**Objectives:**

1. Identify bacterial pathogens commonly responsible for community acquired pneumonia (CAP)and risk factors associated with more resistant pathogens.
2. Determine CAP severity using the PSI, CURB-65, and ATS criteria and use this to determine appropriate site of care.
3. Manage a non-severe and severe CAP in the hospital.
4. Manage CAP in the ambulatory setting.

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**Objective 1: Microbiology and MDR risk factors**

* *Slide Diagnosis*: Ask your learners to recap the signs and symptoms of pneumonia. Highlight that multiple different radiographic patterns can be suggestive of pneumonia. Ask your learners about the most common pathogens in CAP. The pneumococcal vaccine has decreased the rates *S. pneumoniae*CAP, though it remains the predominant cause.
* *Slide Classification – MDR Risk Factors*: A subset of patients have risk factors for more resistant organisms such as MRSA or *Pseudomonas.* Historically, these patients were captured in a separate entity called healthcare associated pneumonia (HCAP). *Click on “Older Guidelines” to review prior designation. Then click on “2019 Guidelines” to reveal new classification.*
	+ The 2019 ATS/IDSA Guidelines have abandoned the use of HCAP because prior criteria (such as residence in a nursing home, dialysis, wound care, etc) were not necessarily predictive of colonization with more resistant organisms and led to overtreatment with broad spectrum antibiotics. Instead, these patients are now captured under CAP with the focus on local epidemiological and validated risk factors.
	+ The most consistent risk factors include 1) prior colonization/infection with MRSA or *Pseudomonas*and 2) prior hospitalization and receipt of IV antibiotics within 90 d.

 **Objective 2: Determine CAP severity using PSI and CURB-65.**

* *Slide Classification – Severity*: Pneumonia severity is scored using either the Pneumonia Severity Score (PSI) or CURB-65 scoring system. PSI is better validated and preferred, but the CURB-65 scoring system can be used as an alternative as its easier to remember.
	+ **PSI** – Multiple demographic data, comorbidities, exam, and laboratory/radiologic findings are used in scoring ([PSI calculator](https://www.mdcalc.com/psi-port-score-pneumonia-severity-index-cap)). Class I-II are considered mild severity; Class III-IV moderate; and Class IV-V severe pneumonia.
	+ **CURB-65** – Criteria are listed, and one point is assigned for each criterion ([CURB-65 calculator](https://www.mdcalc.com/curb-65-score-pneumonia-severity)). Patients with 0-1 have mild pneumonia; 2 is moderate; and 3-5 have severe pneumonia.
	+ **ATS Criteria** – Severe disease as defined by the ATS (> 1 major criterion or ≥ 3 minor criteria).
* PSI (or alternatively, the CURB-65 score) should be used in conjunction with clinical judgement to determine outpatient vs. inpatient management of CAP. The 2019 ATS/IDSA guidelines recommend using the ATS severity criteria to determine ICU vs floor level care.
	+ Patients with mild pneumonia (PSI class I-II, CURB-65 score 0-1) may be treated as an outpatient. Rarely some patients with a CURB-65 score of 1 or PSI class III may be managed with inpatient observation. Patients with PSI class IV-V or CURB-65 score of 2-5 should be managed as an inpatient.
	+ Patients with 1 major ATS severity criteria (septic shock, mechanical ventilation) should be managed in the ICU. Most patients with 3 or more minor criteria should be managed in the ICU, though this should be paired with clinical judgement.

 **Objective 3: Inpatient management**

* *Slide Management – Inpatient:*The first steps in evaluating a patient in the hospital is determining 1) severity of disease and subsequently 2) presence of MDR risk factors.
* All patients with severe disease should have cultures drawn (click on “Obtain cultures”)- blood, sputum, and Legionella and *S. pneumo* urinary Ag testing. These patients should empirically receive coverage for MRSA and *Pseudomonas.*
* Patients with non-severe pneumonia should be assessed for MRSA and *Pseudomonas* RFs. Click on “MDR RFs”.
	+ Patients with prior colonization/ infection with either MRSA or *Pseudomonas* should have cultures drawn and be empirically covered for MRSA or *Pseudomonas*as per prior culture data.
	+ Patients with recent hospitalization and IV antibiotic treatment can receive standard CAP treatment but should have cultures drawn as well.
	+ Adjustments to antibiotic regimens should be made based on culture data Patients empirically treated with broader antibiotics should be narrowed to standard CAP coverage if cultures are negative.
	+ Patients with no risk factors should not be cultured and should receive standard CAP treatment.
* Empiric coverage of MRSA should be with IV vancomycin (linezolid is also an option). Empiric coverage of *Pseudomonas*can be with piperacillin-tazobactam, cefepime, ceftazidime, aztreonam, or meropenem. Patients should continue to receive atypical coverage on these regimens.
* Standard CAP coverage is with IV beta-lactam such as ampicillin-sulbactam or ceftriaxone AND azithromycin or doxycycline for atypical coverage. Azithromycin is preferred but doxycycline can be considered if cardiac considerations or QTc prolongation prohibit use of a macrolide. A respiratory fluoroquinolone (levofloxacin / moxifloxacin) can also be considered.
* *Bonus:* Of note, procalcitonin use is not recommended to determine empiric antibiotic coverage for CAP. While some studies have suggested that procalcitonin 0.1 ug/L does not suggest a bacterial infection, a recent meta-analysis only showed a sensitivity of ~30-90% for detecting bacterial infection.
* *Bonus:* Prior studies have shown mixed data on the use of adjunctive steroids for CAP. Currently, the recommendation is against steroid use.

 **Objective 4: Manage CAP in the ambulatory setting.**

* *Slide Management – Outpatient*: Outpatients with CAP are similar stratified by presence of 1) comorbid conditions and 2) risk factors for MRSA and *Pseudomonas.*
	+ For outpatient adults with no major comorbidities and no MDR risk factors, treatment can be with amoxicillin 1 g TID or doxycycline. Even though amoxicillin monotherapy does not have atypical coverage, several studies have shown efficacy for this regimen. Despite this, some experts recommend addition of azithromycin to amoxicillin for coverage for atypicals in this patient population.² Macrolide (azithromycin) monotherapy is not recommended given high rates of *S. pneumo*resistance in the US.
	+ For outpatient adults with comorbidities, treatment should be with should be more broadly covered with amoxicillin-clavulanate or a cephalosporin AND azithromycin or doxycycline.  Monotherapy with a respiratory fluoroquinolone can also be used. These patients are more likely to have infections from *S. aureus* and GNRs.
	+ Assess for risk factors such as recent antibiotic use or prior infection/colonization with MRSA/ *Pseudomonas.* Patients with prior antibiotic use should be treated more broadly and ideally with an antibiotic in a different class. MRSA and *Pseudomonas* CAP are not commonly managed in the outpatient setting, though MRSA or Pseudomonas coverage can be considered in patients with risk factors.
* *Slide Duration* – In general, duration of antibiotics should be 5-7 days regardless of inpatient or outpatient management. Longer courses can be considered for patients with 1) extrapulmonary infection 2) infections with certain pathogens *(Pseudomonas, Mycobacteria, Burkholdleria)* 3) necrotizing pneumonia, lung abscess, empyema, parapneumonic effusions.²
* Procalcitonin, while not used for initiation of antibiotics, can be used for early discontinuation of antibiotics. While there is emerging data that 3 days of treatment may be sufficient, current guidelines recommend that bacterial CAP should be treated for no less than 5 days.³

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**Take Home Points:**

1. *S. pneumoniae*, GNRs (*H. flu, Moraxella)*, and atypical pathogens are the most common causes of CAP. Risk factors for more resistant pathogens include patients with prior MRSA/ *Pseudomonas* infection or colonization OR have recently been hospitalized with receipt of IV antibiotics.
2. Patients with CAP and PSI class I-II (or CURB-65 score of 0-1) may be able to be managed as an outpatient. Use ATS criteria to identify patients who require ICU level care.
3. Patients with severe disease and prior MRSA or *Pseudomonas* colonization/infection should receive cultures and be empirically covered for MRSA and *Pseudomonas.* Patients with non-severe CAP should not be cultured.
4. Outpatient management of CAP is differentiated by the presence of MDR risk factors and comorbidities.

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**References**

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