Ventilator Associated Event (VAE) – Case Scenarios

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Case Example

- The 16-year-old patient presents to the ED at 9pm on 3/1 with an admitting diagnosis of influenza with a suspicion of a complication related to bacterial pneumonia.
- The patient experiences respiratory distress and is intubated and placed on the ventilator in the ED.
- The patient remains in the ED for several hours before admission to an inpatient unit.
- The patient is admitted to an adult inpatient location (ICU) at 11:30pm on 3/1 (same day).
- VAE surveillance is selected in the monthly reporting plan for the adult ICU.

Is this patient eligible for VAE surveillance?

A. No, this is a pediatric patient.

B. Yes, the patient is located in an adult inpatient unit that is conducting in-plan VAE surveillance.

Case Summary:

- The 16-year-old patient presents to the ED at 9pm on 3/1 with an admitting diagnosis of influenza with a suspicion of a complication related to bacterial pneumonia.
- The patient experiences respiratory distress and is intubated and placed on the ventilator in the ED.
- The patient remains in the ED for several hours before admission to an inpatient unit.
- The patient is admitted to an adult inpatient location (ICU) at 11:30pm on 3/1 (same day).

Answer: Is this patient eligible for VAE surveillance?

- No, this is a pediatric patient.

- **Yes, the patient is located in an adult inpatient unit that is conducting in-plan VAE surveillance.**

VAE surveillance is location based. All patients in the adult inpatient locations found in Chapter 15, **regardless of patient's age**, are included in VAE surveillance.

What are the daily minimum FiO_2 and PEEP values for the patient on 3/1?

A. FiO_2 of 0.40 and PEEP of 5
B. FiO_2 of 0.40 and PEEP of 8
C. FiO_2 of 0.40 and PEEP of 10
D. FiO_2 of 0.60 and PEEP of 10

Date and Time	March 1 2100	2200	2330	March 2 2400 (midnight)	0300	1200	1500	2000	2200
Location	ED	ED	**ICU**	**ICU**	**ICU**	**ICU**	**ICU**	**ICU**	**ICU**
FiO_2	0.40	0.40	0.60	0.70	0.40	0.40	0.75	0.75	0.75
PEEP	5	8	10	10	8	8	5	8	8

Answer: What are the daily minimum FiO_2 and PEEP values for the patient on 3/1?

A. FiO_2 of 0.40 and PEEP of 5

B. FiO_2 of 0.40 and PEEP of 8

C. FiO_2 of 0.40 and PEEP of 10

D. FiO_2 of 0.60 and PEEP of 10

Date and Time	March 1 2100	2200	2330	March 2 2400 (midnight)	0300	1200	1500	2000	2200
Location	ED	ED	**ICU**	**ICU**	**ICU**	**ICU**	**ICU**	**ICU**	**ICU**
FiO_2	0.40	0.40	0.60	0.70	0.40	0.40	0.75	0.75	0.75
PEEP	5	8	10	10	8	8	5	8	8

Explanation: Daily minimum FiO_2 and PEEP values for the patient on 3/1 are FiO_2 of 0.60 and PEEP of 10

- Ventilator data obtained from patients in the Emergency Department or other pre-hospital/pre-inpatient locations should not be included in VAE surveillance. Only ventilator settings that are documented while an admitted patient is located in an adult inpatient location are used to make a VAE determination.

- When no FiO_2 or PEEP value is documented to have been maintained for > 1 hour, the daily minimum FiO_2 or PEEP should default to the lowest setting documented during the calendar day (regardless of how long that setting was maintained).

Date and Time	March 1 2100	2200	2330	March 2 2400 (midnight)	0300	1200	1500	2000	2200
Location	ED	ED	**ICU**	**ICU**	**ICU**	**ICU**	**ICU**	**ICU**	**ICU**
FiO_2	0.40	0.40	0.60	0.70	0.40	0.40	0.75	0.75	0.75
PEEP	5	8	10	10	8	8	5	8	8

Patient Ventilator Settings Example 1

Vent Day	PEEP min	FiO_2 min	Temp	WBC	ABX	ABX	Spec	Org
1	10	60						
2	8	60						
3	8	50						
4	5	50						
5	8	50						
6	8	50						
7	8	50						
8	8	50						

Is a VAE identified for this patient?

A. Yes, in the PEEP parameter

B. Yes, in the FiO_2 parameter

C. No VAE

Vent Day	PEEP min	FiO_2 min	Temp	WBC	ABX	ABX	Spec	Org
1	10	60						
2	8	60						
3	8	50						
4	5	50						
5	8	50						
6	8	50						
7	8	50						
8	8	50						

Answer: Is a VAE identified for this patient?

A. Yes, in the PEEP parameter

B. Yes, in the FiO2 parameter

C. No VAE

Vent Day	PEEP min	FiO_2 min	Temp	WBC	ABX	ABX	Spec	Org
1	10	60						
2	8	60						
3	8	50						
4	5	50						
5	8	50						
6	8	50						
7	8	50						
8	8	50						

- There are 2 calendar days of improving daily minimum PEEP values on MV day 3 and 4 (**baseline period of improvement**).
- While there is worsening PEEP on MV day 5, the increase in daily minimum PEEP values does not meet worsening oxygenation criteria of ≥ 3 cmH_2O over the daily minimum PEEP of the **first day** in the baseline period (MV 3 with PEEP of 8).
- VAC is not met.

Back to the Case Example

- The 16-year-old patient presents to the ED at 9pm on 3/1 with an admitting diagnosis of influenza with a suspicion of a complication related to bacterial pneumonia.
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- The patient remains in the ED for several hours before admission to an inpatient unit.
- The patient is admitted to an adult inpatient location (ICU) at 11:30pm on 3/1 (same day).
- VAE surveillance is selected in the monthly reporting plan for the adult ICU.

Patient Ventilator Settings Example 2

Vent Day	PEEP min	FiO_2 min	Temp	WBC	ABX	ABX	Spec	Org
1	10	60	38.0	12.1				
2	5	60	39.0	15.9			Respiratory secretions	Coronavirus
3	5	50	37.6	15.7				
4	5	50	38.6	14.9	Ceftriaxone			
5	8	50	39	15.2	Ceftriaxone			
6	8	50	38.8	13.6		Azithromycin		
7	8	50	38.0	13.7		Azithromycin		
8	8	50	39.1	12.8		Azithromycin		

Is a VAE identified for this patient? Cont.

A. Yes

B. No, the patient had pneumonia on admission and is excluded from VAE surveillance

Vent Day	PEEP min	FiO_2 min	Temp	WBC	ABX	ABX	Spec	Org
1	10	60	38.0	12.1				
2	5	60	39.0	15.9			Respiratory secretions	Coronavirus
3	5	50	37.6	15.7				
4	5	50	38.6	14.9	Ceftriaxone			
5	8	50	39	15.2	Ceftriaxone			
6	8	50	38.8	13.6		Azithromycin		
7	8	50	38.0	13.7		Azithromycin		
8	8	50	39.1	12.8		Azithromycin		

Answer: Is a VAE identified for this patient? Cont.

- **Yes – VAC is met in the PEEP parameter**

- **No, the patient had pneumonia on admission and is excluded from VAE surveillance**
  - There is no exclusion from meeting a VAE definition (VAC, IVAC, or PVAP) based on an underlying condition or diagnosis.

Case 2 Explanation: Is a VAE identified for this patient?

Vent Day	PEEP min	FiO_2 min	Temp	Org
1	10	60	38.0	
2	5	60	39.0	ronavirus
3	5	50	37.6	
4	5	50	38.6	
5	8	50	39	
6	8	50	38.8	
7	8	50	38.0	
8	8	50	39.1	

- There are 2 calendar days of stable daily minimum PEEP values on MV day 3 and 4 (**baseline period of stability**).
- On MV day 5 the daily minimum PEEP meets the threshold for **worsening oxygenation with an increase of at least 3 cmH2O over the daily minimum PEEP on the first day in the baseline period (from 5 to 8)**.
- The increase is **maintained for at least 2 calendar days**, MV days 5 and 6.
- VAC is met in the PEEP parameter with a date of event on MV day 5 (date of onset of worsening oxygenation).

Let's continue looking at the same example case 2:

Vent Day	PEEP min	FiO_2 min	Temp	WBC	ABX	ABX	Spec	Org
1	10	60	38.0	12.1				
2	5	60	39.0	15.9			Respiratory secretions	Coronavirus
3	5	50	37.6	15.7				
4	5	50	38.6	14.9	Ceftriaxone			
5	8	50	39	15.2	Ceftriaxone			
6	8	50	38.8	13.6		Azithromycin		
7	8	50	38.0	13.7		Azithromycin		
8	8	50	39.1	12.8		Azithromycin		

What level of the VAE algorithm did this patient meet?

A. VAC
B. IVAC
C. PVAP

Vent Day	PEEP min	FiO_2 min	Temp	WBC	ABX	ABX	Spec	Org
1	10	60	38.0	12.1				
2	5	60	39.0	15.9			Respiratory secretions	Coronavirus
3	5	50	37.6	15.7				
4	5	50	38.6	14.9	Ceftriaxone			
5	8	50	39	15.2	Ceftriaxone			
6	8	50	38.8	13.6		Azithromycin		
7	8	50	38.0	13.7		Azithromycin		
8	8	50	39.1	12.8		Azithromycin		

Answer: What level of the VAE algorithm did this patient meet?

- **A. VAC**
  - VAC is met in the PEEP parameter.
  - Foundational definition is met (VAC), progress to review of IVAC criteria.
- **B. IVAC**
  - Temperature and WBC criteria for IVAC met within VAE Window Period.
  - Four consecutive QADs within VAE Window Period.
- **C. PVAP**
  - Although the positive respiratory secretions result for coronavirus is eligible for use in meeting PVAP Criterion 3, the collection date was **outside the VAE Window Period.** PVAP is not met.

Case Explanation: What level of the VAE algorithm did this patient meet?

Vent Day	PEEP min	FiO_2 min	Temp	WBC	ABX	ABX	Spec	Org
1	10	60	38.0	13.1				
2	5	50	37.6	15.7			Respiratory secretions	Coronavirus
3	5	50	37.6	15.7				
4	5	50	38.6	14.9	Ceftriaxone			
5	8	50	39	15.2	Ceftriaxone			
6	8	50	38.8	13.6		Azithromycin		
7	8	50	38.0	13.7		Azithromycin		
8	8	50	39.1	12.8		Azithromycin		

VAC is met in the PEEP parameter with a date of event on MV day 5 (date of onset of worsening oxygenation).

Collected outside the VAE Window Period.

- Temperature > 38 °C OR white blood cell count ≥ 12,000 cells/mm3 met within the VAE Window Period.
- Ceftriaxone and Azithromycin "new" within VAE Window Period.
- 4 QAD requirement can be met with multiple antimicrobial agents, as long as each antimicrobial agent is "new".
- **IVAC met.**

Let's look at a variation on the case example – Example Case 3: Change in the antimicrobial and pathogen information

Vent Day	PEEP min	FiO_2 min	Temp min	Temp max	WBC min	WBC max	ABX	Spec	Polys/ Epis	Org
1	10	60								
2	5	40					Ceftriaxone			
3	5	40	36.9	37.6	12.1	12.1	Ceftriaxone			
4	5	55	38.1	39.2	14.5	16.8	Ceftriaxone	BAL		3+ *P. aeruginosa*
5	8	50	38.4	38.9	12.6	15.9	Ceftriaxone			
6	8	40	36.5	37.8	11.1	13.6	Ceftriaxone			
7	8	40	37.1	38.4	11.4	13.6				
8	5	30								

What level of the VAE algorithm did this patient meet? Cont.

A. VAC
B. IVAC
C. PVAP

Vent Day	PEEP min	FiO_2 min	Temp min	Temp max	WBC min	WBC max	ABX	Spec	Polys/ Epis	Org
1	10	60								
2	5	40					Ceftriaxone			
3	5	40	36.9	37.6	12.1	12.1	Ceftriaxone			
4	5	55	38.1	39.2	14.5	16.8	Ceftriaxone	BAL		3+ *P. aeruginosa*
5	8	50	38.4	38.9	12.6	15.9	Ceftriaxone			
6	8	40	36.5	37.8	11.1	13.6	Ceftriaxone			
7	8	40	37.1	38.4	11.4	13.6				
8	5	30								

Answer: What level of the VAE algorithm did this patient meet? Cont.

- **A. VAC**

- **B. IVAC**
  - Antimicrobial was started outside the VAE Window Period and does not meet the definition of a "new" antimicrobial.
  - Although the temperature and WBC criteria for IVAC were met, both temp/WBC **and** QAD criteria must be met for IVAC.

- **C. PVAP**
  - Although the semi-quantitative result of 3+ *P. aeruginosa* meets PVAP criterion 1 and was collected within the VAE Window Period, remember, **the VAE surveillance algorithm is progressive in terms of criteria to be met**. VAC must be met to assess for IVAC, IVAC must be met to assess for PVAP.

Case 3 Explanation: What level of the VAE algorithm did this patient meet?

Vent Day	PEEP min	FiO_2 min	Temp min	Temp max	WBC min	WBC max	ABX	Spec	Polys/ Epis	Org
1	10	60								
2	5	40					Ceftriaxone			
3	5	40	36.9	37.6	12.1	12.1	Ceftriaxone			
4	5	55	38.1	39.2	14.5	16.8	Ceftriaxone	BAL		3+ *P. aeruginosa*
5	8	50	38.4	38.9	12.6					
6	8	40	36.5	37.8	11.1					
7	8	40	37.1	38.4	11.4					
8	5	30								

- Temperature > 38 °C OR white blood cell count ≥ 12,000 cells/mm3 met within the VAE Window Period.
- Ceftriaxone started outside the VAE Window Period and therefore is not a "new" antimicrobial agent.
- **IVAC not met.**
- Will not progress to PVAP.

Contact the NHSN Helpdesk

- **NHSN-ServiceNow** to submit questions to the NHSN Help Desk.
- Access new portal at **https://servicedesk.cdc.gov/nhsncsp**.
- If you do not have a SAMS login, or are unable to access ServiceNow, you can still email the NHSN Help Desk at NHSN@cdc.gov

For more information, contact CDC
1-800-CDC-INFO (232-4636)
TTY: 1-888-232-6348 www.cdc.gov