National Healthcare Safety Network (NHSN) Ventilator-Associated Event (VAE) Surveillance
Determining Which Patients to Include in VAE Surveillance,[a] and Which Patients to Include in Ventilator Day Counts[b]

Instructions:

The table included in this document is designed to assist you in determining whether to include patients in VAE surveillance and/or in daily counts of patients on invasive mechanical ventilation,[c] based on knowing some basic information about the type of mechanical ventilation and/or related treatments patients are receiving. It is recommended that you review this table with a respiratory care professional and/or critical care expert within your facility to determine what terms and types of invasive mechanical ventilation are used in your facility.

Additional information about VAE surveillance, including the complete VAE surveillance protocol, is available at: http://www.cdc.gov/nhsn/acute-care-hospital/vae/index.html

The "Numerator" column in the table below refers to patients for whom VAEs may be detected, using the VAE Form located here: http://www.cdc.gov/nhsn/forms/57.112_VAE_BLANK.pdf.

The "Denominator" columns in the table below refer to patients who should be included in daily total counts of patients on invasive mechanical ventilation and patients on invasive mechanical ventilation using "APRV" or a related strategy. The NHSN denominator forms are found here: http://www.cdc.gov/nhsn/forms/57.118_DenominatorICU_BLANK.pdf, and http://www.cdc.gov/nhsn/forms/57.117_DenominatorSCA_BLANK.pdf.

NOTE: This table is a surveillance aid only, and is NOT for use in the clinical management of patients. This table is not intended to be a comprehensive listing of types of mechanical ventilation and related treatments. Specific types of invasive mechanical ventilation, related treatments and brands of mechanical ventilators are included in the table to assist in VAE surveillance and should not be construed as representing endorsements of particular ventilation modes, treatments, strategies, or mechanical ventilator manufacturers or brands.

[a]Only patients in adult locations are eligible for VAE surveillance. See the VAE Protocol (http://www.cdc.gov/nhsn/PDFs/pscManual/10-VAE_FINAL.pdf) for additional details.

[b]Daily counts of patients on mechanical ventilators should include all mechanically-ventilated patients, even those (such those ventilated for < 3 days or on an excluded mode of ventilation) who are not eligible for VAE surveillance. See the VAE Protocol (http://www.cdc.gov/nhsn/PDFs/pscManual/10-VAE_FINAL.pdf) for additional details.

[c]A ventilator is defined in NHSN as a device to assist or control respiration inclusive of the weaning period, through a tracheostomy or by endotracheal intubation. NOTE: Lung expansion devices such as 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).

If the patient is receiving this type of mechanical ventilation or related treatment …	**Numerator**	**Denominator**	
	Is the patient included in VAE surveillance?	Should the patient be included in the Denominator Form count for the column entitled, "Number of Patients on a Ventilator / **Total Patients**"?	Should the patient be included in the Denominator Form count for the column entitled, "Number of Patients on a Ventilator / **Number on APRV**"?
Common Types of Mechanical Ventilation			
Controlled Mandatory Ventilation (CMV)	Yes	Yes	No
Assist-Control Ventilation (ACV)	Yes	Yes	No
Synchronized Intermittent Mandatory Ventilation (SIMV)	Yes	Yes	No
Pressure Control Ventilation (PCV)	Yes	Yes	No
Pressure Support Ventilation (PSV)	Yes	Yes	No
Continuous Positive Airway Pressure (CPAP)	Yes	Yes	No
Other Types of Mechanical Ventilation and Life Support			
PCV+ *without* Inverse I:E Ratio (Dräger ventilators)	Yes	Yes	No
Pressure-Regulated Volume Control Ventilation (PRVC)	Yes	Yes	No
Volume Support Ventilation	Yes	Yes	No
Volume-Assured Pressure Support Ventilation	Yes	Yes	No
Adaptive Pressure Control Ventilation	Yes	Yes	No
Mandatory Minute Ventilation (MMV)	Yes	Yes	No
AutoFlow (Dräger ventilators)	Yes	Yes	No
Adaptive Pressure Ventilation (Hamilton GALILEO ventilators)	Yes	Yes	No
Volume Control Plus Ventilation (Puritan-Bennett ventilators)	Yes	Yes	No
Volume Targeted Pressure Control Ventilation	Yes	Yes	No
Pressure Controlled Volume Guarantee Ventilation (General Electric ventilators)	Yes	Yes	No
Adaptive Support Ventilation	Yes	Yes	No

If the patient is receiving this type of mechanical ventilation or related treatment …	**Numerator**	**Denominator**	
	Is the patient included in VAE surveillance?	Should the patient be included in the Denominator Form count for the column entitled, "Number of Patients on a Ventilator / **Total Patients**"?	Should the patient be included in the Denominator Form count for the column entitled, "Number of Patients on a Ventilator / **Number on APRV**"?
Proportional Assist Ventilation	Yes	Yes	No
Bi-Level Ventilation *without* Inverse I:E Ratio (Puritan-Bennett ventilators)	Yes	Yes	No
Airway-Pressure Release Ventilation (APRV)	Yes* (FiO_2 only)	Yes	Yes
Pressure-Control Inverse Ratio Ventilation (PC-IRV)	Yes* (FiO_2 only)	Yes	Yes
Bi-Level Ventilation *with* Inverse I:E Ratio (Puritan-Bennett ventilators)	Yes* (FiO_2 only)	Yes	Yes
Bi-Vent Ventilation (Maquet SERVO-i ventilators)	Yes* (FiO_2 only)	Yes	Yes
PCV+ *with* Inverse I:E Ratio (Dräger ventilators)	Yes* (FiO_2 only)	Yes	Yes
DuoPAP Ventilation (Hamilton GALILEO ventilators)	Yes* (FiO_2 only)	Yes	Yes
Biphasic Intermittent Positive Airway Pressure Ventilation	Yes* (FiO_2 only)	Yes	Yes
Intermittent Mandatory Airway Pressure Release Ventilation	Yes* (FiO_2 only)	Yes	Yes
High Frequency Ventilation (HFV)	No	Yes	No
High Frequency Oscillatory Ventilation (HFOV)	No	Yes	No
High Frequency Jet Ventilation	No	Yes	No
High Frequency Percussive Ventilation	No	Yes	No
Volumetric Diffusive Ventilation (VDR, Percussionaire ventilators)	No	Yes	No
Extracorporeal Life Support (ECLS) with venous-venous cannulation	No	Yes (if patient on vent)	No
Extracorporeal Life Support (ECLS) with venous-arterial cannulation	No	Yes (if patient on vent)	No
Extracorporeal Membrane Oxygenation (ECMO)	No	Yes (if patient on vent)	No

*Patients on these types of mechanical ventilation are included in VAE surveillance, but changes in oxygenation are assessed using fraction of inspired oxygen (FiO_2) data only during the period of time in which patients are on these types of mechanical ventilation. Positive End Expiratory Pressure (PEEP) data are not used to assess for VAEs in these patients while they are receiving mechanical ventilation using one of these types or strategies.

This document was developed with input from members of the CDC's Adult VAE Surveillance Definitions Working Group, and using information from references including:1) Schmidt GA, Hall JB. "Management of the Ventilated Patient," in Hall JB, Schmidt GA, Wood DH, eds. Principles of Critical Care, 3rd edition. McGraw Hill, 2005; 2) MacIntyre NR. "Principles of Mechanical Ventilation," in Mason RJ, Broaddus VC, Martin TR, King TE, Schraufnagel DE, Murray JF, Nadel JA, eds., Textbook of Respiratory Medicine, 5th edition. Saunders Elsevier: Philadelphia, PA, 2010; 3) Santanilla JI, Daniel B, Yeow M-E. Mechanical ventilation. Emerg Med Clin N Am 2008;26:849-62; 4)Hess DR, MacIntyre NR. "Mechanical Ventilation," in Hess DR, Galvin WF, MacIntyre NR, Adams AB, Mishoe SC, eds. Respiratory Care: Principles and Practice, 2nd edition. Jones & Bartlett Learning: Sudbury, MA, 2012; 5) Mireles-Cabodevila E, Diaz-Guzman E, Heresi GA, Chatburn RL. Alternative modes of mechanical ventilation: a review for the hospitalist. Cleveland Clinic J Med 2009;76:417-30.