Body’s Defenses
- Environment: Nasal hair, Stomach acid
  - Aerosolized particles: Tuberculosis – Need nasal hair
  - If we take a PPI and rid of the stomach acid, bug can infect our fertile grounds.
- Systems: Mucociliary System, cough+gag reflex,
- Immunity: Ig, TNF, Interleukins, Complement, macrophages, Polymorphonuclear leukocytes

Community-Acquired Pneumonia Etiology – The body’s defenses are impaired!
- Causative Element: Though most commonly the result of bacteria or viruses, 40-60% of CAP cases fail to identify the causative organism. Ideally, a deep cough providing a sputum culture first-thing in the morning is best
  - Typical: S. pneumoniae, M catarrhalis, H. influenzae (these also colonize your URT)
  - Atypical: Chlamydia, Legionella, Mycoplasma
  - Influenza Virus: May be a causative element, worried about secondary S. pneumoniae infection
- Methods/Routes:
  - Aspiration: Frequently the source of pneumonia – inhalation of particles, or stomach regurgitation
  - Hematogenous Spread (Blood): Though rare, it is the common route for Staph Aureus
  - Colonization of the upper respiratory tract is proximal and capable of leading to pneumonia
- Risk factors: Impaired body defenses, virulent organisms, excess inoculum
  - Age: Both the elderly and neonates are at increased risk, due to ‘wearing out’ or ‘not fully developed’
  - Lifestyle: Booze and smokes
  - Disease
    - Neuromuscular Disorders (MS, Seizures, Guillain Barre’)
    - Cystic Fibrosis: Pseudomonas tends to colonize these excess muci
    - Cardiovascular Disorders: During an MI, aspiration. A stroke may maim the gag reflex
  - Immunocompromised: Due to disease (HIV, Hematologic Malignancy) or medications
  - Impaired Lung Defenses: Altered sensorium (narcotics), Viruses impairing the alveolar function (HIV), depressed mucociliary transport (booze and cigs), colonization, COPD

Community-Acquired Pneumonia Presentation
- S/Sx: Fever, ↑WBC, dry cough, tachypnea, fatigue, ↑HR, chest discomfort, infiltrates on CXR, chills/rigors
  - Lung Sounds:
  - Diagnostic Tools
    - Sputum Culture: Proper technique and timing is critical. Should have >25WBC and <10 Epithelial cells
    - Chest Radiography (CXR): The favored tool. Be careful, dehydration may produce negative test result
    - Recognition of characteristic constellation of clinical signs
    - Outpatient vs Inpatient: Obviously being in the inpatient there are many more diagnostic tools we can use and labs we can run.
- Diagnosing Community-Acquired Pneumonia (CAP)
  - Criteria (1): Acute infection of the pulmonary parenchyma in patients without recent hospitalization or recent residence in a nursing home ….AND…
  - Criteria (2): Clinical Symptoms OR Presence of an infiltrate OR Auscultatory findings (sounds)
  - The reason criteria set 2 has ‘OR’ is because, for example, in case of dehydration, the chest x-ray may be clear.
- Classifying Infection Severity (CURB-65): All components of this tool are weighted equally, nevertheless we must use our clinical judgement in interpreting the validity of our scores.
  - Confusion: Y (1) or N (0)
  - Uremia: BUN > 20mg/dL
  - Respiratory Rate: ≥ 30 RR per min
  - Blood Pressure: <90/60mmHg
  - Age ≥ 65

Importance of Diagnosis and Tx: CAP is the 6th most common cause of death in the US, and its mortality ranges from 2-30% among hospitalized patients. Incidence is significantly associated with advanced (65yo+) age
Treatment of CAP

- **Remember**: Selecting a drug regimen is not a ‘one-size-fit-all’ process, all factors need to be considered, such as:
  - Inpatient vs Outpatient: IV formulations are not available in the outpatient setting.
  - Antibiotic Characteristics: PK, PD, Spectrum, AE
    - GI Tract intact: should be considering oral
    - Sick enough to be in the hospital: More than likely have to use IV
    - Sick enough to be in the ICU: Should be using a *cidal* abx (such as quinolones + β-lactams)
  - Most likely pathogens, clinical experience, formulary considerations
  - Comorbid Conditions: May need to aim for different target plasma levels of the medication
  - Drug-Drug-Interactions: Compare to their current meds, and consider simple errors such as taking iron supplements or consuming dairy with your fluoroquinolones...
  - Cost

- **Length of Therapy**: 7-14 days. **Switch IV to PO** when afebrile for 24-48 hours and GI tract intact, assuming there is no NVD.

- **Outpatient CAP-Treatment** (CURB-65 = 0 or 1)
  - **No recent Abx Therapy**
    - → Macrolide: First-line therapy for CAP. There is no renal adjustment (unless < 30). AE include GI upset, ototoxicity
      - Azithromycin: ZPAK. 500mg Day 1, 250mg Day 2-5.
        - Azithromycin has a long half-life, drug will still be in circulation post-day5.
        - May use Azithromycin ER suspension in children
      - Clarithromycin. Less favored, it is a 3A4 inhibitor – significant DDI, QTc prolongation
    - → Doxycycline: 2nd line agent. There is no renal adjustment, there is a risk of teeth discoloration and GI upset. **Avoid in children**. Avoid concurrent Antacids, Mg, Fe, Ca

- **Recent Abx Therapy or Comorbid Conditions** (Chronic heart, liver, lung, or renal disease, DM, Alcoholism)
  - Respiratory Quinolone
    - Levofloxacin 750mg Qdaily x5 days Moxifloxacin 400mg Qdaily
    - AE: Caution in kids, tendon rupture, hypoglycemia, avoid antacids, Mg, Fe, Ca
  - β-lactam + Macrolide Augmentin/Amoxicillin(high-dose)/Cefuroxime Clarithromycin
  - β-lactam + Doxycycline Augmentin/Amoxicillin(high-dose)/Cefuroxime Doxycycline
    - AE: β-lactams – Rash and diarrhea are frequent

- **Aspiration Pneumonia** (Strep, Moroxilla, Haemophilus, Oral anaerobes)
  - → Clindamycin 300mg PO q6º for 7-14 days --- A Lincosamide
  - AE: big side effect is diarrhea
  - → Augmentin is another option.

- **Inpatient CAP-Treatment** (CURB-65 = 2 or 3)
  - **Non-ICU**
    - Respiratory Fluoroquinolone
      - Levofloxacin 500-750mg IV Qdaily / Moxifloxacin 400mg IV Qdaily
    - β-lactam + (Doxycycline OR Macrolide)
      - Cefuroxime IV 100mg IV Q12º OR Azithromycin 500mg IV Qdaily
      - Ceftriaxone IV Qdaily / Unasyn q6º
      - Doxycycline 100mg IV Q12º

  - **ICU**
    - β-lactam + (Macrolide OR Respiratory Fluoroquinolone)
      - Cefuroxime IV 100mg IV Q12º OR Azithromycin 500mg IV Qdaily
      - Levofloxacin 500-750mg IV Qdaily / Moxifloxacin 400mg IV Qdaily
      - For these patients we are looking at double coverage, and coverage for legionella (FQ)
  - PCN-ALL → Respiratory fluoroquinolone + Aztreonam
  - **Pseudomonal Infection** → Piptazo/Cefepime/Imipenem/Meropenem + Cipro/Levo

- **Prevention**
  - Vaccination – Pneumococcal and Influenza (Especially in neonates and adults > 50yo)
  - Hand Hygiene