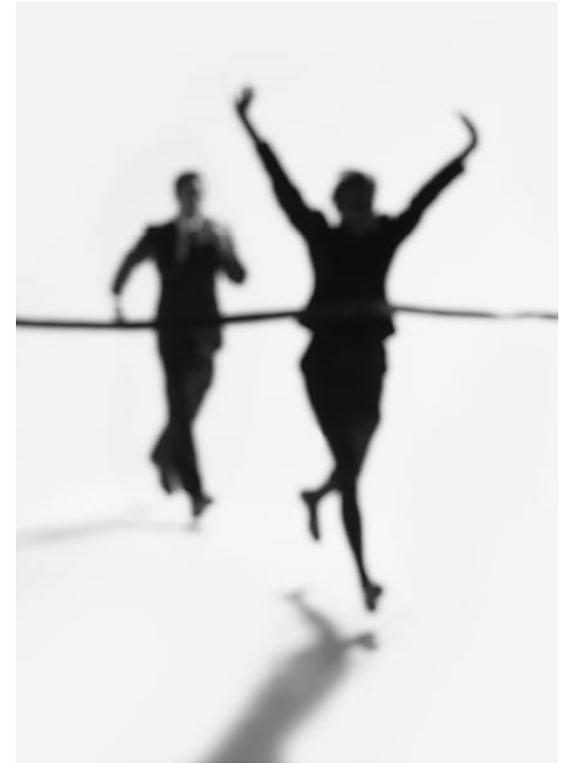


# **Ventilator-Associated Events (VAE)**

**Cindy Gross, MT, SM (ASCP), CIC  
IP Consultant  
March 14, 2014**

# Objectives

- ❑ **Review Ventilator Associated Events (VAE) definitions and surveillance methods**
- ❑ **Describe important changes made to VAE surveillance in 2014**
- ❑ **Review the use of the VAE Calculator**
- ❑ **Describe how to correctly enter VAE into NHSN**
- ❑ **Accurately apply the VAE algorithm to example case scenarios**



# **BACKGROUND AND RATIONALE**

# Why the switch from PNEU-VAP to VAE?

- ❑ **Ventilator-associated pneumonia (VAP) is an important complication of mechanical ventilation**
  - But other adverse events also happen to patients on ventilators
- ❑ **No valid, reliable definition for VAP**
- ❑ **PNEU-VAP definition includes subjective elements and is neither sensitive nor specific for VAP**
  - Not ideal in an era of public reporting of healthcare-associated infection (HAI) rates, comparisons among facilities, pay-for-performance programs
- ❑ **Needed a new approach**

# **Goals of Changing Approach to VAP Surveillance**

- ❑ Improve reliability of definitions**
- ❑ Reduce burden of surveillance**
- ❑ Enhance ability to use surveillance data to drive improvements in patient care and safety**

## **A New Approach for NHSN**

- ❑ Working group convened in 2011 to revamp VAP surveillance**
- ❑ New approach finalized by the working group and implemented in NHSN in January 2013—Ventilator-Associated Events (VAE)**
  - Focuses on objectivity, reliability, automatability
  - Based on work done by Dr. Michael Klompas and CDC Prevention Epicenters
  - Includes more general measures of ventilator-associated conditions and complications (VAC, IVAC)
- ❑ VAE replaced in-plan PNEU/VAP surveillance for ventilated patients in adult locations**

# Adult VAP/VAE Surveillance Definitions Working Group Members

<b>Society/Organization</b>
American Association of Critical-Care Nurses
American Association for Respiratory Care
American College of Chest Physicians
Association of Professionals in Infection Control and Epidemiology
American Thoracic Society
Council of State and Territorial Epidemiologists
HICPAC Surveillance Working Group
Infectious Diseases Society of America
Society of Critical Care Medicine
Society for Healthcare Epidemiology of America
U.S. Department of Health and Human Services/Office of Disease Prevention and Health Promotion
National Institutes of Health

# VAE Surveillance Status

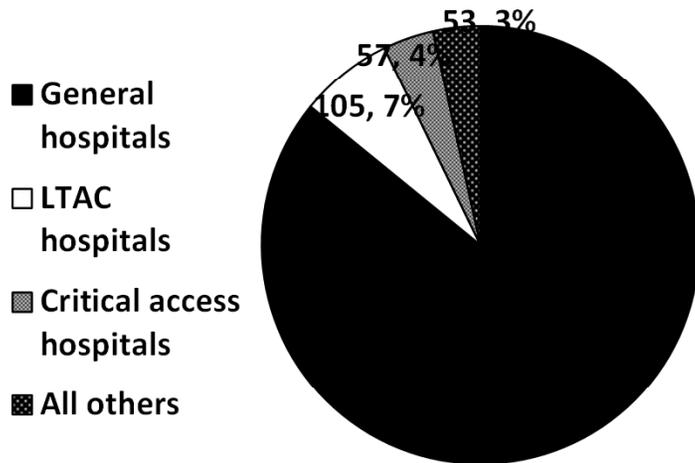
- ❑ **VAE protocol first made available “live” in January 2013**
- ❑ **VAE protocol modifications July 2013**
  - Modified PEEP criterion to address concerns related to VACs detected due to provider weaning preferences, selected clinical situations
  - Daily minimum PEEP values of 0-5 cmH<sub>2</sub>O considered equivalent when making VAC determinations
- ❑ **VAE protocol modifications January 2014**
  - Location based surveillance
  - Daily minimum PEEP and FiO<sub>2</sub> must be maintained for at least 1 hour
  - Purulent respiratory secretions definition adapted to accommodate facilities’ different reporting methods
  - List of antimicrobial agents (Appendix) eligible for IVAC refined

## **NHSN Lower Respiratory Events in 2014**

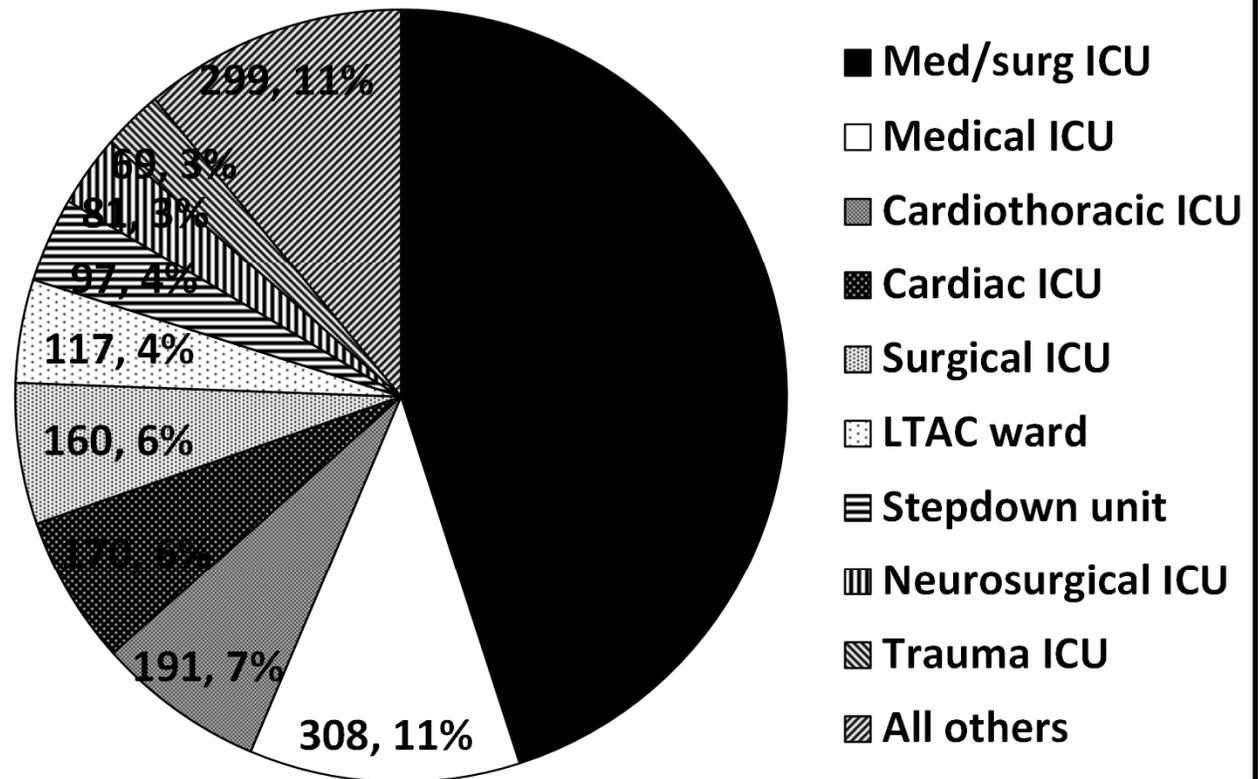
- ❑ VAE is the only in-plan option available for ventilated patients in adult locations as of January 2014.**
- ❑ In 2014, current VAP protocol is in use for in-plan surveillance in pediatric locations ONLY.**
  - In-plan neonatal VAP surveillance is no longer available as of January 2014**
- ❑ In 2014, the current PNEU definitions are still available for off-plan surveillance of VAP in adults , children, neonates or non-ventilated PNEU in adults, children or neonates.**

# What types of facilities and locations are doing VAE surveillance?

**Facilities  
(N=1518)**

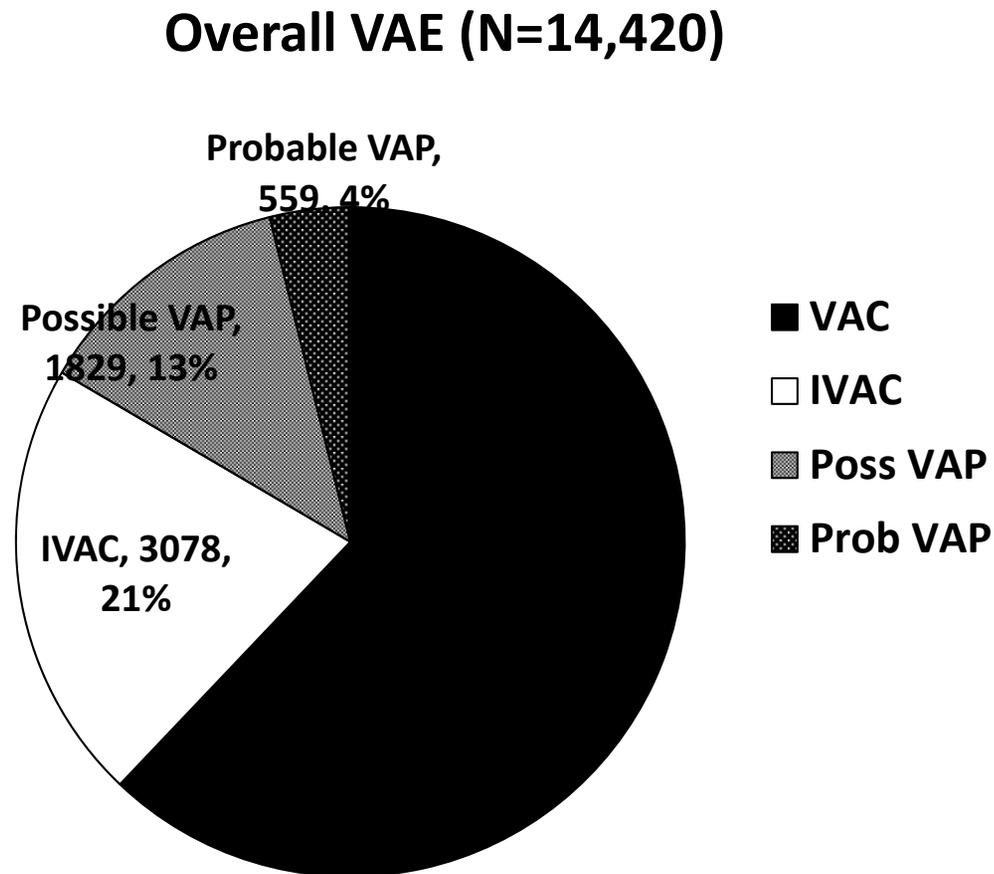


**Locations  
(N=2714)**



Preliminary, unpublished data, subject to change;  
as of February 1, 2014

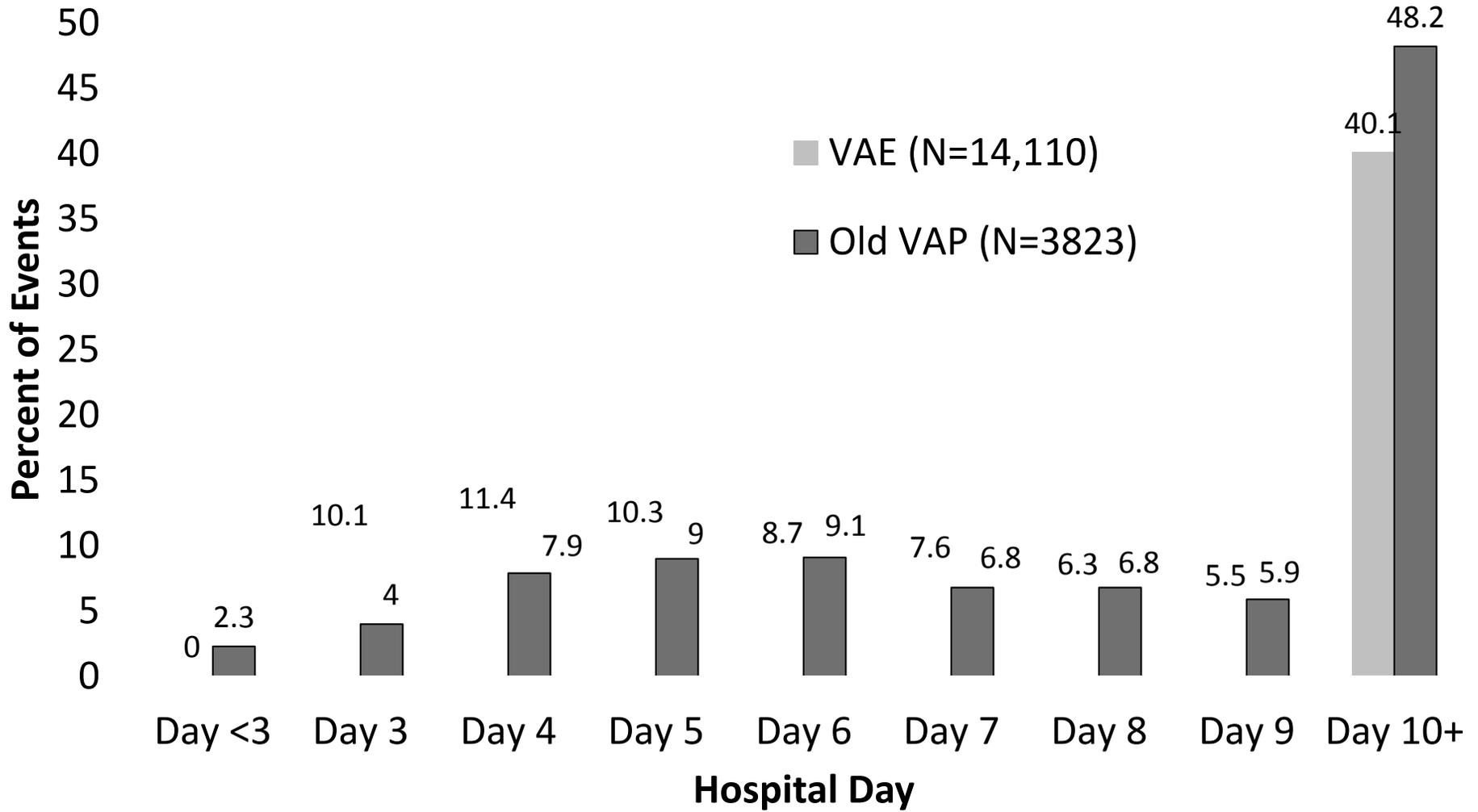
# What is the distribution of specific sites within VAE?



Of all VAEs (i.e., of all events meeting at least the VAC definition)—

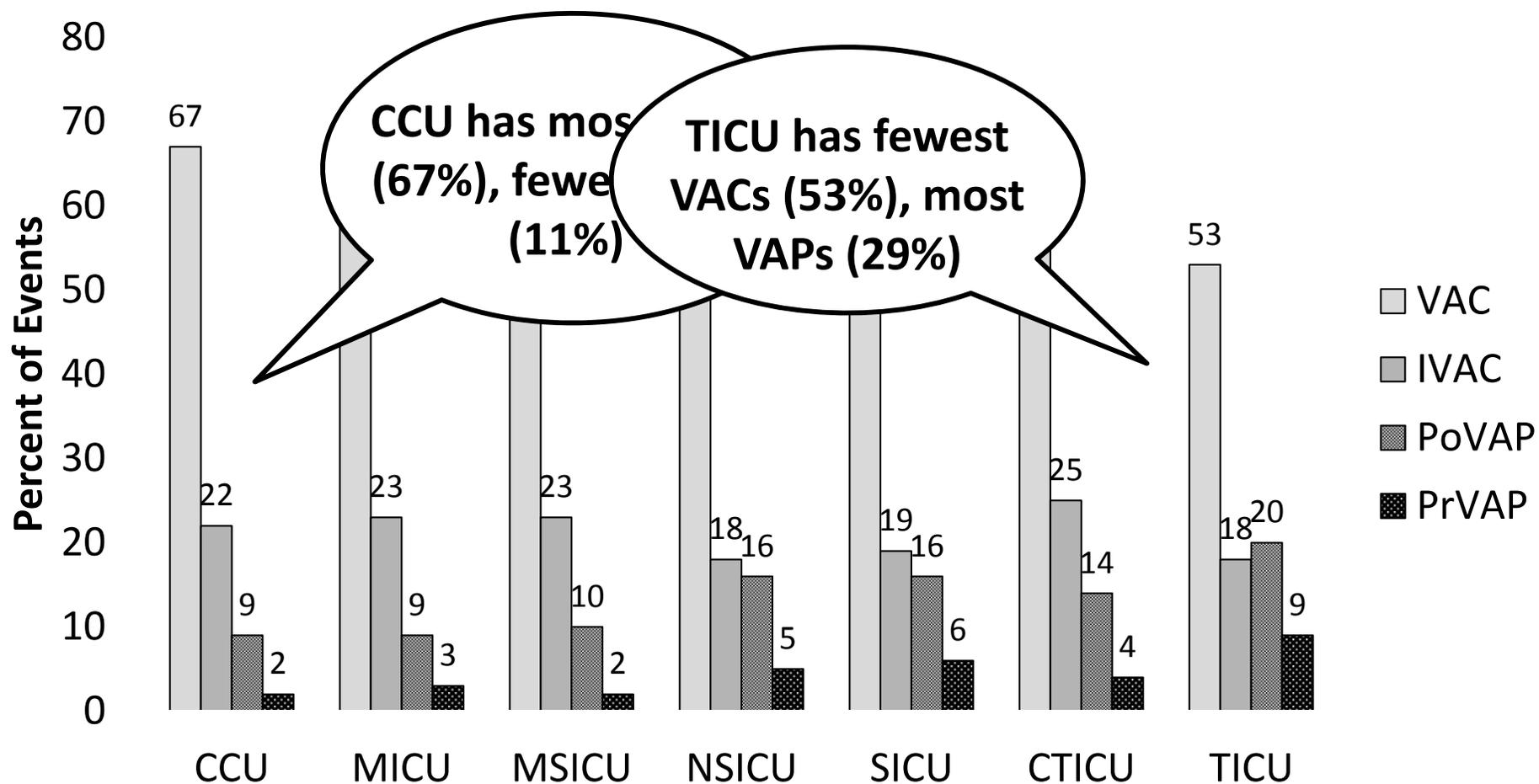
- ~38% met at least the IVAC definition (“IVAC plus”)
- ~17% (almost half of events meeting at least the IVAC definition) met one of the VAP definitions

# Time from Admission to Event Onset, VAE vs. 2012 VAP



Preliminary, unpublished data, subject to change; data as of Feb 1, 2014; data missing for 54 patients.

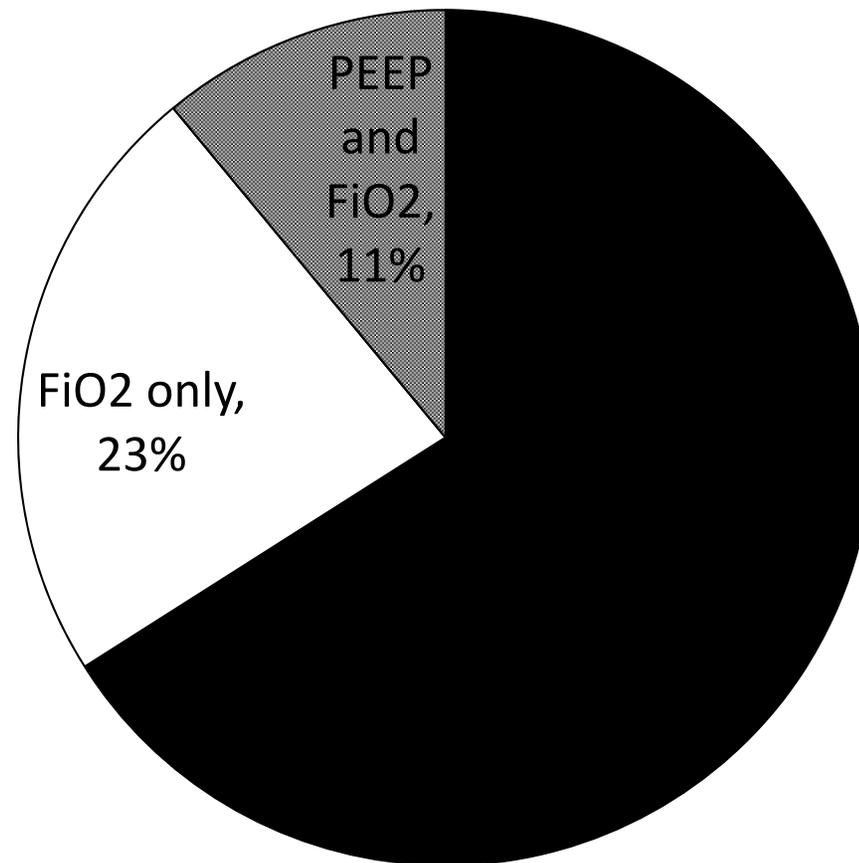
# What's the breakdown of VAEs\* in different locations?



Preliminary, unpublished data, subject to change.

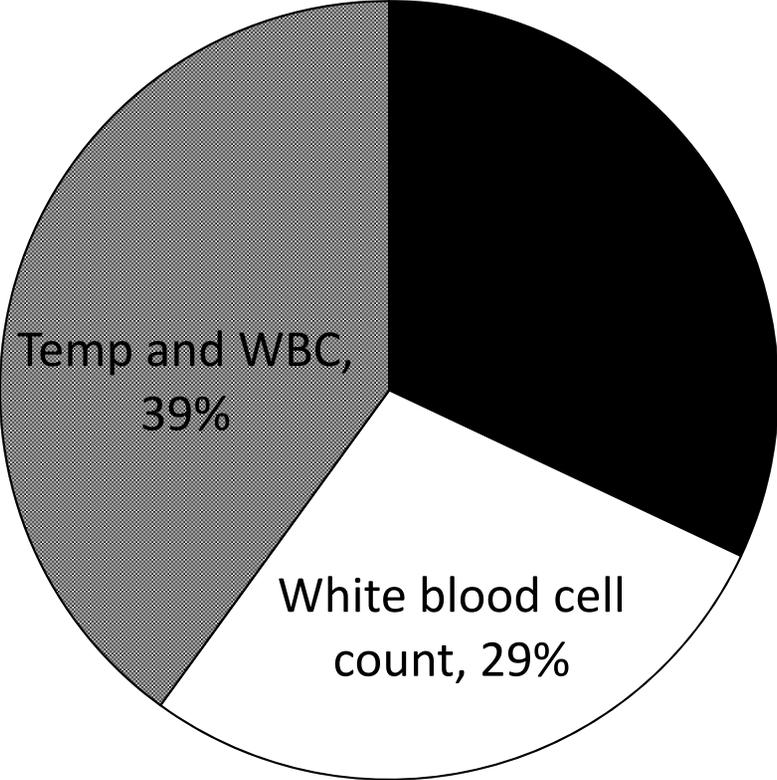
\*Events are mutually exclusive; VAC only; IVAC only, Possible VAP only, Probable VAP only

## Criteria Used to Report VACs (Feb 2014)



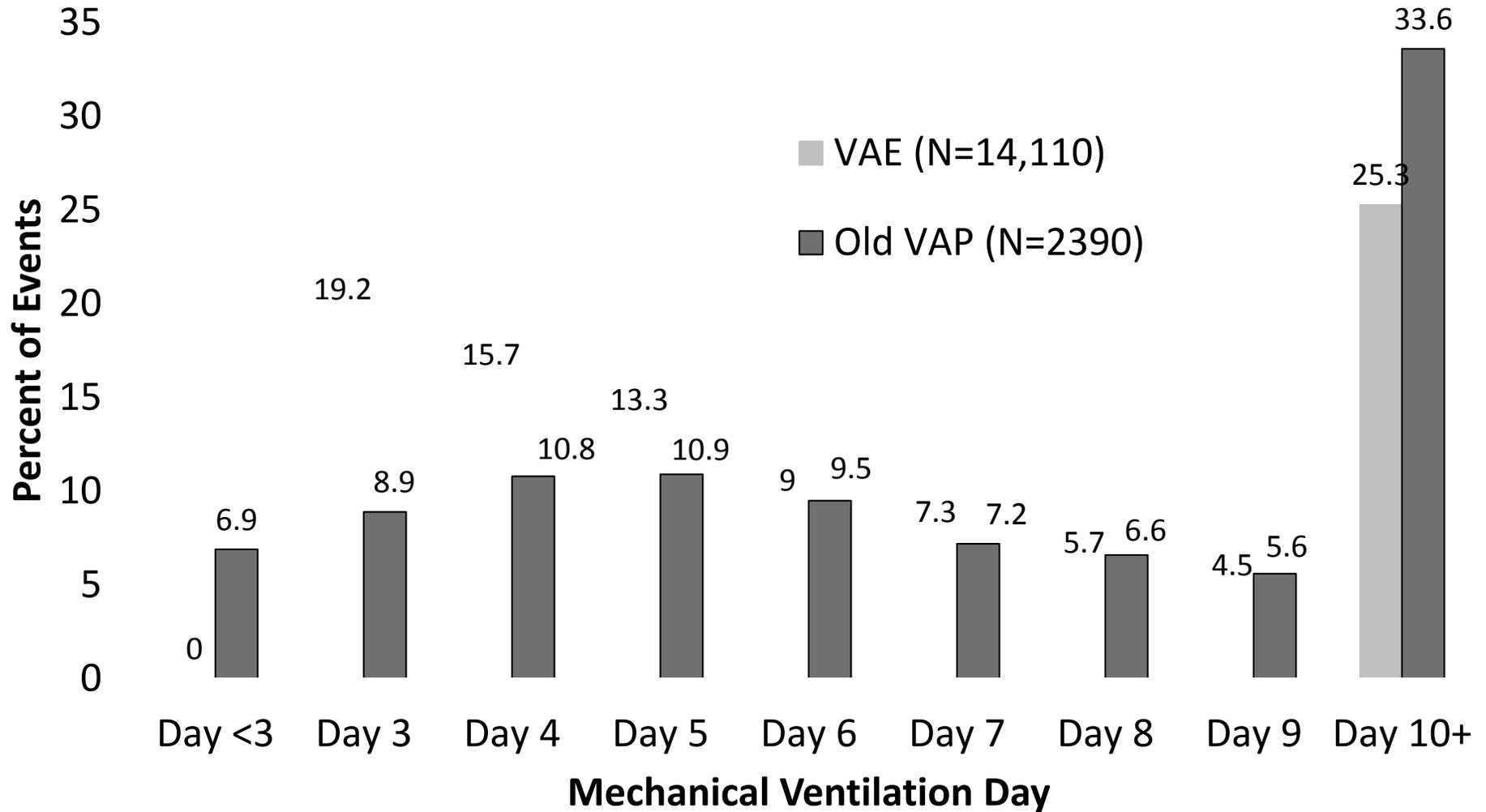
Preliminary, unpublished data, subject to change

# Criteria Used to Report IVACs (Feb 2014)



Preliminary, unpublished data, subject to change

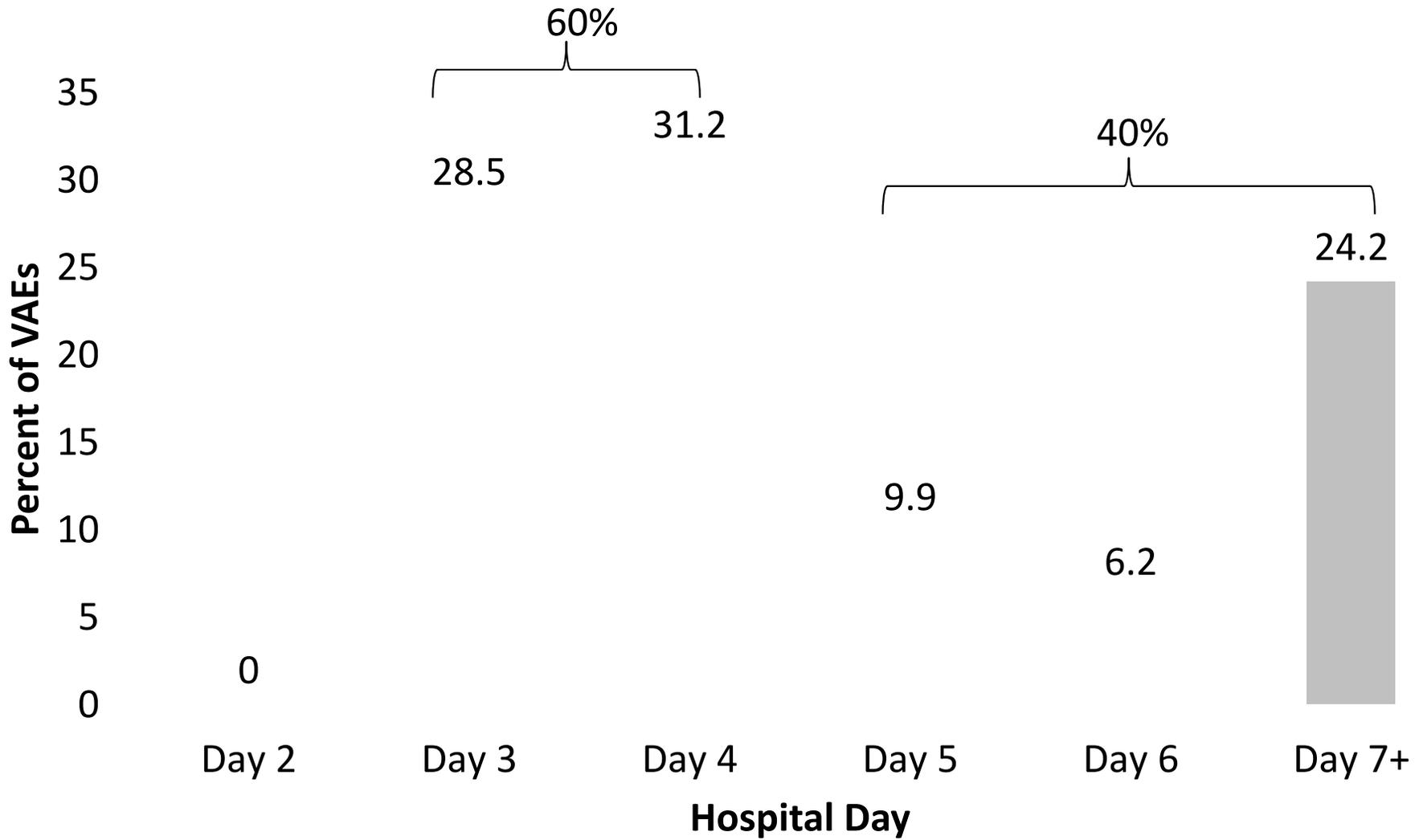
# Time from Intubation/Mechanical Ventilation Initiation to Event Onset, VAE vs. 2012 VAP\*



Preliminary, unpublished data, subject to change; VAE data as of Feb 1, 2014; data missing for 54 patients.

\*device insertion date available for 2390/3823 (63%) of 2012 VAP patients.

# Time from Facility Admission to VAE Onset Among VAEs with Onset on MV Days 3-4 (N=4918\*)



Preliminary, unpublished data, subject to change; as of Feb 1, 2014, data missing for 16 patients.

# Prevention of VAEs: What do we know?

- ❑ **Most important knowledge gap**
- ❑ **Patients who have VAC and IVAC do worse than patients who do not meet these definitions<sup>1,3</sup>**
  - Need to know more about Possible and Probable VAP
- ❑ **VAC definition detects important clinical conditions<sup>1,2</sup>**
  - More work to be done for IVAC, Possible and Probable VAP
- ❑ **Emerging evidence that VAC rates may be responsive to evidence-based interventions in mechanically-ventilated patients<sup>3</sup>**
  - More evidence needed

<sup>1</sup>Klompas M et al. PLoS ONE 2011;6: e18062; <sup>2</sup>Hayashi et al. Clin Infect Dis 2013;56:471-477

<sup>3</sup>Muscudere J, Sinuff T, et al. Chest 2013 Sept. 12.

# **SURVEILLANCE PROTOCOL**

## Who is eligible for VAE surveillance?

- ❑ **Inpatients of acute care hospitals, long term acute care hospitals, inpatient rehabilitation facilities**
- ❑ **In plan VAE surveillance changed in 2014 from age based surveillance to location based surveillance**
  - Patients in adult locations eligible for VAE surveillance
    - Pediatric patients\* in adult locations included in VAE surveillance
    - Adults in pediatric locations included in PED-VAP surveillance

\*NOT recommended to include in VAE surveillance young children housed in adult ICU locations who are not thought to be physiologically similar to the location's adult patient population

## Who is NOT eligible for VAE surveillance?

- ❑ Inpatients of facilities other than acute care hospitals, long-term acute care hospitals and inpatient rehabilitation facilities are not eligible.
- ❑ Patients who have been ventilated < 3 days are not eligible
- ❑ Patients on high frequency ventilation (HFV) or extracorporeal life support (ECLS) are not eligible for VAE surveillance (during the time they are receiving those therapies).

# What about other alternative modes of mechanical ventilation?

- **INCLUDE patients who are receiving a conventional mode of mechanical ventilation and:**
  - Prone positioning
  - Nitric oxide therapy
  - Helium-oxygen mixture
  - Epoprostenol therapy
- **INCLUDE patients on Airway Pressure Release Ventilation (APRV) or related modes. VAC determinations made using  $\text{FiO}_2$**

*If you have questions about mechanical ventilation, check with the Respiratory Care or Respiratory Therapy and/or Critical Care departments in your facility.*

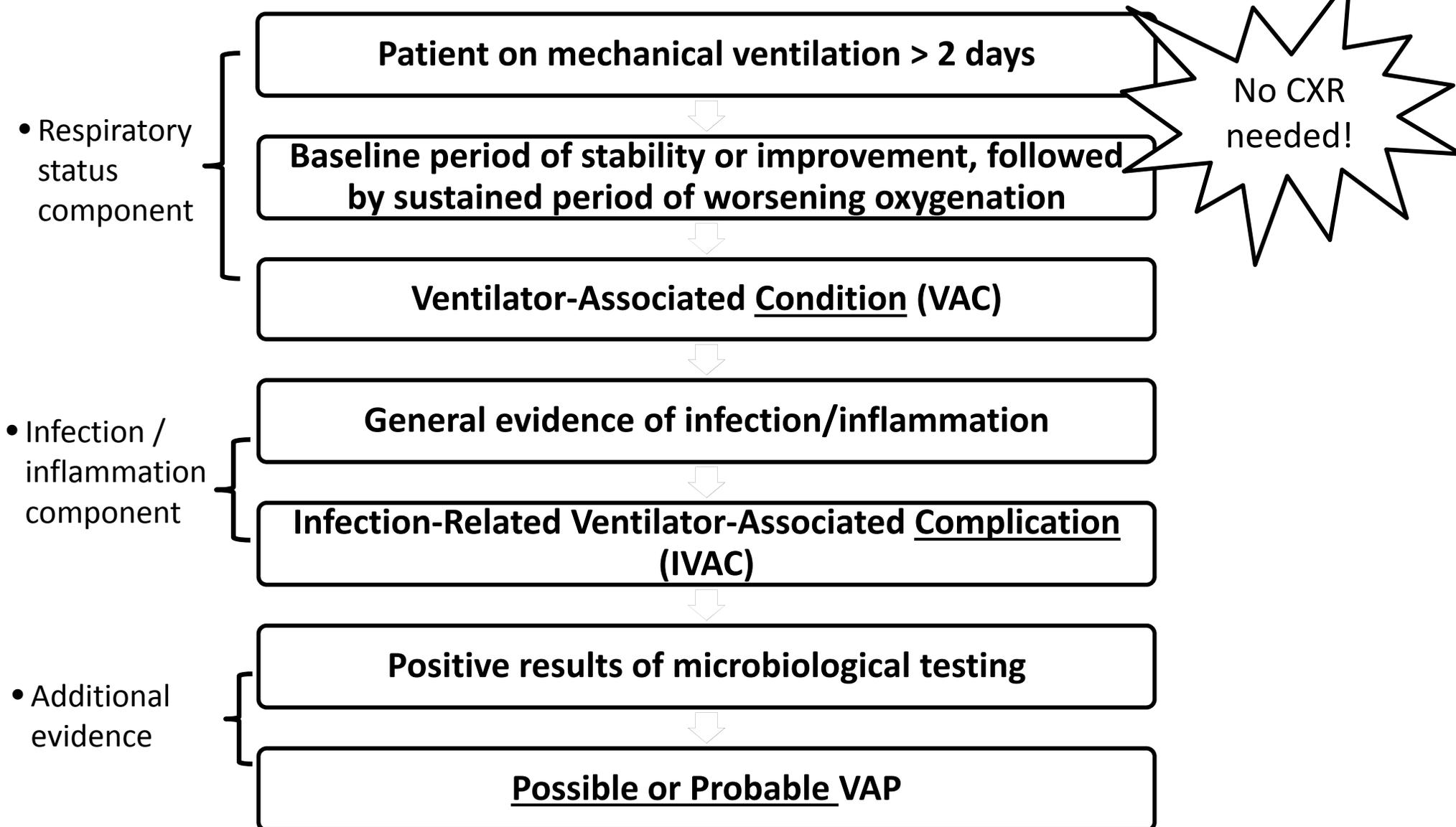
# APRV and VAC Determinations

- ❑ **Evaluating for VAC will be limited to the  $\text{FiO}_2$  parameter when the patient is on APRV for the entire calendar day, since changes in PEEP as indicated in this surveillance algorithm may not be applicable to APRV.**
  - Do not use Hi/Lo values
  - Do not designate PEEP as “0” on data collection tool or enter “0” into the calculator
  - PEEP is N/A
- ❑ **When the patient is on APRV for portions of a calendar day PEEP values recorded during periods of time when the patient is on a conventional mode of ventilation are used to determine the daily minimum PEEP and thus can be used to make VAC determinations**

# VAE ALGORITHM OVERVIEW

*\*\*\*Note that these are NOT clinical definitions and are not intended for use in the management of patients.\*\*\**

# VAE Definition Algorithm Summary



# Ventilator Definition

- **Ventilator is defined as a device to assist or control respiration continuously, inclusive of the weaning period, through a tracheostomy or by endotracheal intubation**
  - Intermittent positive-pressure breathing (IPPB); nasal positive end-expiratory pressure (nasal PEEP); and continuous nasal positive airway pressure (CPAP, hypoCPAP) are not considered ventilators unless delivered via tracheostomy or endotracheal intubation (e.g., ET-CPAP)

*No change from current NHSN ventilator definition*

## **Episode of Mechanical Ventilation**

- A period of days during which the patient was mechanically ventilated for some portion of each consecutive day. A break in mechanical ventilation of at least one full calendar day followed by re-intubation and re-initiation of mechanical ventilation during the same hospitalization is a new episode.**

# Positive End-Expiratory Pressure (PEEP)

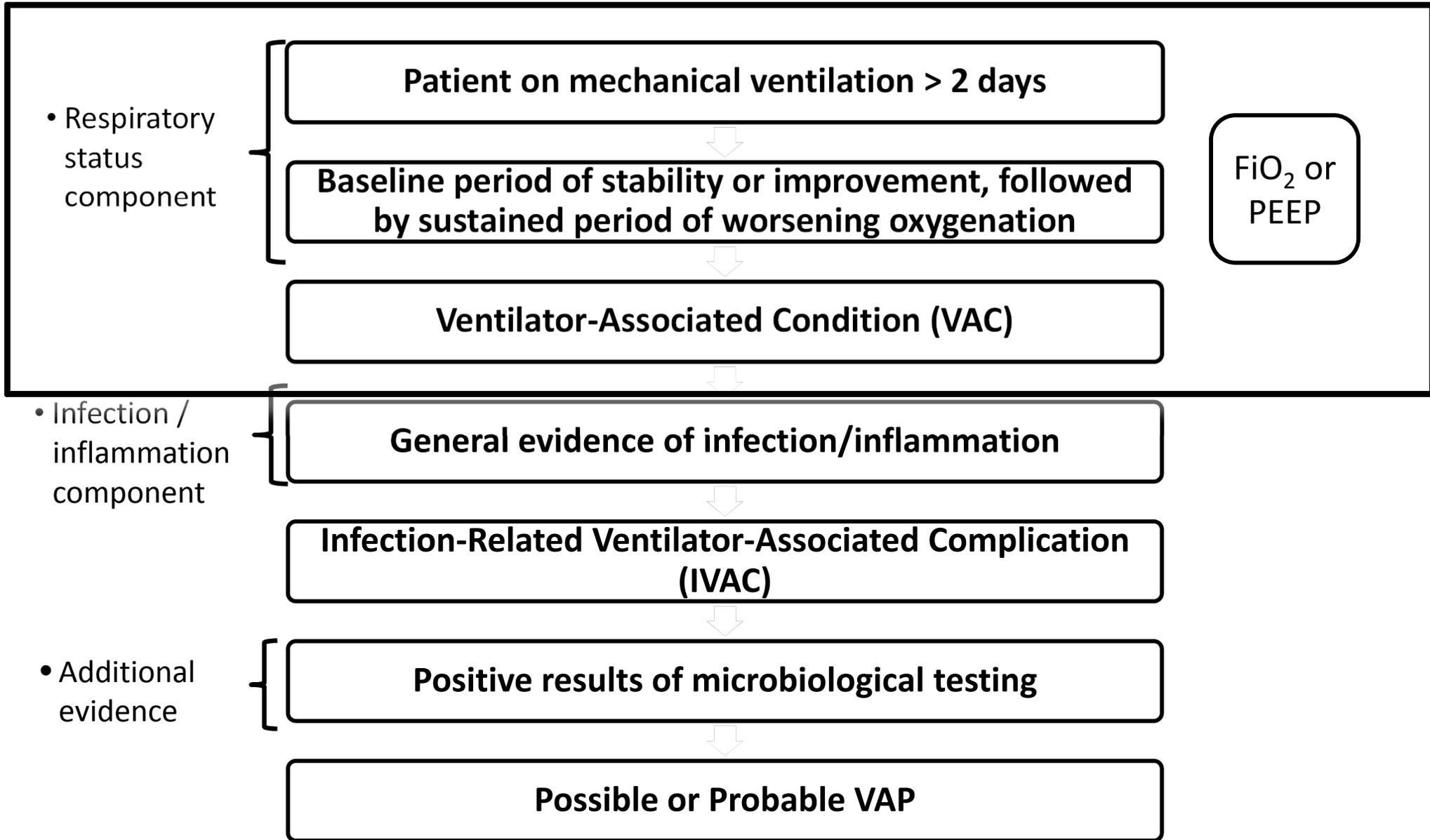
- ❑ **“A technique used in respiratory therapy in which airway pressure greater than atmospheric pressure is achieved at the end of exhalation by the introduction of a mechanical impedance to exhalation.”\***
- ❑ **In patients on conventional mechanical ventilation, PEEP is one of the parameters that can be adjusted depending on the patient’s oxygenation needs.**
- ❑ **A sustained increase in the daily minimum PEEP of  $\geq 3$  cmH<sub>2</sub>O following a period of stability or improvement on the ventilator is one of two criteria that can be used in meeting the VAC definition.**
  - **Daily minimum PEEP must be maintained for at least 1 hour**

\*Stedman’s Medical Dictionary, (28th ed). (2005). Philadelphia: Lippincott, Williams, & Wilkins. Monday

## Fraction of Inspired Oxygen ( $\text{FiO}_2$ )

- ❑ **The fraction of oxygen in inspired gas.**
  - For example, the  $\text{FiO}_2$  of ambient air is 0.21; the oxygen concentration of ambient air is 21%.
- ❑ **In patients on mechanical ventilation, the  $\text{FiO}_2$  is one of the key parameters that can be adjusted depending on the patient's oxygenation needs.**
- ❑ **A sustained increase in the daily minimum  $\text{FiO}_2$  of  $\geq 0.20$  (20%) following a period of stability or improvement on the ventilator is the second of the two criteria that can be used in meeting the VAC definition.**
  - Daily minimum  $\text{FiO}_2$  must be maintained for at least 1 hour

# VAE Definition Algorithm Summary



# Tier 1: VAC

Patient has a baseline period of stability or improvement on the ventilator, defined by  $\geq 2$  calendar days of stable or decreasing daily minimum\*  $\text{FiO}_2$  or PEEP values. The baseline period is defined as the 2 calendar days immediately preceding the first day of increased daily minimum PEEP or  $\text{FiO}_2$ .

\*Daily minimum defined by lowest value of  $\text{FiO}_2$  or PEEP during a calendar day that is maintained for at least 1 hour.

AND

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\*  $\text{FiO}_2$  of  $\geq 0.20$  (20 points) over the daily minimum  $\text{FiO}_2$  in the baseline period, sustained for  $\geq 2$  calendar days.
- 2) Increase in daily minimum\* PEEP values of  $\geq 3$   $\text{cmH}_2\text{O}$  over the daily minimum PEEP in the baseline period<sup>†</sup>, sustained for  $\geq 2$  calendar days.

\*Daily minimum defined by lowest value of  $\text{FiO}_2$  or PEEP during a calendar day that is maintained for at least 1 hour.

<sup>†</sup>Daily minimum PEEP values of 0-5  $\text{cmH}_2\text{O}$  are considered equivalent for the purposes of VAE surveillance.

## Daily Minimum FiO<sub>2</sub> and PEEP

- ❑ **FiO<sub>2</sub> and PEEP ventilator settings documented across the calendar day are used to identify the daily minimum FiO<sub>2</sub> and PEEP values**
- ❑ **FiO<sub>2</sub> and PEEP settings are typically recorded in the paper or electronic medical record, on respiratory therapy and/or nursing flow sheets, in the section of the flow sheet that pertains to respiratory status/mechanical ventilation**
- ❑ **Choose the lowest FiO<sub>2</sub> and PEEP setting during the calendar day that was maintained for at least 1 hour**

# Identifying the Minimum Daily FiO<sub>2</sub> and PEEP

(Select the lowest value recorded for each calendar day that is maintained for at least one hour)

	Monday 12am	3am	6am	9am	12pm	3pm	6pm	9pm
MV mode	ACV	ACV	ACV	ACV	ACV	ACV	ACV	ACV
FiO <sub>2</sub>	1.0	1.0	0.80	0.80	0.80	0.75	0.70	0.70
PEEP	8	8	8	8	8	5	5	8

Note: FiO<sub>2</sub> and PEEP values are maintained for at least 1 hour

# Identifying the Minimum Daily FiO<sub>2</sub> and PEEP

(Select the lowest value recorded for each calendar day that is maintained for at least 1 hour)

	Monday 12am	3am	4am	6am	9am	12pm	3pm	9pm
MV mode	ACV	ACV	ACV	ACV	ACV	ACV	ACV	ACV
FiO <sub>2</sub>	0.80	0.70	0.80	0.80	0.80	0.75	0.75	0.75
PEEP	8	8	8	8	8	8	8	8

0.70 is the lowest value for the calendar day but it was not maintained for 1 hour

## Daily Minimum FiO<sub>2</sub> and PEEP

- **When choosing the daily minimum values, include FiO<sub>2</sub> and PEEP values recorded during spontaneous awakening or spontaneous breathing trials (or other forms of weaning from mechanical ventilation).**
  - Exceptions/Exclusions
    - Periods of time when the patient is on HFV, ECLS
    - Periods of time when the patient is not receiving mechanical ventilation support (e.g., a T-piece trial, or a trach collar trial, where the patient continues to receive supplemental oxygen, but is receiving no additional support from the mechanical ventilator).
    - Periods of time when the patient is being mechanically-ventilated using APRV or a related strategy (e.g. BiLevel, Bi Vent, BiPhasic, PCV+ and DuoPAP): only review FiO<sub>2</sub> data (not PEEP).

## Daily Minimum FiO<sub>2</sub> and PEEP

- ❑ Use the daily minimum FiO<sub>2</sub> and PEEP values when assessing for both the period of stability or improvement and the period that indicates worsening oxygenation.
- ❑ Do not compare values that occur within a calendar day to determine stability, improvement or worsening.
- ❑ Daily minimum FiO<sub>2</sub> and PEEP must be maintained for at least 1 hour
- ❑ Remember daily minimum PEEP values of 0-5 cmH<sub>2</sub>O are considered equivalent (equal to 5) for the purposes of VAE surveillance

## PEEP values of 0-5 cmH<sub>2</sub>O = 5

	Daily Min PEEP	Daily Min FiO <sub>2</sub>
Monday	10	0.75
Tuesday	8	0.50
Wednesday	5	0.45
Thursday	0	0.40
Friday	0	0.40
Saturday	5	0.40
Sunday	5	0.40

Dr. X  
conducts  
SBTs without  
PEEP

Dr. Z  
conducts  
SBTs with  
PEEP 5  
cmH<sub>2</sub>O

***If my facility is doing in-plan VAE surveillance in the MICU, do I have to report this VAC?***

**NO! Protocol changed as of July 2013**

# PEEP Values 0-5 cmH<sub>2</sub>O = 5

MV Day	Daily minimum PEEP	Daily minimum FiO <sub>2</sub>
1	0	100
2	0	90
3	0	90
4	5	50
5	5	50
6	8	50
7	8	50
8	8	50
9	5	60
10	5	50

## Period of Stability or Improvement

- ❑ Patient has a baseline period of stability or improvement on the ventilator, defined by  $\geq 2$  calendar days of stable or decreasing daily minimum\*  $\text{FiO}_2$  or PEEP values.
- ❑ The baseline period is defined as the two calendar days immediately preceding the first day of increased daily minimum PEEP or  $\text{FiO}_2$ .

\*Daily minimum  $\text{FiO}_2$  and PEEP must be maintained for at least 1 hour

## Evidence of Worsening Oxygenation

- ❑ **After a period of stability or improvement on the ventilator, the patient has at least one of the following indicators of worsening oxygenation:**
  - Increase in daily minimum\*  $\text{FiO}_2$  of  $\geq 0.20$  (20 points) over the daily minimum  $\text{FiO}_2$  in the baseline period, sustained for  $\geq 2$  calendar days.

**OR**

- Increase in daily minimum\* PEEP values of  $\geq 3$   $\text{cmH}_2\text{O}$  over the daily minimum PEEP in the baseline period\*\*, sustained for  $\geq 2$  calendar days.

**\*Daily minimum  $\text{FiO}_2$  and PEEP must be maintained for at least 1 hour**

**\*\*Daily minimum PEEP values of 0 to 5  $\text{cmH}_2\text{O}$  are considered equivalent for purposes of VAE surveillance**



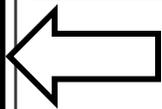




Vent Day	PEEP min	FiO <sub>2</sub> min	Temp min	Temp max	WBC min	WBC max	Abx	Spec	Polys/Epis	Org
1	10	60								
2	5	40								
3	5	40								
4	8	60								
5	8	50								
6	7	40								
7	5	40								
8	5	40								

= VAC

Vent Day	PEEP min	FiO <sub>2</sub> min	Temp min	Temp max	WBC min	WBC max	Abx	Spec	Poly/E pis	Org
1	10	60								
2	5	40								
3	5	40								
4	8									
5	8	50								
6	7	40								
7	5	40								
8	5	40								



**Event Date = Vent Day 4 (first day of worsening oxygenation)**

## Date of Event / Event Date

- The date of onset of worsening oxygenation (day 1 of the required  $\geq 2$  day period of worsening oxygenation). *It is not the date on which all VAE criteria are met.*

# Why is the Event Date important?

## ❑ Defines the “VAE Window Period”

- Period during which criteria for other events—IVAC, Possible, Probable VAP—must be met

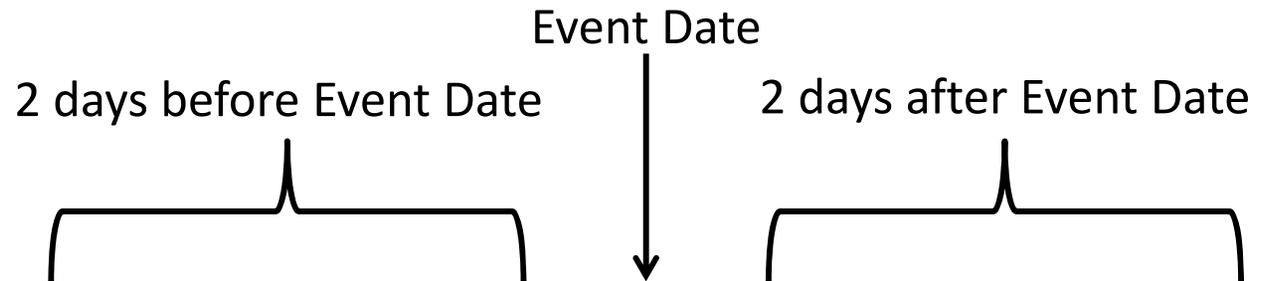
## ❑ Detecting multiple VAEs in the same patient

- Each VAE is 14 days in duration (arbitrary—to standardize).
- Day 1 is the Event Date—so if June 1 is date of onset of worsening oxygenation and a VAC is reported, a second VAE cannot be detected and reported until June 15.
- May not “upgrade” a VAE based on data collected outside the VAE Window Period but within the 14-day event period.
- May not report a new VAE until that 14 day period has elapsed (keep in mind that 14 day period is event date to event date—so baseline period can occur during previous event period).
- Blood cultures must be collected within the 14 day event period for a BSI to be secondary to VAE

## **VAE Window Period**

- This is the period of days around the event date (i.e., the day of onset of worsening oxygenation) within which other VAE criteria must be met. It is usually a 5-day period and includes the 2 days before, the day of, and the 2 days after the VAE event date (i.e., the first day of worsening oxygenation, the day of VAE onset).**

# VAE Window Period



<b>MV Day</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>	<b>16</b>
<b>VAE Day</b>	-3	-2	-1	1	2	3	4
<b>Worsening oxygenation</b>	--	Day 1 of Stability or improvement	Day 2 of stability or improvement	Day 1 of worsening oxygenation	Day 2 of worsening oxygenation		
<b>Temperature or WBC abnormality</b>		← Documented within this shaded period →					
<b>Antimicrobial agent</b>		← Started on within this shaded period, and then continued for at least 4 days →					
<b>Purulent respiratory secretions, positive culture, positive histopathology</b>		← Collected within this shaded period →					

## **VAE Window Period: Important Note**

- There is an exception, however, in which the VAE Window Period is only 3 or 4 days, as follows:**

**In cases where the VAE event date corresponds to MV day 3 or day 4, the window period described above may only be a 3-day or a 4-day window, because it can NOT include any days before the 3<sup>rd</sup> day of MV. For example, if the VAE event date is MV day 3, then the window period includes only the day of VAE onset and the 2 days after VAE onset (because the 2 days before VAE onset are before the 3<sup>rd</sup> day of MV).**

# Exception: VAE Window Period

*When the event occurs early in course of mechanical ventilation*

Can't count data in 1<sup>st</sup> 2 days of MV for IVAC, Poss/Prob VAP

Event Date

2 days after Event Date

MV Day No.	1	2	3	4	5	6	7
VAE Day	-2	-1	1	2	3	4	5
Worsening oxygenation	Day 1 of Stability or improvement	Day 2 of stability or improvement	Day 1 of worsening oxygenation	Day 2 of worsening oxygenation			
Temperature or WBC abnormality			← Documented within this shaded period →				
Antimicrobial agent			← Started on within this shaded period, and then continued for at least 4 days →				
Purulent respiratory secretions, positive culture, positive histopathology			← Collected within this shaded period →				

# Defining the VAE Window Period

Vent Day	PEEP min	FiO <sub>2</sub> min	Temp min	Temp max	WBC min	WBC max	Abx	Spec	Org
1	10	60							
2	5	40							
3	5	40							
4	8	60							
5	8	50							
6	7								
7		40							

# Defining the VAE Window

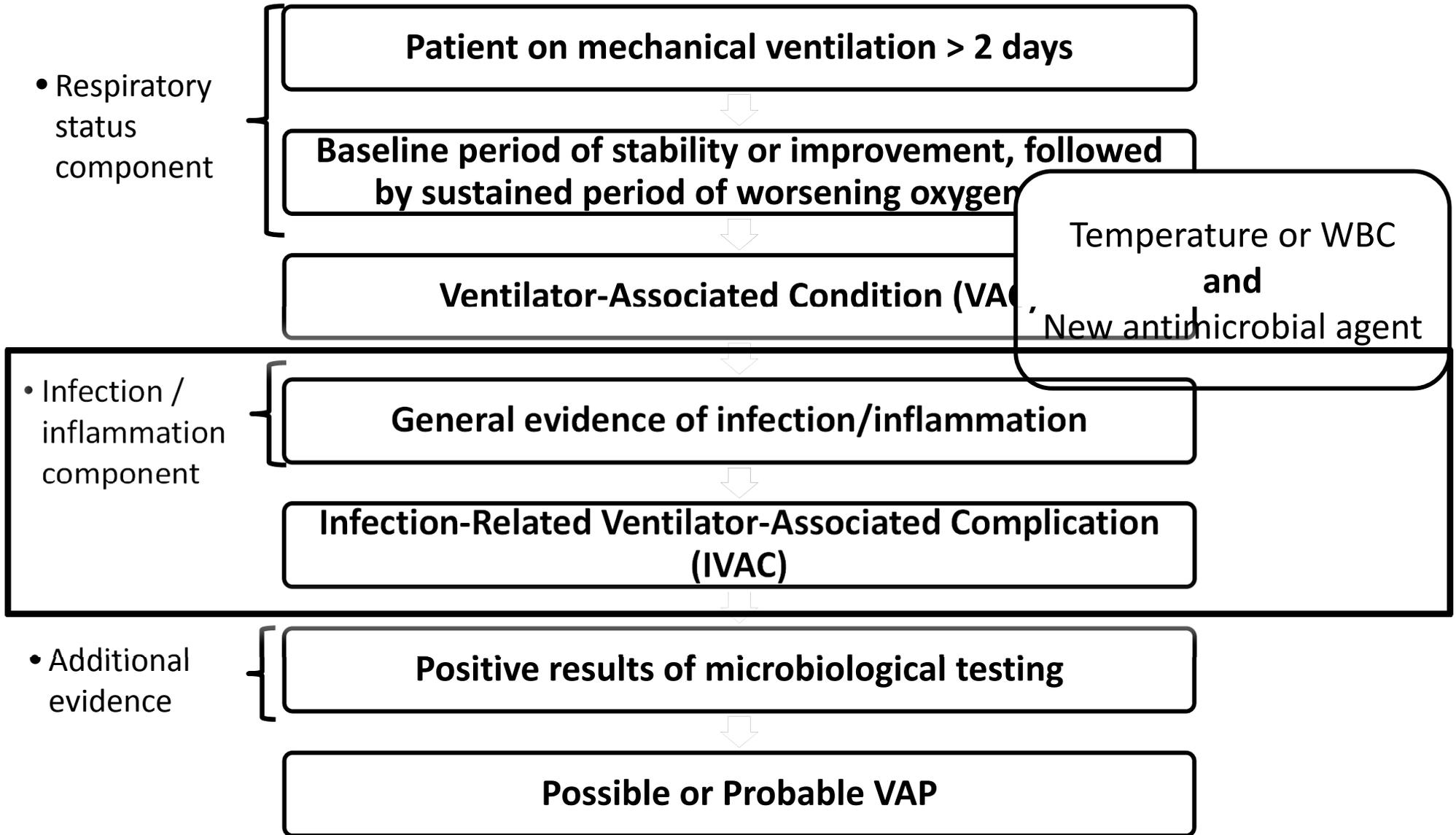
Vent Day	PEEP min	FiO <sub>2</sub> min	Temp min	Temp max	WBC min	WBC max	Abx	Spec	Polys/Epis	Org
1	10	60								
2	5	40								
3	5	40								
4	8	60								
5	8	50								
6	7	40								
7	5	40								
8	5	40								

In this case—there is only 1 day before onset of worsening (because cannot count 1<sup>st</sup> 2 days of MV)

Event Date, day 1 of worsening

2-day period after onset of worsening

# VAE Definition Algorithm Summary



## Tier 2: IVAC

Patient meets criteria for VAC

AND

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  $> 38^{\circ}\text{C}$  or  $< 36^{\circ}\text{C}$ , OR white blood cell count  $\geq 12,000$  cells/mm<sup>3</sup> or  $\leq 4,000$  cells/mm<sup>3</sup>.

AND

2) A new antimicrobial agent(s)\* is started, and is continued for  $\geq 4$  calendar days.

\*See Appendix for eligible agents.

# Infection-related Ventilator-Associated Complication (IVAC)

Patient meets criteria for VAC

AND

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  $> 38^{\circ}\text{C}$  or  $< 36^{\circ}\text{C}$ , OR white blood cell count  $\geq 12,000$  cells/mm<sup>3</sup> or  $\leq 4,000$  cells/mm<sup>3</sup>.

AND

2) A new antimicrobial agent(s)\* is started, and is continued for  $\geq 4$  calendar days.

\*See Appendix for eligible agents.



## Temperature / WBC

- ❑ **As long as there is an abnormal temperature ( $> 38\text{ }^{\circ}\text{C}$  or  $< 36\text{ }^{\circ}\text{C}$ ) or white blood cell count ( $\geq 12,000\text{ cells/mm}^3$  or  $\leq 4,000\text{ cells/mm}^3$ ) documented during the VAE Window Period, it should be used in determining whether the patient meets the IVAC definition or not, regardless of whether the temperature or white blood cell count was also present on admission or before the start of the VAE Window Period.**

# Infection-related Ventilator-Associated Complication (IVAC)

Patient meets criteria for VAC

AND

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  $> 38^{\circ}\text{C}$  or  $< 36^{\circ}\text{C}$ , OR white blood cell count  $\geq 12,000$  cells/mm<sup>3</sup> or  $\leq 4,000$  cells/mm<sup>3</sup>.

AND

- 2) A new antimicrobial agent(s)\* is started, and is continued for  $\geq 4$  calendar days.

\*See Appendix for eligible agents.

## **IVAC Antimicrobial Criterion**

- ❑ Probably the most complicated portion of the VAE surveillance definition algorithm**
- ❑ Rules for meeting this criterion are not perfect—but we need a standardized method for assessment of antimicrobial therapy, without needing knowledge of dosing, renal function, indication for therapy, etc.**

## **What antimicrobial drugs are in the Appendix?**

- ❑ Mostly antibacterials, antifungals, limited antivirals**
- ❑ Drugs that are not included = anti-HIV agents, anti-TB agents, agents used to treat viral hepatitis, agents used to treat herpes virus infections, anti-parasitics**
- ❑ Originally a broad range of agents that could be used to treat healthcare-associated infections—not just respiratory related infections.**

## **IVAC Antimicrobials**

- ❑ Concern when an antimicrobial agent resulted in an IVAC determination and then subsequently a Possible or Probable VAP determination but the agent was not used to treat a respiratory infection**
- ❑ To avoid increasing the complexity the IVAC antimicrobial list (Appendix) was refined and selected antimicrobial agents that would not be used, or would be unlikely to be used, in treating a lower respiratory infection in a critically ill patient were removed:**
  - Oral cephalosporins and penicillins, erythromycin, erythromycin/sulfisoxazole, amantadine, rimantadine, chloramphenicol, tinidazole, fidaxomicin, nitrofurantoin, oral vancomycin and daptomycin**

## Figuring out if a “new” antimicrobial agent(s) has been given

- **New antimicrobial agent**: Defined as any agent listed in the protocol Appendix that is initiated on or after the third calendar day of mechanical ventilation AND in the VAE Window Period (i.e., 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.
  - A new agent must be continued for  $\geq 4$  consecutive days.
  - There is no requirement that the same antimicrobial agent be given on the 4 consecutive days.
  - New agent must be administered IV, IM, via digestive tract or via respiratory tract

## **Figuring out if $\geq 4$ days of therapy have been given: Qualifying Antimicrobial Days (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.**



# QADs: Different Agents

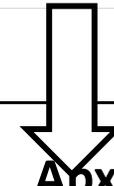
❑ **By contrast, days between administrations of different antimicrobial agents do NOT count as QADs**

- For example, if levofloxacin is given to the patient on VAE Days -2 and -1 only, no antimicrobials are given on VAE Day 1, and meropenem is given only on VAE Day 2 (remember there is no VAE Day 0), then there are not 4 consecutive QADs. VAE Days -2 and -1 count as 2 consecutive QADs, but VAE Day 1 cannot be counted as a QAD because it is a day between different antimicrobial agents.

Different agents, with gap between agents: only 2 consecutive QADs

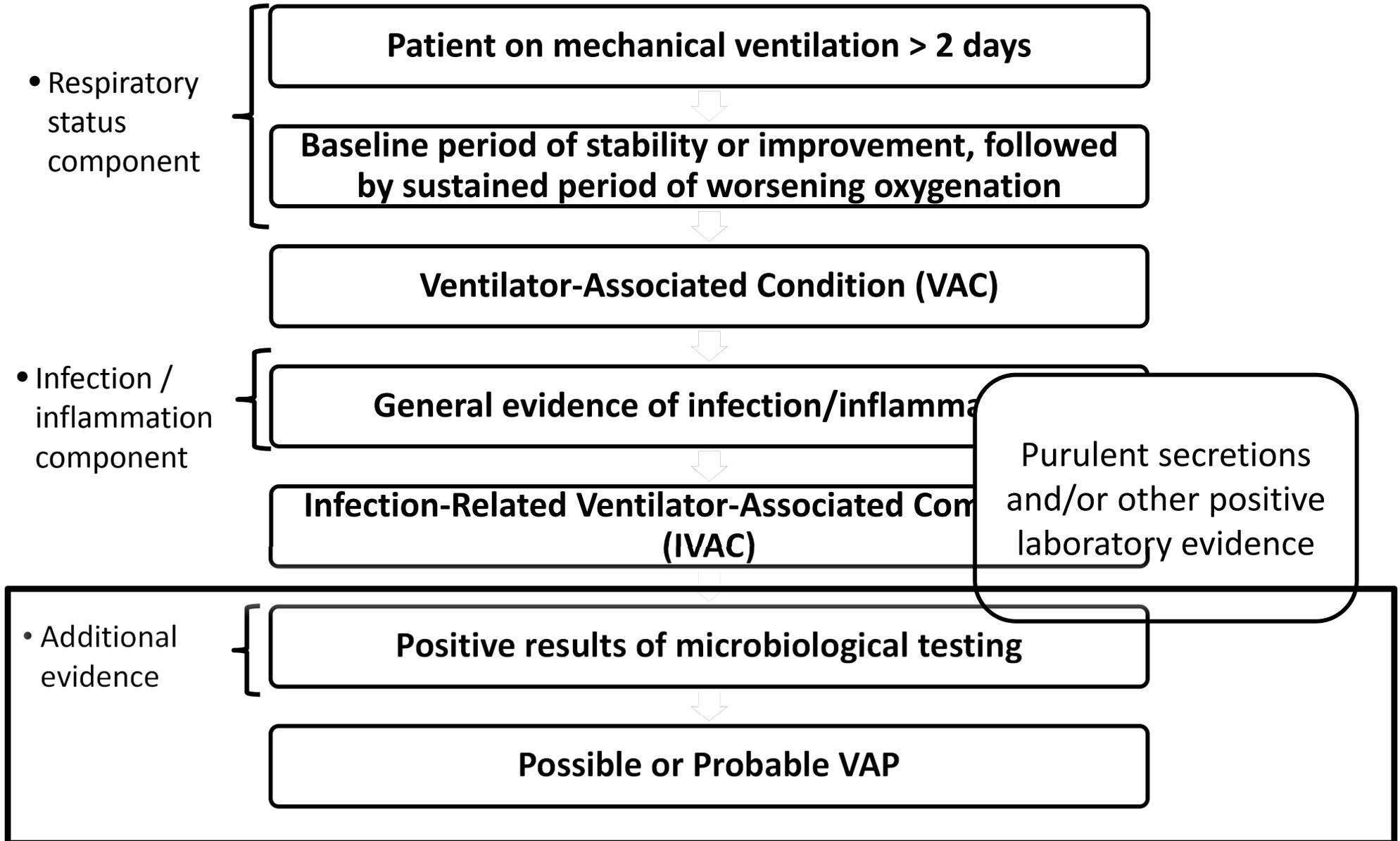
VAE Day	-4	-3	-2	-1	1	2	3	4	5
Abx #1	--	--	Levo	Levo	--		--	--	--
Abx #2	--	--	--	--	--	Mero	--	--	--
QAD	--	--	Yes	Yes	--	Yes	--	--	--

**New antimicrobial agent started and continued for 4 days**



Vent Day	PEEP min	FiO <sub>2</sub> min	Temp min	Temp max	WBC min	WBC max	Abx	Spec	Poly/E pis	Org
1	10	60					None			
2	5	40					None			
3	5	40	36.9	37.6	12.1	12.1	None			
4	8	60	38.1	39.2	14.5	16.8	Yes		= IVAC	
5	8	50	38.4	38.9	12.6	15.9	Yes			
6	7	40	36.5	37.8	11.1	13.6	Yes			
7	5	40					Yes			
8	5	40					Yes			

# VAE Definition Algorithm Summary



# Tier 3: Possible VAP

Patient meets criteria for VAC and IVAC

AND

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:

- 1) Purulent respiratory secretions (from one or more specimen collections)
  - 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].
  - If the laboratory reports semi-quantitative results, those results must be equivalent to the above quantitative thresholds.
- 2) Positive culture (qualitative, semi-quantitative or quantitative) of sputum\*, endotracheal aspirate\*, bronchoalveolar lavage\*, lung tissue, or protected specimen brushing\*

*\*Excludes the following:*

- Normal respiratory/oral flora, mixed respiratory/oral flora or equivalent
- *Candida* species or yeast not otherwise specified
- Coagulase-negative *Staphylococcus* species
- *Enterococcus* species

# Tier 3: Probable VAP

**VAC, IVAC  
plus the  
following...**

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:

1) Purulent respiratory secretions (from one or more specimen collections—and defined as for possible VAP)

AND one of the following (see Table 2):

- Positive culture of endotracheal aspirate\*,  $\geq 10^5$  CFU/ml or equivalent semi-quantitative result
- Positive culture of bronchoalveolar lavage\*,  $\geq 10^4$  CFU/ml or equivalent semi-quantitative result
- Positive culture of lung tissue,  $\geq 10^4$  CFU/g or equivalent semi-quantitative result
- Positive culture of protected specimen brush\*,  $\geq 10^3$  CFU/ml or equivalent semi-quantitative result

*\*Same organism exclusions as noted for Possible VAP.*

2) One of the following (without requirement for purulent respiratory secretions):

- Positive pleural fluid culture (where specimen was obtained during thoracentesis or initial placement of chest tube and NOT from an indwelling chest tube)
- Positive lung histopathology
- Positive diagnostic test for *Legionella* spp.
- Positive diagnostic test on respiratory secretions for influenza virus, respiratory syncytial virus, adenovirus, parainfluenza virus, rhinovirus, human metapneumovirus, coronavirus

## Possible and Probable VAP

- ❑ **Purulent respiratory secretions**
- ❑ **Positive lower respiratory tract cultures**
- ❑ **Other criteria for Probable VAP (less common)**
  - Positive pleural fluid culture
  - Positive lung histopathology
  - Positive tests for *Legionella* or respiratory virus infection
- ❑ **Many other pathogens (including respiratory pathogens such as *Mycoplasma* and *Chlamydophila*) that may be detected using non-culture-based techniques are not currently included in Probable VAP criteria.**

## **Purulent Respiratory Secretions**

- ❑ Defined as secretions from the lungs, bronchi, or trachea that contain  $\geq 25$  neutrophils (“polys”, “PMN”, polymorphonuclear ) and  $\leq 10$  squamous epithelial cells per low power field [lpf, x 100]**
- ❑ Can be used alone to meet Possible VAP definition, or in combination with a semi-quantitative or quantitative culture result (with the appropriate amount of growth) to meet the Probable VAP definition**
- ❑ Refer to Table 2 of the surveillance protocol**

How do I use the purulent respiratory secretions criterion if ...	Instruction
My laboratory reports counts of “white blood cells” or “ <u>polymorphonuclear leukocytes</u> ” or “leukocytes” rather than counts of “neutrophils”?	Assume that counts of cells identified by these other descriptors (e.g., “white blood cells”) are equivalent to counts of neutrophils, unless the laboratory tells you this is not the case.
My laboratory reports semi-quantitative results (not quantitative results) for numbers of neutrophils and squamous epithelial cells?	Check with the laboratory to get information about what quantitative ranges the semi-quantitative reports correspond to.
My laboratory cannot provide additional information on how its semi-quantitative reporting corresponds to quantitative reporting ranges for neutrophils and squamous epithelial cells?	Use the following direct examination results to meet the purulent respiratory secretions criterion: heavy, 4+, or $\geq 25$ neutrophils per low power field (lpf) [x100], AND rare, occasional, few, 1+ or 2+, or $\leq 10$ squamous epithelial cells per lpf [x100] [19].
My laboratory reports <u>only</u> the numbers of neutrophils present, without reporting the number of squamous epithelial cells?	In this situation, the purulent secretions criterion may be met using the specified quantitative and semi-quantitative thresholds for neutrophils alone (i.e., heavy, 4+, or $\geq 25$ neutrophils per lpf [x100]).
My laboratory uses different reporting thresholds for neutrophils and squamous epithelial cells (e.g., maximum report of $\geq 20$ neutrophils per low power field [x100], or minimum report of $\leq 15$ squamous epithelial cells per low power field [x100])?	In this situation, the purulent secretions criterion may be met using the laboratory’s specified maximum quantitative threshold for neutrophils, and/or minimum quantitative threshold for squamous epithelial cells.
My laboratory processes respiratory specimens such as <u>bronchoalveolar lavage fluid</u> using a centrifugation procedure (e.g., “ <u>cytopsin</u> ”), and there is no quantitation or semi-quantitation of neutrophils or white blood cells in the direct examination report?	In this situation, a report indicating the presence of white blood cells, without quantitation, is sufficient to meet the purulent secretions criterion.

**Table 2**  
Some clinical laboratories use different result reporting formats for respiratory secretion direct examination results

# Lower Respiratory Culture Results

- ❑ **Appropriate specimen types include:**
  - Sputum\*, endotracheal aspirate, bronchoalveolar lavage, protected specimen brushings, lung tissue, pleural fluid
- ❑ **Exclude the following as a pathogen unless isolated from lung tissue or pleural fluid**
  - *Candida* species or yeast not otherwise specified
  - Coagulase negative *Staphylococcus* species
  - *Enterococcus* species
- ❑ **Exclude the following culture results (or similar) ...**
  - Normal respiratory flora / Normal oral flora
  - Mixed respiratory flora / Mixed oral flora
  - Altered oral / respiratory flora



**\*sputum is not an acceptable specimen for meeting probable VAP definition**

# Positive Culture Result Reporting

## ❑ Qualitative

- Identification of organism with no quantity assigned
- Example: “Organism 1: *Staphylococcus aureus*”

## ❑ Semi-quantitative

- Identification of organism with estimated quantity
- Example: 1+, 2+, 3+, 4+
- Example: Rare, Few, Moderate , Heavy

## ❑ Quantitative

- Identification of organism with exact quantity expressed
- Example:  $10^4$  cfu/ml (colony forming units/milliliter)

# How do I relate my lab's semi-quantitative culture result reporting to the quantitative thresholds in the algorithm?

- ❑ Ask your laboratory manager/director first—she/he may be able to tell you
- ❑ If your laboratory does not have this information,
  - For the purposes of this surveillance, we will assume that a semi-quantitative result of “moderate” or “heavy” growth, or 2+, 3+ or 4+ growth (in a culture of lung tissue, BAL, PSB, or ETA) meets the Probable VAP surveillance definition.

## **Non-Culture-Based Results: Probable VAP**

- **Pathogens (*Legionella* spp., selected viruses) identified utilizing non-culture-based diagnostic testing may qualify as criterion for meeting Probable VAP.**
  - Antigen testing
  - PCR
  - Direct Fluorescent Antibody Testing
  - Serology

## **Histopathology (Lung) Results**

- ❑ Identification of abscess formation or foci of consolidation with intense neutrophil accumulation in bronchioles and alveoli**
- ❑ Evidence of lung parenchyma invasion by fungi (hyphae, pseudohyphae or yeast forms)**
- ❑ Evidence of infection with viral pathogens (immunohistochemical assays, cytology, microscopy)**

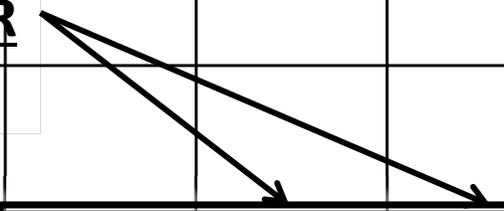


# Pathogen Reporting

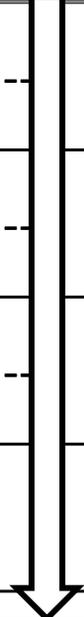
- ❑ **Pathogens may be reported for Possible VAP and Probable VAP, according to the usual pathogen and antimicrobial susceptibility reporting methods utilized in NHSN for other events.**
  - Exception: excluded pathogens
- ❑ **Pathogens are not reported for VAC or for IVAC.**

Vent Day	PEEP min	FiO <sub>2</sub> min	Temp min	Temp max	WBC min	WBC max	Abx	Spec	Polys/Epis	Org
1	10	60	Purulent respiratory secretions <u>OR</u> ETA culture positive for <i>S. aureus</i>							
2	5	40								
3	5	40	36.9	37.6	12.1	12.1	None	ETA	>25/ <10	<i>Staph aureus</i>
4	8	60	38.1	39.2	14.5	16.8	Yes	--	--	--
5	8	50	38.4	38.9	12.6	15.9	Yes	--	--	--
6	7	40	36.5	37.8	11.1	13.6	Yes	--	--	---
7	5	40					Yes			
8	5	40						= Possible VAP		

Purulent respiratory secretions OR  
ETA culture positive for *S. aureus*



ETA      >25/  
<10      *Staph aureus*



= Possible VAP

**Purulent respiratory secretions AND positive quantitative or semi-quantitative\* ETA culture (*meeting specified threshold*)**

Vent Day	PEEP min	FiO <sub>2</sub> min	Temp min	Temp max	WBC min	WBC max	Abx	Spec	Polys /Epis	Org
1	10	60								
2	5	40					None			
3	5	40	36.9	37.6	12.1	12.1	None	ETA	≥25/ ≤10	10 <sup>5</sup> cfu/ml <i>S. aureus</i>
4	8	60	38.1	39.2	14.5	16.8	Yes	--	--	--
5	8	50	38.4	38.9	12.6	15.9	Yes	--	--	--
6	7	40	36.5	37.8	11.1	13.6	Yes	--	--	---
7	5	40					Yes			



**= Probable VAP**

\*semi-quantitative result of “moderate” or “heavy” growth, or 2+, 3+ or 4+ growth (in a culture of lung tissue, BAL, PSB, or ETA) meets the Probable VAP surveillance definition.

**Positive pleural fluid, lung histopathology,  
*Legionella* or viral test result**

Vent Day	PEEP min	FiO <sub>2</sub> min	Temp min	Temp max	WBC min	WBC max	Abx	Spec	Polys/Epis	Org
1	10	60								
2	5	40					None			
3	5	40	36.9	37.6	12.1	12.1	None	<b>Pleural Fluid</b>		<i>Staph aureus</i>
4	8	60	38.1	39.2	14.5	16.8	Yes	--	--	--
5	8	50	38.4	38.9	12.6	15.9	Yes	--	--	--
6	7	40	36.5	37.8	11.1	13.6	Yes	--	--	---
7	5	40					Yes			
8	5	40								

**= Probable VAP**

# What about positive blood cultures that occur around the same time as a VAE?

- ❑ **Secondary BSI may be reported for Possible and Probable VAP**
  - When at least one eligible organism from the blood culture specimen matches an eligible organism from an appropriate respiratory tract specimen collected during the VAE Window Period
  - And when the blood culture was collected within the 14 day event period
- ❑ **Secondary BSIs are not reported for VAC or IVAC.**
- ❑ **Secondary BSI may not be reported for Possible and Probable VAP when a respiratory culture was not performed.**
  - Possible VAP met with purulent respiratory secretions
  - Probable VAP met with histopathology criterion
  - A positive diagnostic test on respiratory secretions for influenza virus, respiratory syncytial virus, adenovirus, parainfluenza virus, rhinovirus, human metapneumovirus, coronavirus

## Secondary BSI and VAE Surveillance

- ❑ **If only the VAC or IVAC definition is met, or if no VAE definition is met**
  - Determine if the BSI is secondary to another HAI found in Chapter 17 to include the PNEU or LRI definitions
  - Remember, for a bloodstream infection to be determined to be secondary to a primary infection site (e.g. related to an infection at another site, primary site of infection may have seeded the bloodstream secondarily), the patient must first meet one of the NHSN HAI definitions.
  - If the patient does not meet one of the HAI definitions in Chapter 17 to which the BSI can be attributed, the BSI may need to be reported as a primary BSI/CLABSI.

# Secondary BSI and Lower Respiratory Site Infections

- **If the Possible VAP or Probable VAP definition is met & the positive blood culture is determined NOT to be secondary to VAE**
  - Determine if the BSI is secondary to another HAI found in Chapter 17 to include the PNEU or LRI definitions
  - If not the BSI may need to be reported as a primary BSI/CLABSI.

## **Location of Attribution**

- The inpatient location where the patient was assigned on the date of the VAE (date of onset of worsening oxygenation)**

## Transfer Rule

- ❑ If a VAE develops on the day of transfer or the day following transfer from one inpatient location to another in the same facility or to a new facility (where the day of transfer is day 1), the event is attributed to the transferring location.











**PREPARING TO CONDUCT VAE  
SURVEILLANCE AND REPORTING  
EVENTS INTO NHSN**

## Tips for Getting Started

- ❑ **Get familiar with the protocol & review the FAQs**
  - <http://www.cdc.gov/nhsn/acute-care-hospital/vae/index.html>
  - <http://www.cdc.gov/nhsn/inpatient-rehab/vae/index.html>
  - <http://www.cdc.gov/nhsn/ltach/vae/index.html>
  
- ❑ **Experiment with the VAE Calculator Version 2.1.**
  - <http://www.cdc.gov/nhsn/VAE-calculator/index.html>



## National Healthcare Safety Network (NHSN)

- NHSN**
- About NHSN
- Enroll Here
- Materials for Enrolled Facilities
  - Acute Care Hospitals/Facilities
    - Surveillance for Antimicrobial Use and Antimicrobial Resistance
    - Surveillance for CAUTI
    - Surveillance for *C. difficile* and MRSA Infections
    - Surveillance for CLABSI
    - Validation Guidance and Toolkit; Validation for 2012 CLABSI in ICUs
    - Surveillance for CLIP Adherence
    - Surveillance for SSI Events
    - **Surveillance for VAE**
      - Surveillance for VAP Events
      - Surveillance for Healthcare Personnel Exposure
      - Surveillance for Healthcare Personnel Vaccination
      - Blood Safety Surveillance
    - Long-term Acute Care Facilities

NHSN > Materials for Enrolled Facilities > Acute Care Hospitals/Facilities

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### Surveillance for Ventilator-associated Events

2014 VAE surveillance is available in plan for adult inpatient locations only. See [PNEU/VAP](#) for in-plan surveillance for pediatric locations. In-plan surveillance for ventilated associated PNEU is no longer available for neonatal patients.

The new [Ventilator-Associated Event Calculator \(Version 2.1\)](#) (must have javascript enabled) operates based upon the currently posted (January 2014) VAE protocol.

#### Resources for NHSN Users Already Enrolled

##### Training

Top

##### Protocols

- Device-associated Module: Ventilator-Associated Event Protocol [PDF - 900 KB] January 2014
- NHSN Overview [PDF - 96 KB] January, 2014
- Identifying Healthcare-associated Infections (HAIs) in NHSN [PDF - 149 KB] January 2014
- Patient Safety Monthly Reporting Plan [PDF - 55 KB] January 2014

Top

##### Data Collection Forms

- 57.112 Ventilator-Associated Event (VAE) Form [PDF - 104 KB] January 2014
  - Customizable form [DOC - 52 KB]
  - Table of instructions [PDF - 56 KB]
- 57.117 Denominators for Specialty Care Area (SCA) form [PDF - 42 KB] January 2014
- Table of instructions [PDF - 42 KB]

#### On this Page

- Training
- Protocols
- Data Collection Forms
- Supporting Materials
- Calculator and Worksheets
- Analysis Resources
- Related Publications and Other Resources
- FAQs

#### New Users - Start Here



- Step 1: Enroll into NHSN
- Step 2: Set up NHSN
- Step 3: Report

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To receive email updates about this page, enter your email address:

What's this? Submit



Contact NHSN:

Centers for Disease Control and Prevention

## Related Publications and Other Resources

- Magill SS, Klompas M, Balk R, Burns SM, Deutschman CS, Diekema D, Fridkin S, Greene L, Guh A, Gutterman D, Hammer B, Henderson D, Hess D, Hill NS, Horan T, Kollef M, Levy M, Septimus E, Vanantwerpen C, Wright D, Lipsett P (2013).  
Developing a new, national approach to surveillance for ventilator-associated events. [↗](#)  
*Crit Care Med.* 41(11):2467-75.
- Developing a new national approach to surveillance for ventilator-associated events: Executive summary. [↗](#)  
*Am J Infect Control.* 2013 Nov;41(11):1096-9.
- Developing a new, national approach to surveillance for ventilator-associated events: Executive summary. [↗](#)  
*Chest.* 2013 Nov 1;144(5):1448-52.
- Developing a new, national approach to surveillance for ventilator-associated events: Executive summary. [↗](#)  
*Respir Care.* 2013 Nov;58(11):1985-9.
- Developing a new, national approach to surveillance for ventilator-associated events: Executive summary. [↗](#)  
*Am J Crit Care.* 2013 Nov;22(6):469-73.
- Developing a new, national approach to surveillance for ventilator-associated events: Executive summary. [↗](#)  
*Infection Control and Hospital Epidemiology.* 2013 Dec; 34(12).
- Muscedere J, Sinuff T, Heyland DK, Dodek PM, Keenan SP, Wood G, Jiang X, Day AG, Laporta D, Klompas M, on behalf of for the Canadian Critical Care Trials Group (2013).  
The Clinical Impact and Preventability of Ventilator-Associated Conditions in Critically Ill Patients Who Are Mechanically Ventilated [↗](#)  
*Chest.* 144(5):1453-1460.
- A New Approach to Surveillance for Ventilator-Associated Events, [↗](#)  
November 2013 *Chest* Podcast Moderator: D. Kyle Hogarth, MD, FCCP, Podcast Editor, CHEST Participants: Shelley S. Magill, MD, PhD; Craig M. Lilly, MD, FCCP
- Lilly CM, Ellison RT (2013).  
Quality Measures for Critically Ill Patients: Where Does Ventilator-Associated Condition Fit in? [↗](#)  
*Chest.* (5):142-143

# Preparing for VAE Surveillance

- **Establish relationships with Respiratory Therapy and/or Critical Care colleagues:**
  - Share the protocol
  - Discuss options for collection of minimum daily PEEP and FiO<sub>2</sub> for each MV day (IP, RT, electronically generated)
  - Inquire about frequency with which excluded therapies (HFV, ECLS) and APRV are used
  
- **Determine your laboratory's approach to Gram stain and culture result reporting.**
  - How does your hospital laboratory report Gram stain results?
  - Does your hospital laboratory report culture results quantitatively
  - What quantitative ranges correspond to the semi-quantitative reports?

# Preparing for VAE Surveillance

- **Develop a plan for organizing the data elements needed to identify VAEs**
  - PEEP and FiO<sub>2</sub>
  - WBC / Temperature
  - Antimicrobials agents (administration not orders)
  - Laboratory results
  
- **Explore use of tools for data collection**



### Ventilator-Associated Events (VAE) Antimicrobial Worksheet

Patient ID: \_\_\_\_\_

Date of Mechanical Ventilation (MV) Initiation: \_\_\_\_\_

VAE Day	-- (-4)	-- (-3)	Baseline (-2)	Baseline (-1)	Event Date: VAE Day 1	2	3	4	5	6	7	8	9	Total consec- utive QADs:	
Date (mm/dd)															
MV Day (1, 2, 3, etc.)															
List antimicrobials:	New?														
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
Qualifying Antimicrobial Days (QADs)															

Are there at least 4 consecutive QADs, starting in the VAE Window Period?

- Yes → meets IVAC, evaluate for Possible and Probable VAP
- No → does not meet IVAC, report as VAC

# Key Things to Remember about Numerator Data Collection

- ❑ **For most patients—will only need to record daily minimum PEEP and FiO<sub>2</sub> while on ventilator. Nothing else!**
- ❑ **Only need to assess temperature and white blood cell count information for patients who fulfill VAC criteria**
  - And only need to look at these values during the VAE Window Period (3-5 days)
- ❑ **Only need to look at antimicrobial administrations for patients with VAC AND abnormal temp or white count**
  - New during the VAE Window Period (3-5 days)
- ❑ **Only need to assess lab/microbiology/pathology data for patients with IVAC**
  - Collection dates during the VAE Window Period (3-5 days)

# VAE Reporting

- ❑ **VAE is not currently included in CMS Hospital Inpatient Quality Reporting program**
  - Whether VAE surveillance/reporting is required in your facility depends on local and/or state requirements
- ❑ **What rates are appropriate for use in public reporting, interfacility comparisons, etc. ?**
  - Overall VAE rate = rate of ALL events meeting at least the VAC definition
  - “IVAC-plus” rate = rate of ALL events meeting at least the IVAC definition
- ❑ **What rates are appropriate only for internal use?**
  - Rates of individual events: VAC only, IVAC only, Possible VAP only, Probable VAP only, or combined Possible + Probable VAP

# Reporting Events In NHSN

- ❑ **Conducting in-plan VAE surveillance requires assessing patients for ALL events:**
  - VAC
  - IVAC
  - Possible or Probable VAP
- ❑ **Hierarchy of definitions:**
  - If a patient meets criteria for VAC and IVAC, report as IVAC.
  - If a patient meets criteria for VAC, IVAC and Possible VAP, report Possible VAP.
  - If a patient meets criteria for VAC, IVAC and Probable VAP, report Probable VAP.
  - If a patient meets criteria for VAC, IVAC, Possible VAP and Probable VAP, report Probable VAP.

\* Location of Mechanical Ventilation Initiation: \_\_\_\_\_

\*Date Initiated: \_\_\_ / \_\_\_ / \_\_\_

\*APRV: Yes No

**Event Details**

\*Specific Event:  VAC  IVAC  Possible VAP  Probable VAP

\*Specify Criteria Used:

STEP 1: VAC (≥1 REQUIRED)

Daily min FiO<sub>2</sub> increase ≥ 0.20 (20 points) for ≥ 2 days<sup>†</sup> **OR**  Daily min PEEP increase ≥ 3 cm H<sub>2</sub>O for ≥ 2 days<sup>†</sup>  
<sup>†</sup>after 2+ days of stable or decreasing daily minimum values.

STEP 2: IVAC

Temperature > 38°C or < 36° **OR**  White blood cell count ≥ 12,000 or ≤ 4,000 cells/mm<sup>3</sup>  
**AND**  
 A new antimicrobial agent(s) is started, and is continued for ≥ 4 days

STEP 3: Possible VAP

Purulent respiratory secretions<sup>†</sup> (defined as secretions from the lungs, bronchi, or trachea that contain ≥25 neutrophils and ≤10 squamous epithelial cells per low power field [lpf, x100], or equivalent semi-quantitative results)

**OR**

One of the following (qualitative, semi-quantitative or quantitative):<sup>†</sup>

- Positive culture of sputum
- Positive culture of endotracheal aspirate
- Positive culture of bronchoalveolar lavage
- Positive culture of lung tissue
- Positive culture of protected specimen brushing

STEP 3: Probable VAP

Purulent respiratory secretions<sup>†</sup>  
**AND** one of the following (meeting quantitative or semi-quantitative threshold as outlined in protocol):<sup>†</sup>

- Positive culture of endotracheal aspirate
- Positive culture of bronchoalveolar lavage
- Positive culture of lung tissue
- Positive culture of protected specimen brushing

**OR**

One of the following results(without requirement for purulent respiratory secretions), as outlined in protocol:<sup>†</sup>

- Positive pleural fluid culture
- Positive lung histopathology
- Positive diagnostic test for Legionella spp.
- Positive diagnostic test for viral pathogens

<sup>†</sup>collected after 2 days of mechanical ventilation and within +/- 2 days of onset of increase in FiO<sub>2</sub> or PEEP.

**Risk Factors** Location of Mechanical Ventilation \* ICU/CCU - ICU/CCU Date Mechanical Ventilation Initiated \* 12/02/2013 APRV \* **Event Details** Specific Event>: PRVAP - Probable Ventilator-Associated Pneumonia 

Specify Criteria Used \*

**STEP 1: VAC ( $\geq 1$  Required)** Daily min  $FiO_2$  increase  $\geq 0.20$  (20 points) for  $\geq 2$  days<sup>†</sup> Daily min PEEP increase  $\geq 3$  cm  $H_2O$  for  $\geq 2$  days<sup>†</sup><sup>†</sup> after 2+ days of stable or decreasing daily minimum values**STEP 2: IVAC** Temperature  $> 38^\circ C$  or  $< 36^\circ C$ **OR**  White blood cell count  $\geq 12,000$  or  $\leq 4,000$  cells/ $mm^3$ **plus** A new antimicrobial agent(s) is started, and is continued for  $\geq 4$  days**STEP 3: PRVAP** Purulent respiratory secretions **plus** one of the following (meeting quantitative or semi-quantitative threshold as outlined in protocol):<sup>‡</sup>**OR** One of the following results (without requirement for purulent respiratory secretions) as outlined in protocol:<sup>‡</sup> Positive culture of endotracheal aspirate Positive pleural fluid culture Positive culture of bronchoalveolar lavage Positive lung histopathology Positive culture of lung tissue Positive diagnostic test for Legionella spp. Positive culture of protected specimen brushing Positive diagnostic test for viral pathogens<sup>‡</sup> Collected after 2 days of mechanical ventilation and within +/- 2 days of onset of increase in  $FiO_2$  or PEEPSecondary Bloodstream 

Infection&gt;:

Died\*\*>: Discharge Date: Pathogens Identified>: Y-Yes  If Yes, specify below ->**Pathogens** Pathogen 1:  Pathogen 2: 

## Denominator Data

- ❑ **Device (ventilator) days and patient days are used for denominators.**
  - Collect data daily at the same time each day.
  - Daily counts are summed and only the total for the month is reported in NHSN.
- ❑ **Ventilator days – number of patients in the chosen location who are managed with a ventilatory device**
  - Ventilator days for all patients are counted to include those on ventilator < 3 days, those receiving excluded therapies
  - Number of patients on APRV mode of ventilation or related modes are included in total and also indicated separately.
- ❑ **Patient days = number of patients in the chosen location**

# Denominator Form

\*required for saving  
Facility ID:

\*Location Code:

\*Month:

\*Year:

Date	*Number of Patients	**Number of patients with 1 or more central lines	**Number of patients with a urinary catheter	**Number of patients on a ventilator	
				Total Patients	Number on APRV
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					

## Add Monthly Reporting Plan

No data found for December, 2013

Mandatory fields marked with \*

Facility ID\*: Decennial Medical Center (ID 15331) ▾

Month\*: December ▾

Year\*: 2013 ▾

No NHSN Patient Safety Modules Followed this Month

---

### Device-Associated Module HELP

Locations

CLABSI DE VAE CAUTI CLIP PedVAP  
(<18  
years)

 ICU/CCU - ICU/CCU ▾

Add Row

Clear All Rows

Copy from Previous Month

# Denominators for Intensive Care Unit (ICU), Other locations (not NICU or SCA)



Mandatory fields marked with \*

**Facility ID\*:** 15331 (Decennial Medical Center)

**Location Code\*:** ICU/CCU - ICU/CCU

**Month\*:** December

**Year\*:** 2013

## Report No Events

**Total Patient Days\*:**

**Central Line Days:**

**Urinary Catheter Days:**

**Ventilator Days\*:**

**APRV Days\*:**

**CLABSI:**

**CAUTI:**

**VAE:**

**PedVAP:**

# VAE Calculator

<http://www.cdc.gov/nhsn/VAE-calculator/index.html>

## National Healthcare Safety Network (NHSN)

### NHSN

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► **Ventilator-Associated Event Calculator**

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## New: Ventilator-associated Event (VAE) Calculator Version 2.1

Welcome to Version 2.1 of the VAE Calculator. Version 2.1 operates based upon the currently posted (January 2014) VAE protocol. The Calculator is a web-based tool that is designed to help you learn how the VAE surveillance definition algorithm works and assist you in making VAE determinations. Please note that the VAE Calculator will not ask you to enter any patient identifiers (other than dates of mechanical ventilation, which you can change as you see fit). The VAE Calculator does not store any patient data that you enter, and it will not report any data that you enter or any VAE determinations to the NHSN. You will not be able to export data entered into the Calculator. If you have questions or suggestions about the Calculator, please feel free to send them to the NHSN mailbox, [nhsn@cdc.gov](mailto:nhsn@cdc.gov).

- Ventilator-Associated Event Calculator (Version 2.1) (must have javascript enabled)

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# Landing Page

## Ventilator-Associated Event (VAE) Calculator Ver. 2.1

Welcome to version 2.1 of the Ventilator-Associated Event Calculator. Version 2.1 operates based upon the currently posted (January 2014) VAE protocol. The list of eligible antimicrobial agents for use in meeting the IVAC definition has been refined. As a reminder, the calculator recognizes PEEP values  $\leq 5$  and corrects entries according to the VAE protocol prior to making a VAC determination. For periods of time where a patient is on APRV or a related type of mechanical ventilation for a full calendar day, a daily minimum PEEP value should not be entered into the calculator. Additionally the calculator finds multiple VAEs per patient as long as they conform to the 14 day rule. It is strongly encouraged that you read and study the VAE protocol found [here](#).

**The calculator runs locally on your machine so no data are reported anywhere. Feel free to enter or change as much data as you like. If you don't understand something there are several mechanisms for getting help. Most of the buttons and table headings will give an expanded description if you hover your mouse over the item in question. Also the explain button will pop up an explanation of the reasoning behind the calculator. The explanation box is movable as are all the popup windows. That allows you to open one up and drag it to the side as you work. The explanation will automatically update itself as you work through the protocol.**

less...

Date:  (mm/dd/yyyy)

Print

Close

# Ventilator-Associated Event (VAE) Calculator Ver. 2.1

Now enter PEEP and/or FiO<sub>2</sub> values and when done, click the "Calculate VAC" button. You do not need to enter data for every day. Concentrate on the dates where you believe a Ventilator-Associated Event may be likely. If your values meet the Ventilator-Associated Condition (VAC) definition, the event day will be identified and the VAE Window will be defined.

MV Day	Date	Min. PEEP (cmH <sub>2</sub> O)	Min. FiO <sub>2</sub> (30 - 100)	VAE
1	1/1/2014	0	20	
2	1/2/2014	0	20	
3	1/3/2014	0	20	
4	1/4/2014	3	30	
5	1/5/2014	3	40	
6	1/6/2014	3	40	
7	1/7/2014	8	40	
8	1/8/2014	8	40	
9	1/9/2014	8	40	
10	1/10/2014			
11	1/11/2014			
12	1/12/2014			

# Ventilator-Associated Event (VAE) Calculator Ver. 2.1

A Ventilator-Associated Condition (VAC) based on PEEP values occurred on 1/7/2014

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.

MV Day	Date	Min. PEEP (cmH <sub>2</sub> O)	Min. FiO <sub>2</sub> (30 - 100)	VAE
1	1/1/2014	5 (0)*	20	
2	1/2/2014	5 (0)*	20	
3	1/3/2014	5 (0)*	20	
4	1/4/2014	5 (3)*	30	
5	1/5/2014	5 (3)*	40	
6	1/6/2014	5 (3)*	40	
7	1/7/2014	8	40	VAC
8	1/8/2014	8	40	
9	1/9/2014	8	40	
10	1/10/2014			
11	1/11/2014			
12	1/12/2014			
13	1/13/2014			
14	1/14/2014			
15	1/15/2014			
16	1/16/2014			

## Explanation:

The two days preceding 1/7/2014 are the baseline period of stability or improvement followed by a sustained period ( $\geq 2$  days) of worsening oxygenation.

(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 Event (VAE) Calculator Ver. 2.1

An IVAC was found for this patient. Click on the "Go To VAP" button to go to the next part of the definition or click on the "Explain..." button for an explanation of how this determination was made.

MV Day	Date	Hide... Min. PEEP (cmH <sub>2</sub> O)	Hide... Min. FiO <sub>2</sub> (30 - 100)	VAE	T<36° or T>38°	WBC≤4,000 or WBC≥12,000 cells/mm <sup>3</sup>	Add... Remove... CEFEPIME	QAD
3	1/3/2014	5 (0)*	20		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
4	1/4/2014	5 (3)*	30		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
5	1/5/2014	5 (3)*	40		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
6	1/6/2014	5 (3)*	40		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
7	1/7/2014	8	40	IVAC	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	yes
8	1/8/2014	8	40		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	yes
9	1/9/2014	8	40		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	yes
10	1/10/2014				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	yes
11	1/11/2014				<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	yes
12	1/12/2014				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	yes
13	1/13/2014				<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	yes

\* All values of PEEP less than 5 cmH<sub>2</sub>O are considered to be 5 cmH<sub>2</sub>O for purposes of the VAC definition. So for PEEP values entered as less than or equal to 5 cmH<sub>2</sub>O, an increase in the daily minimum PEEP to at least 8 cmH<sub>2</sub>, sustained for 2 or more calendar days, is required to meet the VAC definition.

## Explanation

A temperature box is checked within the VAE Window for the VAE on 1/7/2014 so this meets the first part of the IVAC definition.

For the VAE on 1/7/2014 There are at least 4 Qualifying Antimicrobial Days. Therefore this is an IVAC.

An explanation of how to count QADs for the VAE on 1/7/2014 follows:

The drug administered box is checked on day 1/7/2014 for the drug Cefepime. This is a new drug start since this was not administered within the previous two days and falls within the VAE window.

The drug administered box is checked on day 1/9/2014 for the drug Cefepime. This is a QAD since this drug was administered 2 days ago. The intervening day 1/8/2014 is also a QAD by the one day skip rule.

The drug administered box is checked on day 1/11/2014 for the drug Cefepime. This is a QAD since this drug was administered 2 days ago. The intervening day 1/10/2014 is also a QAD by the one day skip rule.

The drug administered box is checked on day 1/13/2014 for the drug Cefepime. This is a QAD since this drug was administered 2 days ago. The intervening day 1/12/2014 is also a QAD by the one day skip rule.

There are 7 Qualifying Antimicrobial Days (QADs) in a row.

(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 Event (VAE) Calculator Ver. 2.1

Start Over

Explain...

The event on 1/7/2014 conforms to a Possible Ventilator-Associated Pneumonia definition and should be reported as such. For a discussion of why, see/click on the Explain button.

MV Day	Date	Hide... Min. PEEP (cmH <sub>2</sub> O)	Hide... Min. FiO <sub>2</sub> (30 - 100)	VAE
3	1/3/2014	5 (0)*	20	
4	1/4/2014	5 (3)*	30	
5	1/5/2014	5 (3)*	40	
6	1/6/2014	5 (3)*	40	
7	1/7/2014	8	40	Possible VAP
8	1/8/2014	8	40	
9	1/9/2014	8	40	
10	1/10/2014			
11	1/11/2014			
12	1/12/2014			
13	1/13/2014			

Legend: VAE Window VAE Date

\* All values of PEEP less than 5 cmH<sub>2</sub>O are considered to be 5 cmH<sub>2</sub>O, an increase in the daily minimum PEEP to at least 5 cmH<sub>2</sub>O is considered to be an increase in the daily minimum PEEP to at least 5 cmH<sub>2</sub>O.

The event on 1/7/2014 conforms to a Possible Ventilator-Associated Pneumonia definition and should be reported as such. For a discussion of why, see/click on the Explain button.

Row	Question	Yes/No	QAD
1	Purulent respiratory secretions (from one or more specimen collections), 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].	<input checked="" type="checkbox"/>	
2	Positive culture (qualitative, semi-quantitative or quantitative) of sputum, endotracheal aspirate, bronchoalveolar lavage, lung tissue, or protected specimen brush.	<input type="checkbox"/>	yes
3	Positive pleural fluid culture (where specimen was obtained during thoracentesis or initial placement of chest tube and NOT from an indwelling chest tube).	<input type="checkbox"/>	yes
4	Positive lung histopathology.	<input type="checkbox"/>	yes
5	Positive diagnostic test for Legionella spp.	<input type="checkbox"/>	yes
6	Positive diagnostic test on respiratory secretions for influenza virus, respiratory syncytial virus, adenovirus, parainfluenza virus, rhinovirus, human metapneumovirus, coronavirus.	<input type="checkbox"/>	

Close

# Ventilator-Associated Event (VAE) Calculator Ver. 2.1

Start Over

Explain...

Now  
expe  
Then

patient  
rea).

For the IVAC on 1/7/2014, did the patient experience any any of the listed conditions in the VAE window 1/5/2014 to 1/9/2014.

MV Day	Date	Hide... Min. PEEP (cmH <sub>2</sub> O)	Row	Question	Yes/No	QAD
1	1/3/2014	5 (0)*	1	Purulent respiratory secretions (from one or more specimen collections), 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].	<input checked="" type="checkbox"/>	
2	1/4/2014	5 (3)*	2	Positive culture (qualitative, semi-quantitative or quantitative) of sputum, endotracheal aspirate, bronchoalveolar lavage, lung tissue, or protected specimen brush.	<input checked="" type="checkbox"/>	
3	1/5/2014	5 (3)*		Positive pleural fluid culture (where specimen was obtained during thoracentesis or initial placement of chest tube and NOT from an indwelling chest tube).	<input type="checkbox"/>	yes
4	1/6/2014	5 (3)*	3	Positive lung histopathology.	<input type="checkbox"/>	yes
5	1/7/2014	8		Positive diagnostic test for Legionella spp.	<input type="checkbox"/>	yes
6	1/8/2014	8	6	Positive diagnostic test on respiratory secretions for influenza virus, respiratory syncytial virus, adenovirus, parainfluenza virus, rhinovirus, human metapneumovirus, coronavirus.	<input type="checkbox"/>	yes
7	1/9/2014	8			<input checked="" type="checkbox"/>	yes
8	1/10/2014				<input checked="" type="checkbox"/>	yes
9	1/11/2014				<input type="checkbox"/>	yes
10	1/12/2014				<input checked="" type="checkbox"/>	yes
11	1/13/2014				<input checked="" type="checkbox"/>	yes

\* All values of PEEP less than 5

PEEP values entered as less than or



# Ventilator-Associated Event (VAE) Calculator Ver. 2.1

Start Over

Explain...

The event on 1/7/2014 conforms to a Probable Ventilator-Associated Pneumonia definition and should be reported as such. For a discussion of why, click on the Explain button.

The event on 1/7/2014 conforms to a Probable Ventilator-Associated Pneumonia definition and should be reported as such. For a discussion of why, click on the Explain button.

MV Day	Date	Hide... Min. PEEP (cmH <sub>2</sub> O)	Hide... Min. FiO <sub>2</sub> (30 - 100)	VAE	T	T	T	T	T
1	1/3/2014	5 (0)*	20						
2	1/4/2014	5 (3)*	30						
3	1/5/2014	5 (3)*	40						
4	1/6/2014	5 (3)*	40						
5	1/7/2014	8	40	Probable VAP					
6	1/8/2014	8	40						
7	1/9/2014	8	40		<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input checked="" type="checkbox"/>	yes
8	1/10/2014				<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	yes
9	1/11/2014				<input type="checkbox"/>	<input type="checkbox"/>		<input checked="" type="checkbox"/>	yes
10	1/12/2014				<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	yes
11	1/13/2014				<input type="checkbox"/>	<input type="checkbox"/>		<input checked="" type="checkbox"/>	yes

Positive quantitative culture of endotracheal aspirate,  $\geq 10^5$  cfu/ml or equivalent semi-quantitative result.



Positive quantitative culture of bronchoalveolar lavage,  $\geq 10^4$  cfu/ml or equivalent semi-quantitative result.



Positive quantitative culture of lung tissue,  $\geq 10^4$  cfu/g or equivalent semi-quantitative result.



Positive quantitative culture of protected specimen brush,  $\geq 10^3$  cfu/ml or equivalent semi-quantitative result.



Close

Legend: VAE Window VAE Date Qualifying Antimicrobial Day (QAD) Cumulative QAD

\* All values of PEEP less than 5 cmH<sub>2</sub>O are considered to be 5 cmH<sub>2</sub>O for purposes of the VAC definition. So for PEEP values entered as less than or equal to 5 cmH<sub>2</sub>O, an increase in the daily minimum PEEP to at least 8 cmH<sub>2</sub>O, sustained for 2 or more calendar days, is required to meet the VAC definition.

# Ventilator-Associated Event (VAE) Calculator Ver. 2.1

Start Over

Explain...

The event on 1/7/2014 conforms to a Possible Ventilator-Associated Pneumonia definition and should be reported as such. For a discussion of why, click on the Explain button.

MV Day	Date	Hide... Min. PEEP (cmH <sub>2</sub> O)	Hide... Min. FiO <sub>2</sub> (30 - 100)	VAE	T<36° or T>38°	WBC≤4,000 or WBC≥12,000 cells/mm <sup>3</sup>
1	1/3/2014	5 (0)*	20		<input type="checkbox"/>	<input type="checkbox"/>
2	1/4/2014	5 (3)*	30		<input type="checkbox"/>	<input type="checkbox"/>
3	1/5/2014	5 (3)*	40		<input type="checkbox"/>	<input type="checkbox"/>
4	1/6/2014	5 (3)*	40		<input checked="" type="checkbox"/>	<input type="checkbox"/>
5	1/7/2014	8	40	Possible VAP	<input checked="" type="checkbox"/>	<input type="checkbox"/>
6	1/8/2014	8	40		<input checked="" type="checkbox"/>	<input type="checkbox"/>
7	1/9/2014	8	40		<input checked="" type="checkbox"/>	<input type="checkbox"/>
8	1/10/2014				<input type="checkbox"/>	<input type="checkbox"/>
9	1/11/2014				<input type="checkbox"/>	<input type="checkbox"/>
10	1/12/2014				<input type="checkbox"/>	<input type="checkbox"/>
11	1/13/2014				<input type="checkbox"/>	<input type="checkbox"/>

Legend: VAE Window VAE Date Qualifying Antimicrobial

\* All values of PEEP less than 5 cmH<sub>2</sub>O are considered to be 5 cmH<sub>2</sub>O for purposes of the VAE definition. An increase in the daily minimum PEEP to at least 8 cmH<sub>2</sub>O, sustained for 2 days, is considered to be 8 cmH<sub>2</sub>O for purposes of the VAE definition.

Print

Close

The event on 1/7/2014 conforms to a Possible Ventilator-Associated Pneumonia definition and should be reported as such. For a discussion of why, click on the Explain button.

Positive quantitative culture of endotracheal aspirate,  $\geq 10^5$  cfu/ml or equivalent semi-quantitative result.

Positive quantitative culture of bronchoalveolar lavage,  $\geq 10^4$  cfu/ml or equivalent semi-quantitative result.

Positive quantitative culture of lung tissue,  $\geq 10^4$  cfu/g or equivalent semi-quantitative result.

Positive quantitative culture of protected specimen brush,  $\geq 10^3$  cfu/ml or equivalent semi-quantitative result.

Close

Explanation:

X

For the event on 1/7/2014 this patient had purulent respiratory secretions and a positive culture of sputum, endotracheal aspirate, bronchoalveolar lavage, lung tissue, or protected specimen brush, but the culture result did not satisfy the quantitative or semi-quantitative equivalent culture result criteria to meet probable VAP. Therefore, this conforms to a Possible Ventilator-Associated Event definition.

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.)

## Key Take-Home Points

- ❑ Patient must be ventilated more than 2 calendar days.
- ❑ Patient must have  $\geq 2$  calendar days of stability or improvement of oxygenation followed by  $\geq 2$  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.

## More Key Take-Home Points

- ❑ **Event Date defines the VAE Window Period:**
  - 2 days before, day of and 2 days after the Event Date – 5 days
  - May be shorter if worsening occurs early in the course of ventilation
- ❑ **All other criteria (for IVAC, Possible VAP, Probable VAP) must be identified within the VAE Window Period.**

# Acknowledgments

- ❑ **NHSN facilities and users**
- ❑ **VAP/VAE Surveillance Definition Working Group**
- ❑ **CDC Prevention Epicenters**
- ❑ **Other subject matter experts**
- ❑ **Federal partners**
- ❑ **CDC VALORI/draft sVAP project collaborators**
- ❑ **Other subject matter experts**
- ❑ **CDC/DHQP colleagues**

The findings and conclusions in this presentation are those of the author and do not necessarily represent the views of the Centers for Disease Control and Prevention.

# Thank you!

[nhsn@cdc.gov](mailto:nhsn@cdc.gov)

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The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

**National Center for Emerging and Zoonotic Infectious Diseases  
Division of Healthcare Quality Promotion**

