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Commentary

Eight initiatives that misleadingly lower ventilator-associated pneumonia rates

Michael Klompas MD, MPH [a,b,*]

[a] Department of Population Medicine, Harvard Medical School and Harvard Pilgrim Health Care Institute, Boston, MA.
[b] Infection Control Department, Brigham and Women's Hospital, Boston, MA

Hospitals are likely to re-examine their ventilator-associated pneumonia (VAP) prevention and surveillance programs in the coming months in light of The Joint Commission's proposal to make VAP prevention a National Patient Safety Goal for 2012. Ideally, the Commission's proposal will trigger broader and more rigorous VAP prevention efforts nationwide. There is some risk, however, that efforts to enhance the rigor of VAP surveillance may undermine some of the momentum for prevention. This is because increasing the rigor of surveillance almost inevitably lowers VAP rates in and of itself despite being independent of patient care. These misleading decreases in VAP rates may lull hospitals into a false sense of complacency that could undermine motivation to enhance prevention. We describe 8 initiatives that well-intentioned hospitals might be considering to make VAP surveillance more rigorous. Each of these initiatives will lower apparent VAP rates despite not materially improving patient care.

INTERPRET CLINICAL SIGNS AS STRICTLY AS POSSIBLE

VAP assessment requires thoughtful weighing of many clinical factors. The surveillance definition includes criteria such as "worsening oxygenation," "rales," "change in the character of sputum," or "increased suctioning requirements."[1] There is wide latitude for judgment and discretion when applying these criteria because ventilated patients' clinical findings are complex and dynamic. Oxygenation, secretions, and clinical examination findings fluctuate in response to mucous plugs, position changes, transient atelectasis, and other factors. Stricter observers seeking unambiguous, sustained evidence that surveillance criteria are being met will inevitably assign fewer VAPs.

INTERPRET CHEST RADIOGRAPHS AS STRICTLY AS POSSIBLE

Radiograph interpretation is probably the most complex, subjective, and contentious part of VAP surveillance. The films themselves are often technically limited (portable studies, poor inspiration, recumbent positioning, frequently rotated, variable penetration, overlying support lines and tubes, poor visualization of the retrocardiac space, and others) and almost always abnormal. Discerning whether "opacities" represent pulmonary edema, effusions, atelectasis, hemorrhage, contusion, infarction, inflammation, fibrotic interstitial disease, or pneumonia is highly subjective.[2] Interobserver agreement between radiologists is only fair at best.[3-6] Interpreters can always reasonably argue that observed opacities are due to something other than pneumonia or that a radiograph's pre-existing opacities or technical limitations preclude meaningful interpretation. Seeking unambiguous radiologic evidence for new or progressive infiltrates invariably leads to rejection of patients with otherwise compatible clinical syndromes for VAP.[3]

REQUIRE CONSENSUS BETWEEN 2 OR MORE INFECTION PREVENTIONISTS

Very reasonable observers adjudicate the VAP surveillance criteria differently and therefore come to different conclusions. This has been borne out in studies of inter-rater variability in VAP surveillance.[4,7] In one study, for example, there was almost a 2-fold difference between surveyors in the number of VAP cases found in a common population.[7] Requiring consensus among multiple observers will lower a program's VAP rate to a level even lower than that of the strictest infection preventionist because other surveyors will inevitably argue with some of his or her determinations. In the same study alluded to above, there was a 3-fold difference in the number of cases agreed on by all observers and the case count of the most liberal observer.[7]

SEEK ENDORSEMENT OF INTENSIVISTS BEFORE "CERTIFYING" SUSPECTED CASES AS VAP

This is a partly a corollary of requiring consensus between infection preventionists and partly an independent effect. Just as infection preventionists reasonably disagree on the interpretation of dynamic clinical signs, so too will physicians.[8] The more observers permitted a veto, the lower the number of VAPs. Involving intensivists typically leads to the rejection of even more cases than involving additional infection preventionists because physicians are apt to focus on their net clinical impression of

* Address correspondence to Michael Klompas, MD, MPH, Department of Population Medicine, Harvard Medical School and Harvard Pilgrim Health Care Institute, 133 Brookline Ave, 6th Floor, Boston, MA 02215.
E-mail address: mklompas@partners.org.
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patients rather than methodically apply a surveillance definition. Physicians' clinical impressions are only confirmed at autopsy in approximately 50% to 60% of cases.[9-11]

REQUIRE BRONCHOALVEOLAR LAVAGE FOR DIAGNOSIS

Mandating positive bronchoalveolar lavage (BAL) cultures to confirm all suspected cases of VAP is deceptively alluring because it yields a quantitative result and seemingly conclusive microbiologic confirmation or refutation of infection. The ostensible objectivity of BAL makes it an attractive option to try to overcome the subjectivity of surveillance using clinical signs alone. Only a minority of patients who fit a clinical definition for VAP, however, will have positive BAL cultures. In one recent trial, for example, only 93 of 220 (42%) clinically suspected VAPs were confirmed by positive BAL cultures.[12] Requiring positive BAL cultures to confirm cases that otherwise meet the surveillance definition can therefore be predicted to drop a unit's VAP rate by 50% or more.

The cases "confirmed" by BAL are not necessarily more accurate than those detected by clinical suspicion alone. BAL sampling is prone to false negatives and false positives to an extent similar to clinical suspicion alone. False negatives can be due to prior antibiotic exposure, sampling the incorrect lung segment, or presence of fastidious organisms. False positives can be due to contamination of the BAL specimen by microorganisms colonizing the oropharynx and/or endotracheal tube. The net sensitivity and specificity of quantitative BAL culture relative to autopsy-proven pneumonia have been variously reported as 11% to 77% and 40% to 95%, respectively.[13-18] Notably, BAL diagnosis has not been shown to improve patient outcomes compared with endotracheal aspirates alone,[19] and lengths of stay and mortality for culture negative patients tend to be as bad or worse compared with culture positive patients.[20]

SET QUANTITATIVE GROWTH THRESHOLDS FOR ENDOTRACHEAL ASPIRATE AND BAL CULTURES

Setting quantitative thresholds for BAL cultures will further reduce their rate of positivity. Morris et al concretely demonstrated this in a study where endotracheal aspirate cultures and BAL cultures were acquired concurrently from a series of patients with clinically suspected VAP.[21] Qualitative endotracheal aspirates (ie, any growth) were positive in 89% of patients, quantitative endotracheal aspirates ($\geq 10^6$ colony-forming units/mL) were positive in 51%, and quantitative BAL cultures ($\geq 10^3$ colony-forming units/mL) were positive in 21% of patients with clinically suspected VAP. On the basis of these data, the investigators' hospital instituted a policy to preferentially use quantitative lavage cultures to diagnose VAP. Lavage use increased from 37% of patients to 58% in the following year, and the rate of microbiologically confirmed VAP fell accordingly from 18 to 9 cases per 1,000 ventilator-days. There was no difference in the rate of clinically suspected pneumonias or patient outcomes following the practice change, however, suggesting that the observed decrease in VAP rates was purely an artifact of the diagnostic protocol rather than a meaningful improvement in care. Meta-analysis of prospective studies comparing quantitative versus qualitative cultures affirms the absence of a clinical benefit to routinely performing quantitative cultures.[19]

TRANSFER PATIENTS WHO REQUIRE PROLONGED MECHANICAL VENTILATION

Prolonged ventilation is a primary risk factor for VAP. Transferring patients with prolonged critical illness to other institutions decreases the hospital's pool of high-risk patients. The VAP rate calculation partially adjusts for the increased likelihood of VAP among long-stay patients insofar as the rate denominator is total ventilator-days for the population. In practice, though, transferring all patients who require prolonged ventilation limits the intensive care unit's population to people with very short ventilator lengths of stay who are at very low risk of VAP. Large numbers of patients ventilated for very short periods will collectively generate a large number of ventilator-days for the denominator and very few, if any, cases for the numerator. The net effect is a very low VAP rate.

EXPAND SURVEILLANCE TO INCLUDE UNCOMPLICATED POSTOPERATIVE PATIENTS

Some smaller hospitals routinely admit postoperative patients who require a few hours to wean from mechanical ventilation to an intensive care unit. Others allow these patients to convalesce until extubation in the postanesthesia recovery room. Admitting these patients to an intensive care unit allows them to contribute to the unit's ventilator-day count. Centers for Disease Control and Prevention rules credit 1 full ventilator-day for any part of a day spent on a ventilator. Each uncomplicated postoperative patient admitted to an intensive care unit therefore contributes a full day to the hospital's VAP denominator, even if extubated within a few hours of admission. As with limiting the intensive care unit population to uncomplicated patients, the net effect is to lower the overall VAP rate by inflating the denominator with patients at very low risk of VAP.

CONCLUSION

The ultimate result of each of these initiatives is to lower the apparent VAP rate despite not doing anything to improve patients' outcomes. This is not necessarily an argument against making surveillance more rigorous but does compel hospitals to exercise great caution when interpreting surveillance figures. There is a risk that decreased VAP rates because of surveillance artifact rather than improved care may give hospitals a false impression of the impact and adequacy of their VAP prevention programs.

The long-term solution to this problem is to revise the surveillance definition to eliminate subjectivity and exclude or better quantify the contribution of patients who spend minimal time on mechanical ventilation. Until that time, institutions should consider alternative measures of the adequacy of their prevention programs. Examples include rates of adherence with process measures, average ventilator-days per patient, average lengths of stay in intensive care, mortality rates, and total antibiotic usage. Notably, The Joint Commission's proposed National Patient Safety Goal stipulates measuring and monitoring "ventilator-associated pneumonia prevention processes and outcomes" but does not specifically stipulate following VAP rates. Concentrating on objective measures instead will give a more meaningful picture of the quality of care for ventilated patients that should drive ongoing refinements in care rather than complacency in the face of misleading surveillance data.

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