Treatment of Hospital-Acquired and Ventilator-Associated Pneumonia - Adult - Inpatient Clinical Practice Guideline

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Introduction
Hospital-acquired pneumonia (HAP) and ventilator-associated pneumonia (VAP) account for approximately 22% of all hospital-acquired infections.[1] VAP mortality is estimated at 13% and HAP patients (particularly those requiring ICU care) have similarly poor prognoses.[2-5] VAP patients have prolonged hospital stays and subsequently increased healthcare costs. HAP is associated with serious complications including respiratory failure, pleural effusions, septic shock, renal failure, and empyema in over 50% of cases.[3,6,7] Accurate diagnosis and early empiric therapy have the potential to improve patient outcomes in HAP and VAP. Appropriate antibiotic de-escalation and duration of therapy minimize the emergence of antibiotic adverse drug events and antibiotic resistance.

Scope
Intended Users: Physicians, Advanced Practice Providers, Nurses, Pharmacists and Respiratory Therapists

Objective: To provide evidence-based recommendations for the treatment of hospital-acquired and ventilator-associated pneumonia

Target Population: Adult inpatients (excluding patients with cystic fibrosis) with suspected or confirmed hospital-acquired and ventilator-associated pneumonia

Clinical Questions Considered:
- What diagnostic methods may be useful in guiding the treatment of HAP and VAP?
- Which antibiotics should be used for the empiric treatment of HAP and VAP?
- What is the optimal duration of antibiotic therapy for patients treated for HAP and VAP?
- How can exposure to unnecessary antibiotic therapy and patient harm be reduced in patients with HAP and VAP?
- What are the differences in treatment approach between aspiration pneumonitis and aspiration pneumonia?

Definitions
1. **Hospital-acquired pneumonia (HAP):** Pneumonia occurring 5 days or more after hospital admission not associated with mechanical ventilation and not incubating at the time of hospital admission.[8]
2. **Ventilator-associated pneumonia (VAP):** Pneumonia occurring over 48 hours after endotracheal intubation.[8]
3. **Ventilator-associated tracheobronchitis (VAT):** Fever with no other recognizable cause, new or increased sputum production and positive endotracheal aspirate (>10^6 CFU/mL) yielding a new bacteria and no radiographic evidence of pneumonia.[8]
4. **Community-acquired bacterial pneumonia (CABP or CAP):** Pneumonia occurring prior to admission or up to 5 days after admission, that is typically caused by standard respiratory bacteria.[9-12]
5. **Severe community-acquired pneumonia:** Pneumonia with a CURB-65 score ≥3, PSI/PORT score >130 or pneumonia requiring treatment in an intensive care unit (ICU).[10,13,14]
6. **Aspiration pneumonia:** Pneumonia occurring after the inhalation of colonized oropharyngeal contents with increased risk for an anaerobic burden of microrganisms.[15]
7. **Aspiration pneumonitis:** Chemical lung injury precipitated by inhalation of sterile gastric contents. Although often confused with CABP, only one quarter of patients with macroaspiration events leading to pneumonitis develop a superimposed bacterial pneumonia (typically 2 to 7 days after the event).[16]
8. **Double coverage:** Refers to two antibiotics, typically from separate classes, which cover *Pseudomonas aeruginosa* or other Gram-negative bacteria with the intent to increase the likelihood of choosing an antibiotic which has susceptibility against the bacteria (e.g. cefepime and tobramycin).
9. **Combination therapy:** Refers to two antibiotics that cover different bacteria (e.g. vancomycin covering methicillin-resistant *Staphylococcus aureus* and cefepime covering *Pseudomonas aeruginosa*).

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Recommendations

1. **Microbiologic methods to guide the treatment of HAP and VAP**
    1.1. In patients with HAP, an expectorated sputum sample is recommended for Gram stain and culture prior to administration or within 24 hours of antimicrobial initiation, to allow for de-escalation of therapy and reduce the risk of the emergence of multi-drug resistant (MDR) organisms.[8,17-19] *(UW Health GRADE very low quality evidence, conditional recommendation)*
        1.1.1. If unable to obtain an expectorated sample within 4 hours, it is reasonable to consider collection of an induced sputum. *(UW Health GRADE very low quality evidence, conditional recommendation)*
        1.1.2. We suggest that patients with suspected HAP (non-VAP) be treated according to the results of microbiologic studies performed on respiratory samples obtained noninvasively, rather than being treated empirically.[8] *(IDSA/ATS GRADE weak recommendation, very low quality evidence)*
        1.1.3. For patients who are unable to provide a noninvasive respiratory culture, it is reasonable to consider more invasive sampling with BAL or mini-BAL to guide treatment of HAP.[20] *(UW Health GRADE low quality evidence, conditional recommendation)*
    1.2. In patients with VAP, it is reasonable to consider invasive sampling with BAL or mini-BAL to guide antimicrobial therapy rather than endotracheal aspirates or brushings.[20] *(UW Health GRADE very low quality evidence, conditional recommendation)*
        1.2.1. Noninvasive sampling with semiquantitative cultures is the preferred methodology to diagnose VAP; however, the panel recognizes that invasive quantitative cultures will occasionally be performed by some clinicians. For patients with suspected VAP whose invasive quantitative culture results are below the diagnostic threshold for VAP [BAL with <10^4 CFU/mL], we suggest that antibiotics be withheld rather than continued.[8] *(IDSA/ATS GRADE weak recommendation, very low quality evidence)*
            1.2.1.1. Diagnostic thresholds should consider length of antibiotic therapy prior to performance of invasive sampling. *(UW Health GRADE very low quality evidence, conditional recommendation)*
        1.2.2. If invasive sampling cannot be performed, it may be reasonable to obtain respiratory cultures noninvasively, including an induced sputum. *(UW Health GRADE very low quality evidence, conditional recommendation)*
    1.3. For patients with HAP or VAP, in a scenario where invasive and noninvasive sampling cannot be performed, MRSA PCRs (nares and throat) may be collected to facilitate early de-escalation of anti-MRSA antibiotic therapy.[21] *(UW Health GRADE low quality evidence, conditional recommendation)*
        1.3.1. It may be reasonable to use extra caution when swabbing the nares for MRSA PCRs in transsphenoidal and facial fracture patients to prevent injury. Swabs are only recommended to be inserted one to two centimeters into the nostril. (*UW Health GRADE very low quality evidence, conditional recommendation*)
            1.3.1.1. Refer to UW Health MRSA/MSSA Nasal PCR Specimen Collection Guide for further information on proper swab technique.
    1.4. For patients with suspected HAP/VAP, we recommend using clinical criteria alone, rather than using serum PCT plus clinical criteria, to decide whether or not to initiate antibiotic therapy.[8] *(IDSA/ATS GRADE strong recommendation, moderate-quality evidence)*
    1.5. For patients with suspected HAP/VAP, we recommend using clinical criteria alone rather than using CRP plus clinical criteria, to decide whether or not to initiate antibiotic therapy.[8] *(IDSA/ATS GRADE weak recommendation, low quality evidence)*
    1.6. For patients with suspected HAP/VAP, we suggest using clinical criteria alone, rather than using CPIS plus clinical criteria, to decide whether or not to initiate antibiotic therapy.[8] *(IDSA/ATS GRADE weak recommendation, low quality evidence)*
    1.7. It is reasonable to consider collecting blood samples per UW Health policy (Policy 2.5.6: Blood Cultures for Adult Patients) and to send for culture in patients with HAP and VAP. *(UW Health GRADE very low quality evidence, strong recommendation)*

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1.7.1. If blood cultures are to be collected, they should be collected before antibiotics are administered but should not delay therapy in patients with severe disease (e.g. septic shock).[10,22,23] *(UW Health GRADE low quality evidence, strong recommendation)*

2. **Empiric Therapy for HAP and VAP**
    2.1. We recommend that empiric antibiotic regimens be based upon the local distribution (antibiogram) of pathogens associated with HAP and VAP and their antimicrobial susceptibilities.[8] *(No IDSA/ATS quality or strength of recommendation provided)*
    2.2. In patients with VAT, we suggest not providing antibiotic therapy.[8] *(IDSA/ATS weak recommendation, low quality evidence)*
    2.3. In patients with suspected HAP or VAP, we recommend including coverage for S. aureus, P. aeruginosa, and other gram negative bacilli in all empiric regimens.[8] *(UW Health GRADE very low quality evidence, strong recommendation)*
    2.4. Empiric coverage for MRSA should include intravenous vancomycin.[8] *(UW Health GRADE very low quality evidence, strong recommendation)*
        2.4.1. Empiric anti-MRSA antimicrobial therapy may continue for 24 to 48 hours, but should be de-escalated based on clinical improvement, respiratory culture results, and/or MRSA PCR results.[8,21] *(UW Health GRADE moderate quality evidence, strong recommendation)*
            2.4.1.1. If MRSA PCR of the nares and throat are negative, agents targeting MRSA should be discontinued. The negative predictive value of these two tests in pneumonia is greater than 95%.[21,24] *(UW Health GRADE moderate quality evidence, conditional recommendation)*
            2.4.1.2. Since the positive predictive value of positive MRSA PCR is only 35%, the continuation of anti-MRSA therapy should be based on clinical status, the results of respiratory cultures and clinician judgement, rather than a positive MRSA PCR alone.[21,24] *(UW Health GRADE moderate quality evidence, conditional recommendation)*
    2.5. Previous respiratory culture data should be considered when choosing empiric antibiotics.[25,26] *(UW Health GRADE moderate quality evidence, strong recommendation)*
    2.6. Empiric coverage for *Pseudomonas aeruginosa* should include cefepime, piperacillin-tazobactam, or meropenem in patients without a contraindication.[8,27] *(UW Health GRADE low quality evidence, strong recommendation)*
        2.6.1. Cefepime is a reasonable first-line option for empiric *Pseudomonas aeruginosa* coverage in most patients. *(UW Health GRADE very low quality evidence, conditional recommendation)*
        2.6.2. In patients who have a lung abscess or suspected aspiration pneumonia (increased need for anaerobic coverage) or in patients who are predisposed to seizures, it may be reasonable to choose piperacillin-tazobactam or meropenem for empiric coverage of *Pseudomonas aeruginosa* over cefepime.[8,28] *(UW Health GRADE moderate quality evidence, conditional recommendation)*
        2.6.3. For patients with HAP/VAP who are being treated empirically, we recommend not using an aminoglycoside as the sole antipseudomonal agent.[8,29] *(UW Health GRADE low quality evidence, strong recommendation)*
        2.6.4. If a patient presents with septic shock, double coverage for *Pseudomonas aeruginosa* with two agents from different classes (aminoglycosides, beta-lactams, fluoroquinolones) may be considered on a patient-specific basis if there is concern for multidrug-resistant pathogens. Automatic double coverage for *Pseudomonas aeruginosa* for all patients with severe sepsis/septic shock may not be clinically necessary.[22] *(UW Health GRADE low quality evidence, conditional recommendation)*
            2.6.4.1. It may be reasonable to consider linezolid over vancomycin for anti-MRSA therapy in the scenario that an aminoglycoside is chosen as part of double-coverage in a patient with acute renal failure. *(UW Health GRADE very low quality evidence, strong recommendation)*

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2.7. For patients with HAP/VAP, we suggest that antibiotic dosing be determined using pharmacokinetic and pharmacodynamic data, rather than the manufacturer's prescribing information.[8] *(IDSA/ATS GRADE weak recommendation, very low quality evidence)*

    2.7.1. Refer to UW Health [Pharmacokinetic and Pharmacodynamic Dose Optimization of Antibiotics for the Treatment of Gram-Negative Infections – Adult – Inpatient/Emergency Department Clinical Practice Guideline](#).

3. Empiric HAP and VAP Therapy for Patients with Beta-Lactam Allergies

3.1. Switching to alternative antibiotics based on a patient reported beta-lactam allergy may adversely affect patient outcomes.[30-32] Alternative agents may have lower efficacy, cause more adverse effects (e.g. *C. difficile* infection), treat too broadly (contributing to increased drug resistance), and be associated with increased costs.[33,34]

3.2. In patients with reported beta-lactam allergies, critical evaluation of the allergy using UW Health [Treatment of Patients with Reported Allergies to Beta-Lactam Antibiotics – Adult – Inpatient Clinical Practice Guideline](#) is suggested.[35] *(UW Health GRADE moderate quality evidence, strong recommendation)*

    3.2.1. If the patient's beta-lactam reaction was severe (hemolysis, Stevens-Johnson Syndrome, toxic epidermal necrolysis, etc) or IgE-mediated (immediate urticaria, angioedema, anaphylaxis), avoidance of beta-lactam antibiotics is recommended.[36] *(UW Health GRADE moderate quality evidence, strong recommendation)*

3.3. It is reasonable to consider aztreonam in place of a beta-lactam in patients with severe or IgE-mediated beta-lactam allergies.[8,37] *(UW Health GRADE low quality evidence, conditional recommendation)*

    3.3.1. Fluoroquinolone use may be considered as empiric treatment if there are no other viable options. *(UW Health GRADE very low quality evidence, conditional recommendation)*

3.4. Empiric coverage for MRSA should still include intravenous vancomycin in patients with beta-lactam allergies.[38] *(UW Health GRADE moderate quality evidence, strong recommendation)*

4. Definitive Therapy for HAP and VAP

4.1. For patients with HAP/VAP, we suggest that antibiotic therapy be de-escalated (directing antimicrobial therapy to the identified pathogen(s) when microbiological testing identifies a respiratory isolate) rather than fixed.[8] *(IDSA/ATS GRADE weak recommendation, very low quality evidence)*

4.2. De-escalation of antimicrobial therapy to the narrowest spectrum antimicrobial possible based on factors such as the patient's clinical status, respiratory isolate(s), culture and susceptibility data, severity of infection, and allergies is recommended. *(UW Health GRADE very low quality evidence, strong recommendation)*

4.3. Vancomycin is recommended as definitive treatment of MRSA HAP or VAP in patients without a contraindication.[8] *(UW Health GRADE very low quality evidence, strong recommendation)*

    4.3.1. Linezolid may be considered for patients with a BMI greater than 40 kg/m^2, acute renal failure, concomitant nephrotoxic medications (e.g. tobramycin), elevated isolate vancomycin MIC (≥2), or when treatment is expected to continue beyond 14 days.[8,39] *(UW Health GRADE low quality evidence, conditional recommendation)*

4.4. For patients with HAP/VAP due to *P. aeruginosa*, we recommend that the choice of an antibiotic for definitive therapy be based upon the results of antimicrobial susceptibility testing.[8] *(IDSA/ATS strong recommendation, low-quality evidence)*

    4.4.1. For patients with HAP/VAP due to P. aeruginosa who are not in septic shock or at a high risk for death, and for whom the results of antibiotic susceptibility testing are known, we recommend monotherapy using an antibiotic to which the isolate is susceptible rather than combination therapy.[8] *(IDSA/ATS GRADE strong recommendation, low quality evidence)*

    4.4.2. For patients who remain in septic shock or at a high risk for death when the results of antibiotic susceptibility testing are known, we suggest combination therapy [double

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coverage] using two antibiotics to which the isolate is susceptible, rather than monotherapy.[8] *(IDSA/ATS GRADE weak recommendation, very low quality evidence)*

4.4.3. For patients with HAP/VAP due to P. aeruginosa, we recommend against aminoglycoside monotherapy.[8] *(IDSA/ATS GRADE strong recommendation, very low quality evidence)*

4.5. For patients with HAP/VAP due to ESBL-producing gram-negative bacilli, we recommend that the choice of an antibiotic for definitive therapy be based upon the results of antimicrobial susceptibility testing and patient-specific factors (e.g. allergies, comorbidities).[8] *(IDSA/ATS GRADE strong recommendation, very low quality evidence)*

4.5.1. Antimicrobial treatment based on MIC values and clinical laboratory standards institute (CLSI) interpretation is recommended in ESBL HAP or VAP. Clinically improved and clinically stable patients with low MIC values to piperacillin-tazobactam or cefepime could receive piperacillin-tazobactam or cefepime for the treatment of ESBL Gram-negative bacilli.[8,40,41] *(UW Health GRADE moderate quality evidence, strong recommendation)*

4.5.2. The simple presence of ESBL-producing Gram-negative bacilli does not automatically require carbapenem therapy.[40,41] *(UW Health GRADE moderate quality evidence, strong recommendation)*

4.6. It may be reasonable to treat *Acinetobacter* species with either ampicillin-sulbactam, a carbapenem (excluding ertapenem), or intravenous minocycline if the isolate is susceptible.[8,42] *(UW Health GRADE low quality evidence, conditional recommendation)*

4.6.1. UW Health antibiogram susceptibility of Acinetobacter is 95% for ampicillin-sulbactam.

4.7. Treatment of carbapenem-resistant HAP and VAP should usually be based off the recommendations of a formal Infectious Diseases consult. *(UW Health GRADE very low quality evidence, strong recommendation)*

4.7.1. It may be reasonable to treat a carbapenem-resistant infection with ceftazidime-avibactam or meropenem-vaborbactam if susceptible. *(UW Health GRADE very low quality evidence, conditional recommendation)*

4.7.2. In patients with HAP/VAP caused by a carbapenem-resistant pathogen that is sensitive only to polymyxins, we recommend intravenous polymyxins (colistin or polymyxin B) *(IDSA/ATS GRADE strong recommendation, moderate-quality evidence)*, and we suggest adjunctive inhaled colistin.[8] *(IDSA/ATS GRADE weak recommendation, low-quality evidence)*

5. Duration of HAP and VAP Therapy

5.1. If clinical criteria supports improvement or resolution of disease, shorter courses of antibiotic therapy (7 days) are associated with similar efficacy and improved outcomes compared to longer durations of therapy for HAP and VAP.[8,43-45] *(UW Health GRADE moderate evidence, strong recommendation)*

5.2. Specific clinical scenarios may prompt shorter or longer durations of antibiotic therapy taking into account clinical, radiologic, and laboratory parameter improvement. *(UW Health GRADE very low quality evidence, conditional recommendation)*

5.2.1. It is reasonable to consider longer durations of therapy (e.g. 14 days) for VAP patients with respiratory isolates of *Acinetobacter* species, *Pseudomonas aeruginosa*, or *Stenotrophomonas maltophilia*.[46] *(UW Health GRADE low quality evidence, conditional recommendation)*

5.2.2. VAP patients with daily ventilator settings with minimum PEEP ≤5 cm H_2O and FiO_2 ≤40% for at least 3 days may be considered for early discontinuation of antibiotic therapy (treatment duration of less than 7 days).[47] *(UW Health GRADE low quality evidence, conditional recommendation)*

5.3. When transitioning from intravenous to oral therapy, total duration of therapy should include the time a patient was on appropriate intravenous and oral antimicrobials. *(UW Health GRADE very low quality evidence, strong recommendation)*

6. Chemical Aspiration and Aspiration Pneumonitis

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6.1. The following recommendations apply to HAP (pneumonia occurring 5 days or more after hospital admission) and VAP (pneumonia occurring over 48 hours after endotracheal intubation) patients only.

    6.1.1. For management of patients who have been hospitalized for less than 5 days (non-HAP) or patients who have been intubated less than 48 hours (non-VAP), please instead refer to [UW Health Treatment of Community-Acquired Bacterial Pneumonia (CABP) – Adult – Inpatient/Emergency Department Clinical Practice Guideline](#) for treating aspiration in community-acquired pneumonia.

6.2. Chemical aspiration is the inhalation of sterile gastric contents. Due to the acidity of the gastric contents and gastric particulates, aspiration may lead to tissue damage in the lungs. This acute chemical lung injury is termed aspiration pneumonitis. These conditions are commonly confused with pneumonia because they can progress to respiratory failure and mirror some pneumonia symptoms.[16,48-50]

6.3. Supportive care is the mainstay of care in aspiration pneumonitis.[49] *(UW Health GRADE moderate quality evidence, strong recommendation)*

    6.3.1. Rapid improvement is anticipated within 48 hours of the aspiration event.[49]

    6.3.2. There is no clinical benefit in providing prophylactic antimicrobial therapy in patients with acute aspiration pneumonitis.[49] *(UW Health GRADE low quality evidence, strong recommendation)*

        6.3.2.1. Providing antimicrobial prophylaxis in this subset of patients has demonstrated no mortality benefit, more frequent escalation of antibiotic therapy, and treatment with longer durations of therapy. Subsequently, prophylactic antimicrobial therapy in these patients may contribute to drug resistance and adverse drug events such as *C. difficile* infection.[49]

    6.3.3. If antibiotics are given to HAP/VAP patients intubated following an aspiration event or patients with suspected aspiration while intubated (e.g. cuff leak), due to this population's inability to adequately clear their lungs, a short course (less than 72 hours) of cefepime plus metronidazole or piperacillin-tazobactam may be considered. (*UW Health GRADE very low quality evidence, conditional recommendation*)

        6.3.3.1. Antibiotics are NOT indicated if vomit and/or bile alone was aspirated.[16] (*UW Health GRADE low quality evidence, conditional recommendation*)

        6.3.3.2. Persistent fevers beyond 72 hours alone are not an indication to escalate to broad-spectrum antibiotics in this subset of patients. (*UW Health GRADE very low quality evidence, conditional recommendation*)

6.4. Although the development of superimposed bacterial pneumonia in patients with aspiration pneumonitis is possible, it only occurs in about one quarter of patients. This condition is referred to as aspiration pneumonia.[49,50]

    6.4.1. It may be reasonable to empirically treat HAP (pneumonia occurring 5 days or more after hospital admission) and VAP (pneumonia occurring over 48 hours after endotracheal intubation) associated with an aspiration event with piperacillin-tazobactam plus vancomycin or cefepime plus metronidazole plus vancomycin for expanded anaerobic coverage.[8,28] *(UW Health GRADE very low quality evidence, conditional recommendation)*

        6.4.1.1. Caution should be exercised in patients receiving piperacillin-tazobactam plus vancomycin for more than 72 hours, because of the associated nephrotoxicity.[51] (*UW Health GRADE low quality evidence, strong recommendation*)

Disclaimer

Clinical practice guidelines assist clinicians by providing a framework for the evaluation and treatment of patients. This guideline outlines the preferred approach for most patients. It is not intended to replace a clinician's judgment or to establish a protocol for all patients. It is understood that some patients will not fit the clinical condition contemplated by a guideline and that a guideline will rarely establish the only appropriate approach to a problem.

Methodology
Development Process

Each guideline is reviewed and updated a minimum of every 3 years. All guidelines are developed using the guiding principles, standard processes, and styling outlined in the UW Health Clinical Practice Guideline Resource Guide. This includes expectations for workgroup composition and recruitment strategies, disclosure and management of conflict of interest for participating workgroup members, literature review techniques, evidence grading resources, required approval bodies, and suggestions for communication and implementation.

Methods Used to Collect the Evidence:
The following criteria were used by the guideline authors and workgroup members to conduct electronic database searches in the collection of evidence for review.

Literature Sources:
- Electronic database search (e.g., PubMed)
- Databases of systematic reviews (e.g., Cochrane Library)
- Hand-searching journals, external guidelines, and conference publications

Time Period: 2004 to 2019

Search Terms:
- Hospital acquired pneumonia, ventilator associated pneumonia AND treatment, duration
- Hospital acquired pneumonia, ventilator associated pneumonia AND diagnostic methods
- Multidrug resistance AND hospital acquired pneumonia, ventilator associated pneumonia
- Hospital acquired pneumonia, ventilator associated pneumonia AND sepsis
- Hospital acquired pneumonia, ventilator associated pneumonia AND beta lactam, allergy

Methods to Select the Evidence:
Clinical practice guidelines, randomized controlled trials, retrospective cohort studies and recent conference publications were examined for inclusion during the literature review phase of this guideline. To be included, the literature had to be available in the English language and be relevant to the clinical questions considered within this guideline.

**Methods Used to Formulate the Recommendations:**
The workgroup members agreed to adopt recommendations developed by external organizations and/or created recommendations internally via a consensus process using discussion of the literature and expert experience/opinion. If issues or controversies arose where consensus could not be reached, the topic was escalated appropriately per the guiding principles outlined in the UW Health Clinical Practice Guideline Resource Guide.

Methods Used to Assess the Quality of the Evidence/Strength of the Recommendations:
Recommendations developed by external organizations maintained the evidence grade assigned within the original source document and were adopted for use at UW Health.

Internally developed recommendations, or those adopted from external sources without an assigned evidence grade, were evaluated by the guideline workgroup using an algorithm adapted from the Grading of Recommendations Assessment, Development and Evaluation (GRADE) methodology (see **Figure 1**).

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Figure 1. GRADE Methodology adapted by UW Health
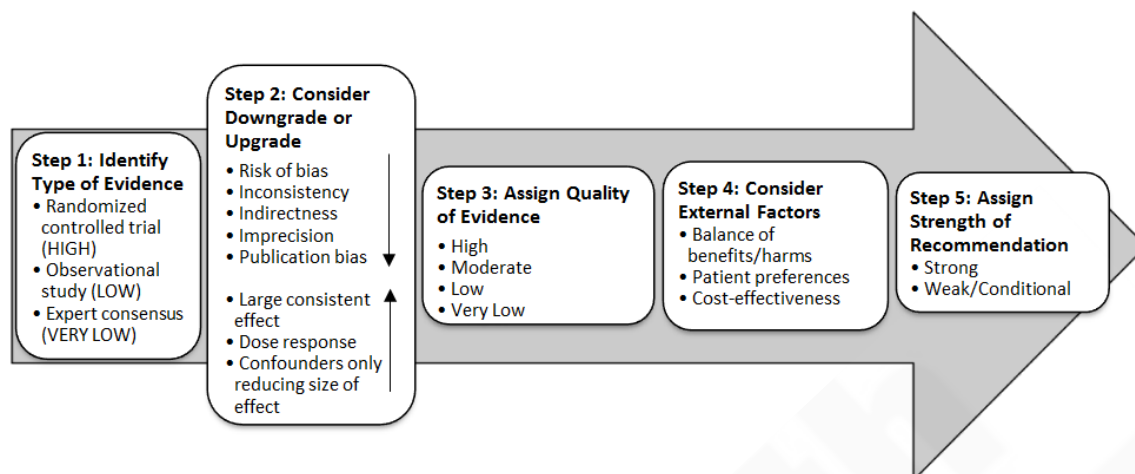
Rating Scheme for the Strength of the Evidence/Recommendations:

GRADE Ranking of Evidence

High	We are confident that the effect in the study reflects the actual effect.
Moderate	We are quite confident that the effect in the study is close to the true effect, but it is also possible it is substantially different.
Low	The true effect may differ significantly from the estimate.
Very Low	The true effect is likely to be substantially different from the estimated effect.

GRADE Ratings for Recommendations For or Against Practice

Strong (S)	Generally should be performed (i.e., the net benefit of the treatment is clear, patient values and circumstances are unlikely to affect the decision.)
Conditional (C)	May be reasonable to perform (i.e., may be conditional upon patient values and preferences, the resources available, or the setting in which the intervention will be implemented.)

Cost Analysis: No cost analysis was performed.

Recognition of Potential Health Care Disparities: No health care disparities identified.

Figure 2. IDSA/ATS GRADE Methodology

Interpretation of Strong and Weak (Conditional) Recommendations

	Strong Recommendation	Weak (Conditional) Recommendation
Patients	Most individuals in this situation would want the recommended course of action, and only a small proportion would not.	The majority of individuals in this situation would want the suggested course of action, but many would not.
Clinicians	Most individuals should receive the intervention. Adherence to this recommendation according to the guideline could be used as a quality criterion or performance indicator. Formal decision aids are not likely to be needed to help individuals make decisions consistent with their values and preferences.	Recognize that different choices will be appropriate for individual patients and that you must help each patient arrive at a management decision consistent with his or her values and preferences. Decision aids may be useful in helping individuals to make decisions consistent with their values and preferences.
Policy makers	The recommendation can be adopted as policy in most situations.	Policymaking will require substantial debate and involvement of various stakeholders.

Collateral Tools & Resources
The following collateral tools and resources support staff execution and performance of the evidence-based guideline recommendations in everyday clinical practice.

Order Sets & Smart Sets
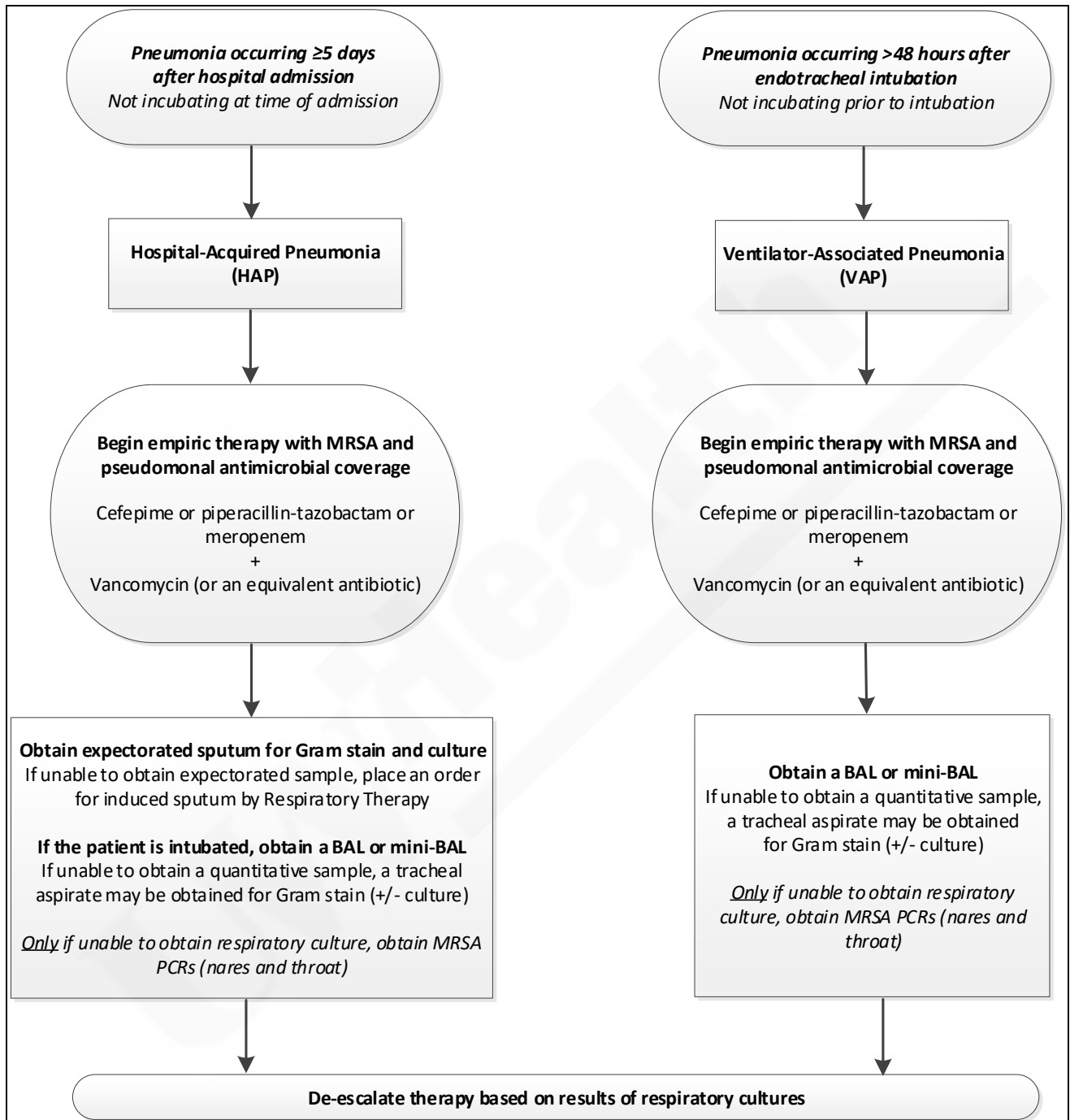- Empiric – Anti-infective Treatment – Adult – Supplemental order set [6474]

Policies
- UW Health Clinical Policy #2.5.6 Blood Cultures for Adult Patients

Companion Guidelines
- UW Health's Treatment of Community-Acquired Bacterial Pneumonia (CABP) – Adult – Inpatient/Emergency Department Clinical Practice Guideline
- Pharmacokinetic/Pharmacodynamic Dose Optimization of Antibiotics (β-lactams, aminoglycosides, and ciprofloxacin) for the Treatment of Gram-Negative Infections – Adult – Inpatient Clinical Practice Guideline
- Intravenous Vancomycin Use – Adult – Inpatient Clinical Practice Guideline
- Procalcitonin Monitoring Related to the Diagnosis and Treatment of Respiratory Tract Infections and Emerging Sepsis – Adult – Inpatient Clinical Practice Guideline
- Treatment of Patients with Reported Allergies to Beta-Lactam Antibiotics – Adult – Inpatient Clinical Practice Guideline
- Diagnosis and Management of Sepsis – Adult – Emergency Department/Inpatient Clinical Practice Guideline
- Medication Route Interchange – Adult – Inpatient Clinical Practice Guideline
- Prevention of Ventilator Associated Pneumonia (VAP) – Pediatric/Neonatal – Inpatient Clinical Practice Guideline

Appendix A. Management of suspected HAP or VAP

Pneumonia occurring ≥5 days after hospital admission
Not incubating at time of admission

↓

Hospital-Acquired Pneumonia (HAP)

↓

Begin empiric therapy with MRSA and pseudomonal antimicrobial coverage

Cefepime or piperacillin-tazobactam or meropenem
+
Vancomycin (or an equivalent antibiotic)

↓

Obtain expectorated sputum for Gram stain and culture
If unable to obtain expectorated sample, place an order for induced sputum by Respiratory Therapy

If the patient is intubated, obtain a BAL or mini-BAL
If unable to obtain a quantitative sample, a tracheal aspirate may be obtained for Gram stain (+/- culture)

Only if unable to obtain respiratory culture, obtain MRSA PCRs (nares and throat)

↓

Pneumonia occurring >48 hours after endotracheal intubation
Not incubating prior to intubation

↓

Ventilator-Associated Pneumonia (VAP)

↓

Begin empiric therapy with MRSA and pseudomonal antimicrobial coverage

Cefepime or piperacillin-tazobactam or meropenem
+
Vancomycin (or an equivalent antibiotic)

↓

Obtain a BAL or mini-BAL
If unable to obtain a quantitative sample, a tracheal aspirate may be obtained for Gram stain (+/- culture)

Only if unable to obtain respiratory culture, obtain MRSA PCRs (nares and throat)

↓

De-escalate therapy based on results of respiratory cultures

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