Ventilator-Associated Pneumonia: New Definitions

M. Chance Spalding, DO, PhD[a,b,*], Michael W. Cripps, MD[c], Christian T. Minshall, MD, PhD[c]

KEYWORDS

• Ventilator-associated pneumonia • Sepsis • Nosocomial infection • Critical care

KEY POINTS

- New NHSN definition for ventilator-associated events (VAE) replaces previous definition of pneumonia.
- Clear, defined objective criteria for each category of VAE eliminates subjectivity of previous definition.
- Shifts focus of reportable events from pneumonia to broader classification of respiratory deterioration.
- May underestimate the rate of clinical pneumonia, but captures other noninfectious causes of respiratory compromise in ventilated patients.
- Definition may need to be modified to account for specific patient populations and alternative modes of ventilation.

INTRODUCTION

Ventilator-associated pneumonia (VAP) remains one of the most common nosocomial infections in the intensive care unit (ICU) affecting one-third of patients that require mechanical ventilation during a noninfectious admission.[1] Despite having a significant attributable mortality (4.6%), VAP remains a single a component of a larger constellation of adverse events, such as aspiration, atelectasis, pulmonary edema, venous thromboembolic event, delirium, and acute respiratory distress syndrome (ARDS), which potentially increase the morbidity, mortality, hospital length of stay (LOS), and cost of care in mechanically ventilated patients. This broader view of complications that arise in patients requiring ventilator support provides the framework for the new

Disclosure Statement: This paper comprises original work created by the authors and they have no commercial or financial conflicts of interest to disclose.

[a] Department of Surgery, Grant Medical Center, 111 South Grant Avenue, Columbus, OH 43215, USA; [b] Department of Surgery, Ohio University College of Osteopathic Medicine, 35 West Green Drive, Athens, OH 45701, USA; [c] Department of Surgery, UT Southwestern, 5323 Harry Hines Boulevard, Dallas, TX 75390, USA
* Corresponding author.
E-mail address: Chance.Spalding@ohiohealth.com

Crit Care Clin ■ (2017) ■–■
http://dx.doi.org/10.1016/j.ccc.2016.12.009 criticalcare.theclinics.com

quality metrics put forth by the Centers for Disease Control and Prevention (CDC) for ventilated patients.

In 2011, CDC a workgroup encompassing physician leaders from multiple professional societies (eg, American College of Chest Physicians, American Thoracic Society, Society of Critical Care Medicine, Infectious Diseases Society of America) in conjunction with representatives of the US Department of Health and Human Services, Office of Disease Prevention and Heath Promotion, National Institutes of Health, and the CDC met to create a new definition of VAP that improves diagnosis, the reliability and validity of surveillance, and create a reporting algorithm for the National Healthcare Safety Network (NHSN).[2] The final product of this workgroup resulted in a tiered system that encompasses the broader classification of ventilator-associated events (VAE), subcategorized by objective criteria for infection-related ventilator-associated condition (IVAC) and then more specifically by possible- and probable-VAP (**Fig. 1**).

This article reviews the criteria for ventilator-associated condition (VAC) and IVAC, including the classifications of probable- or possible-VAP; compares how the tiered definition of pneumonia contrasts to the previous NHSN definition; summarizes the studies validating its application; and explores its utility in surgical patients.

NEW DEFINITION

In 2013, NHSN supplanted the previous definition of pneumonia with the working group's classification of VAE (**Table 1**). The intent is to cast a wider net using defined, objective criteria that captures all potentially preventable complications from data available in the electronic medical record (EMR) in most institutions. Automated surveillance directly from EMR is thought to decrease reporting bias by eliminating subjectivity from the analysis.

VAC is defined as a sustained increase in oxygen requirements in a ventilated patient over a period of 2 days. Sustained oxygen requirement is defined as an increase in the daily minimum positive end-expiratory pressure (PEEP) of greater than or equal to 3 cm H_2O or an increase in the daily minimum fraction of inspired oxygen (F_{IO_2}) of greater than or equal to 20 points for 2 days. To qualify as a VAC, the patient must have had a minimum of 2 days of mechanical ventilation with stable or decreasing oxygen requirements before the days of increased oxygenation.

The progression from VAC to IVAC depends on timing in relation to the increased oxygenation requirements that define a VAC, clinical signs of infection, and treatment of the patient with antibiotics by the ICU team. Patients must be mechanically ventilated a minimum of 3 days and have signs of infection in the 2 days before or 2 days after the diagnosis of VAC. In addition, the patient must have a low-grade fever (>38°C) or hypothermia (<36°C) or leukocytosis ($\geq$12,000 cells/mm^3) or leukopenia ($\leq$4000 cells/mm^3) and be started on a new antimicrobial agent for greater than or equal to 4 days. IVAC suggests a causal relationship between infectious cause and VAC.

In the new classification of VAE, patients that meet the criteria for VAC and IVAC are further characterized with the diagnosis of VAP according to the type of evidence available from their sputum assessment. Possible-VAP requires either a qualitative sputum analysis demonstrating purulent respiratory secretions defined as greater than or equal to 25 neutrophils and less than or equal to 10 squamous cells per low-power field or a positive qualitative, semiquantitative, or quantitative culture obtained from the lungs, bronchi, or trachea. Probable-VAP requires the presence of purulent secretions and specific cutoffs for the number of colony-forming units identified