

Ventilator-Associated Events (VAE) Supplemental Frequently-Asked Questions

March 2013

- 1. If a patient is receiving mechanical ventilator support using Airway Pressure Release Ventilation (APRV) or a related type of mechanical ventilation intermittently (i.e., for less than an entire calendar day), how do I determine the daily minimum FiO₂ and PEEP values? Do I totally disregard PEEP?**

You would only disregard PEEP values on calendar days when the patient was mechanically ventilated using APRV or a related type of mechanical ventilation for the entire calendar day (i.e. from midnight through 11:59 pm). On calendar days when the patient was on APRV for the entire day, you will not record a daily minimum PEEP—you will enter “Not applicable” in your worksheet column for daily minimum PEEP for that particular day.

Note that while patients are mechanically ventilated using APRV or a related strategy (including modes such as BiLevel, Bi Vent, BiPhasic, PCV+, and DuoPAP), they are not excluded from VAE surveillance—but when assessing these patients for VAE, you will use only FiO₂ data to identify periods of stabilization or improvement and worsening. In some cases, patients may be mechanically ventilated using APRV or a related strategy for a portion of a calendar day, but not for the entire calendar day. In these instances, you should look at all FiO₂ data recorded for the entire calendar day when selecting the daily minimum FiO₂, and you should look at the portion of the calendar day when the patient was NOT on APRV or a related mechanical ventilation (strategy) to select the daily minimum PEEP. In other words, when recording the daily minimum PEEP for a patient who spent part of the day on APRV and part of the day on a conventional type of mechanical ventilation (e.g., Assist Control Ventilation, Intermittent Mandatory Ventilation, etc.), you will review PEEP values just from the portion of the day when the patient was on a conventional type of mechanical ventilation.

For example, on January 1 a patient is switched from conventional mechanical ventilation at 11:00 am to APRV. The patient stays on APRV until January 2 at 11 pm, when he is switched back to conventional mechanical ventilation. You will review the FiO₂ data from the entire day on January 1 and January 2, and the PEEP data that were recorded for the period from midnight to 10:59 am on January 1 (since the patient was on conventional mechanical ventilation during this time) and from 11:00 pm to 11:59 pm on January 2 (since the patient was back on conventional mechanical ventilation at this time). You will be able to assign a daily minimum PEEP for each of these days, based on the time spent on conventional mechanical ventilation, and a daily minimum FiO₂, based on each entire calendar day, and review both PEEP and FiO₂ data to determine whether there is a VAE.

Here is another example: On January 1 a patient is switched from conventional mechanical ventilation at 11:00 am to APRV. The patient stays on APRV all day on January 2, and on January 3 until 11 pm, when he is switched back to conventional mechanical ventilation. In this example, you will (as above) have PEEP data to review for January 1 and for January 3, based on the amount of time the patient was on conventional mechanical ventilation. But because the patient was on APRV all day on January 2, the reality is that you will need to rely on the FiO₂ to determine whether there is a VAE during that period of days (because there is a gap in PEEP data, you'd have to start over looking for a baseline period in PEEP on January 3).

2. I know patients on high frequency ventilation (HFV) and extracorporeal life support (ECLS, such as ECMO) are excluded from VAE surveillance—but what if they are on HFV or ECLS for part (but not all) of a calendar day? How do I determine when such patients are eligible for inclusion in VAE surveillance?

In some cases, patients may be on HFV or ECLS for a portion of a calendar day, but not for the entire calendar day. In these instances, the patient is eligible for inclusion in VAE surveillance during the portion of the calendar day when the patient was being mechanically ventilated using a conventional type of mechanical ventilation (not HFV) and was not on ECLS. You should review the FiO₂ and PEEP data recorded for the portion of the calendar day when the patient was NOT on HFV or ECLS to select the daily minimum FiO₂ and PEEP. Once the patient has been switched to HFV or placed on ECLS, he/she is no longer included in VAE surveillance. On calendar days when the patient was on HFV or ECLS for the entire day (i.e., midnight to 11:59 pm), you will not record a daily minimum FiO₂ or PEEP—you will enter “Not applicable” or “Not eligible for surveillance” in your worksheet column for daily minimum FiO₂ and PEEP for that particular day. Once the patient has been switched back from HFV to a conventional type of mechanical ventilation, or once the patient is no longer on ECLS, VAE surveillance may resume. If the patient has been on HFV or ECLS for one or more calendar days (such that there is a gap in recording of the daily minimum FiO₂ and PEEP), then you will essentially need to start over with VAE surveillance and identify a baseline period of stability or improvement on the ventilator before you can detect a VAE.

For example, if the patient was on conventional mechanical ventilation on January 10 until 10:00 am, switched to HFV at 10:00 am, remained on HFV till 1:00 pm on January 11 and was then placed back on a conventional mode of mechanical ventilation, you would be able to evaluate the PEEP and FiO₂ values recorded for the patient from midnight to 10:00 am on January 10 (period on conventional mechanical ventilation) and from 1:00 pm to 11:59 pm on January 11 (period on conventional mechanical ventilation) when looking for VAEs.

If a patient was on HFV for the entire calendar day on January 10 and January 11, then you would exclude them from VAE surveillance. Once the patient returns to conventional mechanical ventilation for some portion of each calendar day you could again begin to include in VAE surveillance and once again begin daily assessment for the minimum daily PEEP and FiO₂ values obtained when the patient was on the conventional mode of ventilation. Upon return to conventional mode of mechanical ventilation, note that a new episode of mechanical ventilation would begin. To meet VAE during this new episode of mechanical ventilation, the patient would have to have at least 2 days of stability or improvement and at least 2 days of worsening oxygenation on the ventilator identified.

3. Are patients included in VAE surveillance during periods of time when they are undergoing weaning/mechanical ventilation liberation trials?

Yes. As long as the patient is receiving support from a mechanical ventilator and is eligible for VAE surveillance, then you should review all FiO₂ and PEEP data that are recorded each day to identify the daily minimum FiO₂ and PEEP values—including FiO₂ and PEEP values that are recorded during periods of time when the patient is undergoing spontaneous awakening or spontaneous breathing trials (or other forms of weaning from mechanical ventilation). The only periods of time that are not taken into consideration when identifying the daily minimum PEEP and FiO₂ values are times when the patient is on HFV, ECLS, or times 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). Keep in mind, too, that during periods of time when the patient is being mechanically-ventilated using APRV or a related strategy (see FAQ #1, above), you will only review FiO2 data (not PEEP).

- 4. I have a patient who meets the VAC definition, and I am now assessing the patient’s information to see if the IVAC definition is met. The patient has had an elevated temperature (or white blood cell count) since admission. The patient also has an elevated temperature (or white blood cell count) during the VAE Window Period. Since the abnormal temperature (or white blood cell count) was present on admission, do I still count the abnormal temperature (or white blood cell count) during the VAE Window Period when determining if the patient meets the IVAC definition?**

Yes. 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.

- 5. What happens if a patient dies before ≥ 4 Qualifying Antimicrobial Days (QADs) are met? If the antimicrobial agent was intended to be given such that the requirement for ≥ 4 QADs would have been satisfied, do I report an IVAC or VAC?**

No. In a patient who has met the VAC definition and has additionally met the temperature and/or WBC requirement for IVAC but dies prior to meeting the requirement for ≥ 4 Qualifying Antimicrobial Days, the IVAC criteria are not fulfilled. In this instance a VAC (not an IVAC) would be reported to NHSN.

- 6. What is meant by “minimum daily value” when referring to PEEP and FiO2?**

There will be multiple FiO2 and PEEP measurements documented each calendar day on mechanically ventilated patients. These FiO2 and PEEP values 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. Please note that the VAE surveillance protocol specifies to use the daily minimum FiO2 and PEEP values when assessing for both the period of stability or improvement and the period that indicates worsening oxygenation. From the multiple readings that will be documented each calendar day, you will identify the minimum (i.e., lowest) value for that calendar day. You are not comparing values that occur within a calendar day to determine stability, improvement or worsening. Operationally you will always be collecting/recording/evaluating those values, at the earliest, one day in arrears so that you can allow for the values obtained for the full 24 hour calendar day to be assessed.

Here is an example of mechanical ventilator data from a single day, May 10:

	12 am	3 am	6 am	9 am	12 pm	3 pm	6 pm	9 pm
MV mode	ACV	ACV	ACV	ACV	ACV	ACV	ACV	ACV
FiO2	1.0	1.0	0.80	0.80	0.80	0.75	0.80	0.70
PEEP	8	8	8	8	8	5	5	8

In this example, the daily minimum FiO₂ for May 10 would be recorded as 0.70 (70%), and the daily minimum PEEP would be recorded as 5 cmH₂O. Note that the daily minimum FiO₂ may have been documented at a different time than the daily minimum PEEP (as in the example above). You will compare the minimum daily value from day to day within the individual parameters (PEEP and FiO₂), looking for a period of stabilization or improvement in PEEP followed by a period of worsening oxygenation in PEEP, or a period of stabilization or improvement in FiO₂ followed by a period of worsening in FiO₂.

7. If a patient is admitted with community-acquired pneumonia requiring intubation and mechanical ventilation, is that patient exempt from VAE surveillance until the pneumonia has resolved?

No. Tracking of daily minimum PEEP and FiO₂ should be done for all patients who are eligible for VAE surveillance in units in which in-plan VAE surveillance is being conducted, regardless of the reason for which the patient was admitted.

8. I am confused about the different lower respiratory tract events that have definitions in NHSN—PNEU, LRI and VAE. Can you explain to me how these do (or do not) relate to one another?

We know this can be an area of confusion. Revising surveillance definitions for respiratory events is a big undertaking, because we need to consider events occurring in patients on mechanical ventilation and events occurring in patients NOT on mechanical ventilation, and we have to consider events that occur in adults and events that occur in neonates and in children. The first area that we decided to work on is respiratory events in adult patients on mechanical ventilation. We still have a lot of work to do to revamp surveillance for respiratory events occurring in patients not on mechanical ventilation, and respiratory events occurring in neonates and children.

Let's review what is available for in-plan or off-plan surveillance of lower respiratory tract events in NHSN. Keep in mind that "in-plan" surveillance means that you have committed to following the NHSN surveillance protocol for that particular event in your NHSN monthly reporting plan. "Off-plan" surveillance is surveillance that is done because you/your facility has decided to track a particular event for internal use. Data that are entered into NHSN "off-plan" are not used or reported on in NHSN annual reports or other NHSN publications. A facility makes no commitment to follow the protocol for "off-plan" events.

What lower respiratory tract event surveillance can be done "in-plan" in 2013?

- 1) - VAE: VAE surveillance in 2013 is what NHSN has available for in-plan surveillance of respiratory events occurring in patients on mechanical ventilation who are being cared for in adult patient locations. This is currently the ONLY in-plan respiratory event surveillance for adults.
- 2) - Pediatric VAP: Pediatric VAP surveillance using the PNEU/VAP definitions continues to be available in 2013 for in-plan surveillance of VAP in neonatal or pediatric locations. This is currently the ONLY in-plan respiratory event surveillance for children.

What lower respiratory tract event surveillance can be done "off-plan" in 2013?

- 1) VAE: VAE surveillance can also be done "off-plan" in adult patient locations.
- 2) VAP: Surveillance for PNEU/VAP (using the "old" definitions) continues to be available in 2013 for off-plan surveillance in mechanically-ventilated adults or children, for those units

who have a particular need to continue monitoring these events. NHSN encourages facilities to switch to VAE for surveillance in adult patient locations.

- 3) PNEU: Surveillance for PNEU (using the “old” definitions) continues to be available in 2013 for off-plan surveillance in non-mechanically-ventilated adults and children.
- 4) LRI: Surveillance for non-pneumonia lower respiratory infections (using the BRON and LUNG definitions) continues to be available in 2013 for off-plan surveillance in adults and children.

Can I conduct surveillance for VAE and PNEU and LRI in the same unit?

In theory, yes, although you may wish to consider whether this is the best use of resources. For example, it is possible for a particular unit to be conducting simultaneous in-plan VAE surveillance and off-plan PNEU and LRI surveillance. These are considered separate events; in other words, detection of one type of event (such as a VAE) in a particular patient would have no bearing on the conduct of surveillance for the other event types in the same patient. Keep in mind that there are specific reporting requirements for the older definitions, PNEU and LRI, such that patients with radiographic evidence of pneumonia are not eligible to meet the LRI-BRON definition, and patients who meet a PNEU definition as well as the LRI-LUNG definition are to be reported as PNEU. Patients who meet a VAE definition and a PNEU definition, or a VAE definition and an LRI definition, would have both events entered into NHSN in units where surveillance for multiple respiratory events is occurring.

9. What about bloodstream infections occurring in patients who are also under surveillance for lower respiratory tract events? How do I handle the reporting of secondary bloodstream infections in these patients?

We understand this is also an area of confusion. To figure out whether a positive blood culture can be called a secondary bloodstream infection (BSI) related to a lower respiratory tract event, consider the following steps:

- 1) - Does the patient meet any of the VAE definitions?
 - a. - If the Possible or Probable VAP definition is met, then you may attribute the blood culture to the VAE (as a secondary BSI) IF the blood culture meets the various requirements as outlined in the VAE protocol—the organism isolated from blood must match an organism isolated from the respiratory tract culture used in meeting the Possible or Probable VAP definition AND the blood culture must be collected during the 14-day VAE event period.
 - b. - If only the VAC or IVAC definition is met, then the positive blood culture CANNOT be secondary to the VAE (because recall that according to the VAE surveillance protocol, BSIs cannot be deemed secondary to VAC or to IVAC).
- 2) - If the Possible VAP or Probable VAP definition is met, then the positive blood culture cannot be secondary to a PNEU or an LRI. It must either be secondary to the VAE (if it meets the VAE secondary BSI criteria outlined in the protocol and summarized in 1a, above), or secondary to one of the other non-respiratory major sites, or it may be a primary BSI/CLABSI.
- 3) - If only the VAC or IVAC definition is met, or if no VAE definition is met, then the positive blood culture can be evaluated to see if it is secondary to any of the major sites as

defined in Chapter 17—including PNEU or LRI. If the patient does not meet one of these other definitions, the BSI may need to be reported as a primary BSI/CLABSI.