Inconsistent VAP definitions raise questions of usefulness

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Ventilator associated pneumonia (VAP) is recognised as one of the most frequent nosocomial infection in Intensive Care Unit (ICU), with infection rates varying from 10-30% of mechanically ventilated patients.[1-3] VAP is undoubtedly a burden on the health care system and has been associated with adverse patient outcomes; increases in ICU Length of stay (LOS), hospital LOS and crudely associated with increased mortality.[1, 4] Furthermore, it has been widely reported to impact on health care resources resulting in significant inflation of health care costs.[5-7]

VAP is broadly defined as pneumonia in persons who have had an invasive device, an endotracheal tube or tracheostomy, to assist ventilation continuously for at least 48hrs. Although, the devil is in the detail when applying the definition for quality surveillance purposes and its lack of objectivity and variability in interpretation is proving problematic for the critical care community. At present, there is little consensus on an effective surveillance definition for Ventilator Associated Pneumonia (VAP). Varying definitions and terminology have existed over time, notably The Centres for Disease Control and Prevention (CDC) provide the most widely-used and reported definition for VAP surveillance. The complexity of the previous definition,[3] and lack of objectivity and sensitivity has posed doubt over its reliability as a benchmarking tool.[8]

The CDC addressed these limitations in September 2011 by establishing a VAP Surveillance Working Group, consisting of clinical experts and stakeholders in the field.[9] Accordingly a revised three tiered definition to be used for surveillance of Ventilator Associated Events (VAE) was introduced by the CDC in January 2013.[10] In light of the changing definition, the PAH (Princess Alexandra Hospital) ICU Quality Taskforce recognised the potential impact of the change in definitions on benchmarking activities and undertook a unit based comparison of the 2009 and 2013 definitions. We hypothesised little concordance between patients classified as VAP (PNU1-Clinically defined pneumonia, PNU2-Pneumonia with specific laboratory findings, PNU3-Pneumonia in immunocompromised patients) according to the 2009 definition compared to patients diagnosed with VAE (Ventilator Associated Event) (VAC-Ventilator Associated Condition, IVAC-Infection-Related Ventilator-Associated Complication, Possible VAP or Probable VAP) on the 2013 criteria (Table 1).

Table 1: Comparison of 2009 and 2013 VAP/VAE definitions

CDC 2009 Definition: Ventilator Associated Pneumonia (VAP)	CDC 2013 Definition: Ventilator Associated Event (VAE)
• All mechanically ventilated patients with positive Chest X-Ray reports (new or progressive and persistent infiltrates, consolidation or cavitation) • Temp >38° and/or WCC <4.0 x 10^9/L or >12.0 x 10^9/L • At least two respiratory symptoms of tachypnoea or dyspnoea, rales or bronchial breath sounds, worsening gas exchange (PaO2/FiO2 ≤240), evidence of new onset of purulent sputum (leukocytes 2+) and/or cough, and/or pleuritic chest pain or haemoptysis (in immunocompromised patients) or >70 years with an altered mental status. NB. Patients were excluded if they were admitted with a respiratory infection, or if there was a likelihood of aspiration pre intubation by a modified rule (a GCS <8 documented pre intubation).	• Patients with ≥2 calendar days of stable ventilation prior to a sustained period of ≥2 calendar days of worsening oxygenation indicated by an increase in FiO2 ≥0.2 and/or increase in daily minimum PEEP ≥3cmH2O • Temp>38°C or < 36°C, and/or WCC <4.0 x 10^9/L or >12.0 x 10^9/L • A new antimicrobial agent commenced and continued for ≥4 calendar days. • Purulent respiratory secretions (leukocytes 2+) and/or a positive culture of sputum, endotracheal aspirate, bronchoalveolar lavage, lung tissue or protected specimen brushing.

All mechanically ventilated patients admitted to the PAH General ICU over a three month period, April to June 2013 (n= 253), were assessed by one of three ICU trained Quality Clinical Nurses for each of the criteria for the diagnosis of PNU 1, 2 or 3 (2009 VAP) or VAC, IVAC, Possible / Probable VAP (2013 VAE); this assessment was then reviewed by at least one of three Consultant Intensivists who were designated members of the ICU Quality Taskforce. Ethical approval was received from Metro South Human Research Ethics Committee.

Patients were 53.1 (SD 19.3) years old; two thirds (67%) male; had a median (IQR) APACHE II of 18 (12-22) and stayed in ICU median (IQR) 3 (1-7) days. ICU mortality was 10.3%, while hospital mortality was 14.6%. Two patients satisfied the 2009 criteria (VAP rate 1.8/1000 ventilator days) while six different patients from the same cohort satisfied the 2013 criteria (VAE rate 5.6/1000 ventilator days) (Table 2).

Table 2: Characteristics of patients diagnosed with VAP/VAE

VAP 1.8/1000 ventilator days					VAE 5.6/1000 ventilator days				
VAP Classification	**AGE**	**Day**	**LOS**	**Admission Diagnosis**	**VAE Classification**	**AGE**	**Day**	**LOS**	**Admission Diagnosis**
PNU1	34	11	38	Spinal/Multi trauma	VAC	51	9	17	Neurological Encephalitis
PNU2	26	5	14	Neurological Haemorrhage/ intracranial haematoma	VAC	34	5	12	Trauma Chest/extremity
					IVAC	62	27	81	Coronary artery bypass grafting
					IVAC	32	3	28	Trauma Isolated cervical spine injury
					IVAC	46	7	25	Gastrointestinal GI Abscess/cyst
					Probable VAP	19	5	14	Trauma Isolated cervical spine

Day: Day of ICU admission when VAP/VAE diagnosis made

In this cohort of mechanically ventilated patients from a tertiary hospital there was no concordance between VAP and VAE data representing the first known report of this discrepancy in the Australian setting; this finding is consistent with international reports[11, 12] and suggests that VAP and VAE surveillance data are not interchangeable. The problem of inconsistency in diagnosis or surveillance rates has also been demonstrated across a range of six different sets of diagnostic criteria, [13] with the incidence of VAP ranging from 4 – 42%. These findings also support the notion that surveillance rates can be manipulated depending on which criteria you use and initiatives designed to increase the rigour of surveillance can have the effect of biasing VAP rates. [14] Use of both these definitions for quality surveillance has proven to be labour intensive, and given the ambiguity in both diagnosis and relationship to outcome, scrutiny of whether this is the best use of resources is essential.

A lack of consistency in surveillance rates dependent on which definitions are used means that comparison over time, or between institutions on a national or international scale, is not possible unless everyone agrees to use the same criteria. Further, use of these data in public reporting or to fund or penalise healthcare organisations is not possible until there has been development and agreement of criteria that are less subjective and examination of the subsequent impact of outcomes.[15, 16]

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