Influenza and Pneumonia Basics
Facts and Fiction

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Michael Anne Preas, RN, CIC
Community Acquired Pneumonia

- Epidemiology
- Microbiology
- Exposure & Relevant History
- Diagnosis
- Prognosis
- Prevention
What Is Pneumonia?

Pneumonia is an infection of the lungs that can cause mild to severe illness in people of all ages. It can be caused by various bacteria or viruses.

Signs/ symptoms include:
• coughing,
• fever,
• fatigue,
• Nausea and or vomiting,
• rapid breathing or shortness of breath,
• chills, or
• chest pain.
What Is Pneumonia?

- Risk factors include:
  - Adults 65 years of age or older
  - Children younger than 5 years of age
  - People up through 64 years of age who have underlying medical conditions (like diabetes or HIV/AIDS)
  - People 19 through 64 who smoke cigarettes or have asthma are also at increased risk for getting pneumonia
Pneumonia

- **HAP**: Hospital-acquired pneumonia
  - ≥ 48 h from admission

- **VAP**: Ventilator-associated pneumonia
  - ≥ 48 h from endotracheal intubation

- **HCAP**: Healthcare-associated pneumonia
  - Long-term care facility (NH), hemodialysis, outpatient chemo, wound care, etc.

- **CAP**: Community-acquired pneumonia
  - Outside of hospital or extended-care facility
Epidemiology

- Flu and Pneumonia are the 8th leading cause of death in US in 2007
- 4-5 million cases per year in US
  - 25% require hospitalization
  - Almost 916,000 cases annually in pts >65 yo
- Case fatality rate has not changed substantially since penicillin

*Per 100,000 population.
*Data for 1993 and 1994 are provisional and are for a 12-month period ending with November.
National and Global Impact

• In 2009, 1.1 million people in the United States were hospitalized with pneumonia and more than 50,000 people died from the disease.

• Globally, pneumonia kills more than 1.5 million children younger than 5 years of age each year. This is greater than the number of deaths from any other infectious disease, such as AIDS, malaria or tuberculosis.

• Access to vaccines and treatment (like antibiotics and antivirals) can help prevent many pneumonia-related deaths.

• Pneumonia experts are also working to prevent pneumonia in developing countries by reducing indoor air pollution and encouraging good hygiene practices.
Impact in the United States

Vaccination
• Percent of adults 65 years and over who had ever received a pneumococcal vaccination: 62.3%

Health Care Use: Hospital inpatient care
• Number of discharges: 1.1 million
• Average length of stay: 5.2 days

Nursing home care
• Number of residents with pneumonia: 33,700
• Percent of residents with pneumonia: 2.3%

Mortality
• Number of deaths: 49,597
• Deaths per 100,000 population: 16.1
• Percent of hospital inpatient deaths from pneumonia: 3.4%

www.cdc.gov
Microbiology

Most common organisms causing pneumonia in over 60% of cases:
S. pneumoniae, Haemophilus influenzae,
   Staphylococcus aureus, Group A streptococci,
   Moraxella catarrhalis, anaerobes, and aerobic gram-negative bacteria

Uncommon organisms accounting for 20-28% of cases
   Legionella spp, Mycoplasma pneumoniae, Chlamydophila
       (formerly Chlamydia) pneumoniae, and C. psittaci
# Microbiology of Community Acquired Pneumonia

<table>
<thead>
<tr>
<th></th>
<th>Outpatient</th>
<th>Inpatient</th>
<th>Intensive Care Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outpatient</strong></td>
<td><em>Streptococcus pneumoniae</em></td>
<td><em>S. pneumoniae</em></td>
<td><em>S. pneumoniae</em></td>
</tr>
<tr>
<td></td>
<td><em>Mycoplasma pneumoniae</em></td>
<td><em>M. pneumoniae</em></td>
<td><em>Legionella spp.</em></td>
</tr>
<tr>
<td></td>
<td><em>Haemophilus influenzae</em></td>
<td><em>H. influenzae</em></td>
<td><em>Legionella</em> species</td>
</tr>
<tr>
<td></td>
<td><em>Chlamydia pneumoniae</em></td>
<td><em>C. Pneumoniae</em></td>
<td><em>Staphylococcus aureus</em></td>
</tr>
<tr>
<td></td>
<td>Respiratory viruses</td>
<td>Respiratory viruses</td>
<td>Gram-negative bacilli</td>
</tr>
<tr>
<td><strong>Inpatient</strong></td>
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</tbody>
</table>
Age-specific Rates of Hospital Admission by Pathogen

Rates of infection for each organism are calculated based on criteria for definite diagnosis. Rates of infection with Legionella spp., M pneumoniae, and C pneumoniae are adjusted for incomplete testing.
## Comorbidities and Associated Pathogens

<table>
<thead>
<tr>
<th>Comorbidity</th>
<th>Associated Pathogens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcoholism</td>
<td>- <em>Strep pneumoniae</em></td>
</tr>
<tr>
<td></td>
<td>- Oral anaerobes</td>
</tr>
<tr>
<td></td>
<td>- <em>Klebsiella pneumoniae</em></td>
</tr>
<tr>
<td></td>
<td>- <em>Acinetobacter</em> spp</td>
</tr>
<tr>
<td></td>
<td>- <em>M. tuberculosis</em></td>
</tr>
<tr>
<td>COPD/Smoking</td>
<td>- <em>Haemophilus influenzae</em></td>
</tr>
<tr>
<td></td>
<td>- <em>Pseudomonas aeruginosa</em></td>
</tr>
<tr>
<td></td>
<td>- <em>Legionella</em> spp</td>
</tr>
<tr>
<td></td>
<td>- <em>S. pneumoniae</em></td>
</tr>
<tr>
<td></td>
<td>- <em>Moraxella catarrhalis</em></td>
</tr>
<tr>
<td></td>
<td>- <em>Chlamydophila pneumoniae</em></td>
</tr>
<tr>
<td>Condition</td>
<td>Pathogens</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Aspiration                      | - Oral Gram-negative enteric pathogens  
                                | - anaerobes                                                                |
| Lung Abscess                    | - CA-MRSA  
                                | - Oral anaerobes  
                                | - Endemic fungi  
                                | - M. tuberculosis  
                                | - Atypical mycobacteria |
| Structural lung disease         | - P. aeruginosa  
                                | - Burkholderia cepacia  
                                | - S. aureus |
| (e.g. bronchiectasis)           |                                                                          |
| Advanced HIV                    | - Pneumocystis jirovecii  
                                | - Cryptococcus  
                                | - Histoplasma  
                                | - Aspergillus  
<pre><code>                            | - P. aeruginosa |
</code></pre>
<table>
<thead>
<tr>
<th>Animal Exposures &amp; Associated Pathogens</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bat or bird droppings</strong></td>
</tr>
<tr>
<td><strong>Birds</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Rabbits</strong></td>
</tr>
<tr>
<td><strong>Farm animals</strong></td>
</tr>
</tbody>
</table>
### Exposures and Associated Pathogens

<table>
<thead>
<tr>
<th>Exposure/Location</th>
<th>Associated Pathogens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hotel or cruise ship</td>
<td>♠️ <em>Legionella</em> species</td>
</tr>
</tbody>
</table>
| Travel or residence in SW US | ♠️ *Coccidioides* species  
  ♠️ *Hantavirus* |
| Travel or residence in SE or E Asia | ♠️ *Burkholderia pseudomallei*  
  ♠️ *Staph aureus*  
  ♠️ *H.influenzae*  
  ♠️ Avian influenza A (H5N1) |
| Influenza active in community | ♠️ *Influenza*  
  ♠️ *S. pneumoniae*  
  ♠️ *Staph aureus (MRSA)*  
  ♠️ *H. influenzae* |
| Cough >2 wks with whoop or posttussive vomiting | ♠️ *Bordetella pertussis* |
MRSA
Community Associated Pneumonia

- 51 *Staphylococcus aureus* CAP cases in 19 states reported 2006-2007
- 79% MRSA
- Median age 16 yrs (range <1 to 81)
- 47% antecedent viral illness
- 33% tested had lab-confirmed influenza

MRSA is a real consideration with CAP, especially during flu season!
Influenza Pneumonia

• Administer antiviral treatment within 48 hrs
  – Reduce likelihood of lower tract complications & antibacterial use in outpatients

• Possible exceptions to <48 h rule
  – Immunocompromised patients
Signs of Improvement

• Clinical improvement w/ effective antibiotics often begins within 48-72 hrs

• Fever can last 2-5 days with Pneumococcus, longer with other etiologies (e.g. S. aureus)

• CXR clearing (if one is done)
Patient not improving

- May need to consider *S. aureus*, virus, MDRO, TB, endemic fungi, *Pneumocystis*

- More unusual pathogens, atypical Mycobacteria, (e.g. Nocardia, actinomycetes), fungi

  OR

- Noninfectious illness:
  - Lung neoplasms with bronchial obstruction
  - Lymphoma
  - Systemic autoimmune disorders
  - Pulmonary Emboli w/ infarct, pulmonary edema, ARDS
Care for the patient with CAP

- Medications as directed by provider
- Rest, rest, rest
- Educate to proper respiratory etiquette
- Hand Hygiene
- Spatial separation if appropriate
Reduce Your Risk: Vaccinate

Pneumonia can be prevented with vaccines. Following good hygiene practices can also help prevent respiratory infections. This includes regularly:

• Cleaning hard surfaces that are touched often
• Coughing or sneezing into a tissue or into your elbow or sleeve
• Limiting exposure to cigarette smoke and treating and preventing conditions like diabetes and HIV/AIDS.
Reduce Your Risk: Vaccinate

In the United States, there are several vaccines that prevent infection by bacteria or viruses that may cause pneumonia. These vaccines include:

- Pneumococcal,
- *Haemophilus influenzae* type b (Hib),
- Pertussis (whooping cough),
- Varicella (chickenpox),
- Measles, and
- Influenza (flu) vaccine.
Pneumococcal vaccine

Disease is caused by *Streptococcus pneumoniae* bacteria. It is a leading cause of vaccine preventable illness and death in the United States. Those most at risk include:

- People 65 years and older
- The very young
- People with chronic health conditions
- People with a weakened immune system
- Smokers

Pneumococcal disease can lead to serious infections of the:

- Lungs (pneumonia),
- Blood (bacteremia), and
- Covering of the brain (meningitis).

Pneumococcal pneumonia kills about 1 out of 20 people who get it. Bacteremia kills about 1 person in 5, and meningitis about 3 people in 10.
**Haemophilus influenzae type b (Hib)**

- Serious disease caused by a bacteria. It usually strikes children under 5 years old.
- You can get Hib disease by being around other children or adults who may have the bacteria and not know it. The germs spread from person to person. If the germs spread into the lungs or the bloodstream, and then Hib can cause serious problems.
- Before Hib vaccine, Hib disease was the leading cause of bacterial meningitis among children under 5 years old in the United States. Hib disease can also cause:
  - pneumonia
  - severe swelling in the throat, making it hard to breathe
  - infections of the blood, joints, bones, and covering of the heart
  - death
  - Before Hib vaccine, about 20,000 children in the United States under 5 years old got severe Hib disease each year and nearly 1,000 people died
Pertussis (Whooping Cough)

- Causes severe coughing spells which can lead to difficulty breathing, vomiting, and disturbed sleep.
- Up to 2 in 100 adolescents and 5 in 100 adults with pertussis are hospitalized or have complications, including pneumonia and death.
- Tdap vaccine was licensed in 2005. It is the first vaccine for adolescents and adults that protects against pertussis as well as tetanus and diphtheria.
Varicella (also called chickenpox)

- Common childhood disease, usually mild, but it can be serious and cause pneumonia, especially in young infants and older adults.
- Causes a rash, itching, fever, and tiredness.
- Can lead to severe skin infection, scars, pneumonia, brain damage, or death.
- Varicella can be spread from person to person through the air, or by contact with fluid from chickenpox blisters.
- A person who has had varicella can get a painful rash called shingles years later.
- Before the vaccine, about 11,000 people were hospitalized for chickenpox each year in the United States, and about 100 people died each year.
- Varicella vaccine can prevent chickenpox.
- Most people who get varicella vaccine will not get chickenpox, but if they do, it is usually very mild case.

www.cdc.gov
Measles, Mumps, and Rubella

Measles
Measles virus causes rash, cough, runny nose, eye irritation, and fever. It can lead to ear infection, pneumonia, seizures, brain damage, and death.

Mumps
Mumps virus causes fever, headache, muscle pain, loss of appetite, and swollen glands. It can lead to deafness, meningitis, painful swelling of the testicles or ovaries, and rarely sterility.

Rubella (German Measles)
Rubella virus causes rash, arthritis (mostly in women), and mild fever. If a woman gets rubella while she is pregnant, she could have a miscarriage or her baby could be born with serious birth defects.

These diseases spread from person to person through the air. You can easily catch them by being around someone who is already infected. Measles, mumps, and rubella (MMR) vaccine can protect from all three of these diseases.
Influenza

• Influenza Basics
• Spread and Transmission
• Clinical Signs and Symptoms
• Prevention and Vaccination
• Debunking Common Myths
Let's talk more about the Flu

• Orthomyxoviridae

• 2 distinct types
  – Influenza A
  – Influenza B

• Subtypes based on surface glycoproteins
  – Hemagglutinin (HA) – viral attachment/entry
  – Neuroaminidase (NA) – enable virus to be released from the host cell
What’s in a Name?

A/Fujian/411/2002 (H3N2)

- Virus type
- Geographic origin
- Strain number
- Year of isolation
- Virus subtype

Type of nuclear material
Neuraminidase
Hemagglutinin
### Antigenic Variation

<table>
<thead>
<tr>
<th>Antigenic Drift</th>
<th>Antigenic Shift</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Small variation</td>
<td>• Large variation</td>
</tr>
<tr>
<td>• Occurs frequently (1-2 yr)</td>
<td>• No immunity in population</td>
</tr>
<tr>
<td>• Epidemics/Seasonal Flu</td>
<td>• Pandemics</td>
</tr>
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**Diagram:**
- Antigenic Drift: Influenza Virus with Neuraminidase and Hemagglutinin changing slightly.
- Antigenic Shift: Influenza Virus with Neuraminidase and Hemagglutinin changing significantly.
## Influenza Viruses

<table>
<thead>
<tr>
<th>Influenza A</th>
<th>Influenza B</th>
</tr>
</thead>
</table>
| • Multiple Hosts  
  – Human, swine, avian, equine | • Humans only |
| • Antigenic Drift  
  Epidemics/Seasonal Flu | • Antigenic Drift ONLY  
  Epidemics/Seasonal Flu |
| • Antigenic Shift  
  Pandemics | • No Antigenic SHIFT |
Influenza

Epidemic

“Seasonal Flu”

• Regional Outbreaks
• Antigenic Drift
• Winter months

Pandemic

• Concurrent global outbreaks
• Antigenic Shift
• Outside usual seasonality

U.S. WHO/NREVSS Collaborating Laboratories
National Summary, 2004-05 through 2007-08

2004 2005 2006 2007

1918 1919

1918-H1N1
## Pandemics

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<td>50 million</td>
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<tr>
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<td>1957-1958</td>
<td>1.5 - 2 million</td>
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<tr>
<td>Hong Kong Flu</td>
<td>1968-1969</td>
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<td>2009 H1N1</td>
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Each Year, Seasonal Influenza

- Affects up to 20% of the Population (60 mil)
- Results in 200,000 hospitalizations
- Results in 30,000 deaths
Percentage of Visits for Influenza-like Illness (ILI) Reported by the U.S. Outpatient Influenza-like Illness Surveillance Network (ILINet), Weekly National Summary, September 28, 2008 – September 1, 2012
Q: Do pork products cause swine flu?
A: Yes, just as the Rocky Mountains cause Rocky Mountain Fever...

Legionnaires cause Legionnaires' disease...
And limes cause Lyme disease!
Influenza Transmission

• Spread from person-to-person
• Infectious 24 hours BEFORE symptoms
• Infectious 5-7 days after symptoms onset
  – Longer for kids, immune suppressed
• Droplet and Contact Transmitted
Transmission

• Droplet Transmission
• Large Respiratory Droplets
• 3-6 feet
Transmission

• Contact Transmission
• Flu virus can live on surfaces, 2-8 hours
• Direct contact with contaminated surfaces
• Then touching eyes, nose, mouth
“Bird Flu” and “Swine Flu”

Direct Transmission

Adaptation

Reassortment
Signs and Symptoms

- Influenza, AKA “The Flu”
  - Fever (>100°F) PLUS Respiratory Symptoms
- Primary viral pneumonia
- Secondary bacterial pneumonia
- Children may have unusual presentations
  - Febrile seizures, transverse myelitis, myocarditis, encephalopathy
Consequences

- Misery
- Absenteeism
- Doctor visits
- Antibiotic use*
- Hospitalizations
- Deaths
Prevention: Vaccination

- Single most important prevention measure!!

- 2012 Vaccine now available (coming to a hospital near you!)
Vaccination

• Made anew each year
• Requires growth of virus in eggs
• Takes at least 6 months to develop
• Includes 3 Antigentic Types
  – 2 Influenza A; 1 Influenza B
  – “Best Guess” of circulating viruses for season
Prevention: Wash Your Hands

off the mark.com
by Mark Parisi

CENTER FOR THE STUDY OF INFECTION DISEASES

EMPLOYEES MUST NOT WASH HANDS BEFORE RETURNING TO WORK.

Wash 'em!

www.cdc.gov/h1n1flu

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Prevention: Respiratory Etiquette

Cover Your Cough!!
Prevention: Social Distancing

Stay away from sick contacts
Prevention: Social Distancing

This little piggy should've stayed home

If your sick stay home!
Prevention

- Good Infection Control
- Isolation of Patients
- Droplet Precautions
- Contact Precautions
Treatment

OINKSIP MAX

SWINE FLU
Lemon & Apple Sauce
with a hint of stuffing

10

Snotty Snouts
Tired Trotters
Chilly Chops

Maximum Medi Parang For Your
Treatment
Who should get Treatment?

• Hospitalized patients
• High-risk patients
  – < 5 years, > 65 years
  – Pregnant women
  – Chronic medical conditions
  – Weakened immune systems
• <19 years receiving long-term aspirin
Chemoprophylaxis

- Not routinely encouraged
- Increases risk of antiviral drug resistance
- Reserved for high risk persons
- Versus education, close monitoring of symptoms PLUS early treatment
FACTOR OR MYTH?

HOW TO PLAY
Myths

“The flu is annoying, but harmless”

“If your young and healthy, you don’t need the flu shot”
Myths

“The flu is annoying, but harmless”

“If your young and healthy, you don’t need the flu shot”

Protect Yourself

Protect Your Patients
Myths

“I don’t need the flu shot, I can just take Tamiflu (or antibiotics)”
Myths

“I don’t need the flu shot, I can just take Tamiflu (or antibiotics)”

• Still at risk for spreading virus
• Resistance is a concern
• Rx shortens duration of Sx 1 day
Myths

“I had the flu shot last year; I don’t need it again”
Myths

“I had the flu shot last year; I don’t need it again”

The components of the vaccine are different each year
Vaccination

• Made anew each year
• Requires growth of virus in eggs
• Takes at least 6 months to develop
• Includes 3 Antigentic Types
  – 2 Influenza A; 1 Influenza B
  – “Best Guess” of circulating viruses for season
Myths

“I had the flu shot last year but it didn’t work; I still had the stomach flu”
Myths

“I had the flu shot last year but it didn’t work; I still had the stomach flu”

Influenza is NOT a cause of gastroenteritis
And therefore, the “flu shot” does not protect against it
Myths

“Last year I got the flu shot and I got the flu anyway”
Myths

“Last year I got the flu shot and I got the flu anyway”

• You may have had a common cold or other respiratory virus
• There may have been a “mismatch”
Myths

“I already had the flu this year so I don’t need the shot”

“If you get the flu, you can’t get it again”
Myths

“Vaccines are dangerous”
Myths

“Vaccines are dangerous”

Vaccines have saved more lives than any other public health intervention
Myths

“I don’t want to get the flu shot, the side effects of the shot are worse than getting the flu”
Myths

“I don’t want to get the flu shot, the side effects of the shot are worse than getting the flu”

Local reactions are the most common side effects
## Vaccine Side Effects

<table>
<thead>
<tr>
<th>Inactivated “Shot”</th>
<th>Intranasal “ Flu Mist”</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Soreness, redness or swelling at site</td>
<td>• Runny nose</td>
</tr>
<tr>
<td>• Fever</td>
<td>• Headache</td>
</tr>
<tr>
<td>• Aches</td>
<td>• Sore throat</td>
</tr>
<tr>
<td>• Allergic reaction</td>
<td>• Cough</td>
</tr>
</tbody>
</table>
Myths

“The flu shot gives you the flu”
Myths

“The flu shot gives you the flu”

The “flu shot” is an inactivated vaccine
It cannot cause the “flu”
Myths

“The nasal mist causes the flu”
Myths

“The nasal mist causes the flu”

The “mist” is a weakened virus
It cannot replicate at body temperature
And thus cannot cause the flu
Myths

“It’s December and I haven’t gotten the vaccine yet, so there is no point in getting it now”
Myths

- **Get the flu shot**
- **...not the flu.**

**Optimal time for vaccination**

**HEIGHT OF FLU SEASON**

CASES

MONTH

What kinds of flu vaccines are available?

Trivalent flu vaccine protects against two influenza A viruses and an influenza B virus

The following trivalent flu vaccines are available:

  - **Standard dose** trivalent that are manufactured using virus grown in eggs. These are approved for people ages 6 months and older.
  - **Egg free** standard dose trivalent vaccine approved for people 18 through 49 years of age.
  - **High dose** trivalent vaccine approved for people 65 and older.
  - **Intradermal** trivalent vaccine injected into the skin instead of the muscle and uses a much smaller needle than the regular flu shot approved for people 18 through 64 years of age.

Quadrivalent flu vaccine will protect against two influenza A viruses and two influenza B viruses

The following quadrivalent flu vaccines will be available:

  - A **standard dose** quadrivalent shot. These are approved for people ages 6 months and older.
  - Quadrivalent vaccine given as a **nasal spray** approved for healthy* people 2 through 49 years of age.
Prevention

Tried & true...

Wash ‘em!

Stay Home!

Cover it!

I can’t cover my shift.

http://www2a.cdc.gov/eCards
Prevention
Tried & true...

Don’t let the flu slow you down. Get vaccinated.