 with an admitting diagnosis of influenza with a suspicion of a complication related to bacterial pneumonia. He is placed on the ventilator in the ER and admitted to an inpatient location the same day. *In-plan VAE surveillance have been selected in the monthly reporting plan in this location.* The patient subsequently declines and is eventually transferred to another facility on the evening of 2/4 for initiation of ECMO. Review his ventilator settings and additional information provided in the table below to determine if a VAE is identified prior to transfer.

Case Study 1

Date	MV DAY	Daily minimum PEEP	Daily minimum FiO_2	Temp	WBC	ABX	ABX	Speci-men	Polys/ Epis	Organism
1/27	1	8	40	38.0	3.6			Sputum		NF with Few *S. pneumoniae*
1/28	2	8	40	38.0	--	Ceftriaxone				
1/29	3	5	50	39.0	--	Ceftriaxone				
1/30	4	5	80	37.6	4.9	Ceftriaxone				
1/31	5	5	80	38.6	--	Ceftriaxone	Azithro-mycin	Endo-tracheal aspirate	Many WBC, Rare Epithelial, Many GPC	Moderate *S. pneumoniae*
2/1	6	5	60	39	5.8	Ceftriaxone				
2/2	7	8	60	38.8	5.4	Ceftriaxone	Azithro-mycin			
2/3	8	8	80	38.0	5.4	Ceftriaxone	Azithro-mycin			
2/4	9	8	80	39.1	10.8	Ceftriaxone	Azithro-mycin			

What event is identified for this patient?

A. None, the patient had pneumonia present on admission and was placed on ECMO and therefore is excluded from VAE surveillance

B. VAC – DOE 1/30

C. PVAP – DOE 2/2

D. VAC – DOE 2/3

What event is identified for this patient?

A. None, the patient had pneumonia present on admission and was placed on ECMO and therefore is excluded from VAE surveillance

B. VAC – DOE 1/30

C. PVAP – DOE 2/2

D. VAC – DOE 2/3

Case Study 1

Date	Daily minimum PEEP	Daily minimum FiO_2
1/27	8	40
1/28	8	40
1/29	5	50
1/30	5	80
1/31	5	80
2/1	5	60
2/2	8	60
2/3	8	80
2/4	8	80

- VAC **met in the PEEP** parameter with a date of event 2/2---date of onset of worsening oxygenation
- Baseline period must be established immediately preceding the evidence of worsening oxygenation so there is no event 1/30 (FiO_2 parameter)
- VAC definition is met on 2/3 (FiO_2 parameter) but is within the 14 day event period established (2/2- 2/15) so no new event

PVAP

Date	MV DAY	Daily minimum PEEP	Daily minimum FiO_2	Temp	WBC	ABX	ABX	Speci-men	Polys/ Epis	Organism
1/27	1	8	40	38.0	3.6			Sputum		NF with Few *S. pneumoniae*
1/28	2	8	40	38.0	--	Ceftriaxone				
1/29	3	5	50	39.0	--	Ceftriaxone				
1/30	4	5	80	37.6	4.9	Ceftriaxone				
1/31	5	5	80	**38.6**	--	Ceftriaxone	**Azithro-mycin**	**Endo-tracheal aspirate**	Many WBC, Rare Epithelial, Many GPC	**Moderate *S. pneumoniae***
2/1	6	5	60	**39**	5.8	Ceftriaxone				
2/2	7	8	60	**38.8**	5.4	Ceftriaxone	**Azithro-mycin**			
2/3	8	8	80	38.0	5.4	Ceftriaxone	**Azithro-mycin**			
2/4	9	8	80	**39.1**	10.8	Ceftriaxone	**Azithro-mycin**			

What criterion of the PVAP definition met?

A. Criterion 1

B. Criterion 2

C. Criterion 3

D. I don’t know I guessed that PVAP was identified

What criterion of the PVAP definition is met?

A. Criterion 1

B. Criterion 2

C. Criterion 3

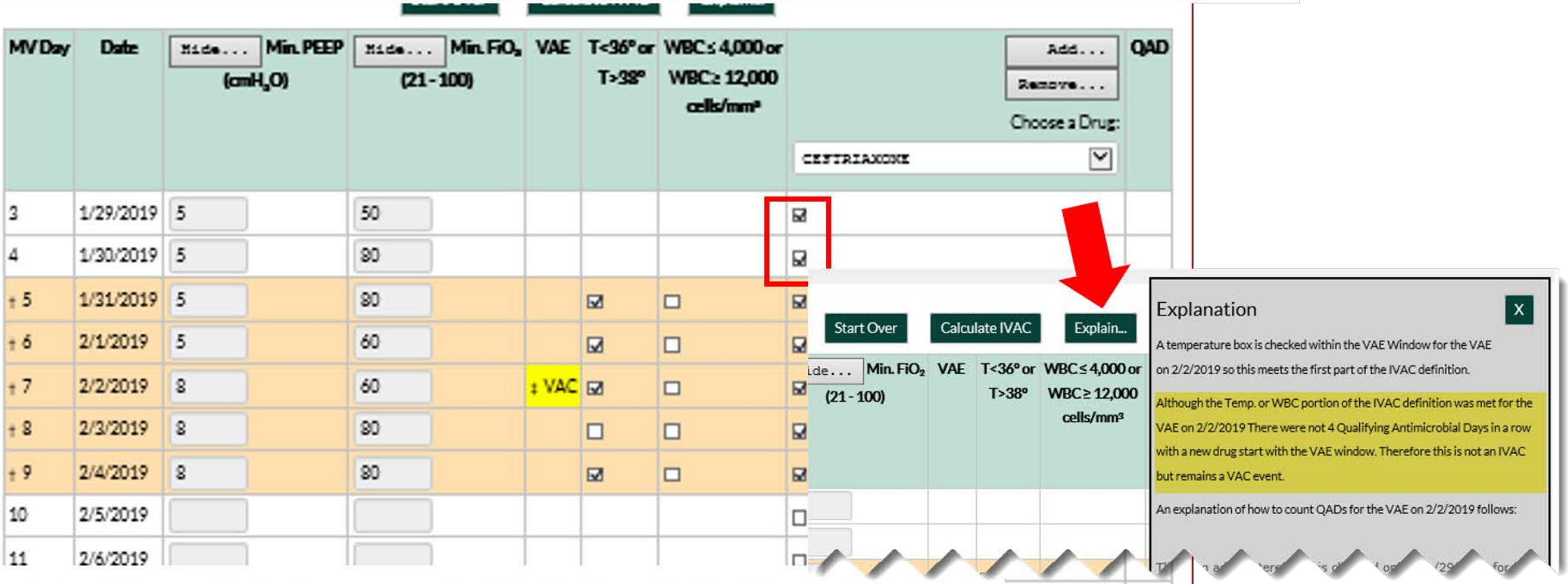
D. I don’t know I guessed that PVAP was identified

Case Study 1 - Rationale

- VAC met

- IVAC met: Eligible temperature, “new” antimicrobial agent providing ≥ 4 QADs

Now that a VAC determination has been made, enter yes (check) or no (leave box unchecked) if the patient has had a temperature > 38° C or < 36° C or a WBC ≥ 12,000 cells/mm³ or ≤ 4,000 cells/mm³ within the VAE Window Period. Choose a drug from the drop down list and **check all the corresponding days shown on the screen** that the agent was administered. If more than one drug was given over the course of treatment, click on the "Add..." button in the drug column header and do the same. Once all data have been entered, **click the "Calculate IVAC" button.**



New antimicrobial agent: Defined as any agent listed in the Appendix that is initiated on or after the third calendar day of mechanical ventilation AND in the VAE Window Period (specifically, the period typically defined by the 2 calendar days before, the day of, and the 2 calendar days after the onset date of the VAE). The agent is considered new for the purposes of this definition if it was NOT given to the patient on either of the 2 days preceding the current start date.

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

MV Day	Date	Hide... Min. PEEP (cmH_2O)	Hide... Min. FiO_2 (21 - 100)	VAE	T<36° or T>38°	WBC≤ 4,000 or WBC≥ 12,000 cells/mm^3	Add... Remove... Choose a Drug: CEFTRIAXONE	Add... Remove... Choose a Drug: AZITHROMYCIN	QAD
3	1/29/2019	5	50				☑	☐	
4	1/30/2019	5	80				☑	☐	
† 5	1/31/2019	5	80		☑	☐	☑	☑	¶ yes
† 6	2/1/2019	5	60		☑	☐	☑	☐	¶ yes
† 7	2/2/2019	8	60	‡ IVAC	☑	☐	☑	☑	¶ yes
† 8	2/3/2019	8	80		☐	☐	☑	☑	¶ yes
† 9	2/4/2019	8	80		☑	☐	☑	☑	¶ yes
10	2/5/2019							☐	
11	2/6/2019							☐	
12	2/7/2019							☐	
13	2/8/2019							☐	

Qualifying Antimicrobial Day (QAD): A day on which the patient was administered an antimicrobial agent that was determined to be "new" within the VAE Window Period. Four consecutive QADs are needed to meet the IVAC antimicrobial criterion—starting within the VAE Window Period. Days on which a new antimicrobial agent is administered count as QADs. Days between administrations of a new antimicrobial agent also count as QADs as long as there is a gap of no more than 1 calendar day between administrations. For example, if levofloxacin is given on VAE Day 1, has not been given in the 2 preceding calendar days, and is given again on VAE Days 3, 5 and 7, there are 7 QADs—because the days between levofloxacin doses also count as QADs. By contrast, days between administrations of different antimicrobial agents do

Case Study 1 - Rationale

- VAC met

- IVAC met: Eligible temperature, “new” antimicrobial agent provides ≥ 4 QADs

- PVAP: Eligible pathogen, eligible specimen, eligible quantity **<u>for Criterion 1</u>**

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-
   instructions for using the purul
3) Criterion 3: One of the following pos
   - Organism identified from
   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

24) My laboratory only performs semi-quantitative cultures of lower respiratory tract specimens, and cannot provide me with additional guidance to help me know what semi-quantitative culture result corresponds to the quantitative thresholds specified in Criterion1 of the PVAP definition. Can you provide more information?

- For the purposes of this surveillance, and in the absence of additional information available from your laboratory, a semi-quantitative result of "moderate" or "heavy" growth, or 2+, 3+ or 4+ growth, meets the PVAP definition (Criterion 1).

January 2019

Possible Ventilator-Associated Pneumonia (PVAP)

PVAP Determination

For the IVAC on **2/2/2019**, did the patient have documentation of any of the following findings during the VAE Window: **1**

Criterion 1. Positive cult

requirement for purulent

- Endotracheal aspira
- Bronchoalveolar lav
- Lung tissue ≥ 10^4 cf
- Protected specimen

*or corresponding semi-

Criterion 2. Positive cult

quantitative/semi-quanti

meet Criterion 1).

- Sputum
- Endotracheal aspira
- Bronchoalveolar lav
- Lung tissue
- Protected specimen

AND

Start Over | Explain... | Go to PVAP

MV Day	Date	Hide... Min. PEEP (cmH_2O)	Hide... Min. FiO_2 (21 - 100)	VAE	T<36° or T>38°	WBC ≤ 4,000 or WBC ≥ 12,000 cells/mm^3	Add... Remove... Choose a Drug: CEFTRIAXONE	Add... Remove... Choose a Drug: AZITHROMYCIN	QAD
3	1/29/2019	5	50				☑	☐	
4	1/30/2019	5	80				☑	☐	
† 5	1/31/2019	5	80		☑	☐	☑	☑	¶ yes
† 6	2/1/2019	5	60		☑	☐	☑	☐	¶ yes
† 7	2/2/2019	8	60	‡ PVAP	☑	☐	☑	☑	¶ yes
† 8	2/3/2019	8	80		☐	☐	☑	☑	¶ yes
† 9	2/4/2019	8	80		☑	☐	☑	☑	¶ yes
10	2/5/2019						☑	☐	
11	2/6/2019						☑	☐	
12	2/7/2019						☑	☐	
13	2/8/2019						☑	☐	

Legend: † - VAE Window | ‡ - VAE Date | ¶ - Qualifying Antimicrobial Day (QAD)

PVAP

Date	MV DAY	Daily minimum PEEP	Daily minimum FiO_2	Temp	WBC	ABX	ABX	Speci-men	Polys/ Epis	Organism
1/27	1	8	40	38.0	3.6			Sputum		NF with Few *S. pneumoniae*
1/28	2	8	40	38.0	--	Ceftriaxone				
1/29	3	5	50	39.0	--	Ceftriaxone				
1/30	4	5	80	37.6	4.9	Ceftriaxone				
1/31	5	5	80	**38.6**	--	Ceftriaxone	**Azithro-mycin**	**Endo-tracheal aspirate**	Many WBC, Rare Epithelial, Many GPC	**Moderate *S. pneumoniae***
2/1	6	5	60	**39**	5.8	Ceftriaxone				
2/2	7	8	60	**38.8**	5.4	Ceftriaxone	**Azithro-mycin**			
2/3	8	8	80	38.0	5.4	Ceftriaxone	**Azithro-mycin**			
2/4	9	8	80	**39.1**	10.8	Ceftriaxone	**Azithro-mycin**			

CASE 1 Recap

- Patients are not excluded from VAE surveillance due to admitting diagnosis, presence of underlying conditions or development of complications
- Exclusions related to mode of ventilation only applies during periods of time while receiving support from the specific mode
- Eligible pathogens identified during the VAE window period are to be used to determine if PVAP definition can be met even if the same or similar pathogen was identified prior to the event detection
- Important to consider all antimicrobial administration days when determining if an agent is “new”
- Days between administration of the same “new” antimicrobial agent count as QADs as long as there is a gap of no more than 1 calendar day
- In the absence of a quantitative reporting semi-quantitative equivalents can be used to meet Criterion 1. Note that purulent respiratory secretions is not required to meet Criterion 1

What if there was no event on 2/2 (PEEP) and we had knowledge that the Azithromycin order was written for continuation until 2/10? What event would have been identified on 2/3?

Date	MV DAY	Daily minimum PEEP	Daily minimum FiO_2	Temp	WBC	ABX	ABX	Specimen	Polys/ Epis	Organism
1/27	1	8	40	38.0	3.6			Sputum		NF with Few *S. pneumoniae*
1/28	2	8	40	38.0	--	Ceftriaxone				
1/29	3	5	50	39.0	--	Ceftriaxone				
1/30	4	5	80	37.6	4.9	Ceftriaxone				
1/31	5	5	80	38.6	--	Ceftriaxone	Azithro-mycin	Endo-tracheal aspirate	Many WBC, Rare Epithelial, Many GPC	Moderate S. pneumoniae
2/1	6	5	60	39	5.8	Ceftriaxone				
2/2	7	↓ 5	60	38.8	5.4	Ceftriaxone	Azithro-mycin			
2/3	8	↓ 5	80	38.0	5.4	Ceftriaxone	Azithro-mycin			
2/4	9	↓ 5	80	39.1	10.8	Ceftriaxone	Azithro-mycin			

What event would have been reported on 2/3?

A. VAC

B. IVAC

C. PVAP

D. I’m lost ☹

What event would have been reported on 2/3?

A. VAC

B. IVAC

C. PVAP

D. I’m lost ☹

What if there was no event on 2/2 (PEEP) and we had knowledge that the Azithromycin order was written for continuation until 2/10? What event would have been reported on 2/3?

Date	MV DAY	Daily minimum PEEP	Daily minimum FiO_2	Temp	WBC	ABX	ABX	Speci-men	Polys/ Epis	Organism
1/27	1	8	40	38.0	3.6			Sputum		NF with Few *S. pneumoniae*
1/28	2	8	40	38.0	--	Ceftriaxone				
1/29	3	5	50	39.0	--	Ceftriaxone				
1/30	4	5	80	37.6	4.9	Ceftriaxone				
1/31	5	5	80	38.6	--	Ceftriaxone	Azithro-mycin	Endo-tracheal aspirate	Many WBC, Rare Epithelial, Many GPC	Moderate S. pneumoniae
2/1	6	5	60	**39**	5.8	Ceftriaxone				
2/2	7	~~8~~ 5	60	**38.8**	5.4	Ceftriaxone	**Azithro-mycin**			
2/3	8	~~8~~ 5	80	38.0	5.4	Ceftriaxone	**Azithro-mycin**			
2/4	9	~~8~~ 5	80	**39.1**	10.8	Ceftriaxone	**Azithro-mycin**			

VAC

Neither antimicrobial agent is "new" and even if one was new QADs are determined by Administration Not Orders

Start Over | Calculate IVAC | Explain...

MV Day	Date	Hide... Min. PEEP (cmH_2O)	Hide... Min. FiO_2 (21 - 100)	VAE	T<36° or T>38°	WBC ≤ 4,000 or WBC ≥ 12,000 cells/mm^3	Add... Remove... Choose a Drug: CEFTRIAXONE	Add... Remove... Choose a Drug: AZITHROMYCIN	QAD
4	1/30/2019	5	80				☑	☐	
5	1/31/2019	5	80				☑	☑	
† 6	2/1/2019	5	60		☑	☐	☑	☐	
† 7	2/2/2019	5	60		☑	☐	☑	☑	
† 8	2/3/2019	5	80	‡ VAC	☐	☐	☑	☑	
† 9	2/4/2019	5	80		☑	☐	☑	☑	
† 10	2/5/2019				☐	☐	☐	☐	
11	2/6/2019						☐	☐	
12	2/7/2019						☐	☐	

Not New

No QADs

Patient D/C on 2/4

No Administration on 2/5

Case Study 2

- A 17 year old male is admitted to the adult medical ICU on 1/1 after suffering a cardiac arrest while participating in a polar plunge event. He was initially ventilated on 1/1 in the ER and had a central line placed on arrival to the ICU. He was improving and extubated on 1/3. Later that same day his respiratory secretions increased in quantity and an expectorated sputum was sent for culture. He became hypoxic and required re-intubation on 1/4. Chest imaging on 1/4 demonstrated a new infiltrate in the right lower lobe and again was noted on 1/5 and 1/7. ***A bronchoscopy was performed on 1/5.***
- In-plan CLABSI and VAE surveillance have been selected in the monthly reporting plan in this location.
- Is a VAE identified ?

Case Study 2

Date	PEEP $_{min}$	FiO_{2min}	Temp	WBC	Abx	Specimen	Polys / Epis	Organism
Jan 1	6	50			Pip/Tazo	--	--	--
2	6	50			Pip/Tazo	--	--	--
3	5	30				Sputum	≥ 25 / ≤ 10	NF & 4+ *P.aeruginosa*
4	5	30	38.2	7.8	Pip/Tazo			
5	8	60	38.3	8.0	Pip/Tazo	BAL		*40,000 CFU/ml Pseudomonas aeruginosa*
6	8	80	39.0	9.2	Pip/Tazo	--	--	--
7	12	60	38.8	12.1	Pip/Tazo			
8	12	50	40.5	19.8	Pip/Tazo	--	--	--
9	12	40			Pip/Tazo	--	--	--
10	12	40			Pip/Tazo	Blood	--	*P. aeruginosa*
11	6	60			Pip/Tazo	--	--	--
12	8	80			Pip/Tazo	--	--	--
13	8	80			Pip/Tazo	--	--	--
14	6	60			Pip/Tazo	--	--	--
15	6	60			Pip/Tazo	--	--	--
16	6	60			Pip/Tazo	--	--	--
17	6	60			No	--	--	--
18	7	85			No	--	--	--
19	7	85			No	--	--	--

Is a VAE identified?

A. VAC
B. IVAC
C. PVAP
D. No VAE

Is a VAE identified?

A. VAC
B. IVAC
C. PVAP
D. No VAE

Case Study 2

Date	PEEP $_{min}$	FiO_{2min}	Temp	WBC	Abx	Speci-men	Polys / Epis	Organism
Jan 1	6	50			Pip/Tazo	--	--	--
2	6	50			Pip/Tazo	--	--	--
3	5	30				Sputum	≥ 25 / ≤ 10	NF & 4+ *P.aeruginosa*
4	5	30	38.					
5	8	60	38.3	8.0	Pip/Tazo	BAL		*40,000 CFU/ml Pseudomonas aeruginosa*
6	8	80	39.0	9.2	Pip/Tazo	--	--	--
7	12	60	38.8	12.1	Pip/Tazo			
8	12	50	40.5	19.8	Pip/Tazo	--	--	--
9	12	40			Pip/Tazo	--	--	--
10	12	40			Pip/Tazo	Blood	--	*P. aeruginosa*
11	6	60			Pip/Tazo	--	--	--
12	8	80			Pip/Tazo	--	--	--
13	8	80			Pip/Tazo	--	--	--
14	6	60			Pip/Tazo	--	--	--
15	6	60			Pip/Tazo	--	--	--
16	6	60			Pip/Tazo	--	--	--
17	6	60			No	--	--	--
18	7	85			No	--	--	--
19	7	85			No	--	--	--

Extubated and re-intubated but no break in MV for a full calendar day

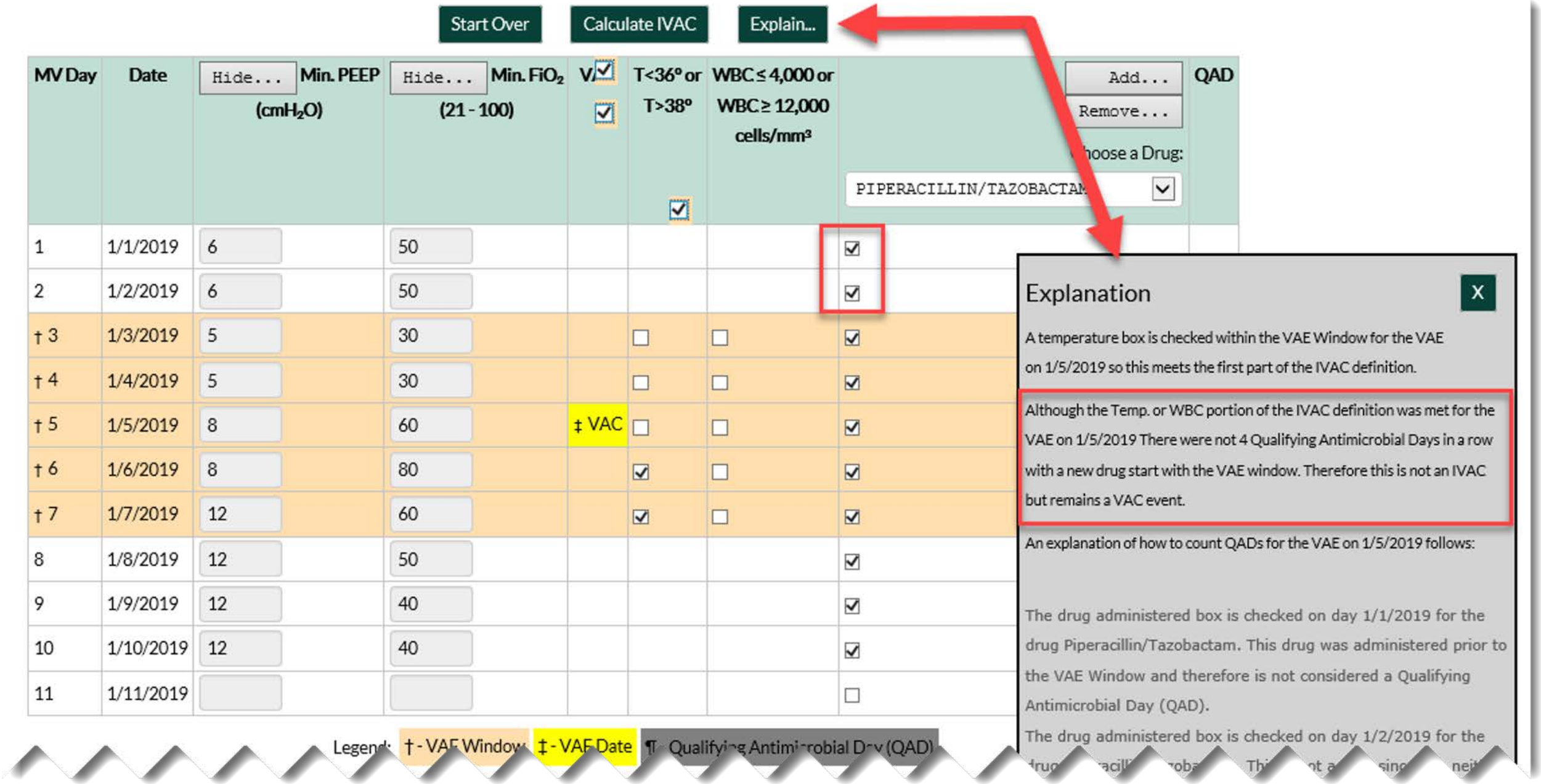
Case Study 2

Date	PEEP $_{min}$	FiO_{2min}	Temp	WBC	Abx	Speci-men	Polys / Epis	Organism
Jan 1	6	50			Pip/Tazo	--	--	--
2	6	50			Pip/Tazo	--	--	--
3	5	30					≥ 25 / ≤ 10	NF & 4+ *P.aeruginosa*
4			38.					
5	8	60	38.5	8.0	Pip/Tazo	BAL		*40,000 CFU/ml Pseudomonas aeruginosa*
6	8	80	39.0	9.2	Pip/Tazo	--	--	--
7	12	60	38.8	12.1	Pip/Tazo			
8	12	50	40.5	19.8	Pip/Tazo	--	--	--
9	12	40			Pip/Tazo	--	--	--
10	12	40			Pip/Tazo	Blood	--	*P. aeruginosa*
11	6	60			Pip/Tazo	--	--	--
12	8	80			Pip/Tazo	--	--	--
13	8	80			Pip/Tazo	--	--	--
14	6	60			Pip/Tazo	--	--	--
15	6	60			Pip/Tazo	--	--	--
16	6	60			Pip/Tazo	--	--	--
17	6	60			No	--	--	--
18	7	85			No	--	--	--
19	7	85			No	--	--	--

If there had been a full day break there would not have been a VAC identified on 3/5

Case Study 2

Date	PEEP $_{min}$	FiO_{2min}	Temp	WBC	Abx	Speci-men	Polys / Epis	Organism
Jan 1	6	50			Pip/Tazo	--	--	--
2	6	50			Pip/Tazo	--	--	--
3	5	30				Sputum	≥ 25 / ≤ 10	NF & 4+ *P.aeruginosa*
4	5	30	38.2	7.8	Pip/Tazo			
5	8	60	38.3	8.0	Pip/Tazo	BAL		*40,000 CFU/ml Pseudomonas aeruginosa*
6	8	80	39.0	9.2	Pip/Tazo	--	--	--
7	12	60	38.8	12.1	Pip/Tazo			
8	12	50	40.5	19.8	Pip/Tazo	--	--	--
9	12	40			Pip/Tazo	--	--	--
10	12	40			Pip/Tazo	Blood	--	*P. aeruginosa*
11	6	60			Pip/Tazo	--	--	--
12	8	80			Pip/Tazo	--	--	--
13	8	80			Pip/Tazo	--	--	--
14	6	60			Pip/Tazo	--	--	--
15	6	60			Pip/Tazo	--	--	--
16	6	60			Pip/Tazo	--	--	--
17	6	60			No	--	--	--
18	7	85			No	--	--	--
19	7	85			No	--	--	--


Start Over
Calculate IVAC
Explain...
MV Day
Date
Hide...
Min. PEEP (cmH_2O)
Hide...
Min. FiO_2 (21 - 100)
VAC
T<36° or T>38°
WBC ≤ 4,000 or WBC ≥ 12,000 cells/mm³
Add...
Remove...
Choose a Drug:
PIPERACILLIN/TAZOBACTAM
QAD
1 1/1/2019 6 50
2 1/2/2019 6 50
† 3 1/3/2019 5 30
† 4 1/4/2019 5 30
† 5 1/5/2019 8 60 ‡ VAC
† 6 1/6/2019 8 80
† 7 1/7/2019 12 60
8 1/8/2019 12 50
9 1/9/2019 12 40
10 1/10/2019 12 40
11 1/11/2019
Legend: † - VAE Window ‡ - VAE Date ¶ - Qualifying Antimicrobial Day (QAD)
Explanation
X
A temperature box is checked within the VAE Window for the VAE on 1/5/2019 so this meets the first part of the IVAC definition.
Although the Temp. or WBC portion of the IVAC definition was met for the VAE on 1/5/2019 There were not 4 Qualifying Antimicrobial Days in a row with a new drug start with the VAE window. Therefore this is not an IVAC but remains a VAC event.
An explanation of how to count QADs for the VAE on 1/5/2019 follows:
The drug administered box is checked on day 1/1/2019 for the drug Piperacillin/Tazobactam. This drug was administered prior to the VAE Window and therefore is not considered a Qualifying Antimicrobial Day (QAD).
The drug administered box is checked on day 1/2/2019 for the

Case Study 2

Date	PEEP $_{min}$	FiO_{2min}	Temp	WBC	Abx	Speci-men	Polys / Epis	Organism
Jan 1	6	50			Pip/Tazo	--	--	--
2	6	50			Pip/Tazo	--	--	--
3	5	30				Sputum	≥ 25 / ≤ 10	NF & 4+ *P.aeruginosa*
4	5	30	38.2	7.8	Pip/Tazo			
5	8	60			Pip/Tazo	BAL		*40,000 CFU/ml Pseudomonas aeruginosa*
6	8	80			Pip/Tazo	--	--	--
7	12	60	38.8	12.1	Pip/Tazo			
8	12	50	40.5	19.8	Pip/Tazo	--		--
9	12	40			Pip/Tazo	--		--
10	12	40			Pip/Tazo	Blood		*P. aeruginosa*
11	6	60			Pip/Tazo	--	--	--
12	8	80			Pip/Tazo	--	--	--
13	8	80			Pip/Tazo	--	--	--
14	6	60			Pip/Tazo	--	--	--
15	6	60			Pip/Tazo	--	--	--
16	6	60			Pip/Tazo	--	--	--
17	6	60			No	--	--	--
18	7	85			No	--	--	--
19	7	85			No	--	--	--

VAC

Is a CLABSI identified?

A. Yes, CLABSI
B. No, BSI is secondary to VAE
C. No, BSI is secondary to PNEU
D. I don’t know I’m sending this one to NHSN@cdc.gov

Is a CLABSI identified?

A. Yes, CLABSI
B. No, BSI is secondary to VAE
C. No, BSI is secondary to PNEU
D. I don't know I'm sending this one to NHSN@cdc.gov

Secondary BSI and VAE

- Must meet PVAP

REPORTING INSTRUCTIONS (additional guidance may be found in the FAQs at the end of this chapter):

- Conducting in-plan VAE surveillance means assessing patients for the presence of ALL events included in the algorithm—from VAC to IVAC to PVAP. At this time, a unit conducting in-plan VAE surveillance cannot decide, for example, that only surveillance for VAC (and not for IVAC or PVAP) will be performed.
- There is a hierarchy of definitions within VAE:
  - If a patient meets criteria for VAC and IVAC, report as IVAC.
  - If a patient meets criteria for VAC, IVAC and PVAP, report PVAP.
- Do not upgrade an event using findings that occur outside the VAE Window period.
- If the date of event (date of onset of worsening oxygenation) is on or after the date of documentation of evidence of consent AND the patient is being supported for organ donation purposes, the event should not be reported as a VAE.
- Pathogens are not reported for VAC or IVAC events.
- Secondary BSIs are not reported for VAC or IVAC events (see FAQ no.11).
- Pathogens may be reported for PVAP events, provided they are isolated or identified from appropriate specimen types according to the requirements of the algorithm and are

- If No PVAP look to other site specific to include PNEU

Appendix B: Secondary BSI Guide (*not applicable to Ventilator-associated Events [VAE]*)

The purpose of using the CDC/NHSN infection criteria is to identify and consistently categorize infections that are healthcare-associated into major and site-specific infection types. LCBI criteria include the caveat that the organism(s) identified from the blood cannot be related to infection at another site (in other words, it must be a primary BSI). One must be sure that there is no other CDC/NHSN defined primary site-specific infection that may have seeded the bloodstream secondarily; otherwise the bloodstream infection may be misclassified as a primary BSI and erroneously associated with the use of a central line, specifically called a CLABSI. For locations performing in-plan VAE surveillance, refer to Figure B2 in this appendix, as well as the VAE chapter for specific guidance on assigning a secondary BSI to a VAE. When conducting BSI surveillance the PNEU definitions (as well as UTI, SSI and all definitions found in Chapter 17) are available for attributing a secondary BSI for any patient in any location. For example, a ventilated patient in an adult location where VAE surveillance is being conducted can have a secondary BSI assigned to VAE or PNEU. A ventilated patient in a neonatal location where in-plan PedVAP surveillance is not an option can have a secondary BSI assigned to PNEU.

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
[illegible]	[illegible]
PNEU	2 or 3
[illegible]	[illegible]
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) 6a or 7a plus other criteria as listed
GIT	1b or 2c
IAB	2b or 3b
JNT	3c
MEN	2c or 3c
[illegible]	[illegible]
PNEU	2 or 3
[illegible]	[illegible]
UMB	1b
USI	3b or 4b

Case Study 2

- A 17 year old male is admitted to the adult medical ICU on 1/1 after suffering a cardiac arrest while participating in a polar plunge event. He was initially ventilated on 1/1 in the ER and had a central line placed on arrival to the ICU. He was improving and extubated on 1/3. Later that same day his respiratory secretions increased in quantity and an expectorated sputum was sent for culture. He became hypoxic and required re-intubation on 1/4. Chest imaging on 1/4 demonstrated a new infiltrate in the right lower lobe and again was noted on 1/5 and 1/7. A bronchoscopy was performed on 1/5.
- In-plan CLABSI and VAE surveillance have been selected in the monthly reporting plan in this location.
- What if any events are identified ?

Case Study 2

Date	PEEP $_{min}$	FiO_{2min}	Temp	WBC	Abx	Specimen	Polys / Epis	Organism
Jan 1	6	50			Pip/Tazo	--	--	--
2	6	50			Pip/Tazo	--	--	--
3	5	30				Sputum	≥ 25 / ≤ 10	NF & 4+ P.aeruginosa
4	5	30	38.2	7.8	Pip/Tazo			
5	8	60	38.3	8.0	Pip/Tazo	BAL		40,000 CFU/ml Pseudomonas aeruginosa
6	8	80	39.0	9.2	Pip/Tazo	--	--	--
7	12	60	38.8	12.1	Pip/Tazo			
8	12	50	40.5	19.8	Pip/Tazo	--	--	--
9	12	40			Pip/Tazo	--	--	--
10	12	40			Pip/Tazo	Blood	--	P. aeruginosa
11	6	60			Pip/Tazo	--	--	--
12	8	80			Pip/Tazo	--	--	--
13	8	80			Pip/Tazo	--	--	--
14	6	60			Pip/Tazo	--	--	--
15	6	60			Pip/Tazo	--	--	--
16	6	60			Pip/Tazo	--	--	--
17	6	60			No	--	--	--
18	7	85			No	--	--	--
19	7	85			No	--	--	--

How is the Secondary BSI attributed to the PNEU event?

A. PNEU (PNU2) Secondary BSI Scenario 1
B. PNEU (PNU2) Secondary BSI Scenario 2

How is the Secondary BSI attributed to the PNEU event?

A. PNU2 Secondary BSI Scenario 1

B. PNU2 Secondary BSI Scenario 2

Case Study 2

- A 17 year old male is admitted to the adult medical ICU on 1/1 after suffering a cardiac arrest while participating in a polar plunge event. He was initially ventilated on 1/1 in the ER and had a central line placed on arrival to the ICU. He was improving and extubated on 1/3. Later that same day his respiratory secretions increased in quantity and an expectorated sputum was sent for culture. He became hypoxic and required re-intubation on 1/4. Chest imaging on 1/4 demonstrated a new infiltrate in the right lower lobe and again was noted on 1/5 and 1/7. A bronchoscopy was performed on 1/5.
- In-plan CLABSI and VAE surveillance have been selected in the monthly reporting plan in this location.

Case Study 2

Date	PEEP $_{min}$	FiO_{2min}	Temp	WBC	Abx	Specimen	Polys / Epis	S/S Imaging	Organism
Jan 1	6	50			Pip/Tazo	--	--		--
2	6	50			Pip/Tazo	--	--		--
3	5	30				Sputum	≥ 25 / ≤ 10	Increase secretion	NF [redacted] *eruginosa*
4	5	30	38.2	7.8	Pip/Tazo			**New infiltrate** Increase O2 demand	
5	8	60	38.3	8.0	Pip/Tazo	BAL		infiltrate	*40,000 CFU/ml Pseudomonas aeruginosa*
6	8	80	39.0	9.2	Pip/Tazo	--	--		--
7	12	60	38.8	12.1	Pip/Tazo			infiltrate	
8	12	50	40.5	19.8	Pip/Tazo	--	--		--
9	12	40			Pip/Tazo	--	--		--
10	12	40			Pip/Tazo	Blood	--		*P. aeruginosa*
11	6	60			Pip/Tazo	--	--		--
12	8	80			Pip/Tazo	--	--		--
13	8	80			Pip/Tazo	--	--		--
14	6	60			Pip/Tazo	--	--		--
15	6	60			Pip/Tazo	--	--		--
16	6	60			Pip/Tazo	--	--		--
17	6	60			No	--	--		--
18	7	85			No	--	--		--
19	7	85			No	--	--		--

Table 2: Specific Site Algorithms for Pneumonia with Common Bacterial or Filamentous Fungal Pathogens and Specific Laboratory Findings (PNU2)

Imaging Test Evidence	Signs/Symptoms	Laboratory
Two or more serial chest imaging test results with at least ***one*** of the following[1,2,14]: New and persistent **or** Progressive and persistent • Infiltrate • Consolidation • Cavitation • Pneumatoceles, in infants ≤1 year old **Note**: In patients ***without*** underlying pulmonary or cardiac disease (for example: respiratory distress syndrome, bronchopulmonary dysplasia, pulmonary edema, or chronic obstructive pulmonary disease), one definitive chest imaging test result is acceptable.[1]	At least ***one*** of the following: • Fever (>38.0°C or >100.4°F) • Leukopenia (≤4000 WBC/mm^3) or leukocytosis (≥12,000 WBC/mm^3) • For adults ≥70 years old, altered mental status with no other recognized cause And at least ***one*** of the following: • New onset of purulent sputum[3] or change in character of sputum[4], or increased respiratory secretions, or increased suctioning requirements • New onset or worsening cough, or dyspnea or tachypnea[5] • Rales[6] or bronchial breath sounds • Worsening gas exchange (for example: O_2 desaturations [for example: PaO_2/FiO_2 ≤240][7], increased oxygen requirements, or increased ventilator demand)	At least ***one*** of the following: • Organism identified from blood[8,13] • Organism identified from pleural fluid[9,13] • Positive quantitative culture or corresponding semi-quantitative culture result[2] from minimally-contaminated LRT specimen (specifically, BAL, protected specimen brushing or endotracheal aspirate) • ≥5% BAL-obtained cells contain intracellular bacteria on direct microscopic exam (for example: Gram's stain) • Positive quantitative culture or corresponding semi-quantitative culture result [2] of lung tissue • Histopathologic exam shows at least ***one*** of the following evidences of pneumonia: o Abscess formation or foci of consolidation with intense PMN accumulation in bronchioles and alveoli o Evidence of lung parenchyma invasion by fungal hyphae or pseudohyphae

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		☑	Purulent resp. secretions, increase in secretions	- HAI		
4. - 1/4/2019	✓	☑	CXR, fever, increase O2/vent demand	-		
5. - 1/5/2019		☑	CXR, fever, BAL 40,000 P. aeruginosa			
6. - 1/6/2019		☑	fever			
7. - 1/7/2019		☑	CXR, fever,			
8. - 1/8/2019						
9. - 1/9/2019						
10. - 1/10/2019						Blood: P. aeruginosa
11. - 1/11/2019						
12. - 1/12/2019						
13. - 1/13/2019						
14. - 1/14/2019						
15. - 1/15/2019						
16. - 1/16/2019						

Table B1: Secondary BSI Guide: List of all NHSN making secondary BSI determinations using Scen

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

Case 2 - Recap

- VAE is location based surveillance – age of patient age does not result in exclusion
- A new episode of MV does not occur unless there is a break in mechanical ventilation of at least one full calendar day, followed by reintubation and/or re-initiation of mechanical ventilation during the same hospitalization – only 1 episode in this example
- Can meet VAC in both parameters but this is not required
- Must meet VAC to meet IVAC and must meet IVAC to meet PVAP – don't waste time collecting data that is not going to be used
- BSI can only be secondary to VAE if PVAP is met
- PNEU definition is available for secondary BSI assignment when performing VAE surveillance