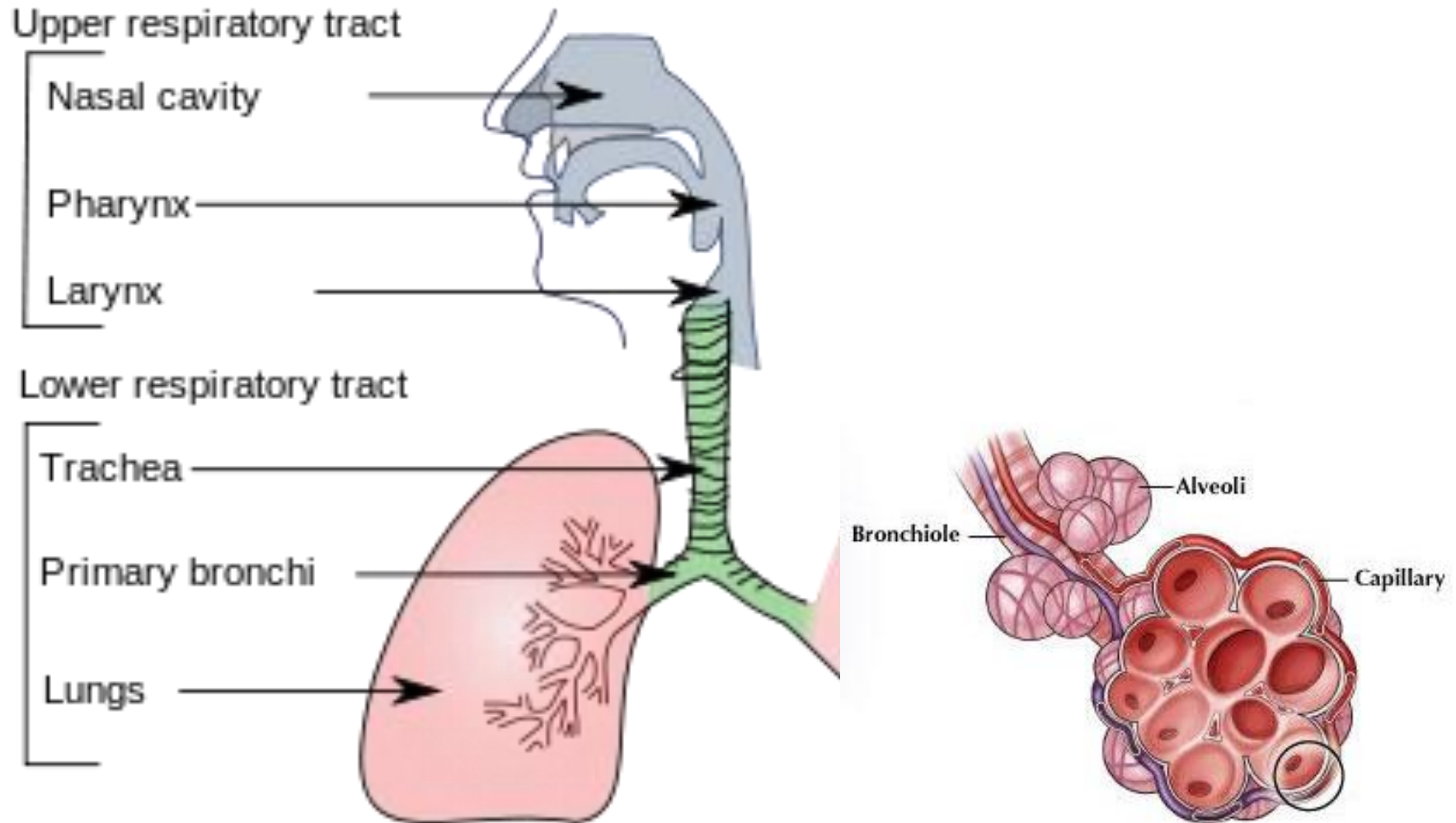


RESPIRATORY TRACT INFECTIONS

CLS 212: Medical Microbiology

Anatomy of the Respiratory System



Respiratory Infections

- Respiratory tract can be divided into:
- Upper Respiratory Tract (URT):
 - Sinuses
 - Nasopharynx,.
 - Oropharynx.
 - Epiglottis
 - Larynx (voice cord)
- Lower Respiratory Tract (LRT):
 - Trachea.
 - Bronchial tubes.
 - Alveoli.
 - Lungs.

Respiratory Tract Infections

- Normal flora of the **upper respiratory tract** (**URT**) might cause opportunistic infections of the respiratory system.
- Infectious diseases of the **URT** are more common than infectious diseases of the **LRT**

Upper Respiratory Tract Infection

Definitions

Sinusitis

Inflammation of the lining of one or more of the paranasal sinuses.

Pharyngitis

Inflammation of the mucous membrane and the underlying tissue of the pharynx.

Laryngitis

Inflammation of the mucous membrane of the larynx.

Epiglottitis

Inflammation of the epiglottis. It may cause respiratory obstruction especially in children.

Lower Respiratory Tract Infection

Definitions

Bronchitis

Inflammation of the mucous membrane lining the bronchial tubes.

Pneumonia

Inflammation of one or both lungs. The alveolar sacs will be filled with inflammatory cells, fibrin, and exudates.

Bronchopneumonia

Combination of bronchitis and pneumonia.

Infections of the URT

Viral Infection of the URT:

- Common Cold.

Bacterial infections of the URT:

- Pharyngitis (Sore throat).
- Diphtheria.





Common Cold

Common Cold

- Viral infection of the lining of the nose, throat, and sinuses. Also known as: *Acute Viral Rhinitis*.
- **Symptoms:** coughing, sneezing, runny nose, sore throat, fever, chills, and malaise.
- Secondary bacterial infection (otitis media, sinusitis) may follow.
- **Causative viruses:** Rhinovirus, Influenza virus, Parainfluenza virus, Corona virus,...
- Rhinoviruses is the major cause of cold in adults (more than 100 types).
- **Transmission:** (person-to person)
airborne droplet inhalation, direct contact with infected human or his belongings.

Pharyngitis



Pharyngitis

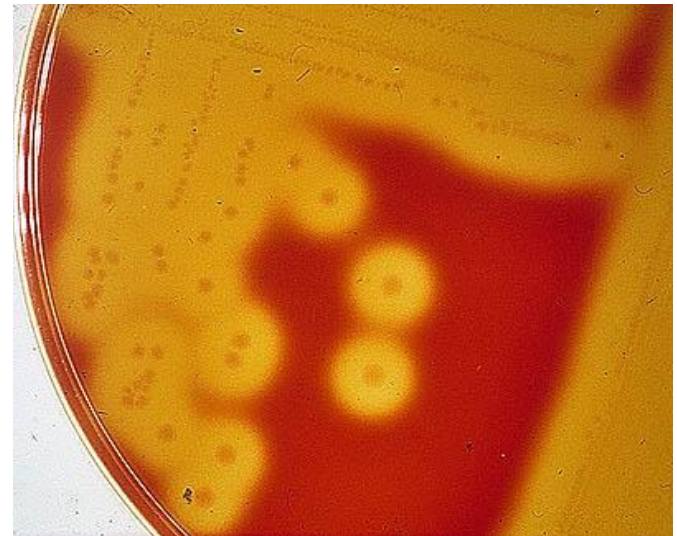
- Acute bacterial infection of the throat. Also known as: *Strept throat*.
- **Symptoms:** sore throat, chills, fever, headache; beefy red throat; white pus patches on pharynx; enlarged tonsils, enlarged cervical lymph nodes.
- The infection might spread to sinuses, middle ear, or hearing organs.
- **Causative Bacteria:** *Streptococcus pyogenes* also known as Strept group A.
- **Transmission:** (person-to person)
Airborne droplet inhalation, direct contact with infected human or his belongings. Also direct contact with nasal carrier of the infection.
- **Treatment:** Penicillin G (Erythromycin).

Streptococcus pyogenes

- **Gram positive** cocci arranged in chains.
- β -haemolytic on Blood Agar media.
- Normal flora of the throat and skin.



S. agalactiae



Streptococcus pyogenes

- Group A strep usually causes relatively mild illnesses, such as streptococcal sore throat (strep throat) and streptococcal skin infections (impetigo). Group A strep can also cause more serious illnesses such as **Scarlet Fever, Rheumatic Fever, Postpartum Fever, Wound Infections, and Pneumonia.**
- Occasionally, a deadly type of group A strep bacteria can invade the blood, muscle and fat tissue, or lungs and cause a serious and often life-threatening type of infection called **Invasive group A strep.** Two rare, but very severe, forms of invasive group A strep infections are **Necrotizing Fasciitis** and **Streptococcal Toxic Shock Syndrome.**

Acute Bacterial Pharyngitis

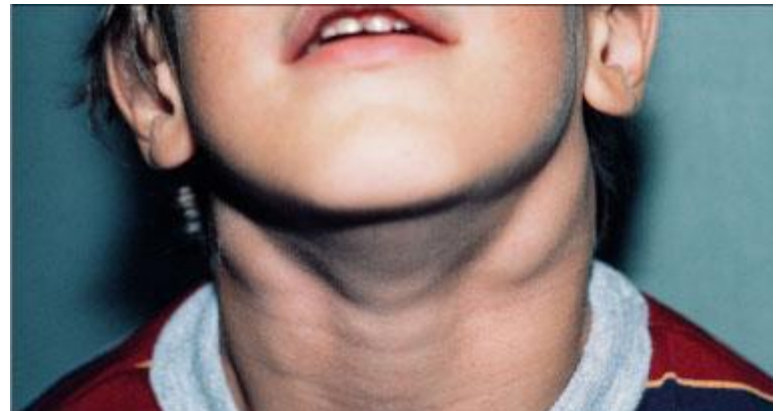
White pus patches on
pharynx; enlarged
tonsils



enlarged cervical lymph nodes



Impetigo: Skin Infection,
more common on the face
of children.



Scarlet Fever

Characterized by pharyngitis, fever, and rash.



Strawberry Tongue



Invasive group A strep.

- **Necrotizing Fasciitis "flesh-eating disease"**

Is an infection that attacks the deep layers of tissue. It is usually caused when a deadly strain of group A strep infects an opening in the skin. For unknown reasons, the strain becomes very aggressive and releases a **toxin** (poison) that quickly and irreparably destroys flesh and muscle. Doctors often must remove skin, large groups of muscle, or entire limbs to save a person's life.

- **Streptococcal Toxic Shock Syndrome**

Another type of rapidly progressing strep infection, causes a dangerous drop in blood pressure, shock, and damage to the kidneys, liver, and lungs. As in necrotizing fasciitis, the toxin damages the tissues and organs so quickly that treatment is difficult and often too late.

Infections of the LRT

Viral Infections of the LRT:

- Viral Respiratory disease.
- Avian Influenza (Bird Flu).
- Influenza (flu).
- Severe Acute Respiratory Syndrome (SARS).
- Hantavirus Pulmonary Syndrome (HPS).

Infections of the LRT

Bacterial Infections of the LRT:

- Legionnaire's Disease (Pontiac Fever).
- Primary Atypical Pneumonia
- Tuberculosis (TB).
- Whooping Cough.

Fungal Infections of the LRT:

- Pneumocystis pneumonia (PCP).

Pneumonia

Acute non-specific infection of the small air sacs (alveoli) and tissues of the lungs.

- Often secondary to viral respiratory infection.
- **Symptoms:** fever, productive cough (sputum), acute chest pain, chills, and shortness of breath.
- **Transmission:** (person-to person or bird-to-person) airborne droplet inhalation, direct oral contact.
- Pneumonia can be community acquired or hospital acquired.
- **Types of Community Acquired Pneumonia:**
 1. Typical Pneumonia.
 2. Atypical Pneumonia.

“Typical” versus “Atypical” pneumonia

Typical Pneumonia: (virulent bacteria)

- Sudden onset.
- Productive cough with purulent sputum.
- Pleuritic chest pain.
- leukocytosis (high no. of WBC) or leukopenia (low no. of WBC).

Atypical Pneumonia: (viral, *M. pneumoniae*, others)

- Gradual onset.
- Nonproductive cough.
- Substernal chest pain.
- White blood count normal.

Typical Community Acquired Pneumonia

- Community acquired bacterial pneumonia is most frequently caused by *Streptococcus pneumoniae*.
- *Strept. pneumoniae* is the most common cause of pneumonia in the world.

Other bacteria causing typical pneumonia:

1. *Haemophilus influenzae*.
2. *Staphylococcus aureus*.
3. *Klebsiella pneumoniae*.
4. *Moraxella catarrhalis*.
5. Less common Gram negative bacilli & anaerobes.

Atypical Community Acquired Pneumonia

Pneumonia not due to *Streptococcus pneumoniae*.

- **Bacteria causing atypical pneumonia:**

1. *Legionella pneumophila*.
2. *Mycoplasma pneumoniae*.
3. *Chlamydophila pneumoniae*.
4. *Chlamydophila psittaci*.
5. *Mycobacterium tb*.

Atypical Community Acquired Pneumonia

Viruses causing atypical pneumonia:

1. Adenovirus.
2. Respiratory syncytial virus (RSV).
3. Parainfluenza viruses.
4. CMV (Cytomegalovirus).
5. Measles virus.
6. Chickenpox virus.

Fungi causing atypical pneumonia:

Histoplasma, Candida albicans, Cryptococcus neoformans, Aspergillus.

Hospital Acquired Pneumonia

- Account for 15% of hospital acquired infections.
- The most common fatal hospital acquired infection with a mortality rate of: 20-50%.
- **People at risk:** Immunocompromised patients.
- Most often caused by **Gram-negatives** and more resistant organisms **e.g.** *Pseudomonas aeruginosa*, *Enterobacter*, *Klebsiella*,..



Influenza (Flu)

Influenza is an acute viral respiratory infection.

Symptoms: fever, chills, headache, body aches and pain, sore throat, cough, nasal drainage, sometimes nausea, vomiting, and diarrhea especially in children.

Causative Agent: Influenza virus A, B, and C.

- Influenza A viruses causes severe symptoms and are associated with pandemics and epidemics.
- Influenza B viruses causes less severe disease and more localized epidemics.
- Influenza C viruses usually do not cause significant disease or epidemics.

Influenza (Flu)

- **Carriers:**

human is the main carrier of virus but it also might be carried by birds and pigs.

➤ Pigs serve as “mixing bowls” for both avian and human strains resulting in new strains.

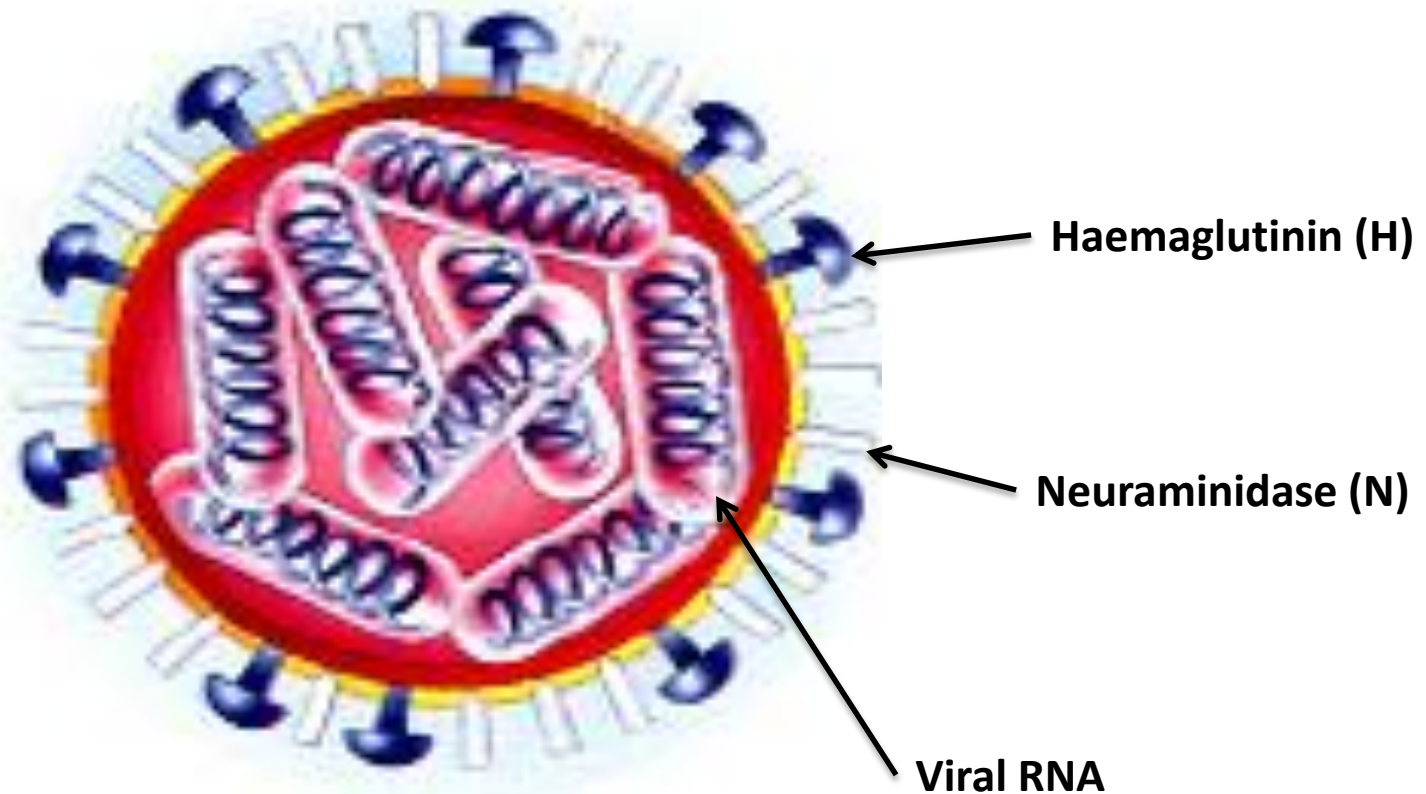
- **Transmission:**

Airborne spread or direct contact.

Flu Vaccine

- Travelers.
- Children 6 months – 5 years.
- Elderly > 65.
- Residents of nursing homes.
- People with long term-illnesses (e.g. heart/lung).
- People with depressed immunity.
- Pregnant women in 2nd-3rd trimester.
- Healthcare workers.
- EVERYONE in the face of a Pandemic-threat.

Structure of Influenza A Virus



Antigenic **DRIFT** causes yearly epidemics.

Antigenic **SHIFT** causes influenza pandemic (every 10-40 years).

Flu Pandemics

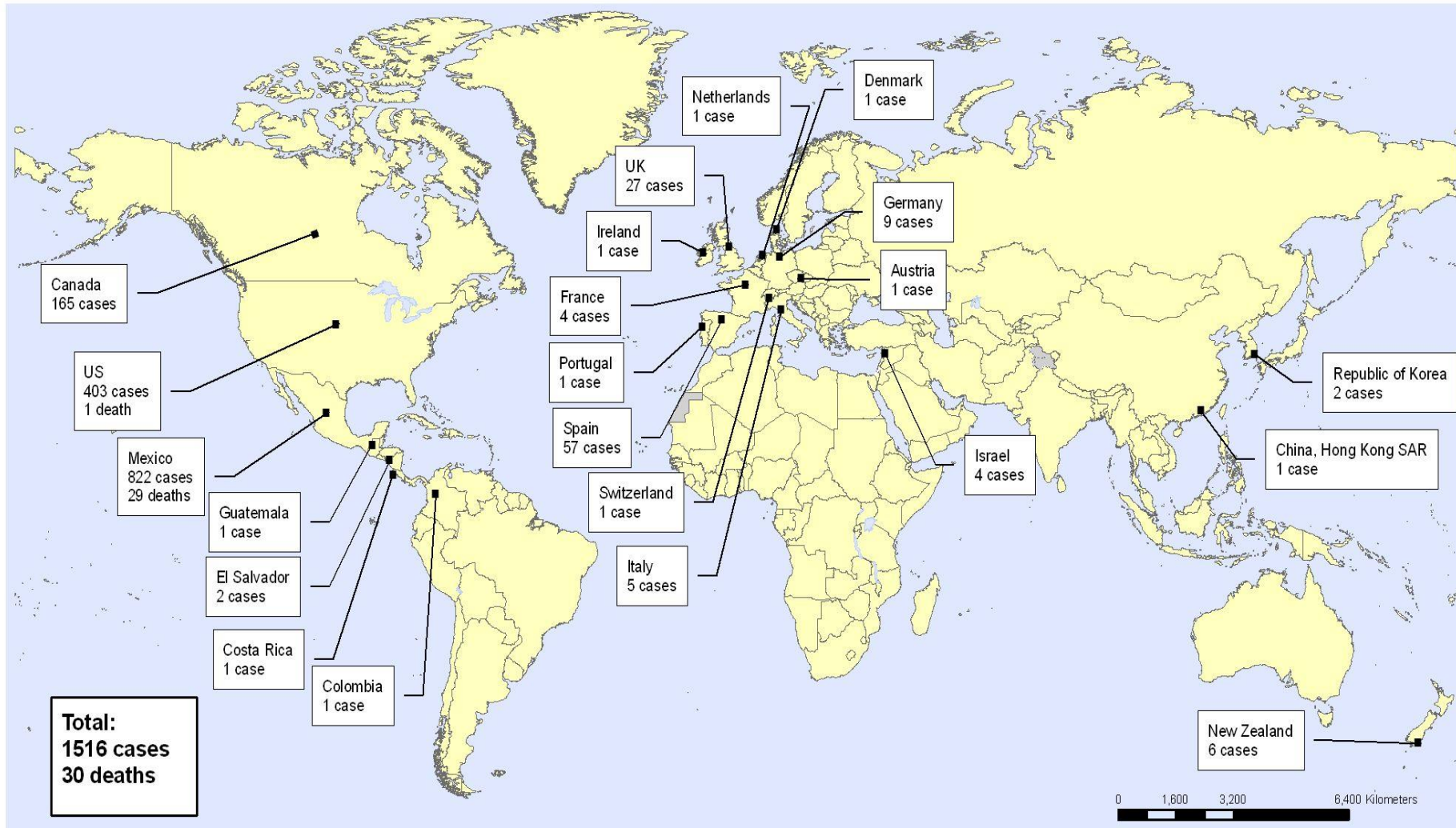
- **1918-1919 Spanish flu:** also known as the swine flu epidemic which killed 20-50 million people worldwide.
- **1957-1958 Asian flu** killed about 1 million people.
- **1968-1969 Hong Kong flu** killed about 0.7 million people.

Swine Flu H1N1 Outbreak- 2009

- April 4: 1st case in Mexico.
- April 12: First death.
- April 21-23: US confirms first 4 cases.
- April 26: Canada confirms first cases.
- April 27: Europe, Spain & Britain. WHO raises pandemic alert status to phase 4.
- April 28: New Zealand & Israel.
- April 29-30: Germany, Austria, Switzerland, Netherlands.
- May 1: Hong Kong, Denmark, France.
- May 2: South Korea, Italy.

New Influenza A (H1N1), Number of laboratory confirmed cases and deaths as reported to WHO

Status as of 6 May 2009
06:00 GMT



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: World Health Organization
Map Production: Public Health Information
and Geographic Information Systems (GIS)
World Health Organization



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The A/H1N1 virus

*An unusual cocktail
of avian, swine and human viruses*



Bird flu

Human flu



Swine flu

Pigs may harbour several flu viruses simultaneously. The pathogens may mix to create a new viral strain



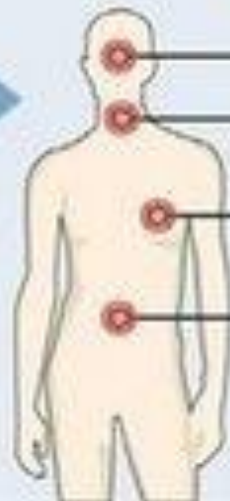
Transmission

**Pig
to human**

*By inhaling
viral particles
(there is no risk
from eating
cooked pork)*



**Human
to human**
*By inhaling
viral particles*



Symptoms

- High fever
- Coughing, sneezing
- Breathing difficulties
- Loss of appetite

Routes of Exposure to Spread the Infection

- **Primary Exposure Route:**

Person to Person

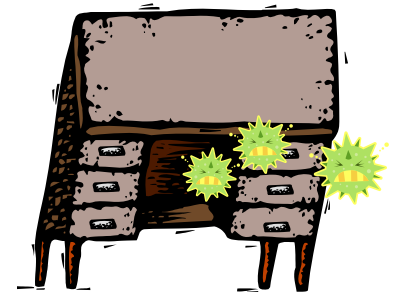
- Inhalation of Airborne Droplets from Infected Person Coughing or Sneezing.



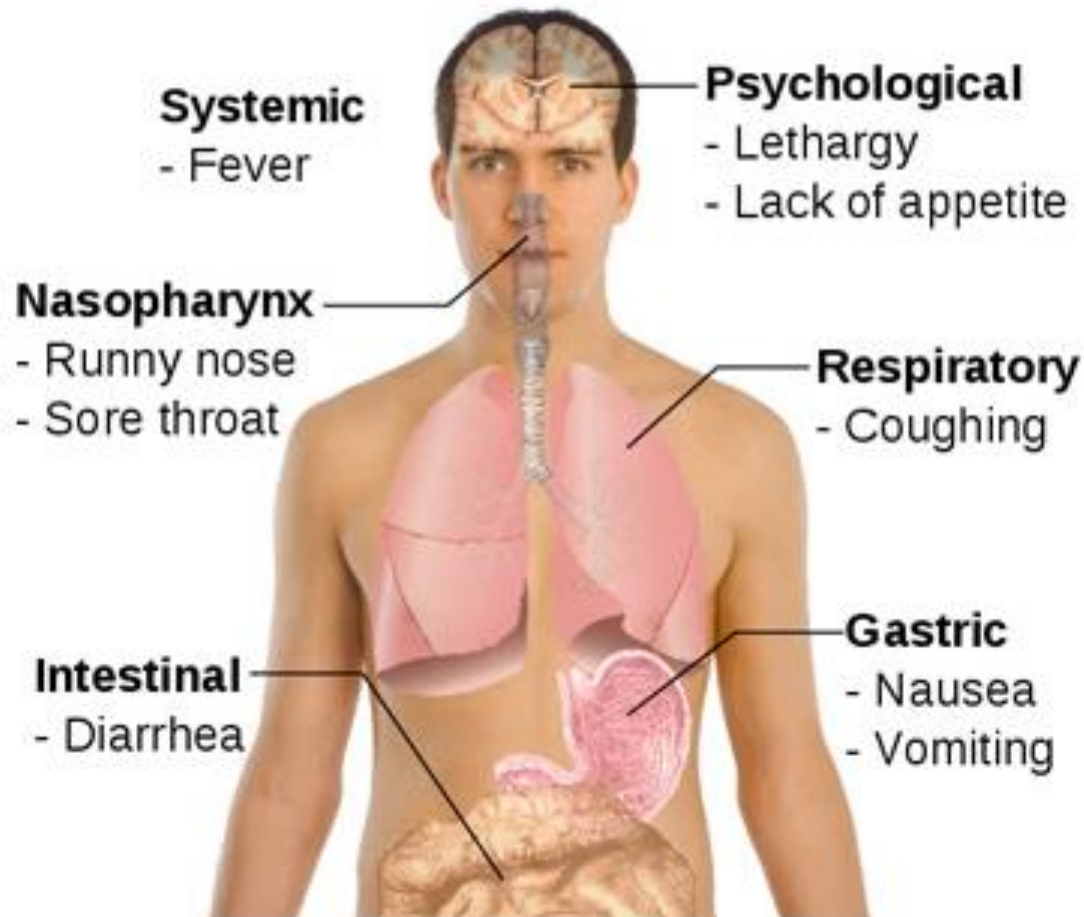
- **Secondary Route of Exposure:**

Viruses on Surfaces

- Can Live on Surfaces for 2 Hours or More.
- Person Touching Contaminated Tables, Doorknobs, Desks, Then Touching Face, Eyes, Nose, or Mouth.



SYMPTOMS OF INFLUENZA A (H1N1-2009)



Does Influenza Vaccine Protect from H1N1??

In the PAST: It does NOT protect against H1N1.

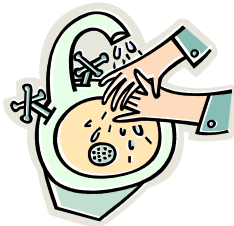


NOW: It protect against H1N1 as they integrated it in the Influenza vaccine.

Prevention

- Cough/Sneeze - Cover Nose/Mouth with Tissue or Sneeze into the Sleeve.

“Dispose Used Tissues in the Trash”.



- Wash Hand with Soap & Water (At Least 20 Seconds) or Use Alcohol-Based Hand Sanitizers.
- Avoid Touching Eyes, Nose, or Mouth.
- Avoid Contact with Sick People.

“If Sick, Stay at Home Away from Work or School and Limit Contact with Others”.

