

CONCISE COMMUNICATION

Does the Specific Time of Day Used to Capture Data on Ventilator-Days Have an Impact on the Documented Rates of Ventilator-Associated Pneumonia?

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Definitions of ventilator-associated pneumonia do not note a preferred daily time for obtaining denominator data. We examined collecting data on the number of ventilator-days at different times of day in 7 intensive care units. Rates of ventilator-associated pneumonia did not significantly differ when denominator data were collected at midnight, 8 AM, or 4 PM, supporting standard definitions.

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For healthcare-associated infections (HAIs), standardized surveillance definitions are essential for consistency of measurement and comparisons of data between specific healthcare units and facilities. The definitions developed by the Centers for Disease Control and Prevention (CDC) are the recognized gold standard for defining HAIs such as ventilator-associated pneumonia (VAP).^{1,2} The CDC recommends measuring the incidence of VAP in terms of rates of complication over an appropriate denominator population that best reflects the risk of developing VAP, namely, per 1,000 ventilator-days. To determine the number of ventilator-days, the CDC recommends that data on number of patients receiving mechanical ventilation be collected daily, at the same time each day, by specific surveillance units.³ The specific time of day at which to determine the presence of a ventilator, however, is not given.

Clinicians at our institution have voiced concerns that collecting denominator data on number of ventilator-days at certain times of day (eg, midnight) may exclude persons intubated for less than 24 hours, particularly those admitted immediately after surgery, leading to falsely elevated rates of VAP. Others have argued for use of a denominator that captures all patients intubated at any time during the day, which is not recommended by the CDC. We performed an analysis to determine whether assessment of ventilator-day data at different times of day significantly impacts assessment of VAP rates at a tertiary care center.

METHODS

During the period from April 1, 2008, through September 30, 2008, data on the number of ventilator-days for 7 intensive care units (ICUs) at Vanderbilt University Medical Center

(Nashville, TN) were collected using an electronic ventilator management “dashboard” (a summary chart or scorecard noting progress on key quality indicators). This system detects all persons receiving mechanical ventilation in real time by means of electronic documentation of ventilator settings and is integrated with nurse charting, respiratory therapy charting, physician orders, and patient location information. Ventilator-days were captured for each day at midnight, 8 AM, and 4 PM and as an aggregate count of all persons receiving mechanical ventilation at any time during the day. Cases of VAP were determined prospectively by trained infection preventionists in accordance with CDC definitions.¹ VAP rates were calculated for each denominator and were compared using Poisson regression.

RESULTS

VAP rates did not significantly differ for all 7 ICUs combined or for each individual ICU whether denominator data were collected at midnight, 8 AM, or 4 PM (Tables 1 and 2). Capture of ventilator-days at 4 PM did result in a lower denominator and higher VAP rates in 5 of the 7 ICUs, but this increase was not statistically significant. Use of an aggregate count of all patients receiving mechanical ventilation during the 24-hour period resulted in significantly lower VAP rates for all ICUs combined, compared with the VAP rates calculated using denominator data captured at 8 AM or 4 PM; this finding did not reach statistical significance for individual ICUs or compared with rates with denominator data captured at midnight (Table 2).

DISCUSSION

Use of standardized definitions to assess HAI outcomes has numerous advantages. First, adherence to these definitions helps provide an internal consistency of assessment of an institution’s infection rates over time. Second, use of standardized definitions facilitates comparison of HAI data between healthcare facilities and allows for benchmarking. As more states begin public reporting of HAI outcomes, HAI definitions may come under increased scrutiny. Therefore, explicit examination of the methods used to determine infection rates is essential for providing valid interfacility comparisons.

Current guidance regarding determination of denominators for use with device-associated infections importantly notes that the assessment for device-days should occur at a consistent time each day.³ There is no requirement, however,

TABLE 1. Ventilator-Associated Pneumonia (VAP) Rates for Various Intensive Care Units (ICUs), Ascertained Using Denominator Capture at Various Times of Day

ICU (no. of VAP cases), time of day of data collection	No. of ventilator-days	No. of VAP cases per 1,000 ventilator-days
ICU A (6 cases)		
Midnight	328	18.3
8 AM	332	18.1
4 PM	311	19.3
Anytime	419	14.3
ICU B (40 cases)		
Midnight	1,476	27.1
8 AM	1,482	27.0
4 PM	1,369	29.2
Anytime	2,057	19.4
ICU C (4 cases)		
Midnight	1,228	3.3
8 AM	1,273	3.1
4 PM	1,104	3.6
Anytime	1,639	2.4
ICU D (5 cases)		
Midnight	847	5.9
8 AM	702	7.1
4 PM	786	6.4
Anytime	1,524	3.3
ICU E (7 cases)		
Midnight	893	7.8
8 AM	908	7.7
4 PM	798	8.8
Anytime	1,100	6.4
ICU F (10 cases)		
Midnight	1,273	7.9
8 AM	1,272	7.9
4 PM	1,146	8.7
Anytime	1,630	6.1
ICU G (5 cases)		
Midnight	2,113	2.4
8 AM	2,076	2.4
4 PM	2,050	2.4
Anytime	2,684	1.9
All ICUs (77 cases)		
Midnight	8,158	9.4
8 AM	8,045	9.6
4 PM	7,564	10.2
Anytime	11,053	7.0

NOTE. "Anytime" is the aggregate count of all patients receiving mechanical ventilation during the 24-hour period.

regarding a specific time for such capture (eg, at midnight). Questions regarding the appropriate time of day for capture of ventilator-days recently arose at our institution. Because of a perceived high proportion of patients intubated for a short period of time (eg, for several hours after an operative procedure), clinicians wondered whether assessment of ventilator-days at later hours of the day might lead to capture

TABLE 2. Comparison of Ventilator-Associated Pneumonia (VAP) Rates Based on Timing of Denominator Capture (All Intensive Care Units Combined)

Times of day of data collection	VAP rates ^a	IRR (95% CI)
Midnight vs 8 AM	9.4/9.6	1.0 (0.7–1.4)
Midnight vs 4 PM	9.4/10.2	1.0 (0.8–1.5)
Midnight vs anytime	9.4/7.0	1.3 (0.98–1.9)
8 AM vs 4 PM	9.6/10.2	1.0 (0.8–1.5)
8 AM vs anytime	9.6/7.0	1.4 (1.0–1.9)
4 PM vs anytime	10.2/7.0	1.5 (1.1–2.0)

NOTE. "Anytime" is the aggregate count of all patients receiving mechanical ventilation during the 24-hour period. CI, confidence interval; IRR, incidence rate ratio.

^a No. of VAP cases per 1,000 ventilator-days.

of fewer patients receiving mechanical ventilation, thus resulting in a higher VAP rate for their unit. Others argued that a more accurate assessment of the population at risk for VAP was a measurement that counted all patients intubated at any time during the entire day, a method that is not recommended by the CDC.

Our assessment, however, reassuringly noted that VAP rates did not significantly differ according to time of day of ventilator-day capture. In addition, we observed that use of an aggregate ventilator-day count to calculate VAP rates resulted in lower VAP rates in all units. These data support the CDC methodology for denominator capture, especially the lack of recommendations for using an aggregate ventilator-day count to calculate VAP rates. The advent of publicly reported HAI data may encourage healthcare facilities to explore alternative methods for defining HAIs, such as the use of an aggregate ventilator-day count that may lead to lower infection rates, compared with rates calculated by other methods. Such an aggregate denominator capture is not consistent with CDC definitions, and healthcare facilities should be discouraged from using such a denominator to calculate VAP rates.

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