Ventilator Associated Pneumonia & Bronchoscopy

This article is written for healthcare providers, but patient education materials are available. Please visit the Centers for Medicare and Medicaid Services or the Centers for Disease Control and Prevention for more information.
Despite the best infection control protocols, ventilator associated pneumonia (VAP) remains one of the most common hospital acquired infections. Approximately half of intensive care unit (ICU) patients develop some kind of nosocomial infection with nearly one-third of critically ill patients developing pneumonia. One VAP review estimates that “between 250,000 and 300,000 cases per year occur in the United States alone, which is an incidence rate of 5 to 10 cases per 1,000 hospital admissions.” This rate is corroborated in management guidelines. Globally, VAP prevalence remains at approximately 15.6% across ICU admissions.

The greatest risk factor for nosocomial pneumonia is intubation or mechanical ventilation. An infection is considered VAP if it onsets during a hospital visit, more than 48 hours after a patient received mechanical ventilation.
Ventilator-associated pneumonia (VAP) is a challenge to hospitals and health care providers alike. Myriad studies highlight ways to handle VAP, but it’s difficult to sort through often conflicting data. This document intends to provide a quick reference for critical care physicians, respiratory therapists, and other support staff charged with reducing VAP rates in the hospital. Embedded links connect readers to primary literature and endorsed guidelines.

Each section includes a brief overview and practical strategies that can be implemented at any hospital. Click the outline below to navigate:

1 Impact
Learn the latest data about how VAP can negatively impact patient length of stay, mortality rates, and care costs.

2 Causes
VAP is often polymicrobial, but there are common causative pathogens. See how pathogens can enter patient airways via contaminated respiratory equipment, including via reusable bronchoscopes.

3 Diagnosis
One of the most controversial elements of VAP is how to definitively diagnose it. Read about challenges associated with culture techniques, and why it’s important to pair them with other diagnostic strategies.

4 Prevention
Tried and true strategies to reduce VAP rates include hand hygiene, oral decontamination, and minimizing sedation. Learn how hospitals have reduced VAP rates by incorporating these strategies into patient care checklists and bundles.

5 Practical Challenges
Reprocessing respiratory equipment—including bronchoscopes—involves manual cleaning and high-level disinfection. Find out how even thorough cleaning regimens can result in contaminated equipment.

6 Standard Precautions
Learn how proper bronchoscope disinfection and handling can help keep VAP rates low.

7 Innovations
Many hospitals have developed ways to circumvent challenges associated with reusable bronchoscopes. Read more about:
- Removing secretions from endotracheal tubes,
- Implementing single-use bronchoscopes,
- Reducing ventilator circuit cleaning, and
- Minimizing antibiotic use.
**Section 1: Impact**

Some patients who develop VAP recover, but many do not. High-risk patients, such as the elderly, or patients in ICUs are most susceptible. But, precise mortality rates for VAP are difficult to calculate. Affected populations vary, from acute respiratory distress syndrome (ARDS) patients, to surgical ICU patients, to acute trauma patients—all of whom may require ventilators for varying lengths of time and have different respiratory infection susceptibilities. VAP incidence rates may also overlap with other lower respiratory tract infections, such as tracheobronchitis in critically ill patients.

Available therapies for VAP vary based on causative organisms, further complicating overall calculations. Higher mortality rates may be associated with drug-resistant infections. Across studies, mortality rates for VAP range from 0-50%! Some studies narrow the range for VAP mortality to 33-50%, but “this rate is variable and relies heavily on the underlying medical illness.” The most contemporary studies place overall VAP mortality at closer to 10%. VAP is associated with a higher crude mortality than other hospital associated infections. Mortality rates have declined in recent decades, but VAP is a persistent challenge for hospitals.

Critical patients, already at risk from their primary illness, may be more vulnerable to VAP than other populations. Children are also more susceptible than adults. Patients receiving mechanical ventilation concomitant with nasogastric feeding may be more likely to develop VAP, due to biofilm and microbial contamination on the feeding tube. Once a patient develops VAP, they are also more likely to require extended mechanical ventilation, that can worsen prognosis.

VAP is associated with considerable economic burden. A VAP diagnosis significantly extends length of stay (LOS) in the hospital and increases patient care costs. By some analyses, patients with VAP can expect to spend an extra 4.3-13 days in the hospital, costing an extra $40,000 per episode. As expected, costs vary widely based on health system. For patients at one suburban, tertiary care U.S. hospital, VAP tacks on an additional $11,897 in hospital costs per episode. At the same hospital VAP increases average ICU stay six-fold (from 4 to 26 days). Experts say VAP “is associated with a statistically significant resource utilization burden, which underscores the need for cost-effective interventions.” Regulating bodies agree. The “economic impact” of VAP is one factor that has prompted the Centers for Disease Control and Prevention to regularly update treatment recommendations.
Section 2: Causes

VAP is caused by microbial contamination in the lungs. Microbes may enter the lung during intubation or mechanical ventilation. Common species associated with VAP include (most common listed first): Pseudomonas, Staphylococcus aureus, Enterobacteriaceae, Streptococcus, Haemophilus, Acinetobacter, and Neisseria. VAP is commonly polymicrobial. Causative pathogens—and their associated drug resistance rates—vary based on hospital and geography. VAP is not normally due to fungal or virus infections in immunocompetent hosts. VAP-causing pathogens generally remain in the lung, spreading into blood or pleural space in less than 10 percent of cases.
The source of causative pathogens is another matter. Bronchoscopes, tubing, endotracheal cuffs, and other respiratory accessories and instruments can all be colonized by VAP-causing pathogens. Pathogens can also originate in the environment (air, water, fomites) or be transmitted between staff and patients. It is less likely that pathogens are directly inhaled by patients than they are introduced into the airway by healthcare devices or via aspiration.

Commonly, VAP can be traced to reusable bronchoscopes. Bronchoscopes are used to perform bronchoalveolar lavages (BALs), collect diagnostic cultures, aid sample collection, and assist intubation. They provide a look inside the airway and an open channel for other instruments to pass into the airway. Contamination can occur during procedures or any time a bronchoscope is handled. Infection from patient flora can be introduced as the bronchoscope passes through the oropharynx and into the airway. Contamination from exogenous bacteria can also occur during reusable bronchoscope cleaning, transport, or storage.

Contaminated, reused bronchoscopes may spread pathogens to subsequent patients and are a noted cause of VAP. Even with properly disinfected bronchoscopes, individual patients may experience “distal spread of organisms” that can lead to pulmonary infection. Bronchoscopes may also cause abrasions in the airway that may increase risk of microbial colonization and VAP.

Outbreaks associated with contaminated bronchoscopes can be deadly. Even the most sophisticated hospitals are not immune. In 2000, *P. aeruginosa* on bronchoscopes contributed to the deaths of three critically ill patients and caused 48 respiratory and bloodstream infections. An earlier outbreak in South Carolina led to extremely pathogenic, multidrug-resistant *Mycobacterium tuberculosis* spreading into the community. Respiratory infections like VAP occur worldwide due to contaminated bronchoscope and ventilator equipment, and prevention is a challenge for small and large hospitals alike.
Section 3: Diagnosis

There are many approaches to confirming VAP. “Diagnosing VAP remains difficult and controversial,” writes one critical care provider. “The diagnosis can be made on the basis of radiographic findings, clinical findings, results of microbiological tests of sputum, or invasive testing such as bronchoscopy.” Providers should integrate any culture results with clinical evaluation before making a VAP diagnosis. The American Thoracic Society and the Infectious Diseases Society of America outline several (bacteriologic and clinical) diagnostic strategies for VAP. Hospitals should use diagnostic approaches appropriate for the individual patient—and that are feasible for their workflow.

Quantitative cultures can help diagnose VAP. Bronchoscope-guided culture techniques, such as protected specimen brushings or BAL, can be used to collect specimens from the respiratory tract for antibiotic sensitivity testing. Bronchoscopes reach directly into the airway. This increases culture specificity, allowing providers to identify patients with a true lung infection.

While some consider BALs “essential” for VAP diagnoses, BALs are invasive, and as such carry risks including hypoxemia, bleeding, or arrhythmia. Endotracheal aspirate culture may offer a more practical approach to obtaining diagnostic cultures in critically ill patients. However, endotracheal aspirate cultures are not collected directly from the lung. Contamination from other flora is common in endotracheal cultures. Their low specificity makes it difficult to extrapolate results to VAP. Worse, VAP diagnoses based on endotracheal aspirate cultures alone could initiate inappropriate antibiotic treatment regimens that contribute to resistance.

One study compared BAL and endotracheal aspirate techniques for diagnosing VAP. Across 311 suspected VAP cases, Gram staining and semiquantitative culture results were comparable between diagnostic approaches. But, VAP incidences varied widely depending on which strategy was used for diagnosis. In the end, high BAL specificity and sensitivity led the authors to conclude BAL is preferred over aspirates “for the diagnosis, differential diagnosis, and treatment of VAP.”

Early recognition of causative pathogens is essential. Accurate microbial identification informs appropriate antibiotic therapy and thus may determine outcome. But providers should not rely on cultures alone for VAP diagnosis. Respiratory fluid sampling is necessary, but not always specific. Respiratory tract cultures for VAP diagnosis can be compromised by bronchiolitis, or oropharyngeal contamination. It’s important to pair any culture results with other clinical observations, as there is no “gold standard” VAP diagnosis technique. If a provider suspects VAP, they should move quickly to select an appropriate strategy, based on the most recent recommendations, to confirm diagnosis and initiate treatment. Current guidelines state “failure to initiate prompt appropriate and adequate therapy has been a consistent factor associated with increased mortality.”
**Section 4: Prevention**

The best way to prevent VAP is to avoid intubation, or other invasive respiratory procedures whenever possible. Noninvasive positive pressure ventilation is not appropriate for all patients, but this strategy decreases LOS and mortality rates as compared to invasive ventilation. Intubation and mechanical ventilation increase pneumonia risk so significantly (6 to 21-fold) that clinical guidelines state these interventions “should be avoided whenever possible.”

For patients who must undergo mechanical ventilation, consistent and thorough hand hygiene is a tried and true strategy to prevent VAP. All healthcare personnel must wash their hands not only after patient contact, but before and after contact with a patient’s respiratory equipment or respiratory secretions. Even if gloves are used, staff should wash hands before and after donning them. One meta-analysis found enhanced hand washing protocols lowered VAP risk by up to 65.5%. Regular hand washing audits can help encourage compliance. One hospital found that announced hand hygiene audits reduced VAP rates by 59%. Incorporating alcohol-based hand rubs into care protocols can also lower VAP incidence, although to a lesser degree than hand washing. Combination strategies are optimal, such as those that include hand washing protocols, alcohol-based disinfectant dispensers placed near each ICU bed, and foot-activated sinks. Implementing these three strategies simultaneously reduced overall VAP mortality from 44.3% to 32.5% at one hospital.

In general, VAP prevention centers around reducing microbial colonization and aspiration in ventilated patients. Early intervention is most effective, as VAP risk is highest early on in ventilation and decreases over time. Reducing colonization begins with the intubation route. Oral intubation is associated with lower VAP rates than nasal intubation. Secretions are common in the upper airways of patients receiving mechanical ventilation. If transmitted to the airway, secretions can cause VAP. Elevating the head of the bed to 30-45° is a simple, common strategy that improves drainage.

Oral decontamination should be ongoing. Oral hygiene, from tooth brushing to thoroughly suctioning secretions from the mouth, decreases oropharynx colonization by potentially harmful pathogens. Antibiotic oral rinses can also reduce colonization rates. Secretions may pool in elements of the ventilator equipment, such as the tube cuff. This presents a hazard for patients and places them at risk of aspiration. Endotracheal tubes with subglottic secretion drainage ports should be used for patients expected to require multiple days of mechanical ventilation. These ports, used for suction, help keep tubes clear of secretions and have been shown to reduce VAP rates by 55%. Oral care programs have been shown to be a cost-effective way to reduce VAP rates in ICUs.
Minimizing sedation can also lower VAP rates. Providers should avoid prescribing sedatives unless absolutely necessary, instead relying on other pain management approaches or antipsychotics when indicated. Sedation medications are immunosuppressive and may put mechanically ventilated patients at increased risk for VAP. Many experts recommend daily sedation interruptions for mechanically ventilated patients. These “sedation vacations” can reduce mechanical ventilation days for patients and LOS, lowering their risk of VAP. This could be due in part to the fact that a break from sedatives provides a window for patients to show they can breathe independently. “Patients are more likely to pass a spontaneous breathing trial and be extubated if they are maximally awake at the time of the breathing trial,” writes one group of providers. Daily sedative interruptions can help providers properly evaluate patients for extubation. Reassuringly, a study of 2,553 mechanically ventilated patients found “daily sedation vacations” did not lead to patient-initiated, unplanned extubation.

Hospitals often choose to “bundle” common VAP prevention strategies into single interventions (see sidebar). With thoughtful procedure selection, evidence suggests bundles can lower VAP rates. One study of 120 Belgian ICUs cut VAP rates from 28% of ventilated patients to 10.1% over six years by implementing a bundle. The VAP bundle included: assessment of sedation, endotracheal cuff pressure control, oral care with chlorhexidine, and semirecumbent position. More comprehensive bundles, that integrate process surveillance in addition to prevention practice interventions, are also effective. One study of 11 hospitals in Argentina successfully reduced VAP rates by 52% across 14 ICUs with such an approach.

ICU patients have benefitted from VAP bundles that include daily rounding checklists. Checklists serve as a guide for hospital staff and include common interventions such as hand hygiene, aspiration prophylaxis, sedation checks, respiratory device checks, and prophylactic medications. In one Taiwanese hospital, a comprehensive bundle checklist helped cut VAP incidence by over half across 27,125 surgical ICU patients. Checklists are one measure that can support hospital staff charged with spearheading VAP bundle programs. Identifying a nurse champion for a VAP bundle program may also help maximize its efficacy. One high-volume U.S. ICU team emphasized “developing nurse and physician champions is vital” when implementing VAP and other bundles. The team successfully increased bundle compliance by using nurse and physician champions. They also noted “the support of our medical director, associate director of clinical nursing, and administration leadership along with staff involvement [was] a key factor to our success.”

There are many studies highlighting benefits of VAP bundles, but each bundle is different. VAP bundle components remain controversial. Data to support VAP interventions are not yet comprehensive and VAP definitions still vary from hospital to hospital. Hospitals may want to develop VAP bundles “using a systematic approach to elicit clinician perceptions on potential interventions,” writes one clinical care team. By following this approach, the team identified 65 possible interventions! Hospitals seeking clinician input may have similar, potentially overwhelming results. Yet the team found “obtaining clinician input on what interventions to include increases the likelihood that providers will adhere to the bundle.”

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Tried-and-true strategies are published to help hospitals narrow lists of VAP prevention measures into manageable bundles. The Institute for Healthcare Improvement describes several evidence-based VAP prevention measures in a how-to guide for hospitals interested in creating VAP bundles. The Society for Healthcare Epidemiology of America also regularly updates VAP prevention guidelines.
Many VAP prevention measures may seem elementary to experienced providers. Yet the most effective strategies are often small interventions. A comprehensive review urges: “The clinician must give careful attention to the mundane and seemingly small interventions, such as regularly assessing endotracheal cuff pressure, performing endotracheal suctioning, draining ventilator tube condensate, avoiding gastric overdistention, avoiding the supine position, avoiding unnecessary ventilator circuit changes, application of heat and moisture exchangers (HMEs) when appropriate, minimizing out-of-ICU transports, and regular hand cleaning with soap or alcohol disinfectant.” Together, these are tried-and-true strategies to prevent VAP.
Section 5: Practical Challenges

Bronchoscopes are one of the most commonly used instruments in the hospital. Their frequent use and high cost necessitate reprocessing. But a brand new, reusable bronchoscope can cost hospitals upwards of $20,000—not to mention ongoing repair costs and accessories. As technology advances, costs have climbed to accommodate video capabilities and high-precision lenses. These new features require delicate components that may be more susceptible to damage. Fragile components are also more difficult to clean. Still, every bronchoscopy must begin with a clean, disinfected instrument.

Bronchoscopes have myriad niches that can foster microbial growth. Suction valves, channels, and tubing are stubborn sources of contamination. These areas resist traditional cleaning methods and are difficult to scrub. The instruments also have many moving parts. Over time, loose caps and ports may shelter organisms from disinfection. “Bronchoscopes are designed with narrow working channels, ports with obtuse angles, and linings vulnerable to damage and subsequent biofilm formation, forming obstacles to proper cleaning and disinfection or sterilization,” writes one team of providers. Each bronchoscope requires different cleaning strategies based on its features. Bronchoscopes contaminated with hepatitis, human immunodeficiency virus, or mycobacteria, will also require different cleaning regimens.

Any contamination on a bronchoscope has the potential to infect the airway and could lead to VAP. But not all patients need bronchoscopies for the same reason—some may have pulmonary hemorrhage, ulcers, or lesions that put them at increased risk for infection by contaminated bronchoscopes. Others may have acute trauma elsewhere in the body but healthy airways that place them at lower risk of infection. Hospitals are faced with implementing bronchoscope reprocessing protocols that cover everyone. These will vary by disinfectants used, bronchoscopy volume, and facilities available.

Unfortunately, most reusable bronchoscopes cannot tolerate the same autoclave temperatures and disinfectants that other instruments can. They must be reprocessed in a step-wise fashion that requires meticulous manual cleaning followed by treatment in a designated reprocessing machine. This approach is exceptionally time-consuming. The Food and Drug Administration recommends, at a minimum, that bronchoscopes undergo “high-level disinfection” with a liquid disinfectant containing glutaraldehyde, peracetic acid, hydrogen peroxide, and/or orthophthaldehyde. Specific guidelines are ever-changing but updated online. The FDA considers bronchoscopes “semi critical” as they come in contact with mucus membranes. They do not require sterilization, as with surgical equipment, but they must be disinfected. Some thought leaders suggest...
that endoscopes—including bronchoscopes—be upgraded to “critical” devices that require sterilization. One study found that even when reprocessing protocols align with current CDC guidelines, contamination remains. “A shift toward the use of sterilized bronchoscopes is recommended,” wrote the authors.

Manual pre-cleaning is paramount immediately after a bronchoscopy. Automated reprocessors cannot remove all contaminants on their own. After transportation to the reprocessing area, detailed manual cleaning precedes high-level disinfection to remove biologic matter before it has a chance to dry. Hospital staff must remove bronchoscope attachments, scrub the outside of the scope, and use custom brushes to get inside channels. The bronchoscope must be immersed in detergent to check for leaks. All cleaning swabs, brushes, and water must be discarded after use. Reused brushes have caused outbreaks. Poor adherence to reprocessing protocols can be deadly. One outbreak of drug-resistant M. tuberculosis was due to a single bronchoscope that was never immersed in disinfectant. A review of 14 M. tuberculosis outbreaks in caused by contaminated bronchoscopes point to other causes, most commonly non-sterile rinse water and over-reliance on automated reprocessors.

After manual cleaning, bronchoscopes should be connected to automated reprocessors. These machines run high-level disinfectants through the instrument (that must be rinsed off afterward). Yet not all bronchoscopes are compatible with all automated reprocessors. And even automated reprocessors can become contaminated. Biofilms in reprocessors resist even aggressive cleaning measures. When one group had a Mycobacterium chelonae biofilm in their hospital bronchoscope reprocessor, they tried introducing sterile water in wash and rinse cycles, increasing disinfectant exposure duration, and replacing disinfectant. It wasn’t until they manually rinsed bronchoscopes exiting the reprocessor with 70% alcohol that they could eliminate the outbreak strain.

It’s important to note that reprocessing bronchoscopes does not always decontaminate them. Even when following guidelines exactly, contamination can persist. One study found 58% of bronchoscopes used across three study sites had microbial contamination after disinfection procedures. The study sites regularly—and unknowingly—used damaged, contaminated scopes during procedures. Reprocessing bronchoscopes is also tedious. It also requires careful coordination between bronchoscopists, nurses, ancillary staff, infection control practitioners, and instrument manufacturers. All team members must stay up to date on published guidelines and communicate to recognize adherence breaches and ensure patient safety. Poor adherence to reprocessing guidelines puts patients at risk for serious infection, including VAP.
Section 6: Standard Precautions

With nearly 500,000 bronchoscopies performed annually in the United States, human error is unavoidable. But there are many ways a bronchoscopist or bronchoscopy team can minimize the risk of VAP associated with bronchoscopies.

Proper bronchoscope disinfection and handling can help keep VAP numbers low. Although reprocessing protocols can be extensive, they are a tried and true method to keep infection rates low. Revising disinfection protocols to keep up with current recommendations, or in response to outbreaks, can also improve outcomes.

Automated reprocessors deserve special attention. Reprocessing staff should check that machines are properly penetrating bronchoscope channels during disinfection. By checking for proper connectors and bronchoscope-reprocessor compatibility, staff can ensure automated reprocessors are operating efficiently. Reprocessors should be examined regularly for contamination. “Although the inside of the devices is periodically disinfected, water supply tanks, tubing, and pumps are not in contact with disinfectant. These areas may serve as reservoirs for contaminating pathogens,” cautions one group. Bronchoscopy teams can regularly disinfect these elements to reduce biofilm formation. With regular maintenance, automated reprocessors can ensure cleaning consistency and eliminate human errors.

Even after manual and automated cleaning, staff can take additional measures to prevent VAP. Bronchoscopes exit automated reprocessors wet. They must be rinsed in non-contaminated water and hung to dry. Staff should not reassemble bronchoscopes until they are fully dry. Post-reprocessing is a prime opportunity for contamination. Hand hygiene, while often emphasized at point of care, is paramount even when transporting scopes to and from storage. The most common contaminants found on bronchoscopes in storage are skin flora species, suggesting improper handling. Even traditionally non-pathogenic bacteria put patients at risk if introduced to the respiratory tract.

Bronchoscopists can also routinely review microbiologic data looking for unexpected clusters or trends. Although costly, this is one way to check for effective bronchoscope reprocessing protocols. Hospitals should formulate surveillance plans that include which bronchoscope components to sample, and the significance of different organisms and bacterial burdens. These will vary based upon bronchoscopy volume and ICU patient population. Proper overall VAP surveillance stratified by outcome and causative organism can help identify infection control breaches. Extensive guidance is available from the Association for Professionals in Infection Control and Epidemiology, including example surveillance forms and calculators.
Many hospitals have developed ways to circumvent challenges associated with reusable bronchoscopes. Each could help reduce VAP rates:

**Removing secretions from endotracheal tubes.** Endotracheal tubes can contain stagnant secretions that contribute to biofilm formation. New devices that insert into endotracheal tubes can help wipe tubes clear of blockages and contamination. In one study, tubes treated with a wiping device every eight hours showed reduced mucus accumulation, and reduced colonization by VAP-causing bacteria. Devices that combine wiping with endotracheal tube suction may further help reduce bacterial colonization, but additional trials are needed to confirm this.

**Implementing single-use bronchoscopes.** Single-use bronchoscopes eliminate challenges associated with reprocessing. Simplified instruments, single-use bronchoscopes provide basic functionality and may be easier to operate than their reusable counterparts. They require less prep time and may quicken procedures in the ICU. Their cost-effectiveness depends upon bronchoscopy load at a given hospital. Providers should consider reprocessing and repair costs associated with reusable bronchoscopes in cost-effectiveness calculations. More broadly, they must consider costs associated with cross-contamination and VAP. Single use bronchoscopes are not single patient. These scopes cannot be disinfected and stored for reuse in the same patient—even simply to check tube placement—without risk. They are designed for a single procedure. Single-use accessories should be handled similarly. Accessories such as disposable bronchoscope suction valves may also help minimize cross-contamination in the bronchoscopy suite.

**Reducing ventilator circuit cleaning.** A perhaps counterintuitive innovation, studies have shown less is more when it comes to ventilator circuit cleaning. More frequent flushes do not affect VAP incidence. There is still a risk of circuit contamination from patient secretions, but this risk does not outweigh the risk of contamination associated with increased circuit handling and processing. Current guidelines from The Society for Healthcare Epidemiology of America indicate ventilator circuits should only be changed when they are visibly contaminated or malfunctioning.

**Minimizing antibiotic use.** Antibiotic prophylaxis has also undergone an overhaul when it comes to mechanically ventilated patients. “Antibiotics have fallen out of favor as a way to prevent VAP in a unit, due to fears that the drugs will progressively alter the host gastrointestinal flora and lead to superinfections with multidrug-resistant organisms,” note infection control specialists. These fears are appropriate, given the sheer volume of antibiotics now prescribed in ICUs. Approximately half of all antibiotics administered in ICUs are to treat VAP. Antibiotic treatment duration is also changing. One randomized trial of 401 VAP patients found no difference in mortality rates, or mechanical ventilation days, when comparing 8- and 15-day courses. Current guidelines align with these findings, and encourage providers to tailor antibiotic regimens to results of lower respiratory tract cultures, and shorten duration of therapy to the minimal effective therapy.

These innovations are encouraging. Overall, while VAP is a persistent challenge for hospitals, mortality associated with the complication are declining. New strategies are evolving to prevent colonization, aspiration, and infection in mechanically ventilated patients. More data to support certain methods are certainly needed, but hospitals are already beginning to identify novel approaches that have true impact on VAP rates.
VAP is front of mind for any experience critical care staff member. It affects enormous swaths of ICU patients worldwide and can be deadly. It is also preventable in many cases. Hospital staff can learn from thousands of published case studies, clinical trials, and retrospective reviews. Each offers an insight into new ways to prevent, diagnose, and treat VAP. In many cases, small changes to infection control protocols, including inside the bronchoscopy suite, can reduce VAP. There are also several emerging approaches to reducing VAP risk that include procedure and equipment alternatives. Hospitals can customize approaches to meet their unique needs, and ultimately, reduce VAP caused by bronchoscopy.

For more information about ways to reduce VAP rates in the hospital, please visit the Centers for Medicare and Medicaid Services or the Centers for Disease Control and Prevention.