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Brief report

Developing a new national approach to surveillance for ventilator-associated events: Executive summary

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This article is an executive summary of a report from the Centers for Disease Control and Prevention Ventilator-Associated Pneumonia Surveillance Definition Working Group, entitled "Developing a new, national approach to surveillance for ventilator-associated events" and published in *Critical Care Medicine*. The full report provides a comprehensive description of the Working Group process and outcome.

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Critical care
Mechanical ventilation

In September 2011, the Centers for Disease Control and Prevention (CDC) convened a Ventilator-Associated Pneumonia (VAP) Surveillance Definition Working Group to organize a formal process for leaders and experts of key stakeholder organizations to discuss the challenges of VAP surveillance definitions and to propose new approaches to VAP surveillance in adult patients (Table 1). The charges to the Working Group were to (1) critically review a draft, streamlined VAP surveillance definition developed for use in adult patients; (2) suggest modifications to enhance the reliability and credibility of the surveillance definition within the critical care and infection prevention communities; and (3) propose a final adult surveillance definition algorithm to be implemented in the CDC's National Healthcare Safety Network (NHSN), taking into consideration the potential future use of the definition algorithm in public reporting, interfacility comparisons, and pay-for-reporting and pay-for-performance programs.

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The Working Group's surveillance definition algorithm, which is referred to as the *ventilator-associated events* or *VAE surveillance definition algorithm*, represents a purposeful departure from VAP toward more general, objective measures of conditions and complications occurring in patients on mechanical ventilation (Fig 1; VAE surveillance protocol available at http://www.cdc.gov/nhsn/acute-care-hospital/vae/index.html). The VAE surveillance definition algorithm uses a tiered approach, moving from measures of ventilator-associated conditions (VAC), to infection-related ventilator-associated complications (IVAC), to possible and probable VAP.

The first tier of VAE surveillance, VAC, seeks to identify episodes of sustained respiratory deterioration and will capture both infectious and noninfectious conditions and complications occurring in mechanically ventilated patients. VAC is defined by a sustained period of worsening oxygenation that immediately follows a baseline period of stability or improvement on the ventilator. To meet the VAC definition, a mechanically ventilated patient must have at least 2 calendar days of stable or decreasing daily minimum positive end-expiratory pressure (PEEP) or fraction of inspired oxygen (F_{IO_2}), followed by at least 2 days of increased daily minimum PEEP or F_{IO_2}, where the increase in the daily minimum PEEP is $\geq$3 cm H_2O greater than the daily minimum PEEP during the baseline period, or where the increase in the daily minimum F_{IO_2} is $\geq$0.20 (or 20 percentage points in oxygen concentration) greater than the daily minimum F_{IO_2} during the baseline period. For example, if a patient's daily minimum F_{IO_2} requirement on days 4 and 5 of mechanical ventilation is 0.40, then the patient's daily minimum F_{IO_2} requirement would need to be at least 0.60 on days 6 and 7 of mechanical ventilation for the VAC definition to be met. The Working Group's decisions to set specific thresholds of 3 cm H_20 and 0.20 (20 points) for the increases in PEEP and F_{IO_2}, respectively, and to define a "sustained" increase as an increase persisting for at least 2 calendar days were based on expert opinion of what criteria would likely identify clinically important events, while minimizing inadvertent inclusion of other types of events resulting in transient changes in oxygenation, such as surgery or performance of other procedures. Thresholds were also selected based on published data indicating that increases of $\geq$2.5 cm H_2O in PEEP or $\geq$0.15 (15 points) in F_{IO_2} sustained for at least 2 days were associated with longer duration of mechanical ventilation, intensive care unit (ICU) and hospital stays, and increased mortality.[1] Subsequently, additional data have been published that support the Working Group's approach to VAC.[2]

Table 1
VAP Surveillance Definition Working Group organizations, representatives and federal participants

Organization	Representative(s)
American Association of Critical-Care Nurses	Suzanne Burns and Beth Hammer
American Association for Respiratory Care	Dean Hess
American College of Chest Physicians	Robert Balk and David Gutterman
American Thoracic Society	Nicholas Hill and Mitchell Levy
Association for Professionals in Infection Control and Epidemiology	Linda Greene
Council of State and Territorial Epidemiologists	Carole VanAntwerpen
Healthcare Infection Control Practices Advisory Committee Surveillance Working Group	Daniel Diekema
Infectious Diseases Society of America	Edward Septimus
Society for Healthcare Epidemiology of America	Michael Klompas
Society of Critical Care Medicine	Clifford Deutschman, Marin Kollef, and Pamela Lipsett
US Department of Health and Human Services, Office of Disease Prevention and Health Promotion	Don Wright
National Institutes of Health	David Henderson
Centers for Disease Control and Prevention, Division of Healthcare Quality Promotion	Scott Fridkin, Alice Guh, Shelley Magill, Teresa Horan, others

The second tier, IVAC, attempts to identify the subset of VACs that are potentially related to infection, as evidenced by an abnormal white blood cell count or temperature and initiation of a new antimicrobial agent. IVAC will likely capture patients with pulmonary infections and extrapulmonary infections of sufficient severity to trigger respiratory deterioration. The Working Group recognized the low predictive value of an abnormal temperature or white blood cell count in ICU patients, and Klompas et al have shown that the addition of fever or abnormal white blood cell count to VAC definition does not substantially enhance the definition's predictive value for death.[2] Nevertheless, these are objective and readily available signs that are frequently used at the bedside to assess for the presence of infection. The additional required