



# Patient Safety Component Pediatric Ventilator-associated Event (PedVAE)

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# Learning Objectives

At the conclusion of this presentation, participants will be able to

- Describe PedVAE key terms
- Determine Daily Minimum Values
- Apply the PedVAE surveillance algorithm
- Use the PedVAE calculator
- Report PedVAEs into the NHSN application

# PedVAE Surveillance - History

# Ventilated Patients and the Need for Surveillance

- Ventilated patients are at high risk for complications and poor outcomes
  - Ventilator-associated pneumonia (VAP), sepsis, Acute Respiratory Distress Syndrome (ARDS), pulmonary embolism, barotrauma, and pulmonary edema
- Such complications can lead to longer duration of mechanical ventilation, longer stays in the ICU and hospital, increased healthcare costs, and increased risk of morbidity and mortality
- In preterm neonates, prolonged mechanical ventilation for respiratory distress syndrome can contribute to the development of chronic lung disease
- Prolonged mechanical ventilation in extremely low birthweight infants is also associated with neurodevelopmental delay

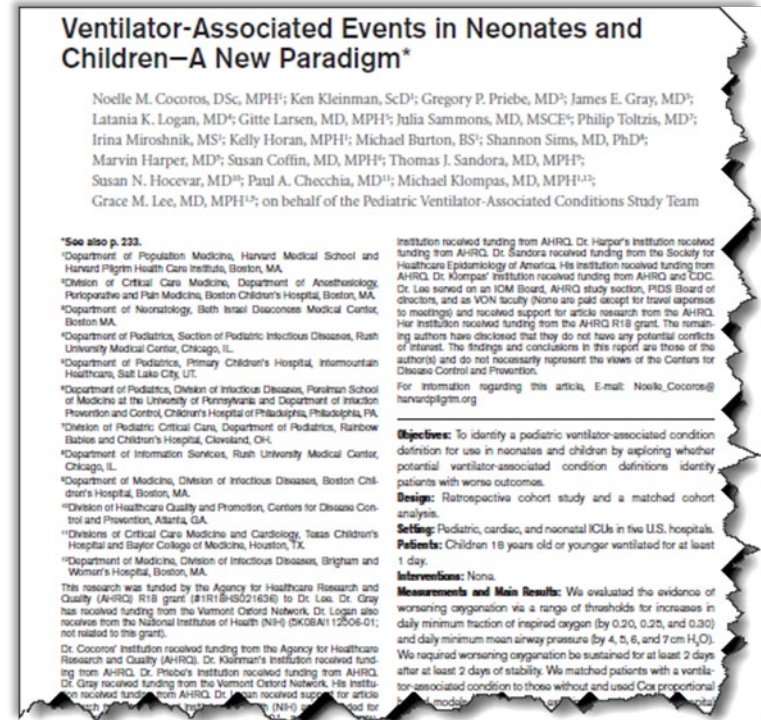
# PedVAE Surveillance: Development

- **Pediatric and Neonatal VAE Surveillance Working Group** convened in 2012 to explore use of VAE (adult algorithm) in pediatric and neonatal inpatient locations
  - Insufficient data available to inform development of a pediatric VAE definition

# PedVAE Surveillance: Evidence Base

- Publication\* in 2016 on the use of a pediatric VAE-like definition demonstrated detection of events defined by changes in  $\text{FiO}_2$  and Mean Airway Pressure were associated with increases in length of stay and mortality

\*Cocoros NM, Kleinman K, Priebe GP, et al. Ventilator-Associated Events in Neonates and Children—A New Paradigm. Crit Care Med. 2016 Jan;44:14-22.



# PedVAE Surveillance: Available as of 2019

- Pediatric and Neonatal VAE Surveillance Working Group consensus reached to begin development of PedVAE, with plans to implement as an available event in NHSN
- PedVAE field testing conducted in 2017
- PedVAE available as an NHSN surveillance event beginning January 2019

The image shows a thumbnail of a document titled "Pediatric Ventilator-Associated Event (PedVAE)" from the NHSN. The document is for use in neonatal and pediatric locations only. It includes a table of contents and an introduction section. The table of contents lists sections such as Introduction, Settings, Definitions, Reporting Instructions, and various data tables. The introduction discusses the importance of mechanical ventilation and the risks associated with complications like VAP, sepsis, and ARDS.

**NHSN**  
NATIONAL HEALTHCARE  
SAFETY NETWORK

## Pediatric Ventilator-Associated Event (PedVAE)

*For use in neonatal and pediatric locations only*

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### Introduction

Mechanical ventilation is an essential, life-saving therapy for patients with critical illness and respiratory failure. Hundreds of thousands of patients receive mechanical ventilation in the United States each year [1-3]. These patients are at high risk for complications and poor outcomes, including death [1-5]. Ventilator-associated pneumonia (VAP), sepsis, Acute Respiratory Distress Syndrome (ARDS), pulmonary embolism, barotrauma, and pulmonary edema are among the complications that can occur in patients receiving mechanical ventilation. Such complications can lead to longer duration of mechanical ventilation, longer stays in the ICU and hospital, increased healthcare costs, and increased risk of disability and death. In preterm neonates, prolonged mechanical ventilation for respiratory distress syndrome can contribute to the development of chronic lung disease [6]. Prolonged mechanical ventilation in extremely low birthweight infants is also associated with neurodevelopmental delay [7].

Surveillance for ventilator-associated events in the National Healthcare Safety Network (NHSN) prior to 2013 was limited to VAP. Traditional VAP definitions, including the NHSN PNEU definitions (revised in 2002), have well-described limitations [8-11]. They typically require radiographic evidence of pneumonia, although data suggest that chest radiograph findings do not accurately identify VAP. The subjectivity and variability inherent in chest radiograph technique, interpretation, and reporting make chest imaging ill-suited for inclusion in a definition algorithm to be used for the potential purposes of public reporting, inter-facility comparisons, and pay-for-reporting and pay-for-performance programs. Another major limitation of the available VAP definitions is their reliance on specific clinical signs or symptoms, which are subjective and may be poorly or inconsistently documented in the medical record.

# **PedVAE Surveillance - Resources**



# Where do I find the PedVAE surveillance guidance?

<https://www.cdc.gov/nhsn/index.html>

National Healthcare Safety Network (NHSN)

CDC's National Healthcare Safety Network is the nation's most widely used healthcare-associated infection tracking system. NHSN provides facilities, states, regions, and the nation with data needed to identify problem areas, measure progress of prevention efforts, and ultimately eliminate healthcare-associated infections.

In addition, NHSN allows healthcare facilities to track blood safety errors and important healthcare process measures such as healthcare personnel influenza vaccine status and infection control adherence rates.

**COVID-19 Modules and Dashboards**  
COVID-19 reporting and vaccination resources for all healthcare facilities.

**COVID-19 Modules and Dashboards**  
COVID-19 reporting and vaccination resources

[NHSN Requirements & Recommendations for Application Use](#)

**Resources by Facility** NHSN Components

- Acute Care / Critical Access Hospitals
- Ambulatory Surgery Centers
- Long-term Acute Care Hospitals
- Long-term Care Facilities
- Inpatient Rehabilitation Facilities
- Inpatient Psychiatric Facilities
- Dialysis Facilities

[View All Facilities](#)

**About NHSN**  
CDC's NHSN is the largest HAI reporting system in U.S.

**Enroll New Facility**  
For first-time facility enrollment

**NHSN Training**  
Self-paced trainings, videos & quick learns

**Data & Reports**  
See national and state reports using NHSN data

**Newsletters**  
View NHSN newsletters

**NHSN Application**  
NHSN Member Login

**CMS Requirements**  
CMS reporting requirements through NHSN

**Analysis Resources**  
Analysis resources and guides for the PS Component

**Data Validation & Guidance**  
Data Validation & Guidance

**CDA Submission Support (CSSP)**  
Toolkits, FAQs, webinars & resources

**ACH Modules & Events**

Access relevant training, protocols, data collection forms and supporting materials for each module.

- AUR Module**  
Antimicrobial Use & Resistance Options
- BSI Events**  
Bloodstream Infections
- CLIP Events**  
Central Line Insertion Practice Adherence
- MDRO & CDI Events**  
Multidrug-Resistant Organism & *C. difficile* Infections
- PedVAE**  
Pediatric Ventilator-associated Events
- HCP COVID-19 Vaccination**  
Healthcare Personnel Safety Component

- PNEU Events**  
Pneumonia (PedVAP) Events
- SSI Events**  
Surgical Site Infection Events
- UTI Events**  
Urinary Tract Infections
- VAE**  
Ventilator-associated Events
- HCP Flu Vaccination**  
Healthcare Personnel Safety Component
- HCP Exposure**  
Healthcare Personnel Safety Component

# What PedVAE resources are available?

- <https://www.cdc.gov/nhsn/psc/pedvae/index.html>
- Protocol
- Calculator
- Training
- FAQs
- Forms
- And more!

## Pediatric Ventilator-associated Events (PedVAE)

[Print](#)

Available In-Plan for Pediatric and Neonatal Inpatient Locations Only.

PedVAP surveillance using the [PNEU](#) protocol continues to be available for in-plan surveillance for pediatric locations only. See [VAE](#) for in-plan surveillance for adult locations

! Not available for Inpatient Psychiatric Facilities (IPFs)

PedVAE Calculator  
operates based upon the currently posted PedVAE protocol.

PedVAE Training

Educational Roadmap

CMS Requirements

HAI Checklists

FAQs

[PedVAE](#)

### Protocols

[Chapter 11: Pediatric Ventilator-Associated Event \(PedVAE\) Protocol – January 2023](#) [PDF – 600 KB]

[2023 Summary of Updates](#) [PDF – 199 KB]

### Supporting Chapters

[Chapter 1: NHSN Overview – January 2023](#) [PDF – 350 KB]

[Chapter 3: Patient Safety Monthly Reporting Plan – January 2023](#) [PDF – 300 KB]

[Chapter 15: CDC Location Labels and Location Descriptions – January 2023](#) [PDF – 1 MB]

# **PedVAE Surveillance – Inclusion Criteria**

# Ventilator Definition

- **Ventilator:** Any device used to support, assist, or control respiration (inclusive of the weaning period) through the application of positive pressure to the airway when delivered via an artificial airway, specifically an oral/nasal endotracheal or tracheostomy tube.
- **Note:** Ventilation and lung expansion devices that deliver positive pressure to the airway (for example, CPAP, BiPAP, Bi-level, IPPB, and PEEP) via non-invasive means (for example, nasal prongs, nasal mask, full face mask, total mask, etc.) are not considered ventilators unless positive pressure is delivered via an artificial airway (oral/nasal endotracheal or tracheostomy tube).

# Who is eligible for PedVAE surveillance?

- Ventilated inpatients of acute care hospitals, long term acute care hospitals, inpatient rehabilitation facilities
- Patients in [pediatric and neonatal locations](#) where denominator data (patient days and ventilator days) can be collected
  - Ventilated adults in pediatric locations are included in PedVAE surveillance – regardless of age



# Who is NOT eligible for PedVAE surveillance?

- Patients on extracorporeal life support or paracorporeal membrane oxygenation are not eligible for VAE surveillance
  - Ineligibility only applies to periods of time while receiving this form of support
- Patients in non-acute care locations in acute care facilities (such as a chronic care unit)
- Pediatric patients in adult inpatient locations
  - Ventilated pediatric patients in adult locations are included in VAE surveillance

# What about other modes of mechanical ventilation?

- INCLUDE patients on:
  - High Frequency Oscillatory or Jet Ventilation
  - Airway Pressure Release Ventilation (APRV)
  - Volumetric Diffusive Respiration (VDR) – FiO<sub>2</sub> parameter only
- INCLUDE patients who are receiving mechanical ventilation while also receiving:
  - Surfactant
  - Corticosteroids
  - Prone positioning
  - Nitric oxide therapy
  - Helium-oxygen mixture (heliox)
  - Epoprostenol therapy



# PedVAE Definition – Overview

*Remember: The PedVAE definition algorithm is for use in surveillance. It is not a clinical definition algorithm and is not intended for use in the clinical management of patients.*



# PedVAE Definition Algorithm Summary

**Patient initiated on mechanical ventilation**



**Identification of a baseline period of stability or improvement, followed by a sustained period of worsening oxygenation**



**Pediatric Ventilator-associated Event (PedVAE)**

# PedVAE Determination

- PedVAEs are determined by identification of deterioration in respiratory status after a period of stability or improvement on the ventilator
- Assessed by monitoring two key parameters that reflect oxygenation status in neonatal and pediatric ventilated patients:
  - Fraction of Inspired Oxygen -  $\text{FiO}_2$
  - Mean Airway Pressure - MAP

## FiO<sub>2</sub> – Fraction of inspired oxygen

- Fraction of Oxygen in inspired gas
  - FiO<sub>2</sub> of room air is 0.21
  - Oxygen concentration of room air is 21%
- FiO<sub>2</sub> is a setting on the ventilator and is one of the key parameters that can be adjusted depending on the patient's oxygenation requirements

# MAP – Mean Airway Pressure

- Mean Airway Pressure – Mean (average) pressure exerted on the airway and lungs from the beginning of inspiration until the beginning of the next inspiration (inspiratory cycle)
- MAP is a measured/calculated value (not a ventilator setting) that is determined by
  - PEEP - Peak End-Expiratory Pressure
  - PIP - Peak Inspiratory Pressure
  - Inspiratory time
  - Frequency
- MAP for purposes of PedVAE surveillance is **NOT** Mean Arterial Pressure

**Daily Minimum FiO<sub>2</sub> and MAP**

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

- FiO<sub>2</sub> ventilator settings and MAP values documented during the calendar day are used to identify the daily minimum FiO<sub>2</sub> and daily minimum MAP values
- FiO<sub>2</sub> settings and MAP 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
- Use a calendar day, not any other “24-hour capture period”

## Daily Minimum FiO<sub>2</sub> and MAP, continued

- When determining the daily minimum FiO<sub>2</sub> and MAP, use all documented values that are recorded throughout the calendar day during times when the patient is receiving support from an eligible mode of mechanical ventilation
  - Include FiO<sub>2</sub> and MAP values documented during weaning/mechanical ventilation liberation trials as long as the patient is receiving ventilator support during those trials
  - Exclude FiO<sub>2</sub> and MAP values documented during periods of time when the patient is on extracorporeal life support or paracorporeal membrane oxygenation

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

- The daily minimum FiO<sub>2</sub> is defined as the **lowest documented FiO<sub>2</sub> setting that was maintained for > 1 hour during a calendar day**
- Protocol provides examples of how > 1 hour is to be determined to ensure standardization across all facilities
  - If tracking every 15 minutes, 5 consecutive recordings at the same setting would be needed (for example, at 09:00, 09:15, 09:30, 09:45 and 10:00)
  - If tracking every 30 minutes, 3 consecutive recordings at the same setting would be needed (for example, at 09:00, 09:30, and 10:00)
  - If tracking every hour, 2 consecutive recordings at the same setting (for example, at 09:00 and 10:00)
- If there is no setting that has been maintained for > 1 hour, then select the lowest setting regardless of the period of time in which the setting was maintained



## Identify the Daily Minimum FiO<sub>2</sub> for Monday

- Select the lowest value recorded for the calendar day that is maintained for > 1 hour

	Monday 12am	3am	4am	6am	9am	12pm	3pm	9pm	11pm
FiO <sub>2</sub>	0.80	0.70	0.90	0.80	0.80	0.75	0.75	0.75	0.75

- Monday: 0.75** is the Daily Minimum FiO<sub>2</sub>. The lowest value of 0.70 was not maintained for > 1 hour.

## Identify the Daily Minimum FiO<sub>2</sub> for Monday and Tuesday

- Ventilation is initiated late in the calendar day on Monday

	Monday 2300	2330	Tuesday 0030	0100	0300	0600	0900	1200
FiO <sub>2</sub>	0.70	0.80	0.80	0.80	0.80	0.75	0.75	0.80

- **Monday:** 0.70 is the Daily Minimum FiO<sub>2</sub> - there was no value maintained for > 1 hour
  - Do not look to the next calendar day to determine if a setting was maintained > 1 hour
- **Tuesday:** 0.75 is the Daily Minimum FiO<sub>2</sub> - the lowest value maintained for > 1 hour

## Daily Minimum MAP

- The daily minimum MAP is the **lowest value documented during a calendar day regardless of how long the value is maintained**
- When determining the daily minimum MAP, if MAP values include a decimal place, then round the MAP value to the nearest whole number. For example:
  - A MAP of 10.00 – 10.49 is rounded to 10
  - A MAP of 10.50 – 10.99 is rounded to 11

## Daily Minimum MAP, continued

- For patients < 30 days MAP values of 0-8 cmH<sub>2</sub>O are considered equal to 8 cmH<sub>2</sub>O
  - Any day where daily minimum MAP is 0-8 cmH<sub>2</sub>O will be assigned a daily minimum MAP value of 8 cmH<sub>2</sub>O.
- For patients ≥ 30 days MAP values 0-10 cmH<sub>2</sub>O are considered equal to 10 cmH<sub>2</sub>O
  - Any day where daily minimum MAP is 0-10 cmH<sub>2</sub>O will be assigned a daily minimum MAP value of 10 cmH<sub>2</sub>O.

## Identify the Daily Minimum MAP for a Patient < 30 Days

- Select the lowest value recorded for each calendar day regardless of how long it was maintained

	Monday 12 am	3am	6am	9am	12pm	3pm	6pm	9pm
MAP	8	6	8	5 (8)	5	8	10	10

- **Monday:** Daily Minimum MAP is 8 cmH<sub>2</sub>O
- **Explanation:** The lowest value is 5 cmH<sub>2</sub>O on Monday, but remember that for patients < 30 days, MAP values 0-8 = 8.

## Identify the Daily Minimum MAP for a Patient $\geq 30$ Days

- Select the lowest value recorded for each calendar day regardless of how long it was maintained

	Monday 12 am	3am	6am	9am	12pm	3pm	6pm	9pm
MAP	8	6	8	5(10)	5	8	10	10

- Monday:** Daily Minimum MAP is **10 cmH<sub>2</sub>O**
- Explanation:** The lowest value is 5 cmH<sub>2</sub>O on Monday, but remember that for patients  $\geq 30$  days, MAP values 0-10 = 10.

# Identify the Daily Minimum MAP

- Select the lowest value recorded for each calendar day regardless of how long it was maintained

	Monday 12am	3am	6am	9am	12pm	3pm	6pm	9pm
MAP	12.4	12.1	12.9	11.8	12.4	12.0	12.7	12.7
	12	12	13	12	12	12	13	13

- **Monday:** Daily Minimum MAP is 12 cmH<sub>2</sub>O
- **Explanation:** Remember to round MAP values as follows:
  - MAP of 12.00 – 12.49 is rounded to 12
  - MAP of 12.50 – 12.99 is rounded to 13

# Applying the PedVAE Algorithm



# PedVAE Surveillance Algorithm

The PedVAE Surveillance Algorithm is located on p. 11-8 in the PedVAE protocol

Figure 1: Pediatric Ventilator-Associated Events (PedVAE) Surveillance Algorithm

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 MAP values. The baseline period is defined as the 2 calendar days immediately preceding the first day of increased daily minimum MAP or  $\text{FiO}_2$ .

\*Daily minimum  $\text{FiO}_2$  is defined as the lowest value of  $\text{FiO}_2$  documented during a calendar day that is maintained for  $> 1$  hour. Daily minimum MAP is the lowest value documented during the calendar day.

For patients  $< 30$  days old, daily minimum MAP values 0-8  $\text{cmH}_2\text{O}$  are considered equal to 8  $\text{cmH}_2\text{O}$  for the purposes of surveillance. For patients  $\geq 30$  days old, daily minimum MAP values 0-10  $\text{cmH}_2\text{O}$  are considered equal to 10  $\text{cmH}_2\text{O}$  for the purposes of surveillance.

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  $\geq 0.25$  (25 points) over the daily minimum  $\text{FiO}_2$  of the first day in the baseline period, sustained for  $\geq 2$  calendar days.
- 2) Increase in daily minimum MAP values of  $\geq 4$   $\text{cmH}_2\text{O}$  over the daily minimum MAP of the first day in the baseline period, sustained for  $\geq 2$  calendar days.

**Pediatric Ventilator-Associated Event (PedVAE)**

## Meeting the PedVAE Definition

- Patients must be mechanically ventilated for some portion of the day for at least 4 consecutive calendar days to fulfill PedVAE criteria (where the day of intubation or initiation of mechanical ventilation is day 1)
  - At least **2 days** of stability or improvement
  - At least **2 days** of evidence of worsening oxygenation

## Use of Daily Minimum FiO<sub>2</sub> and MAP

- The daily minimum FiO<sub>2</sub> and daily minimum MAP values are used to determine both the period of stability or improvement and the period that indicates worsening oxygenation
- Stability or improvement and worsening are not identified by comparing FiO<sub>2</sub> settings and MAP values that occur during a calendar day but by comparing the daily minimum values from calendar day to calendar day
- The period of stability or improvement and the evidence of worsening oxygenation must occur in the same parameter
- Each parameter is assessed independently of the other – PedVAE may be met in the FiO<sub>2</sub> parameter, or in the MAP parameter, or in both parameters

# Period of Stability or Improvement

- **Period of Stability or Improvement:**  $\geq 2$  calendar days of stable or decreasing daily minimum FiO<sub>2</sub> or MAP values

Stability:

Vent day	FiO2
1	40
2	40
3	40

Improvement:

Vent day	FiO2
1	50
2	40
3	30

- **Baseline Period:** the 2 calendar days immediately preceding the first day of evidence of worsening oxygenation

# Evidence of Worsening Oxygenation

- **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  $\geq 0.25$  (**25 points**) over the daily minimum  $\text{FiO}_2$  of the first day in the baseline period, sustained for  $\geq 2$  calendar days.

**OR**

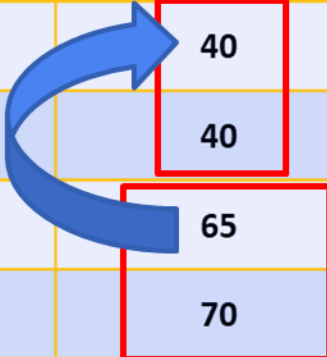
- Increase in daily minimum MAP values of  $\geq 4$  **cmH<sub>2</sub>O** over the daily minimum MAP of the first day in the baseline period, sustained for  $\geq 2$  calendar days.

## PedVAE Determination – FiO<sub>2</sub> Parameter

**FiO<sub>2</sub> Parameter:** A baseline period of stability or improvement immediately followed by an increase in the daily minimum FiO<sub>2</sub> of **≥ 0.25 (25 points)** over the daily minimum FiO<sub>2</sub> of the first day in the baseline period, sustained for ≥ 2 calendar days

# Operationalizing PedVAE - FiO<sub>2</sub> - Example #1

Vent Day	Daily Minimum MAP	Daily Minimum FiO <sub>2</sub>
1	13	60
2	10	40
3	10	40
4	12	65
5	12	70
6	10	70
7	8	60
8	8	60



## PedVAE met

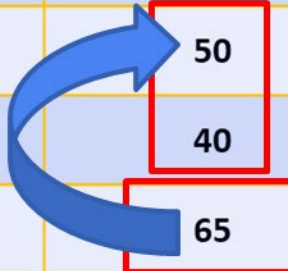
**Baseline period of stability**

**Increase of  $\geq 0.25$  (25 points)  
over the first day of the  
baseline period**

**Sustained for  $\geq 2$  calendar days**

## Operationalizing PedVAE - FiO<sub>2</sub> - Example #2

Vent Day	Daily Minimum MAP	Daily Minimum FiO <sub>2</sub>
1	13	60
2	10	50
3	10	40
4	12	65
5	12	70
6	10	70
7	8	60
8	8	60



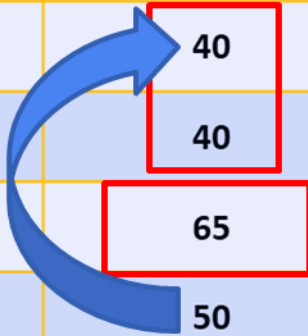
### No PedVAE

≥ 0.25 (25%) increase is not over the first day in the baseline period



# Operationalizing PedVAE - FiO<sub>2</sub> - Example #3

Vent Day	Daily Minimum MAP	Daily Minimum FiO <sub>2</sub>
1	13	60
2	10	40
3	10	40
4	12	65
5	12	50
6	10	40
7	8	40
8	8	40



## No PedVAE

**≥ 0.25 (25%) increase over the baseline period is not sustained for ≥ 2 days**

## PedVAE Determination - MAP Parameter

**MAP Parameter:** A baseline period of stability or improvement immediately followed by an increase in the daily minimum MAP value of  $\geq 4$  cmH<sub>2</sub>O over the daily minimum MAP of the first day in the baseline period, sustained for  $\geq 2$  calendar days

# Operationalizing PedVAE – MAP – Example #1

\*patient < 30 days of age – MAP values 0-8 = 8

Vent Day	Daily Minimum MAP	Daily Minimum FiO <sub>2</sub>
1	13	60
2	8 (7)*	
3	8 (7)*	
4	12	
5	12	
6	10	
7	8	40
8	8	40

≥ 2-day period of stability  
in MAP parameter

≥ 2-day period of worsening in  
MAP parameter with an increase  
of ≥ 4 cm H<sub>2</sub>O over the first day  
of the baseline period

## PedVAE met

# Operationalizing PedVAE – MAP – Example #2

\*patient  $\geq 30$  days of age – MAP values 0-10 = 10

No  
PedVAE

Vent Day	Daily Minimum MAP	Daily Minimum FiO <sub>2</sub>
1	13	60
2	10 (7)*	
3	10 (7)*	
4	12	
5	12	
6	10	40
7	8	40
8	8	40



10 (7)\*  
10 (7)\*

$\geq 2$ -day period of stability  
in MAP parameter

Increase in MAP parameter does not  
meet the requirement of  $\geq 4$  cm H<sub>2</sub>O  
over the first day of the baseline period

# Operationalizing PedVAE – MAP – Example #3

\*patient  $\geq 30$  days of age – MAP values 0-10 = 10

## PedVAE met

Vent Day	Daily Minimum MAP	Daily Minimum FiO <sub>2</sub>
1	13	60
2	10 (7)*	
3	10 (7)*	
4	14	
5	14	
6	10	
7	8	40
8	8	40

$\geq 2$ -day period of stability in MAP parameter

$\geq 2$ -day period of worsening in MAP parameter with an increase of  $\geq 4$  cm H<sub>2</sub>O over the first day of the baseline period

## Date of Event

- The date of onset of worsening oxygenation (day 1 of the required  $\geq 2$ -day period of worsening oxygenation following a  $\geq 2$ -day period of stability or improvement on the ventilator)
  - Earliest date of event for PedVAE is mechanical ventilation day 3 (first day of worsening oxygenation)
  - The first two days of mechanical ventilation can establish the baseline period

## 14-day Event Period

- PedVAEs are defined by a 14-day period
- The Date of Event is day 1 of the 14-day Event Period
  - A new PedVAE cannot be reported until the 14-day period has elapsed
  - For example, if a PedVAE is reported with a date of event March 1, this sets a 14-day event period March 1 - 14, and the earliest date a new PedVAE can be detected and reported is March 15
  - The 2 days of stability or improvement for a new PedVAE can occur during the previous 14-day event period

# Operationalizing PedVAE – Date of Event (patient < 30 days)

Vent Day	MAPmin	FiO <sub>2</sub> min
1	13	60
2	8 (7)	40
3	8 (7)	40
4	12	40
5	12	50
6	10	40
7	8	40
8	8	40

**Event Date = Vent Day 4  
(first day of worsening oxygenation)  
14-day Event Period is Vent Day 4 – Vent Day 17**



# PedVAE Calculator


# Accessing the PedVAE Calculator

<https://www.cdc.gov/nhsn/psc/pedvae/index.html>

## Pediatric Ventilator-associated Events (PedVAE)

Available In-Plan for Pediatric and Neonatal Inpatient Locations Only.

PedVAP surveillance using the [PNEU](#) protocol continues to be available for in-plan surveillance for pediatric locations only. See [VAE](#) for in-plan surveillance for adult locations

 Not available for Inpatient Psychiatric Facilities (IPFs)

PedVAE Calculator

operates based upon the currently posted PedVAE protocol.



# Accessing the PedVAE Calculator, continued

<https://www.cdc.gov/nhsn/pedvae-calculator/index.html>

## Pediatric Ventilator-Associated Event Calculator

Version 1.0

Welcome to Version 1.0 of the PedVAE Calculator. Version 1.0 operates based upon the currently posted PedVAE protocol.

The Calculator is a web-based tool that is designed to help you learn how the PedVAE surveillance definition algorithm works and assist you in making PedVAE determinations.

Please note that the PedVAE 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 PedVAE Calculator does not store any patient data that you enter, and it will not report any data that you enter or any PedVAE 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).



Pediatric Ventilator-Associated Event Calculator

Version 1.0

(must have javascript enabled)

# PedVAE Calculator

## National Healthcare Safety Network (NHSN)


[CDC](#) > [NHSN](#) > [Materials for Enrolled Facilities](#)

### NHSN Pediatric Ventilator-Associated Event (PedVAE) Calculator Ver. 1.0

Welcome to the Pediatric Ventilator-Associated Event Calculator. Version 1.0 operates based upon the currently posted PedVAE protocol. It is strongly encouraged that you thoroughly review the [PedVAE protocol](#).

- The calculator recognizes Mean Airway Pressure (MAP) values 0-8 cmH<sub>2</sub>O as equal to 8 for patients < 30 days of age and MAP values 0-10 cmH<sub>2</sub>O as equal to 10 for patients ≥ 30 days of age and corrects entries according to the PedVAE protocol prior to making a PedVAE determination.
- Daily minimum MAP readings are to be rounded to the nearest whole number using the following method as an example: A MAP value 10.00 - 10.49 is rounded to 10 and a MAP value 10.50 - 10.99 is rounded to 11.
- The calculator finds multiple PedVAEs per patient as long as they conform to the 14 day rule.

To get started, **enter a date below that corresponds to the first day the patient was placed on mechanical ventilation during the mechanical ventilation episode of interest.** You may type in a date or use the popup calendar when it appears. You may only enter dates within the past year. If the patient has been on mechanical ventilation for more than one year during the current mechanical ventilation episode, choose a start date that is more recent but is at least 7 days before the period of interest. [more...](#)

Mechanical Ventilation Start Date:   (mm/dd/yy)

Is the patient's day of life (where date of birth = day of life 1) less than 30 days on the Mechanical Ventilation Start Date?

Click "more" for additional instructions on using the PedVAE Calculator.

# Mechanical Ventilation Start Date

Enter the actual date on which mechanical ventilation was initiated

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- The calculator finds multiple PedVAEs per patient as long as they conform to the 14 day rule.

To get started, enter a date below that corresponds to the first day the patient was mechanically ventilated. You may only enter dates within the current mechanical ventilation episode, choose a start date that is more recent but is at least 14 days before the end of the episode.


The calculator runs locally on your machine. Data that you enter are not stored, nor are they shared with anyone else. If you don't understand something, there are several mechanisms for getting help. Most of the buttons have a question mark icon. Also the explain button will pop up an explanation of the reasoning behind the calculation. You can click and drag it to the side as you work. The explanation will automatically update itself as you change the data. [less...](#)

January 2023

Su	Mo	Tu	We	Th	Fr	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

mechanical ventilation episode of interest. You may type in the start date or use the popup calendar when it appears. You may only enter dates within the current mechanical ventilation episode, choose a start date that is more recent but is at least 14 days before the end of the episode.


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 have a question mark icon. Also the explain button will pop up an explanation of the reasoning behind the calculation. You can click and drag it to the side as you work. The explanation will automatically update itself as you change the data. [less...](#)

Mechanical Ventilation Start Date:   (mm/dd/yyyy)

Is the patient's day of life (where date of birth = day of life 1) less than 30 days on the Mechanical Ventilation Start Date?

# Day of Life


Used to determine which Daily Minimum MAP value interpretation to apply

Mechanical Ventilation Start Date:   (mm/dd/yyyy)

Is the patient's day of life (where date of birth = day of life 1) less than 30 days on the Mechanical Ventilation Start Date?

Yes  
No

If the patient is less than 30 days old, you will also answer the following:

Mechanical Ventilation Start Date:   (mm/dd/yyyy)

Is the patient's day of life (where date of birth = day of life 1) less than 30 days on the Mechanical Ventilation Start Date?

What is the patient's Day of Life (date of birth = day of life 1) on the Mechanical Ventilation Start Date?

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10


# PedVAE Calculator (patient < 30 days)

- The patient is < 30 days on the Mechanical Ventilation Start Date

- Enter the Daily Minimum MAP and FiO<sub>2</sub> values and click on **Calculate PedVAE**

Is the patient's day of life (where date of birth = day of life 1) less than 30 days on the Mechanical Ventilation Start Date?

What is the patient's Day of Life (date of birth = day of life 1) on the Mechanical Ventilation Start Date?



MV Day	Date	Day of Life	Min. MAP 0 - 50 (cmH <sub>2</sub> O)	Min. FiO <sub>2</sub> (21 - 100)	PedVAE
1	1/1/2023	10	<input type="text" value="5"/>	<input type="text" value="60"/>	
2	1/2/2023	11	<input type="text" value="6"/>	<input type="text" value="60"/>	
3	1/3/2023	12	<input type="text" value="7"/>	<input type="text" value="50"/>	
4	1/4/2023	13	<input type="text" value="12"/>	<input type="text" value="50"/>	
5	1/5/2023	14	<input type="text" value="12"/>	<input type="text" value="40"/>	
6	1/6/2023	15	<input type="text" value="12"/>	<input type="text" value="40"/>	

# PedVAE Calculator (patient < 30 days), Continued

NHSN Pediatric Ventilator-Associated Event (PedVAE) Calculator Ver. 1.0

A Pediatric Ventilator-Associated Event (PedVAE) based on MAP values occurred on 1/4/2023.

Click on the "Explain" button to see how this determination was made.

Is the patient's day of life (where date of birth = day of life 1) less than 30 days on the Mechanical Ventilation Start Date?

What is the patient's Day of Life (date of birth = day of life 1) on the Mechanical Ventilation Start Date?

MV Day	Date	Day of Life	Min. MAP 0 - 50 (cmH <sub>2</sub> O)	Min. FiO <sub>2</sub> (21 - 100)	PedVAE
1	1/1/2023	10	8 (5)*	60	
2	1/2/2023	11	8 (6)*	60	
3	1/3/2023	12	8 (7)*	50	
4	1/4/2023	13	12	50	‡ PedVAE
5	1/5/2023	14	12	40	
6	1/6/2023	15	12	40	

- A **PedVAE** is identified in the **MAP** parameter with a date of event 1/4/2023
- The calculator interprets MAP values of 0-8 cmH<sub>2</sub>O as equal to 8 cm H<sub>2</sub>O since the patient is **< 30 days**



# PedVAE Calculator (patient $\geq 30$ days)

NHSN Pediatric Ventilator-Associated Event (PedVAE) Calculator Ver. 1.0

No Pediatric Ventilator-Associated Event (PedVAE) detected. Click on the "Explain" button to see an explanation of the PedVAE definition.

- No PedVAE is identified because the increase in MAP is not  $\geq 4$  cmH<sub>2</sub>O over the baseline period
- The calculator interprets MAP values of 0-10 cmH<sub>2</sub>O as equal to 10 cmH<sub>2</sub>O for patients  $\geq 30$  days
- Select the **Explain** button for an explanation of the determination

Is the patient's day of life (where date of birth = day of life 1) less than 30 days on the Mechanical Ventilation Start Date?

MV Day	Date	Min. MAP 0 - 50 (cmH <sub>2</sub> O)	Min. FiO <sub>2</sub> (21 - 100)	PedVAE
1	1/1/2023	10 (5)*	60	
2	1/2/2023	10 (6)*	60	
3	1/3/2023	10 (7)*	50	
4	1/4/2023	12	50	
5	1/5/2023	12	40	
6	1/6/2023	12	40	

**Reporting PedVAE**

# PedVAE Data Collection Forms and Instructions

<https://www.cdc.gov/nhsn/psc/pedvae/index.html>

- Event forms
- Denominator forms
  - ICU
  - NICU
- Tables of Instructions

## Data Collection Forms & Instructions

All Data Collection Forms are Print-only

### PedVAE

[Pediatric Ventilator-associated Event \(PedVAE\) form – January 2021 \(57.113\)](#)  [PDF – 190 KB]


- [Customizable form](#)  [DOCX – 60 KB]

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- [Table of Instructions](#)  [PDF – 150 KB]

### Denominator Forms

#### ACH

[Denominators for Intensive Care Unit \(ICU\)/Other locations \(not NICU or SCA\) form – January 2021 \(57.118\)](#)  [PDF – 80 KB]

- [Customizable form](#)  [DOCX – 60 KB]

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- [Table of Instructions](#)  [PDF – 200 KB]

[Denominators for Neonatal Intensive Care Unit \(NICU\) form – January 2021 \(57.116\)](#)  [PDF – 80 KB]

- [Customizable form](#)  [DOCX – 60 KB]

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- [Table of Instructions](#)  [PDF – 200 KB]

# PedVAE: Monthly Reporting Plan



## Edit Monthly Reporting Plan

Mandatory fields marked with \*

Facility ID \*: DHQP Memorial Hospital (ID 10000)

Month \*: March

Year \*: 2023

No NHSN Patient Safety Modules Followed this Month

Pediatric and neonatal locations: PedVAE is eligible for selection.

### Device-Associated Module

	Locations	CLABSI	VAE	CAUTI	CLIP	PedVAP	PedVAE
	NICU 3 - LEVEL 3 NICU	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	PICU2 - PEDIATRIC ICU	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	SICU - SURGICAL ICU	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Add Row

Clear All Rows

Copy from Previous Month

# PedVAE: Event Information

- Select Event Type: PedVAE
- Fill in Date of Event
- Fill in patient's Location on the Date of Event
- For in-plan events, enter Date Admitted to Facility

Event Information

Event Type \*: PedVAE - Pediatric Ventilator-Associated Event

Date of Event \*: 03/01/2023

Post-procedure:

MDRO Infection Surveillance \*: No, this infection's pathogen/location are not in-plan for Infection Surveillance in the MDRO/CDI Module

Location \*: NICU 3 - LEVEL 3 NICU

Date Admitted to Facility >: 02/15/2023

# PedVAE: Risk Factors

- Enter Location of Mechanical Ventilation
- Enter Date Mechanical Ventilation Initiated
- For Neonatal Intensive Care Unit (NICU) patients
  - Birth Weight
  - Gestational Age

## Risk Factors

Location of Mechanical Ventilation \*: CSEC - C-SECTION ROOM

Date Mechanical Ventilation Initiated \*: 02/15/2023

Birth Weight (grams) \*: 500 Birth Code: A For NICU only

Gestational Age (weeks) \*: 24

# PedVAE: Event Details

- Select the specific criteria used to meet the PedVAE definition
  - $\text{FiO}_2$
  - MAP

## Event Details

### Specify Criteria Used \*

Daily min  $\text{FiO}_2$  increase  $\geq 0.25$  (25 points) for  $\geq 2$  days<sup>†</sup>

Daily min Mean Airway Pressure (MAP)  $\geq 4$  cm H<sub>2</sub>O for  $\geq 2$  days<sup>†</sup>

<sup>†</sup> after 2+ days of stable or decreasing daily minimum values

# PedVAE: Clinical Event

- Select “Yes” if the PedVAE is associated with any clinical diagnoses or events
- If “Yes,” check all that apply
- If “Other” is checked, there is a 200-character limit

Clinical event associated with the PedVAE?:  If yes, check all that apply:

<input type="checkbox"/> Ventilator-associated Pneumonia	<input type="checkbox"/> Sepsis or Septic Shock
<input type="checkbox"/> Atelectasis	<input type="checkbox"/> Neonatal Respiratory Distress Syndrome (RDS)
<input type="checkbox"/> Acute Respiratory Distress Syndrome (ARDS)	<input type="checkbox"/> Bronchopulmonary Dysplasia/Chronic Lung Disease
<input type="checkbox"/> Pulmonary Hypertension	<input type="checkbox"/> Reopened Patent Ductus Arteriosus (PDA)
<input type="checkbox"/> Pulmonary Edema	<input type="checkbox"/> Weaning from mechanical ventilation or other change in mechanical ventilation approach <u>without</u> clinical worsening
<input type="checkbox"/> Pulmonary Hemorrhage	<input type="checkbox"/> Other (specify) <input type="text"/>



## PedVAE: Antimicrobial Agents

- Select “Yes” if an antimicrobial agent listed in the PedVAE Appendix was administered on the Date of Event or within 2 days before or 2 days after
- If “Antimicrobial agent(s) administered?” = Y, record drug (up to 3) and enter the Drug Start date
  - Drug Start date is limited to 1 year prior to current admission date

Antimicrobial agent(s) administered?:

Drug 1 :   Drug 1 Start date

Drug 2 :   Drug 2 Start date

Drug 3 :   Drug 3 Start date

## PedVAE: Pathogens

- Pathogen identified – listed specimens: Select “Yes” if a pathogen was detected in any of the specimen types listed with collection dates on the Date of Event or within 2 days before or 2 days after
- Pathogen identified from BLOOD: Select “Yes” if a pathogen was identified from blood with a specimen collection date within 2 days before to 13 days after the Date of Event
- If “Yes,” enter up to 3 pathogens

Pathogen identified from one or more of the listed specimens?:  If Yes, which specimen type? (check all that apply)


Lower Respiratory       Upper Respiratory

Lung Tissue       Pleural Fluid

Urine for Legionella or Streptococcus pneumoniae antigen testing

Pathogen identified from BLOOD?:

# PedVAE: Pediatric Location Summary Data



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

Mandatory fields marked with \*

Facility ID \*:

Location Code \*:

Month \*:

Year \*:

Denominator Data		Report No Events
Total Patient Days *	<input type="text"/>	
Central Line Days:	<input type="text"/>	CLABSI: <input type="checkbox"/>
Urinary Catheter Days:	<input type="text"/>	CAUTI: <input type="checkbox"/>
Ventilator Days *	<input type="text"/>	VAE: <input type="checkbox"/> PedVAE: <input type="checkbox"/> PedVAP: <input type="checkbox"/>
APRV Days:	<input type="text"/>	
Episodes of Mechanical Ventilation:	<input type="text"/>	

Sample Values For Estimating Denominator Data		
		Check Box(es) if Sampling Used
Sample Patient Days:	<input type="text"/>	
Sample Central Line Days:	<input type="text"/>	<input type="checkbox"/>
Sample Urinary Catheter Days:	<input type="text"/>	<input type="checkbox"/>

Total Patient Days and Ventilator Days are required.

# PedVAE: Neonatal ICU Location Summary Data

**Neonatal Intensive Care Unit**

Mandatory fields marked with \*

Facility ID \*: DHQP Memorial Hospital (ID 10000) ▼

Location Code \*: NICU 3 - LEVEL 3 NICU ▼

Month \*: February ▼

Year \*: 2023 ▼

Birth Weights								
Birth Weight	Patient Days *	CL Days	No CLABSI	Vent Days *	No PedVAE	No PedVAP	EMV	UrC Days
<=750	<input type="text"/>	<input type="text"/>	<input type="checkbox"/>	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>
751-1000	<input type="text"/>	<input type="text"/>	<input type="checkbox"/>	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>
1001-1500	<input type="text"/>	<input type="text"/>	<input type="checkbox"/>	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>
1501-2500	<input type="text"/>	<input type="text"/>	<input type="checkbox"/>	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>
>2500	<input type="text"/>	<input type="text"/>	<input type="checkbox"/>	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>

Total Patient Days and Vent Days by Birth Weight are required.

Patient Days and Vent Days by Gestational Age are optional.

Gestational Ages				
Gestational Age	Patient Days	Vent Days	No PedVAE	EMV
Extremely preterm (<28 weeks)	<input type="text"/>	<input type="text"/>	<input type="checkbox"/>	<input type="text"/>
Very preterm (28 to <32 weeks)	<input type="text"/>	<input type="text"/>	<input type="checkbox"/>	<input type="text"/>
Moderate to late preterm (32 to <37 weeks)	<input type="text"/>	<input type="text"/>	<input type="checkbox"/>	<input type="text"/>
Term (>=37 weeks)	<input type="text"/>	<input type="text"/>	<input type="checkbox"/>	<input type="text"/>

**In Closing...**

# Presentation Summary

- Today's presentation covered the basics of PedVAE surveillance
  - Key terms
  - Daily minimum values
  - PedVAE surveillance algorithm
  - PedVAE calculator
  - PedVAE reporting

# PedVAE Surveillance Resources

- Familiarize yourself with the PedVAE webpage
- Read the PedVAE protocol and the tables of instructions
- Read the PedVAE FAQs
- Review the PedVAE training resources
- Use the PedVAE calculator
- Email the NHSN Help Desk at [nhsn@cdc.gov](mailto:nhsn@cdc.gov)

**For any questions or concerns,  
contact the NHSN Helpdesk at [nhsn@cdc.gov](mailto:nhsn@cdc.gov)**

**For more information please contact Centers for Disease Control and Prevention**

1600 Clifton Road NE, Atlanta, GA 30333

Telephone, 1-800-CDC-INFO (232-4636)/TTY: 1-888-232-6348

E-mail: [cdcinfo@cdc.gov](mailto:cdcinfo@cdc.gov) Web: [www.cdc.gov](http://www.cdc.gov)

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.

