

# AHRQ Safety Program for Improving Antibiotic Use

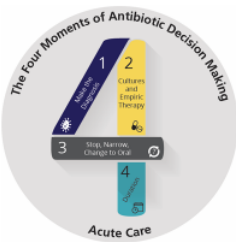
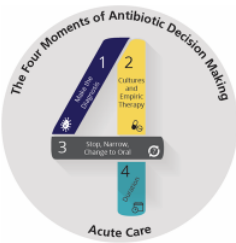


## Best Practices in the Diagnosis and Treatment of Ventilator-Associated Pneumonia

### Acute Care

Slide Title and Commentary	Slide Number and Slide
<p><b>Best Practices in the Diagnosis and Treatment of Ventilator-Associated Pneumonia</b></p> <p>SAY:</p> <p>This presentation is titled “Best Practices in the Diagnosis and Treatment of Ventilator-Associated Pneumonia.”</p>	<p><b>Slide 1</b></p>
<p><b>Objectives</b></p> <p>SAY:</p> <p>This presentation will address:</p> <ol style="list-style-type: none"> <li>1. The approach to diagnosing ventilator-associated pneumonia (VAP)</li> <li>2. Empiric treatment recommendations for VAP</li> <li>3. Opportunities for de-escalation of antibiotic therapy for VAP after additional clinical and microbiological data are available</li> <li>4. Reasonable durations of antibiotic therapy for VAP</li> </ol>	<p><b>Slide 2</b></p>



Slide Title and Commentary	Slide Number and Slide
<p><b>The Four Moments of Antibiotic Decision Making</b></p> <p>SAY:</p> <p>As we discuss the diagnosis and treatment of VAP, we will continue to use the Four Moments of Antibiotic Decision Making framework.</p> <p>As a reminder, Moment 1 asks: Does my patient have an infection that requires antibiotics?</p> <p>Moment 2 consists of two questions and asks: Have I ordered appropriate cultures before starting antibiotics? What empiric therapy should I initiate?</p> <p>Moment 3 consists of three questions and asks: A day or more has passed. Can I stop antibiotics? Can I narrow therapy, or change from intravenous to oral therapy?</p> <p>And finally, Moment 4 asks: What duration of therapy is needed for my patient’s diagnosis?</p>	<p><b>Slide 3</b></p> <p>The Four Moments of Antibiotic Decision Making</p>  <ol style="list-style-type: none"> <li>1. Does my patient have an infection that requires antibiotics?</li> <li>2. Have I ordered appropriate cultures before starting antibiotics? What empiric therapy should I initiate?</li> <li>3. A day or more has passed. Can I stop antibiotics? Can I narrow therapy or change from IV to oral therapy?</li> <li>4. What duration of antibiotic therapy is needed for my patient's diagnosis?</li> </ol> <p>AHRQ Safety Program for Improving Antibiotic Use – Acute Care</p> <p>VAP 3</p>
<p><b>The Four Moments of Antibiotic Decision Making</b></p> <p>SAY:</p> <p>The first moment of the Four Moments of Antibiotic Decision Making asks the question, “Does my patient have an infection that requires antibiotics?”</p>	<p><b>Slide 4</b></p> <p>The Four Moments of Antibiotic Decision Making</p>  <ol style="list-style-type: none"> <li>1. Does my patient have an infection that requires antibiotics?</li> </ol> <p>AHRQ Safety Program for Improving Antibiotic Use – Acute Care</p> <p>VAP 4</p>

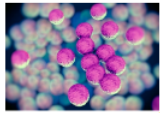
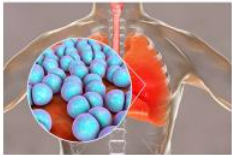
Slide Title and Commentary	Slide Number and Slide
<p><b>Moment 1: Diagnosing VAP</b></p> <p>SAY:</p> <p>VAP occurs 48 hours or more after endotracheal intubation. VAP presents with increased purulent tracheal secretions, a new infiltrate on chest imaging, and worsening oxygenation. It is also usually associated with fever or hypothermia and leukocytosis.</p> <p>Diagnosing VAP can be challenging because there are several reasons why a patient can have respiratory decompensation while mechanically ventilated, such as mucus plugs, pulmonary embolisms, and volume overload.</p> <p>Additionally, there are several reasons why a patient may have abnormalities on chest imaging, such as aspiration pneumonitis, atelectasis, and volume overload; thus, the diagnosis is not always straightforward. It is important to remember that even if antibiotics for suspected VAP are initiated, antibiotic decisions should be reviewed on a daily basis during an antibiotic time out.</p> <p>Also note that the clinical diagnosis for VAP differs from National Healthcare Safety Network or NHSN surveillance definitions for ventilator-associated events including infection-related ventilator-associated complications and possible VAP.</p>	<p><b>Slide 5</b></p> <p>Moment 1: Diagnosing VAP</p> <ul style="list-style-type: none"> <li>VAP: pneumonia occurring 48 hours or more after endotracheal intubation<sup>1</sup> <ul style="list-style-type: none"> <li>Increased, purulent tracheal secretions</li> <li>New infiltrate on chest imaging</li> <li>Worsening oxygenation               <ul style="list-style-type: none"> <li>Usually with fever/hypothermia and leukocytosis</li> </ul> </li> </ul> </li> </ul>  <p>AHRQ Safety Program for Improving Antibiotic Use – Acute Care</p> <p>VAP 5</p>
<p><b>The Four Moments of Antibiotic Decision Making</b></p> <p>SAY:</p> <p>During Moment 2 ask, “Have I ordered appropriate cultures before starting antibiotics? What empiric therapy should I initiate?”</p>	<p><b>Slide 6</b></p> <p>The Four Moments of Antibiotic Decision Making</p> <ol style="list-style-type: none"> <li>Does my patient have an infection that requires antibiotics?</li> <li>Have I ordered appropriate cultures before starting antibiotics? What empiric therapy should I initiate?</li> </ol>  <p>AHRQ Safety Program for Improving Antibiotic Use – Acute Care</p> <p>VAP 6</p>

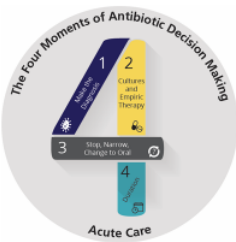

Slide Title and Commentary	Slide Number and Slide
<p><b>Moment 2: Microbiologic Diagnosis</b></p> <p>SAY:</p> <p>Common organisms implicated in VAP include <i>Staphylococcus aureus</i>, <i>Pseudomonas aeruginosa</i>, and other gram-negative bacilli. <i>Legionella</i> should be considered for hospitalized patients but particularly those who are immunocompromised or severely ill. Enterococci and <i>Candida</i> species are often isolated from the sputum but generally represent contaminants and should not be treated with anti-infectives in the majority of patients.</p> <p>It is important to remember that VAP occurs after 48 hours or more of intubation. If patients develop pneumonia before this time, they are not considered to have VAP. Patients who develop pneumonia before 48 hours of intubation are most likely infected with organisms such as <i>Streptococcus pneumoniae</i> or <i>Haemophilus influenzae</i>.</p>	<p><b>Slide 7</b></p> <p><b>Moment 2: Diagnosing VAP</b></p> <ul style="list-style-type: none"> <li>• Common organisms include: <ul style="list-style-type: none"> <li>– <i>Staphylococcus aureus</i>, <i>Pseudomonas aeruginosa</i>, and other Gram-negative bacilli</li> </ul> </li> <li>• Role of other organisms <ul style="list-style-type: none"> <li>– <i>Legionella</i> should be considered, particularly in immunocompromised patients or severely ill patients</li> <li>– Enterococci and <i>Candida spp.</i> are often isolated from the sputum but generally represent contaminants and should not be treated with anti-infectives</li> </ul> </li> <li>• Remember: If patients develop pneumonia within 48 hours of intubation, they do not have VAP. <ul style="list-style-type: none"> <li>– Common organisms: <i>Streptococcus pneumoniae</i>, <i>Haemophilus influenzae</i></li> </ul> </li> </ul> <p><small>AHRQ Safety Program for Improving Antibiotic Use – Acute Care</small></p> <p><small>VAP 7</small></p>

Slide Title and Commentary	Slide Number and Slide
<p><b>Moment 2: Obtaining Microbiologic Specimens for VAP</b></p> <p>SAY:</p> <p>The 2016 Infectious Diseases of America (or IDSA) and American Thoracic Society (or ATS) Clinical Practice Guidelines for management of VAP recommend use of noninvasive culture techniques such as endotracheal aspirates over invasive techniques like bronchoscopy because they can be performed more rapidly than invasive sampling, with fewer complications and resources. If cultures cannot be obtained with noninvasive sampling, invasive methods should be considered.</p> <p>Respiratory specimens should be sent for Gram stain and bacterial culture. VAP is unlikely when the bacterial burdens are below 1,000 CFU/mL for protected specimen brush samples, less than 10,000 CFU/mL for bronchoscopic alveolar lavage fluid, and less than 100,000 CFU/mL for endotracheal aspirates.</p> <p>Blood cultures may be positive in up to 15 percent of patients, so are reasonable to obtain when VAP is suspected.</p> <p>Hospitalized patients are at risk for <i>Legionella</i> pneumonia. A <i>Legionella</i> urinary antigen should be considered for severely ill patients or immunocompromised patients.</p>	<p><b>Slide 8</b></p> <p><b>Moment 2: Diagnostic Tests for VAP</b></p> <ul style="list-style-type: none"> <li>• Noninvasive culture techniques such as endotracheal aspirate are recommended over invasive techniques like bronchoscopy<sup>1</sup> <ul style="list-style-type: none"> <li>– Send respiratory specimen for Gram stain and culture</li> </ul> </li> <li>• VAP is unlikely with bacterial burdens below the following thresholds <ul style="list-style-type: none"> <li>– Protected specimen brush &lt;1,000 CFU/mL</li> <li>– Bronchoscopic alveolar lavage fluid &lt;10,000 CFU/mL</li> <li>– Endotracheal aspirate &lt;100,000 CFU/mL</li> </ul> </li> <li>• Blood cultures may be positive in up to 15% of patients</li> <li>• Obtain <i>Legionella</i> urinary antigen if concerns for <i>Legionella</i></li> </ul> <p><small>AHRQ Safety Program for Improving Antibiotic Use – Acute Care</small></p> <p><small>VAP 8</small></p>


Slide Title and Commentary	Slide Number and Slide
<p><b>Moment 2: Empiric Therapy for VAP</b></p> <p>SAY:</p> <p>The 2016 IDSA/ATS Guidelines recommend that two antipseudomonal agents from different classes should be considered as empiric therapy for suspected VAP in patients at risk for antibiotic-resistant organisms. For patients without risk factors for antibiotic resistance, a single anti-pseudomonal agent can be used.</p> <p>One approach is to administer an agent such as cefepime or piperacillin-tazobactam as empiric therapy for suspected cases of VAP. The addition of an aminoglycoside or ciprofloxacin or levofloxacin to cefepime or piperacillin/tazobactam—or, alternatively, the use of an anti-pseudomonal carbapenem like meropenem or imipenem/cilastatin as monotherapy should be considered for severely ill patients, patients who recently received either cefepime or piperacillin-tazobactam, or patients who previously had Gram-negative organisms recovered which were resistant to either cefepime or piperacillin-tazobactam.</p> <p>For patients with severe penicillin allergy, consider the use of aztreonam, ciprofloxacin, or levofloxacin. If the patient is severely ill, consider adding an aminoglycoside to these agents. Vancomycin or linezolid is recommended for Gram-positive coverage unless levofloxacin is part of the regimen because neither aztreonam, aminoglycosides, nor ciprofloxacin provide Gram-positive coverage. Of note, as fluoroquinolones have coverage against <i>Legionella</i>, for patients receiving fluoroquinolone therapy, additional coverage is not needed to target <i>Legionella</i>.</p>	<p><b>Slide 9</b></p> <p><b>Moment 2: Empiric Therapy for VAP</b></p> <ul style="list-style-type: none"> <li>• Cefepime (± aminoglycoside or ciprofloxacin or levofloxacin if severely ill) ± vancomycin or linezolid<sup>1</sup></li> <li>• Piperacillin-tazobactam (± aminoglycoside or ciprofloxacin or levofloxacin if severely ill) ± vancomycin or linezolid<sup>1</sup></li> <li>• Recent receipt of cefepime or piperacillin-tazobactam or recovery of pathogens resistant to these agents: anti-pseudomonal carbapenems (meropenem, imipenem) ± vancomycin or linezolid<sup>1</sup></li> <li>• Severe penicillin allergy: Aztreonam or ciprofloxacin or levofloxacin (+ vancomycin or linezolid if aztreonam or ciprofloxacin are used)<sup>1</sup></li> <li>• Concern for <i>Legionella</i>: add azithromycin only to regimens that do not contain fluoroquinolones</li> </ul> <p><small>AHRQ Safety Program for Improving Antibiotic Use – Acute Care</small></p> <p><small>VAP 9</small></p>




Slide Title and Commentary	Slide Number and Slide
<p><b>Moment 2: Empiric Therapy for VAP</b></p> <p>SAY:</p> <p>The 2016 IDSA/ATS guidelines recommend the addition of targeted methicillin-resistant <i>Staphylococcus aureus</i> or MRSA therapy when there is a reasonable proportion of patients colonized with MRSA locally—when at least 20 percent of <i>S. aureus</i> isolates from a unit are methicillin resistant.</p> <p>It can be difficult to obtain these data, and they may not reflect an individual patient’s risk of MRSA colonization. Thus, other patient-level risk factors should prompt the initiation of empiric anti-MRSA VAP therapy. These include a known history of MRSA colonization or infection, intravenous drug use, the presence of necrotizing pneumonia, an ill-appearing patient with a recent stay in a nursing home or skilled nursing facility, or a patient with a prolonged hospitalization with an unknown MRSA colonization status.</p> <p>A meta-analysis including 32 studies and over 5,000 patients investigated the diagnostic value of MRSA nasal swab results in predicting the likelihood of MRSA pneumonia. The investigators found that the negative predictive value of the swab was 97 percent; meaning that if the swab was negative for MRSA, there was a 97 percent chance that MRSA was not the cause of pneumonia during that same hospitalization.</p>	<p><b>Slide 10</b></p> <p><b>Moment 2: Empiric Therapy for VAP</b></p> <ul style="list-style-type: none"> <li>• When should I add anti-MRSA coverage on an empiric basis? <ul style="list-style-type: none"> <li>– High local prevalence of MRSA</li> <li>– Known patient history of MRSA colonization or infection<sup>2,3</sup></li> <li>– Intravenous drug use</li> <li>– Necrotizing pneumonia</li> <li>– Ill-appearing patient with a recent stay in a nursing home or skilled nursing facility</li> <li>– Prolonged hospitalization with unknown MRSA colonization status</li> </ul> </li> </ul>  <p>AHRQ Safety Program for Improving Antibiotic Use – Acute Care</p> <p>VAP 10</p>
<p><b>Vancomycin vs. Linezolid?</b></p> <p>SAY:</p> <p>Both vancomycin and linezolid are reasonable options for MRSA coverage for pulmonary infections. At least four meta-analyses of randomized controlled trials have shown that use of vancomycin versus linezolid for the treatment of MRSA pulmonary infections yield similar outcomes.</p> <p>Daptomycin is inactivated by pulmonary surfactant and is not a suitable option for the treatment of pneumonia.</p>	<p><b>Slide 11</b></p> <p><b>Vancomycin vs. Linezolid?</b></p> <ul style="list-style-type: none"> <li>• Both vancomycin and linezolid are reasonable options for MRSA coverage for pulmonary infections<sup>4,5,6,7</sup></li> <li>• At least 4 meta-analyses of randomized controlled trials have shown use of vancomycin versus linezolid for the treatment of MRSA pulmonary infections yield similar outcomes</li> <li>• Daptomycin is inactivated by pulmonary surfactant and is not a suitable option for the treatment of pneumonia</li> </ul>  <p>AHRQ Safety Program for Improving Antibiotic Use – Acute Care</p> <p>VAP 11</p>

Slide Title and Commentary	Slide Number and Slide
<p><b>The Four Moments of Antibiotic Decision Making</b></p> <p>SAY: Moment three occurs after a day or more has passed. Ask: Can I stop antibiotics? Can I narrow therapy or change from intravenous or IV to oral therapy?</p>	<p><b>Slide 12</b></p> <p>The Four Moments of Antibiotic Decision Making</p>  <ol style="list-style-type: none"> <li>1. Does my patient have an infection that requires antibiotics?</li> <li>2. Have I ordered appropriate cultures before starting antibiotics? What empiric therapy should I initiate?</li> <li>3. A day or more has passed. Can I stop antibiotics? Can I narrow therapy or change from IV to oral therapy?</li> </ol> <p>AHRQ Safety Program for Improving Antibiotic Use – Acute Care</p> <p>VAP 12</p>
<p><b>Moment 3: De-escalation of VAP Therapy</b></p> <p>SAY:</p> <p>In patients for whom an alternate diagnosis is identified, stop VAP-targeted therapy.</p> <p>If VAP is the likely diagnosis, use respiratory culture results to direct therapy. Determine if the beta-lactam agent you started can be narrowed. If anti-MRSA coverage was added empirically, discontinue it if MRSA was not recovered. If an aminoglycoside or fluoroquinolone was added to the beta-lactam, discontinue if an appropriate beta-lactam is available for treatment.</p> <p><i>S. aureus</i> and Gram-negative bacilli grow easily in culture. If these organisms are not isolated, coverage for methicillin-resistant <i>S. aureus</i> and multidrug-resistant Gram-negative bacilli can be discontinued.</p>	<p><b>Slide 13</b></p> <p>Moment 3: De-escalation of VAP Therapy</p> <ul style="list-style-type: none"> <li>• In patients for whom an alternate diagnosis is identified, stop VAP-targeted therapy</li> </ul>  <ul style="list-style-type: none"> <li>• If VAP is the likely diagnosis, use respiratory culture results to narrow therapy</li> </ul> <p>AHRQ Safety Program for Improving Antibiotic Use – Acute Care</p> <p>VAP 13</p>

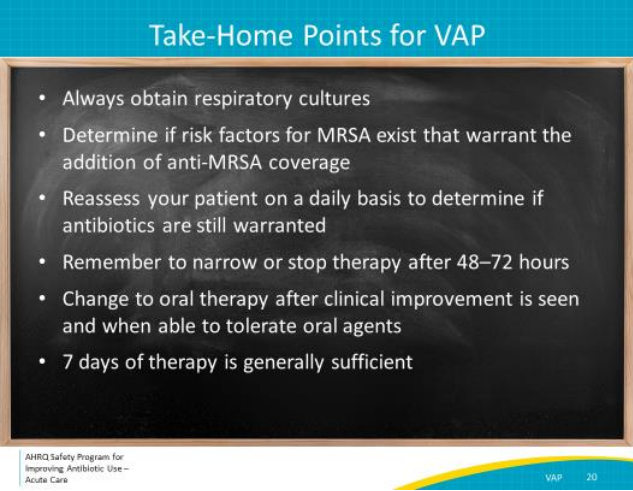
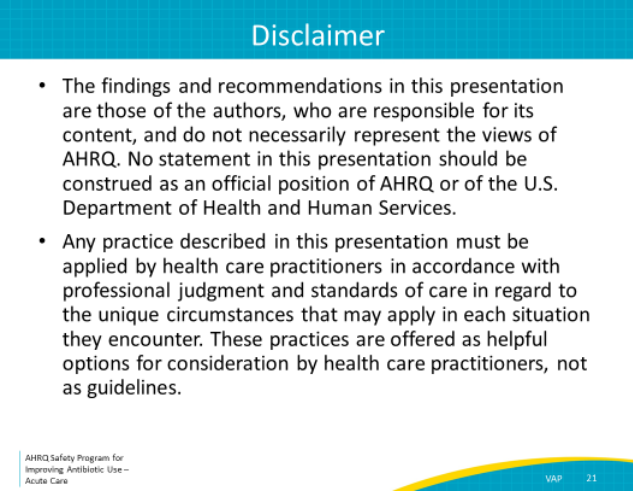


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<p><b>Reassessing the Decision To Treat for VAP</b></p> <p>SAY:</p> <p>The diagnosis of VAP can be ambiguous, and it is reasonable to initiate therapy early even when uncertain of the diagnosis. It is important, however to reassess this decision daily.</p> <p>If a patient initiated on therapy for presumed VAP shows rapid recovery and is able to be weaned from a ventilator within a day or two, the diagnosis of VAP is unlikely, and it is reasonable to discontinue antibiotics.</p> <p>Patients with stable serial ventilator settings may be able to have antibiotics discontinued early. In a study of 1,290 patients, patients with minimal and stable ventilator settings were treated with 1 to 3 days versus greater than 3 days of antibiotics. The two groups had similar comorbidities and clinical presentations. There were no differences between the groups with regards to time to extubation or mortality.</p> <p>Evaluating serial ventilator settings may help clinicians identify candidates for early antibiotic discontinuation.</p>	<p><b>Slide 14</b></p> <p><b>Reassessing the Decision To Treat for VAP</b></p> <ul style="list-style-type: none"> <li>Serial evaluations of ventilator settings can assist with determining when to discontinue antibiotic therapy<sup>8</sup></li> </ul>  <p>AHRQ Safety Program for Improving Antibiotic Use – Acute Care</p> <p>VAP 14</p>																					
<p><b>Meta-analyses Evaluating Combination Therapy for <i>Pseudomonas</i> Infections</b></p> <p>SAY:</p> <p>In the past, some have advocated for combination therapy for <i>Pseudomonas aeruginosa</i> infections based on studies where aminoglycosides were used as monotherapy. However, aminoglycoside monotherapy is now discouraged for the treatment of infections other than urinary infections as bacteria can develop resistance to these agents relatively quickly. Additionally, aminoglycosides don't penetrate some body sites very efficiently when administered systemically, including lung tissue.</p> <p>Combination therapy has not been shown to improve the outcomes of patients with invasive Pseudomonal infections if a single agent with good activity against <i>Pseudomonas</i> is available.</p>	<p><b>Slide 15</b></p> <p><b>Meta-analyses Evaluating Combination Therapy for <i>Pseudomonas</i> Infections</b></p> <table border="1" data-bbox="867 1230 1463 1545"> <thead> <tr> <th>Study</th> <th>Design</th> <th>Clinical outcomes* OR/RR (95% CI)</th> </tr> </thead> <tbody> <tr> <td>Paul 2002<sup>9</sup> Cochrane</td> <td>68 RCTs</td> <td>Mortality: 0.87 (0.34-2.24) Clinical failure: 1.41 (0.90-2.22)</td> </tr> <tr> <td>Paul 2003<sup>10</sup> BMJ</td> <td>47 RCTs</td> <td>Mortality: 0.78 (0.24-2.56) Clinical failure: 1.46 (0.23-9.41)</td> </tr> <tr> <td>Paul 2004<sup>11</sup> BMJ</td> <td>64 RCTs</td> <td>Mortality: 1.50 (0.70-32.84) Clinical failure: 1.01 (0.68-1.49)</td> </tr> <tr> <td>Paul 2006<sup>12</sup> Cochrane</td> <td>64 RCTs, observational</td> <td>Clinical failure: 1.02 (0.68-1.51)</td> </tr> <tr> <td>Marcus 2011<sup>13</sup> J Antimicrob Ag</td> <td>52 RCTs</td> <td>Mortality: 3.18 (0.49-20.65) Clinical failure: 1.55 (1.24-1.93)</td> </tr> <tr> <td>Safdar 2004<sup>14</sup> Lancet Infect Dis</td> <td>17 observational</td> <td>Mortality: 1.50 (1.30-1.79)</td> </tr> </tbody> </table> <p>*Comparing monotherapy with combination therapy in adult patients</p> <p>AHRQ Safety Program for Improving Antibiotic Use – Acute Care</p> <p>VAP 15</p>	Study	Design	Clinical outcomes* OR/RR (95% CI)	Paul 2002 <sup>9</sup> Cochrane	68 RCTs	Mortality: 0.87 (0.34-2.24) Clinical failure: 1.41 (0.90-2.22)	Paul 2003 <sup>10</sup> BMJ	47 RCTs	Mortality: 0.78 (0.24-2.56) Clinical failure: 1.46 (0.23-9.41)	Paul 2004 <sup>11</sup> BMJ	64 RCTs	Mortality: 1.50 (0.70-32.84) Clinical failure: 1.01 (0.68-1.49)	Paul 2006 <sup>12</sup> Cochrane	64 RCTs, observational	Clinical failure: 1.02 (0.68-1.51)	Marcus 2011 <sup>13</sup> J Antimicrob Ag	52 RCTs	Mortality: 3.18 (0.49-20.65) Clinical failure: 1.55 (1.24-1.93)	Safdar 2004 <sup>14</sup> Lancet Infect Dis	17 observational	Mortality: 1.50 (1.30-1.79)
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<p><b>Moment 3: Oral Step-Down Therapy for VAP</b></p> <p>SAY:</p> <p>After a patient shows clinical improvement and the ability to tolerate oral medications, switch to oral therapy. If <i>Pseudomonas</i> has been isolated in cultures, consider ciprofloxacin or levofloxacin, if susceptible. If pseudomonal coverage is not needed because <i>Pseudomonas</i> has not been isolated, consider agents like second- or third-generation oral cephalosporins or amoxicillin-clavulanate, based on culture results.</p> <p>If a patient has a severe penicillin allergy, consider a respiratory fluoroquinolone such as levofloxacin or moxifloxacin.</p> <p>If MRSA has been isolated, consider clindamycin, trimethoprim/sulfamethoxazole, or linezolid based on culture results.</p> <p>After the patient shows clinical improvement and the ability to tolerate oral medications, antibiotic therapy should be adjusted based on susceptibility results, if available.</p>	<p><b>Slide 16</b></p> <p><b>Moment 3: Oral Step-Down Therapy for VAP</b></p> <ul style="list-style-type: none"> <li>• After patient shows clinical improvement and the ability to tolerate oral medications <ul style="list-style-type: none"> <li>– If pseudomonal coverage needed: consider ciprofloxacin or levofloxacin (based on susceptibility results)</li> <li>– If pseudomonal coverage <b>not</b> needed: consider second- or third-generation oral cephalosporin or amoxicillin-clavulanate (based on susceptibility results)</li> <li>– Severe penicillin allergy: respiratory fluoroquinolone</li> <li>– If MRSA coverage is needed: clindamycin, trimethoprim/sulfamethoxazole, or linezolid (based on susceptibility results)</li> </ul> </li> </ul> 
<p><b>The Four Moments of Antibiotic Decision Making</b></p> <p>SAY:</p> <p>The fourth moment of antibiotic decision making is asking the question, “What duration of antibiotic therapy is needed for my patient's diagnosis?”</p>	<p><b>Slide 17</b></p> <p><b>The Four Moments of Antibiotic Decision Making</b></p>  <ol style="list-style-type: none"> <li>1. Does my patient have an infection that requires antibiotics?</li> <li>2. Have I ordered appropriate cultures before starting antibiotics? What empiric therapy should I initiate?</li> <li>3. A day or more has passed. Can I stop antibiotics? Can I narrow therapy or change from IV to oral therapy?</li> <li>4. What duration of antibiotic therapy is needed for my patient's diagnosis?</li> </ol> 

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<p><b>A Week of Antibiotic Therapy Is Sufficient</b></p> <p>SAY:</p> <p>Generally, a week of antibiotic therapy is sufficient for the treatment of VAP.</p> <p>In a double-blind clinical trial conducted in 51 French intensive care units or ICUs that included 401 patients with VAP, patients were randomized to 8 or 15 days of antibiotic therapy.</p> <p>As indicated on the survival curve, there was no difference in all-cause mortality comparing the 8-day and 15-day groups. Furthermore, there was no difference in mechanical ventilation-free days or length of ICU stay.</p> <p>Importantly, multidrug-resistant bacteria emerged less frequently in patients receiving 8 days of antibiotics compared with those received 15 days. Although this study did not specifically evaluate 7 days of antibiotics for VAP, most clinicians extrapolate the findings from this study to indicate that 7 days of therapy for VAP is sufficient. The IDSA/ATS guidelines recommend 7 days of antibiotic therapy for most cases of VAP.</p>	<p><b>Slide 18</b></p> <p><b>A Week of Antibiotic Therapy Is Sufficient<sup>15</sup></b></p> <ul style="list-style-type: none"> <li>• A week of antibiotic therapy is sufficient for the treatment of VAP.</li> <li>• In a double-blind clinical trial conducted in 51 French ICUs, patients were randomized to 8 or 15 days of antibiotic therapy.</li> <li>• There was no difference in all-cause mortality or length of ICU stay comparing the 8-day and 15-day groups.</li> <li>• Multidrug-resistant bacteria emerged less frequently in patients receiving 8 days of antibiotics compared with those received 15 days.</li> </ul>  <p>AHRQ Safety Program for Improving Antibiotic Use – Acute Care</p> <p>VAP 18</p>

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<p><b>Improving VAP Management at Your Hospital</b></p> <p>SAY:</p> <p>The diagnosis of VAP causes significant clinical challenge given that respiratory symptoms can be multifactorial. Antibiotic stewardship teams and providers can take steps to minimize inappropriate treatment and optimize treatment for patients with true pneumonia.</p> <p>First, ensuring respiratory cultures are sent for all patients with suspected VAP whenever possible is critical to streamline therapy and discontinue antibiotics that are no longer needed.</p> <p>Even if MRSA nasal surveillance swab data are not routinely obtained in your hospital, they should be considered for patients for whom anti-MRSA coverage has been initiated to assist with de-escalation—particularly for providers uncomfortable discontinuing MRSA coverage in these settings.</p> <p>Patients who are otherwise healthy with suspected pneumonia that has occurred within 72 hours of hospitalization are more likely to be infected with common respiratory pathogens like <i>Streptococcus pneumoniae</i> or <i>Haemophilus influenzae</i> and unlikely to be infected with <i>Pseudomonas</i>. Ceftriaxone or ampicillin/sulbactam is a reasonable treatment option for these patients. Moxifloxacin can be considered for these low-risk patients if they have serious penicillin allergies.</p> <p>Finally, continued emphasis on shorter courses of therapy for VAP —7 days—is often needed because providers may be unaware of studies supporting this duration. A process should be put in place to ensure that an end date is noted in the medical record before patients are transferred out of the intensive care unit to the floor.</p>	<p><b>Slide 19</b></p> <p>Improving VAP Management at Your Hospital</p> <ul style="list-style-type: none"> <li>• Respiratory cultures should be sent for all patients with suspected VAP, whenever possible.</li> <li>• If MRSA nasal surveillance swab data are not available, they should be considered for patients for whom anti-MRSA coverage has been initiated to assist with de-escalation.</li> <li>• Ceftriaxone or ampicillin/sulbactam are reasonable treatment options for low-risk patients. <ul style="list-style-type: none"> <li>– Moxifloxacin can be considered for patients with serious penicillin allergies.</li> </ul> </li> </ul> <p>AHRQ Safety Program for Improving Antibiotic Use – Acute Care</p> <p>VAP 19</p>

Slide Title and Commentary	Slide Number and Slide
<p><b>Take Home Points for VAP</b></p> <p>SAY:</p> <p>To summarize some important take-home points for VAP:</p> <ul style="list-style-type: none"> <li>• Always obtain a respiratory sample for Gram stain and culture.</li> <li>• Determine if risk factors for MRSA exist that warrant the addition of anti-MRSA coverage</li> <li>• As the diagnosis of VAP is challenging, reassess your patient on a daily basis to determine if antibiotics are still warranted</li> <li>• Remember to narrow or stop therapy after 48–72 hours</li> <li>• Change to oral therapy after clinical improvement is observed and when able to tolerate oral agents</li> <li>• Seven days of therapy is generally sufficient</li> </ul>	<p><b>Slide 20</b></p>  <p><b>Take-Home Points for VAP</b></p> <ul style="list-style-type: none"> <li>• Always obtain respiratory cultures</li> <li>• Determine if risk factors for MRSA exist that warrant the addition of anti-MRSA coverage</li> <li>• Reassess your patient on a daily basis to determine if antibiotics are still warranted</li> <li>• Remember to narrow or stop therapy after 48–72 hours</li> <li>• Change to oral therapy after clinical improvement is seen and when able to tolerate oral agents</li> <li>• 7 days of therapy is generally sufficient</li> </ul> <p>AHRQ Safety Program for Improving Antibiotic Use – Acute Care</p> <p>VAP 20</p>
<p><b>Disclaimer</b></p> <p>SAY:</p> <p>The findings and recommendations in this presentation are those of the authors, who are responsible for its content, and do not necessarily represent the views of AHRQ. No statement in this presentation should be construed as an official position of AHRQ or of the U.S. Department of Health and Human Services.</p> <p>Any practice described in this presentation must be applied by health care practitioners in accordance with professional judgment and standards of care in regard to the unique circumstances that may apply in each situation they encounter. These practices are offered as helpful options for consideration by health care practitioners, not as guidelines.</p>	<p><b>Slide 21</b></p>  <p><b>Disclaimer</b></p> <ul style="list-style-type: none"> <li>• The findings and recommendations in this presentation are those of the authors, who are responsible for its content, and do not necessarily represent the views of AHRQ. No statement in this presentation should be construed as an official position of AHRQ or of the U.S. Department of Health and Human Services.</li> <li>• Any practice described in this presentation must be applied by health care practitioners in accordance with professional judgment and standards of care in regard to the unique circumstances that may apply in each situation they encounter. These practices are offered as helpful options for consideration by health care practitioners, not as guidelines.</li> </ul> <p>AHRQ Safety Program for Improving Antibiotic Use – Acute Care</p> <p>VAP 21</p>

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<p><b>References</b></p>	<p><b>Slide 22</b></p> <p style="text-align: center;"><b>References</b></p> <ol style="list-style-type: none"> <li>1. Kalil AC, Metersky ML, Klompas M, et al. Executive Summary: Management of adults with hospital-acquired and ventilator-associated pneumonia: 2016 Clinical Practice Guidelines by the Infectious Diseases Society of America and the American Thoracic Society. <i>Clin Infect Dis</i>. 2016 Sep 1;63(5):e61-e111. PMID: 27418577.</li> <li>2. Parente DM, Cunha CB, Mylonakis E, et al. The clinical utility of methicillin resistant <i>Staphylococcus aureus</i> (MRSA) nasal screening to rule out MRSA pneumonia: a diagnostic meta-analysis with antimicrobial stewardship implications. <i>Clin Infect Dis</i>. 2018 Jun 18;67(1):1-7. PMID: 29340593.</li> <li>3. Wooten DA, Winston LG. Risk factors for methicillin-resistant <i>Staphylococcus aureus</i> in patients with community-onset and hospital-onset pneumonia. <i>Respir Med</i>. 2013 Aug;107(8):1266-70. PMID: 23756035.</li> <li>4. Vardakas KZ, Mavros MN, Roussos N, et al. Meta-analysis of randomized controlled trials of vancomycin for the treatment of patients with gram-positive infections: focus on the study design. <i>Mayo Clin Proc</i>. 2012 Apr;87(4):349-63. PMID: 22469348.</li> </ol> <p>AHRQ Safety Program for Improving Antibiotic Use – Acute Care <span style="float: right;">VAP 22</span></p>
<p><b>References</b></p>	<p><b>Slide 23</b></p> <p style="text-align: center;"><b>References</b></p> <ol style="list-style-type: none"> <li>5. Walkey AJ, O'Donnell MR, Wiener RS. Linezolid vs glycopeptide antibiotics for the treatment of suspected methicillin-resistant <i>Staphylococcus aureus</i> nosocomial pneumonia: a meta-analysis of randomized controlled trials. <i>Chest</i>. 2011 May;139(5):1148-1155. PMID: 20864609.</li> <li>6. Kalil AC, Klompas M, Haynatzki G, et al. Treatment of hospital-acquired pneumonia with linezolid or vancomycin: a systematic review and meta-analysis. <i>BMJ Open</i>. 2013 Oct 14;3(10):e003912. PMID: 24127058.</li> <li>7. Kalil AC, Murthy MH, Hermsen ED, et al. Linezolid versus vancomycin or teicoplanin for nosocomial pneumonia: a systematic review and meta-analysis. <i>Crit Care Med</i>. 2010 Sep;38(9):1802-8. PMID: 20639754.</li> <li>8. Klompas M, Li L, Menchaca JT, et al. Ultra-short-course antibiotics for patients with suspected ventilator-associated pneumonia but minimal and stable ventilator settings. <i>Clin Infect Dis</i>. 2017 Apr 1;64(7):870-6. PMID: 28034888.</li> <li>9. Paul M, Soares-Weiser K, Grozinsky S, et al. Beta-lactam versus beta-lactam-aminoglycoside combination therapy in cancer patients with neutropenia. <i>Cochrane Database Syst Rev</i>. 2002;(2):CD003038. PMID: 12076467.</li> </ol> <p>AHRQ Safety Program for Improving Antibiotic Use – Acute Care <span style="float: right;">VAP 23</span></p>
<p><b>References</b></p>	<p><b>Slide 24</b></p> <p style="text-align: center;"><b>References</b></p> <ol style="list-style-type: none"> <li>10. Paul M, Soares-Weiser K, Leibovici L. Beta lactam monotherapy versus beta lactam-aminoglycoside combination therapy for fever with neutropenia: systematic review and meta-analysis. <i>BMJ</i>. 2003 May 24;326(7399):1111. PMID: 12763980.</li> <li>11. Paul M, Benuri-Silbiger I, Soares-Weiser K, et al. Beta lactam monotherapy versus beta lactam-aminoglycoside combination therapy for sepsis in immunocompetent patients: systematic review and meta-analysis of randomised trials. <i>BMJ</i>. 2004 Mar 20;328(7441):668. PMID: 14996699.</li> <li>12. Paul M, Silbiger I, Grozinsky S, et al. Beta lactam antibiotic monotherapy versus beta lactam-aminoglycoside antibiotic combination therapy for sepsis. <i>Cochrane Database Syst Rev</i>. 2006 Jan 25;(1):CD003344. PMID: 16437452.</li> <li>13. Marcus R, Paul M, Elphick H, et al. Clinical implications of <math>\beta</math>-lactam-aminoglycoside synergism: systematic review of randomised trials. <i>Int J Antimicrob Agents</i>. 2011 Jun;37(6):491-503. PMID: 21292449.</li> <li>14. Safdar N, Handelsman J, Maki DG. Does combination antimicrobial therapy reduce mortality in Gram-negative bacteraemia? A meta-analysis. <i>Lancet Infect Dis</i>. 2004 Aug;4(8):519-27. PMID: 15288826.</li> </ol> <p>AHRQ Safety Program for Improving Antibiotic Use – Acute Care <span style="float: right;">VAP 24</span></p>



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References 4	<p data-bbox="846 218 971 254"><b>Slide 25</b></p> <div data-bbox="846 254 1479 317" style="background-color: #0099cc; color: white; text-align: center; padding: 5px;">References</div> <p data-bbox="883 338 1446 401">15. Chastre J, Wolff M, Fagon JY, et al. Comparison of 8 vs 15 days of antibiotic therapy for ventilator-associated pneumonia in adults: a randomized trial. <i>JAMA</i>. 2003 Nov 19;290(19):2588-98. PMID: 14625336.</p> <div data-bbox="867 705 976 743" style="font-size: small;">AHRQ Safety Program for Improving Antibiotic Use – Acute Care</div> <div data-bbox="1235 705 1479 743" style="text-align: right; font-size: small;">VAP 25</div>