2017 NCAPA Winter Conference Pulmonary Review

Kenyon Railey, MD
Assistant Professor
Duke Physician Assistant Program
Disclosure Statement

- Dr. Railey has no relevant financial or nonfinancial relationships to disclose.

**CAP = Clinical Application Point**

- If you see the CAP, pay attention!
- This tool or tip may be useful in your clinical practice.
Objectives

At the conclusion of this session, participants will be able to do the following for each category and affiliated conditions (see PANRE blueprint):

- Review physical diagnosis techniques involved in a thorough assessment of pulmonary complaints.
- Outline an approach to interpretation of frontal chest radiographs.
- Explore the concept of inattention bias and review specific tools to perform consistent and culturally competent patient assessments.
- Explore risk factors, epidemiological data, historical elements, and associated physical exam findings.
- Review common diagnostic studies and the interpretation of these studies used in the diagnosis.
- Describe an appropriate treatment plan, including pharmaceutical therapy and associated adverse effects and/or contraindications, surgical procedures when indicated, monitoring precautions and patient education.
Blueprint
Content Areas

• **Infectious Disease**
  • Acute bronchitis  Bronchiolitis  Epiglottitis  Croup
  • Influenza  Pertussis  Pneumonias  RSV
  • Tuberculosis

• **Obstructive Pulmonary Disease**
  • Asthma  Bronchiectasis  Chronic bronchitis
  • Emphysema/COPD  Cystic fibrosis

• **Restrictive Pulmonary Disease**
  • Sarcoidosis  Pneumoconiosis  Idiopathic pulmonary fibrosis

• **Pleural Diseases**
  • Pleural effusion  Pneumothorax

• **Pulmonary circulation**
  • Cor pulmonale  PE  Pulmonary HTN

• **Neoplastic Disease**
  • Pulmonary nodules  Lung cancer  Carcinoid tumors

• **Other**
  • ARDS  FB aspiration  Hyaline membrane disease

Kenyon Railey, MD
Pre Test Case #1

- A 65-year-old female, PMH of HTN, OA, and GERD presents to your clinic for hospital follow up 1 week after her discharge following elective knee surgery. She is complaining of cough and shortness of breath. Her post surgical course required a 1 day stay in the ICU due to a difficult extubation, but she quickly improved. Her total stay was 5 days and there were no further complications.

- Today, she reports 2 days ago of temperature to 39.1°C (102.4°F), a cough with sputum production, and shortness of breath. Her vital signs reveal mild tachycardia and fever, but normal blood pressure. A CXR in your office reveals a LLL infiltrate. What is the most likely cause of this patient’s symptoms?
  
  A. C. pneumoniae
  B. M. catarrhalis
  C. Legionella species
  D. P. aeruginosa
Pre-Test Case #2

- A 23-year-old male, no PMH, presents to the emergency department with the sudden onset of moderate to severe right-sided chest pain and shortness of breath. No trauma or accident. His vital signs are normal. Physical exam reveals diminished breath sounds on the right and hyper resonance. CXR reveals a loss of markings along the right lung margins, involving about 10% of the lung space. The mediastinum has not shifted. What is the most appropriate management plan?

A. Decompression of the chest by insertion of a large-bore intravenous catheter into the right second intercostal space at the midclavicular line
B. Oxygen supplementation and close observation with bed rest
C. Pleurodesis
D. Wedge resection

Kenyon Railey, MD
Pre Test Case #3

A 4 year old presents to the clinic with a fever to 104, sore throat, low appetite and difficulty breathing. The family recently immigrated to the United States. He was apparently fine yesterday. Mom says that she left him in his playroom for a few minutes this morning and he seemed fine but over the last few hours, his condition has worsened. On physical exam, the patient appears ill, is cyanotic, tachypneic and sitting upright with his neck extended. He is drooling. His lung exam reveals wheezing and retractions. What is the first step in the management of this patient?

A. Perform on oral exam and visualize the foreign body he swallowed
B. Immediate intubation and protection of his airway (Acute epiglottitis)
C. IV antibiotics
D. X-ray of the neck
Part I
Back to the Basics
Lung Anatomy

- Trachea
- Superior lobe
- Main (primary) bronchus
- Lobes (secondary bronchi)
- Segmental (tertiary) bronchi
- Cardiac notch
- Inferior lobe
- Right lung
- Left lung
Lung Anatomy

Organizational structure determined by branching airways
Normal Lung Anatomy

Organizational structure determined by branching airways

- Pathology
  - Acute Bronchitis
  - Pneumonia/COPD

- Pathology
  - Acute bronchiolitis

- Pathology
  - COPD/
  Emphysema, CF, Pneumonia
Landmarks

[Image: https://meded.ucsd.edu/clinicalmed/lung.htm]

Kenyon Railey, MD
Anatomy on CXR

1. Trachea
2. R Main Stem Bronchus
3. L Main Stem Bronchus
4. Carina
5. Spinous processes
6. Disc space
7. Costophrenic angle
8. Viscus air
9. 1st Left Rib
10. Left clavicle

Kenyon Railey, MD
Comprehensive Pulmonary Examination

• Starts when you walk in the room.
• Look at the patient
  o Color?
  o Use of accessory muscles?
  o How is the body positioned?
• How fast are they breathing. . . Really?
• How are they breathing?
• Can the patient talk?
Comprehensive Pulmonary Examination

• Starts when you walk in the room.
• Look at the patient
  o Color?
  o Use of accessory muscles?
  o How is the body positioned?
• How fast are they breathing. . . Really?
• How are they breathing?
• Can the patient talk?
The Pulmonary Exam

• Inspection
• Palpation
• Percussion
• Auscultation

Thoracic Expansion

Percussion

Tactile Fremitus

Kenyon Railey, MD
Consolidation & Effusion

In the presence of consolidation, fremitus becomes more pronounced.

If the normal, air-filled tissue has been displaced by fluid (e.g. pleural effusion) or infiltrated with white cells and bacteria (e.g. pneumonia), percussion will generate a deadened tone.

Fremitus over an effusion will be decreased.

https://meded.ucsd.edu/clinicalmed/lung.htm
Do NOT examine over clothing.

https://meded.ucsd.edu/clinical.med/lung.htm
Lung Sound Review

- **Vesicular breath sounds: Normal**
  - Soft inspiratory sound as air rushes into the lungs, with little noise produced on expiration. These are referred to as

- **Wheeze: Abnormal**
  - Are whistling-type noises produced during expiration (and sometimes inspiration) when air is forced through airways narrowed by bronchoconstriction, secretions, and/or associated mucosal edema.
  - Wheezing heard only on inspiration is referred to as stridor and is associated with mechanical obstruction at the level of the trachea/upper airway.

- **Rales (a.k.a. crackles): Abnormal**
  - Scratchy sounds that occur in association with processes that cause fluid to accumulate within the alveolar and interstitial spaces.

- **Egophony: Abnormal**
  - E to A change indicating consolidation of the lung parenchyma, as can occur with pneumonia,

- **Muffled or absent: Abnormal**
  - Could indicate effusion or pneumothorax.
Reading a CXR

- **Airway**
- **Bones & Soft Tissue**
- **Cardiac Silhouette**
- **Diaphragm**
- **Edges/Effusions**
- **Fields/Fissures**
Part II
Infectious Disease

- RSV
- Acute bronchitis
- Bronchiolitis
- Croup
- Epiglottitis
- Influenza
- Pertussis
- Pneumonias
- Tuberculosis

Kenyon Railey, MD
RSV (Respiratory Syncytial Virus)

• **Background**
  - Upper respiratory virus transmitted by droplet spread and direct contact
  - Most cases are self-limited but RSV accounts for 90,000 hospitalizations per year with over 4000 deaths
  - RSV season generally starts in October, peaks in January and declines in the spring

• **Clinical Features**
  - Symptoms are most severe in ages 2-6 months
  - Can present with apnea in infants, generally wheezing in children
  - Can be associated with bronchiolitis and bronchitis
  - *(remember, most common cause of acute bronchiolitis)*
  - Diagnose by ELISA RSV antigen detection or staining of nasal secretions

• **Treatment**
  - Supportive care and symptom alleviation
  - Infection is usually self limited.
  - Bronchodilators, corticosteroids, ribavarin are not used routinely.

Kenyon Railey, MD
Acute Bronchitis

• **Background**
  - Acute bronchitis is one of the most common conditions encountered in clinical practice.
  - Self limited inflammation of large airways (trachea, bronchi) characterized by *cough*.
  - More than 90% of cases are caused by viruses (influenza, rhinovirus, coronavirus, RSV).
  - In smokers or patients with chronic lung disease, bacterial causes are usually involved (H. influenza, S. pneumoniae, and M. catarrhalis).

• **Clinical Features**
  - Signs and symptoms include cough (with or without sputum), dyspnea, sore throat, headache, myalgias, substernal discomfort, wheezes.
    - Fever is unusual and generally associated with pneumonia or influenza.
  - Generally, labs are not helpful and CXR is usually negative.
Acute Bronchitis

• Treatment
  o Usually supportive
  o Symptomatic treatment using a nonsteroidal anti-inflammatory drug, aspirin, acetaminophen and/or ipratropium
  o Antibiotics for acute exacerbations of chronic bronchitis (think bacteria),
  o For acute exacerbations in otherwise healthy adults, no empiric treatment is needed
The common cold.

Table 1. Effective Treatments for Symptoms of the Common Cold

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Study</th>
<th>Outcomes</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anticholinergics</td>
<td>Cochrane systematic review (n = 2,144 children and adults 12 to 70 years of age)</td>
<td>Ipratropium improved rhinorrhea but not nasal congestion</td>
<td>Adverse effects included nasal dryness, blood-tinged mucus, and epistaxis</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>Cochrane systematic review (n = 11,306 adults and children with 9,649 cold episodes, with subgroup analysis of 598 elite athletes)</td>
<td>Did not prevent colds; shortened cold duration by 8% (95% CI, 3% to 12%) in adults and by 14% (95% CI, 7% to 21%) in children (P &lt; .00001); reduced symptom severity by days of work/school missed; prevented colds in elite athletes (relative risk = 0.48; 95% CI, 0.35 to 0.64)</td>
<td>Dosages of at least 1 g per day produced greater benefits</td>
</tr>
<tr>
<td>Zinc</td>
<td>Cochrane systematic review (n = 1,387 adults and children 1 to 65 years of age for treatment and 394 for prophylaxis)</td>
<td>Treatment: reduced duration of cold by 1 day (95% CI, −1.72 to −0.34; P = .003) and decreased the proportion of participants who were symptomatic after 7 days of treatment (odds ratio = 0.45; 95% CI, 0.20 to 1.00; P = .05), but did not affect cold severity Prophylaxis: reduced incidence of colds (incidence rate ratio = 0.64; 95% CI, 0.47 to 0.88; P = .006), decreased school absence (P = .0003) and antibiotic prescriptions (P &lt; .00001)</td>
<td>Adverse effects include bad taste and nausea; intranasal administration associated with anosmia</td>
</tr>
</tbody>
</table>

CI = confidence interval.
Information from references 1 through 3.

INEFFECTIVE
Antihistamines alone, prophylactic use of Echinacea preparations, and antibiotics are ineffective for treating symptoms of the common cold. When started after symptom onset, vitamin C is also ineffective.

HARMs OUTFвеч программ
Over-the-counter cough and cold medications for children younger than six years are ineffective and are associated with overdose and toxicity. Intranasal zinc can cause permanent anosmia.

FPIN’s Clinical Inquiries
Treatments for Symptoms of the Common Cold

Kenyon Railey, MD
Acute Bronchiolitis

• **Background**
  - Inflammation of the bronchioles (airways smaller than 2 mm)
  - Primarily an illness of young children and infants (less than 2 years old)
  - **RSV is the most common cause** (but parainfluenza, adenovirus, and rhinovirus are also associated)
  - Some infants will develop asthma later in life

• **Clinical Features**
  - Signs and symptoms include rhinorrhea, sneezing, wheezing, and low-grade fever
  - Nasal flaring, tachypnea, and retractions indicate respiratory distress
**Acute Bronchiolitis**

- **Laboratory findings**
  - CBC is usually normal
  - Nasal washings for RSV culture and antigen assay can be done, but don’t change management.
  - CXR is usually normal, but can show peribronchial thickening or fullness

- **Treatment**
  - Supportive measures are usually recommended
  - Inhaled epinephrine, inhaled hypertonic saline, oxygen, IV fluids, nebulized albuterol can all used, but there is no current evidence of benefit
  - Corticosteroids generally have NO effect

---

Kenyon Railey, MD
Croup aka (Laryngotracheobronchitis)

• **Background**
  - More commonly affects children 6 months to 5 years
  - Most common cause is parainfluenza virus types 1 and 2. Others (RSV, adenovirus, influenza, and rhinovirus are also implicated).

• **Clinical Findings**
  - Harsh barking seal-like cough, inspiratory stridor, hoarseness, low-grade fever, rhinorrhea
  - **Diagnosis is usually clinical**
  - CXR may show subglottic narrowing (steeple Sign)
  - A lateral CXR will help differentiate from epiglottitis (more on that later)

Steeple sign on an AP neck X-ray of a child with croup
Croup aka (Laryngotracheobronchitis)

- **Treatment**
  - Antibiotics are not indicated.
  - Mild symptoms can be treated at home with humidity, temperature control, fluids.
  - Moderate to severe symptoms are usually treated with oxygen, nebulized epinephrine and corticosteroids.
  - Hospitalization may also be required.

Steeple sign on an AP neck X-ray of a child with croup.
Acute Epiglottitis

• **Background**
  - Severe life threatening infection of the epiglottis
  - May be viral or bacterial.
  - Can occur at any age, most common between 2 and 7, but in adults most cases occur 45-65 age range
  - *H. influenzae type B vaccination (Hib) has decreased the incidence of epiglottitis in children*
  - Increasing in adults due to strep and staph

• **Clinical Features**
  - Signs and symptoms include sudden onset of high fever, respiratory distress, severe dysphagia, drooling and muffled voice
  - Exam may reveal mild stridor with little or no coughing, patients usually sit upright with their necks extended
  - Direct visualization of the epiglottis is diagnostic, but manipulation may initiate sudden, fatal airway obstruction
  - Lateral neck X-ray will show swollen epiglottis (thumbprint sign)
Thumbprint Sign

Acute Epiglottitis

- Treatment
  - Secure airway, do not move or upset child unless ready to manage airway
  - Broad spectrum second or third generation cephalosporin for 7-10 days
Influenza

• **Background**
  o Inflammation of the nasal mucosa, pharynx, conjunctiva, and respiratory tract
  o Influenza A and B
  o Transmission via respiratory droplets
  o Most seasonal flu activity typically occurs between October and May. Flu activity most commonly peaks in the United States between December and February.

• **Clinical Features**
  o Fever, chills, myalgias, headache, cough

• **Treatment**
  o Usually self limited but can be fatal (especially in at risk groups, very young, elderly)
  o Neuraminidase inhibitors:
    • Oseltamviiir (Tamiflu)
    • Zanamivir (Relenza)
Antiviral Treatment Overview

- Clinical trials and observational data show that early antiviral treatment can shorten the duration of fever and illness symptoms, and may reduce the risk of complications from influenza (e.g., otitis media in young children, pneumonia, and respiratory failure).
- Early treatment of hospitalized patients can reduce death.
- In hospitalized children, early antiviral treatment has been shown to shorten the duration of hospitalization.
- **Clinical benefit is greatest when antiviral treatment is administered early, especially within 48 hours of influenza illness onset.**
- Antiviral treatment is recommended as early as possible for any patient with confirmed or suspected influenza who:
  - is hospitalized;
  - has severe, complicated, or progressive illness; or
  - is at higher risk for influenza complications.
High Risk = Antiviral Treatment

- Persons at higher risk for influenza complications recommended for antiviral treatment include:
  - children aged younger than 2 years;1
  - adults aged 65 years and older;
  - persons with chronic pulmonary (including asthma), cardiovascular (except hypertension alone), renal, hepatic, hematological (including sickle cell disease), and metabolic disorders (including diabetes mellitus), or neurologic and neurodevelopment conditions (including disorders of the brain, spinal cord, peripheral nerve, and muscle, such as cerebral palsy, epilepsy [seizure disorders], stroke, intellectual disability [mental retardation], moderate to severe developmental delay, muscular dystrophy, or spinal cord injury);
  - persons with immunosuppression, including that caused by medications or by HIV infection;
  - women who are pregnant or postpartum (within 2 weeks after delivery);
  - persons aged younger than 19 years who are receiving long-term aspirin therapy;
  - American Indians/Alaska Natives;
  - persons who are morbidly obese (i.e., body mass index is equal to or greater than 40); and
  - residents of nursing homes and other chronic care facilities.
What about vaccination?

Table. Adjusted vaccine effectiveness estimates for influenza seasons from 2005-2016

<table>
<thead>
<tr>
<th>Influenza Season†</th>
<th>Reference</th>
<th>Study Site(s)</th>
<th>No. of Patients</th>
<th>Adjusted Overall VE (%)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004-05</td>
<td>Belongia 2009</td>
<td>WI</td>
<td>762</td>
<td>10</td>
<td>-36.40</td>
</tr>
<tr>
<td>2005-06</td>
<td>Belongia 2009</td>
<td>WI</td>
<td>346</td>
<td>21</td>
<td>-52.59</td>
</tr>
<tr>
<td>2006-07</td>
<td>Belongia 2009</td>
<td>WI</td>
<td>871</td>
<td>52</td>
<td>22.70</td>
</tr>
<tr>
<td>2007-08</td>
<td>Belongia 2011</td>
<td>WI</td>
<td>1914</td>
<td>37</td>
<td>22.49</td>
</tr>
<tr>
<td>2008-09</td>
<td>Unpublished</td>
<td>WI, MI, NY, TN</td>
<td>6713</td>
<td>41</td>
<td>30.50</td>
</tr>
<tr>
<td>2009-10</td>
<td>Griffin 2011</td>
<td>WI, MI, NY, TN</td>
<td>6757</td>
<td>56</td>
<td>23.75</td>
</tr>
<tr>
<td>2010-11</td>
<td>Treanor 2011</td>
<td>WI, MI, NY, TN</td>
<td>4757</td>
<td>60</td>
<td>53.66</td>
</tr>
<tr>
<td>2011-12</td>
<td>Ohmit 2014</td>
<td>WI, MI, PA, TX, WA</td>
<td>4771</td>
<td>47</td>
<td>36.56</td>
</tr>
<tr>
<td>2012-13</td>
<td>McLean 2014</td>
<td>WI, MI, PA, TX, WA</td>
<td>6452</td>
<td>49</td>
<td>43.55</td>
</tr>
<tr>
<td>2013-14</td>
<td>Gaglani 2009</td>
<td>WI, MI, PA, TX, WA</td>
<td>5999</td>
<td>52</td>
<td>44.59</td>
</tr>
<tr>
<td>2014-15</td>
<td>Zimmerman 2016</td>
<td>WI, MI, PA, TX, WA</td>
<td>9311</td>
<td>19</td>
<td>10.27</td>
</tr>
<tr>
<td>2015-16†</td>
<td>ACIP presentation, Flannery [332 KB, 26 pages]</td>
<td>WI, MI, PA, TX, WA</td>
<td>7563</td>
<td>47†</td>
<td>39.53†</td>
</tr>
</tbody>
</table>

*Estimate from Nov 2, 2015 - April 15, 2016.

- [http://www.cdc.gov/flu/professionals/vaccination/effectiveness-studies.htm](http://www.cdc.gov/flu/professionals/vaccination/effectiveness-studies.htm)

- Kenyon Railey, MD
Pertussis (i.e. Whooping Cough)

• **Background**
  - Caused by *Bordetella pertussis*
  - Highly contagious

• **Clinical Features**
  - Paroxysmal cough and inspiratory whoop
  - Associated with dry coughs for greater than 2 weeks
    - Catarrhal phase (1-2 weeks of cold symptoms)
    - Paroxysmal phase (starts during 2nd week), severe cough and whoop
    - Convalescent phase (1-3 weeks, but can be longer)
  - Suspect in patients who give a history of post-tussive emesis
  - Characteristic whoop is not ALWAYS present (usually present in children, not necessarily in adolescents and adults)
  - Can diagnosis with nasal swab

• **Treatment**
  - Macrolides (azithromycin/clarithromycin), TMP/SMX
  - Tdap for adolescents, adults and pregnant patients

Kenyon Railey, MD
Community Acquired Pneumonia

- **Background**
  - Ranks among top ten causes of death, regardless of age
  - Most common infection-related cause of death
  - Infection, usually acute, of pulmonary parenchyma via inhalation, aspiration, or hematogenous spread
  - Predisposing factors include increased age, immunosuppression, smoking, alcoholism, and chronic bronchitis
  - Usually bacterial in etiology but can be caused by viruses, fungi or protozoa
  - 2 types
    - **Community Acquired Pneumonia** (aka CAP or Walking Pneumonia)
    - **Nosocomial Pneumonia**
      - Hospital-acquired
      - Ventilator-associated
      - Health care-associated
Community Acquired Pneumonia

“TYPICAL” etiologies

- **S. pneumoniae**
  - accounts for majority of cases of CAP (16-60%) in older adults
- **H. influenzae** (3-30%)
- **M. catarrhalis** – associated with COPD
- **S. aureus** (2-5%) - post-influenza
  - CA-MRSA: severe disease with high mortality
- Gram negative bacteria (7-18%)

“AYTPICAL” etiologies

- **M. pneumoniae** (10-40%)
  - Most common in older children, adolescents & young adults
- **C. pneumoniae** (6-20%)
- **Legionella spp.** (2-30%)
  - geographic variation; associated with males, high fevers, multilobar disease
- **Viruses**
  - influenza
  - RSV
  - hMPV
  - coronavirus (SARS)
Pneumonia Clinical Clues

- Young, otherwise healthy
- Rust colored sputum
- Contaminated water droplets from cooling and ventilation (AC)
- Currant jelly sputum
- Alcohol abuse
- Cystic Fibrosis
- THINK atypical
- THINK S. pneumoniae
- THINK Legionella
- THINK Klebsiella pneumoniae
- THINK Pseudomonas
Community Acquired Pneumonia

- **Clinical Features**
  - Acute onset
  - **Cough (+/- sputum)**
    - *Typical* presentation is a 1-10 day history of cough, purulent sputum (rust colored or blood streaked), SOB, tachycardia, chest pain, fever, sweats, and or chills
    - *Atypical* presentation is low grade fever with relatively mid pulmonary symptoms, usually occurring in young, otherwise health adults. Can have non productive cough, myalgia, and fatigue.
  - GI symptoms can be present with atypical etiologies
  - Altered mental status (especially in older patients)

- Physical examination may reveal tachycardia, increased respiratory rate, altered breath sounds and crackles, dullness to percussion, course breath sounds
- Approximately 80% are febrile (can be absent in older patients).
- No clear constellation accurately predicts pneumonia
Community Acquired Pneumonia

• Laboratory evaluation:
  o CBC: elevated WBC with left shift
  o Sputum: Gram stain and culture (cultures positive in < 5% of cases of CAP)
  o Blood cultures: positive in ~ 10-30% of cases
    • establish the microbial diagnosis when positive
  o Immunoassays
  o Nasopharyngeal swab in influenza season

• Imaging:
  o CXR: “gold” standard; findings classically vary with etiology
  o x-ray findings may also vary with clinical presentation
Community-Acquired Pneumonia

**Laboratory evaluation:**
- CBC: elevated WBC with left shift
- Sputum: Gram stain and culture (cultures positive in < 5% of cases of CAP)
- Blood cultures: positive in ~ 10-30% of cases
- Immunoassays
- Nasopharyngeal swab in influenza season

**Imaging:**
- CXR: “gold” standard; findings classically vary with etiology
- X-ray findings may also vary with clinical presentation
Community Acquired Pneumonia

• Radiologic evaluation
  
  o The presence of an infiltrate on plain chest radiograph is considered the "gold standard" for diagnosing pneumonia
    • may also have lobar consolidation or cavitation

It has been taught that lobar consolidation is due to the typical bacteria and interstitial infiltrates are due to atypical bacteria and viruses, but in actuality, radiologists cannot reliably differentiate bacterial from nonbacterial pneumonia on the basis of the radiographic appearance.
Treatment

- **Usually empiric:**
  - respiratory quinolones, macrolides, second and third generation cephalosporins are antibiotics of choice
  - high dose amoxicillin (children), amoxicillin-clavulanate and doxycycline are alternatives
  - drug resistance of *S. pneumoniae* is always a consideration
  - Regimen length is usually 5-21 days; may need to cover both typical and atypical bacteria

- **Outpatient versus Inpatient?**