



# RS

## MICROBIOLOGY

### MODIFIED NO. 2.2



كتابة: ليث الخزاعلة و ريناس الخريسات





تدقيق: تم

الدكتور: حافظ المومني

# Respiratory System Infections

## Color code

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	Slides
	Doctor
	Additional info
	Important

# Laboratory diagnosis

- Variety of Rapid influenza diagnostic tests (RIDTs).
  - These tests are inoculated by point-of-care personnel and give results within 15–20 minutes.
  - Unfortunately, these tests have variable sensitivity and commonly yield false negative results.
- Hemagglutination of erythrocytes (due to hemagglutinin action) or complement fixation.
- Patient serum antibodies



The diagnosis of influenza is primarily based on clinical presentation and physical examination. In most cases, a detailed patient history and observation of common symptoms such as sneezing, coughing, and high-grade fever are sufficient for diagnosis. Additional diagnostic tests are usually not required.

Rapid Influenza Diagnostic Tests (RIDTs) are available on the market; however, their sensitivity is relatively low, making them less commonly used in routine clinical practice. These tests are more beneficial for research purposes rather than for diagnosing individual patients.

The oral Oseltamivir is the most commonly used antiviral effective against influenza, while intravenous Peramivir is less commonly used. However, in young and healthy patients with mild symptoms, antivirals are typically not prescribed. This is because antivirals are most effective when administered within the first 48 hours of symptom onset or exposure to the virus.

Antiviral treatment is recommended for high-risk groups, including residents of nursing homes, the elderly, immunocompromised individuals, and pregnant women. These groups are at a higher risk of developing severe complications from influenza, such as pneumonia, respiratory failure, or exacerbation of chronic conditions. Antivirals may also be used as prophylaxis in these populations to prevent infection.

# Treatment

- Three drugs that inhibit influenza neuraminidase activity are available: inhaled zanamivir, oral **oseltamivir (Tamiflu)**, and intravenous peramivir.
  - Can shorten the course of the disease.
  - Should start less than 48 hours from exposure or symptom for prophylaxis or treatment
  - Nursing home, young, old, pregnant, chronic lung, immunocompromised



- A more effective means of controlling influenza outbreaks, though, is vaccination.
  - Every year against the strains expected to be predominant.
  - three or four viruses are selected—the two most prevalent influenza A strains and one or two influenza B strains.
  - Most of the influenza vaccines over the past decade have had an effectiveness of about 50%

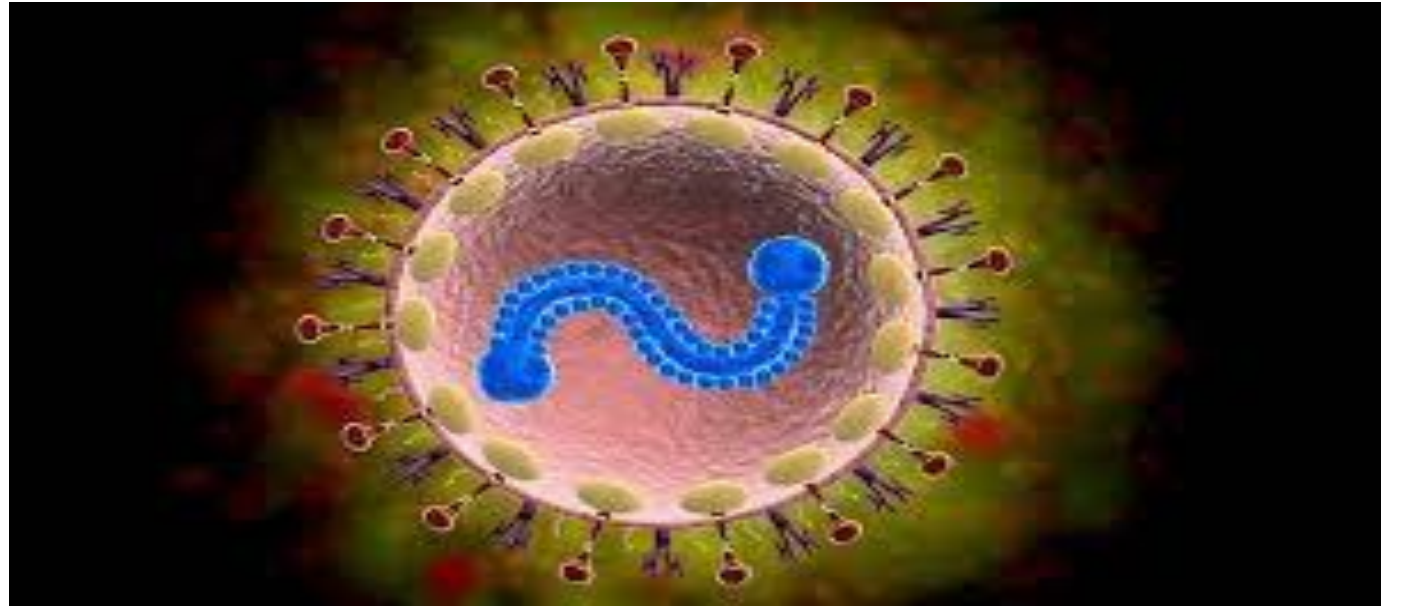
# Bronchiolitis/RSV

- Inflammation of bronchioles (small airway)
- RSV is the most common cause of bronchiolitis and pneumonia in children younger than 1 year of age
- Pediatric less than 2 years (peak at 6 months)
- Runny nose, cough, **wheeze**, **cyanosis**, fever, fatigue and reduce activity
- Difficulty feeding due to **respiratory distress**.
- Wheezing and crackles on auscultation. Tachypnea (rapid breathing), Retractions (intercostal, subcostal), Nasal flaring and Cyanosis in severe cases.



# Treatment

- Assess severity
- Determine risks factors
- Supportive



Evade immune system and antibodies production: no natural immunity

Reinfection not sever



**Bronchiolitis** is a respiratory condition that typically affects children aged 1 to 2 years, with its peak incidence occurring at around 6 months of age. If a child older than 2 years (e.g., 4 years old) presents with similar clinical symptoms, the diagnosis would likely be **bronchitis** rather than bronchiolitis.

The bronchioles are small airways in the lungs that are naturally narrow. During an infection, severe inflammation and narrowing occur, which can lead to **wheezing** and, in severe cases, **cyanosis**.

**Cyanosis** refers to a bluish discoloration of the skin and mucous membranes caused by insufficient oxygen in the blood.

#### **RSV (Respiratory Syncytial Virus):**

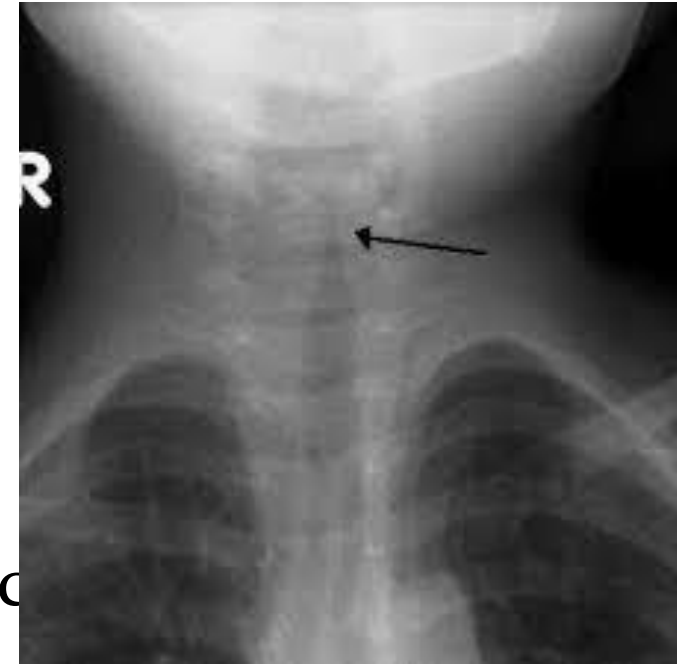
- **Serotype:** RSV has only one serotype, but it is common for children to get reinfected within a short period (e.g., a few months). This happens because the immature immune system in young children is unable to produce sufficient antibodies to develop lasting immunity.
- **Vaccine:** Currently, there is no vaccine available for RSV.

## Case Presentation:

- A 7-month-old infant is brought to the pediatric clinic with symptoms of respiratory distress. The mother reports that the baby has been having a runny nose, cough, and mild fever for the past two days. Over the last 12 hours, the baby has become more irritable, has difficulty feeding, and seems unusually fatigued. The mother also mentions that the baby is breathing faster than usual and that she has noticed some unusual flaring of the nostrils.
- On examination, the baby appears tired and is showing signs of respiratory distress. The pediatrician observes:
  - **Physical Exam:**
  - **Tachypnea:** Rapid breathing (about 70 breaths per minute).
  - **Retractions:** Intercostal and subcostal retractions visible with each breath.
  - **Nasal Flaring:** Clear sign of increased effort to breathe.
  - **Cyanosis:** Mild bluish discoloration around the lips during episodes of difficulty breathing.
  - **Auscultation:** Wheezing and crackles are heard in both lungs.
- Based on the clinical presentation and examination, the pediatrician suspects **bronchiolitis** caused by **RSV**.
- This case simplifies the understanding of bronchiolitis and RSV by presenting common symptoms and physical signs in a way that mirrors what a healthcare professional might encounter in a clinical setting. It helps in recognizing the typical features of the disease in infants, especially under 1 year of age, and emphasizes the signs of respiratory distress like tachypnea, retractions, nasal flaring, and cyanosis.

# Croup

- Laryngotrachibronchitis
- Viral (most common: parainfluenza virus).
- Cough (seal like, barking)
- More in fall
- **Inspiratory stridor** (An obstruction in the extrathoracic airway)
- nose, fever, hoarseness
- Most common: **parainfluenza virus**, RSV
- Treatment:
  - Supportive
  - If severe: epinephrine, dexamethasone, O<sub>2</sub>
- **DX: Bacteria Tracheitis (S aureus)**



Steeple sign

Additional video :

<https://youtu.be/sZrrtC7Pj6I?si=s2MqJsakBm2nqpr->

**Croup** is a viral infection that affects three main areas of the respiratory tract: **bronchi**, **larynx** (voice box), and **trachea** (windpipe). It is most commonly caused by the **parainfluenza virus** and typically spreads during the **fall** season. The hallmark symptoms of croup include a **seal-like or barking cough** and **inspiratory stridor**, a high-pitched wheezing sound heard during inhalation. This is caused by inflammation and obstruction in the trachea and larynx. Additional symptoms include **hoarseness** and difficulty breathing. On an **X-ray**, the characteristic **steeple sign** (narrowing of the upper trachea) is often seen, which helps confirm the diagnosis of croup. Treatment for mild cases is supportive, while moderate or severe cases may require anti-inflammatory treatment with **dexamethasone**, along with **epinephrine** (to reduce swelling) and **oxygen** to improve breathing. If the child does not improve with these treatments, it may suggest a misdiagnosis, and the actual condition could be **bacterial tracheitis**, often caused by **Staphylococcus aureus**, which requires antibiotics for treatment.

### Clinical Case:

A 2-year-old child is brought to the emergency department with a 3-day history of a worsening cough, fever, and difficulty breathing. The mother describes the cough as “barking” and noticed the child has been breathing with difficulty, especially when inhaling. On examination, the child appears distressed, with a **high-pitched inspiratory stridor** and mild **hoarseness**. The child also has **tachypnea** (rapid breathing) and **nasal flaring**. An **X-ray** shows a **steeple sign**. Given these symptoms and the seasonal context, the diagnosis of **croup** is made. The child receives supportive treatment, including **dexamethasone** and **nebulized epinephrine**, along with **oxygen**. The child shows improvement after treatment.

Feature	Croup
<b>Etiology</b>	Viral (most common: <b>parainfluenza virus</b> ).
<b>Age Group</b>	Typically affects children <b>6 months to 3 years</b> .
<b>Onset</b>	Gradual, often preceded by <b>cold-like symptoms</b> (runny nose, fever, mild cough).
<b>Key Symptoms</b>	- <b>Barking, "seal-like" cough.</b> - <b>Inspiratory stridor.</b> - <b>Hoarseness.</b>
<b>Severity</b>	Usually <b>mild to moderate</b> (can be severe in rare cases).
<b>Response to Treatment</b>	Stridor improves with <b>humidified air, nebulized epinephrine, or corticosteroids.</b>
<b>Voice Changes</b>	Hoarseness common.
<b>Fever</b>	Low-grade fever.
<b>Airway Management</b>	Rarely requires intubation unless severe (e.g., impending respiratory failure).
<b>Treatment</b>	- <b>Mild cases:</b> Supportive care (humidified air, hydration). - <b>Moderate/severe cases:</b> Corticosteroids (e.g., dexamethasone), nebulized epinephrine.

## Clinical presentation to bacterial tracheitis

Feature	Bacterial Tracheitis
<b>Etiology</b>	Bacterial (most common: <b>Staphylococcus aureus</b> ; others include Streptococcus, Moraxella).
<b>Age Group</b>	Slightly older children ( <b>5–8 years</b> ), but can occur in younger children.
<b>Onset</b>	Rapid progression following a viral illness or can appear suddenly.
<b>Key Symptoms</b>	- High fever. - <b>Severe stridor (inspiratory and expiratory)</b> . - Toxic appearance (lethargy, cyanosis, severe distress).
<b>Severity</b>	Severe and <b>life-threatening</b> due to airway obstruction from thick purulent secretions.
<b>Response to Treatment</b>	Minimal or no response to treatments for croup (e.g., epinephrine).
<b>Voice Changes</b>	Hoarseness is less common but may occur.
<b>Fever</b>	High fever.
<b>Toxic Appearance</b>	Frequently present: patient appears <b>toxic and ill</b> .
<b>Airway Management</b>	High risk of airway obstruction; <b>intubation is often required</b> to manage secretions.
<b>Treatment</b>	- Requires <b>broad-spectrum IV antibiotics</b> (e.g., ceftriaxone + vancomycin). - Airway clearance under controlled conditions (e.g., bronchoscopy or suctioning).

# Viral bronchitis/chest cold

- **Viral bronchitis** refers to inflammation of the bronchi (large airways) caused by a viral infection. It is one of the most common causes of **acute bronchitis** and is usually self-limited, resolving within a few weeks.
- **Common Viruses:**
  - Influenza virus, Parainfluenza virus, Respiratory Syncytial Virus (RSV), Adenovirus and Coronavirus
- **Cough** (hallmark symptom):
  - Begins as dry and unproductive.
  - Progresses to a productive cough with mucus (clear, yellow, or green sputum).
  - For 10-20 days

- Other Symptoms:

- Low-grade fever, Fatigue, **Wheezing** or mild dyspnea, Sore throat (often a prodromal symptom), Chest discomfort or tightness (due to coughing).

- Signs:

- **Rhonchi or wheezing** on auscultation (which may improve after coughing).

- Most cases resolve within 2–3 weeks.

- Supportive Care:

- Hydration: To thin mucus and maintain airway clearance.
- Rest: Allow recovery.
- Analgesics/Antipyretics: Acetaminophen or ibuprofen for fever and discomfort.
- Cough Suppressants (e.g., dextromethorphan)

- Bronchodilators:

- Short-acting beta-agonists (e.g., albuterol) may be used if wheezing or bronchospasm is present



Rhonchi (plural of the word rhonchus) are **continuous, low-pitched sounds that are best heard when you're breathing out** (also called “expiration”). The sound might move around to different parts of your chest when you cough, moving mucus around

### Clinical Case:

A 4-year-old child presents to the clinic with a 5-day history of coughing, low-grade fever, and mild fatigue. The cough started as dry but has progressed to a productive one with yellow mucus. The mother also reports mild wheezing and chest discomfort due to frequent coughing. On examination, the child appears mildly ill but not in severe distress. **Rhonchi** are heard on auscultation, which improve after coughing. There is no significant respiratory distress. The child's fever is low-grade, and there are no signs of bacterial infection. Given the symptoms and duration, the diagnosis of **viral bronchitis** is made. The child is advised to stay hydrated, rest, and given **acetaminophen** for fever and **dextromethorphan** for cough. If wheezing persists, a **short-acting beta-agonist** like **albuterol** is prescribed.

# Viral Pneumonia

- Viruses cause fewer cases of pneumonia than bacteria;
- Several viruses can lead to pneumonia in children and the elderly.
  - adenoviruses, Coronaviruses, influenza viruses, parainfluenza viruses, and respiratory syncytial viruses.
- The signs and symptoms produced by these viruses can range from mild cold-like symptoms to severe cases of pneumonia,
  - the virulence of the virus strain and the strength of the host defenses

- Bacteria is the most common cause of pneumonia . Rarely is caused by viruses , and if it was the cause ,it will be MILD PNEUMONIA .
- All viruses can cause pneumonia like : ( influenza viruses, parainfluenza viruses also Rinitis , although it's rare but it can cause pneumonia .
- So we've mainly focused on 2 points :
  - 1- All viruses can cause pneumonia , but is it severe like bacterial pneumonia ? - No it's MILD
  - 2-bacteria its most common cause of pneumonia

# Coronaviruses.

- Large family of RNA viruses that usually cause mild to moderate upper- respiratory tract illnesses
  - Severe acute respiratory syndrome (SARS)
  - Middle East respiratory syndrome (MERS)
  - SARS-CoV-2
- zoonotic infections
- Bats and civet cats are thought to have been the reservoirs for SARS;
- Camels seem to be the reservoir for MERS.

• **Coronavirus** is an RNA virus that, like the **rhinovirus**, initially caused mild illnesses such as the **common cold** and **upper respiratory tract infections (URTI)**. However, over time, more severe strains of the virus emerged, leading to more serious infections and complications.

- All coronaviruses are believed to have an **animal origin**, with transmission to humans typically occurring through intermediate hosts. One of the most severe types of coronavirus is **MERS-CoV** (Middle East Respiratory Syndrome Coronavirus), which, while more severe, is less prevalent compared to other strains like **SARS-CoV** and **SARS-CoV-2** (the virus responsible for the COVID-19 pandemic).

# SARS-CoV

- SARS (2002, china)
  - Fever, chills, and body aches which usually progressed to pneumonia.
  - Within about 1 year, more than 8,000 people experienced influenza-like symptoms and nearly 800 people died.
  - 10% fatality rate
  - No human cases of SARS have been reported anywhere in the world since 2004.

- Only **yellow highlighted lines** are mentioned in previous case

- Read the following medical scenario and answer its question below

•**Clinical Case:**

•A 32-year-old male presents to the hospital with a **5-day history of fever**, chills, and body aches. He reports worsening **shortness of breath and a dry cough**. The symptoms started after returning from an international trip to East Asia. On physical examination, he appears fatigued, with a **temperature of 39.2°C (102.5°F)** and oxygen saturation of 88% on room air. Chest X-ray reveals **bilateral pneumonia** with patchy infiltrates.

•The patient's travel history and symptoms raise suspicion of a severe respiratory viral infection. Further investigation identifies a coronavirus strain as the causative agent.

**What is the most likely diagnosis, and which statement about this condition is true?**

- A) Middle East Respiratory Syndrome (MERS-CoV); No cases have been reported since 2012.
- B) Severe Acute Respiratory Syndrome (SARS-CoV); No human cases have been reported since 2004.
- C) COVID-19 caused by SARS-CoV-2; The case fatality rate is approximately 10%.
- D) Influenza A (H1N1); It primarily causes gastrointestinal symptoms.
- E) Legionnaires' Disease; It is caused by a coronavirus.

**Answer:**

- B) Severe Acute Respiratory Syndrome (SARS-CoV); No human cases have been reported since 2004.

# MERS-CoV

- MERS (2012) :
  - Emerged in 2012
  - Fever, cough, and shortness of breath which often progress to pneumonia or kidney failure; GI symptoms
  - 35% people with MERS have died.
  - Sporadic MERS cases continue to occur, primarily in the Arabian Peninsula.
  - As of 2015, over 1,300 people in 27 countries have been infected.
    - 500 people have died.
- There are no specific treatments for either MERS or SARS.

- Only **yellow highlighted lines** are mentioned in previous case

- Read the following medical scenario and answer its question below

•**Clinical Case:**

•A 54-year-old male presents to the emergency department with a 5-day history of **fever, cough, and worsening shortness of breath.** He also reports **nausea, diarrhea, and abdominal pain.** On examination, he appears tachypneic with oxygen saturation of 85% on room air, a temperature of 38.8°C (101.8°F), and blood pressure of 90/60 mmHg. Chest X-ray reveals bilateral pneumonia, and initial lab results indicate elevated creatinine and signs of acute kidney injury.

•**The patient recently returned from the Middle East, where he had close contact with camels.**

**What is the most likely diagnosis, and which feature is most characteristic of this condition?**

- A) COVID-19; Acute kidney failure is a common complication.
- B) Severe Acute Respiratory Syndrome (SARS-CoV); Gastrointestinal symptoms are rare.
- C) Middle East Respiratory Syndrome (MERS-CoV); It often involves pneumonia and kidney failure.
- D) Influenza A (H5N1); Animal exposure is not a risk factor.
- E) Legionnaires' Disease; It is primarily associated with waterborne transmission.

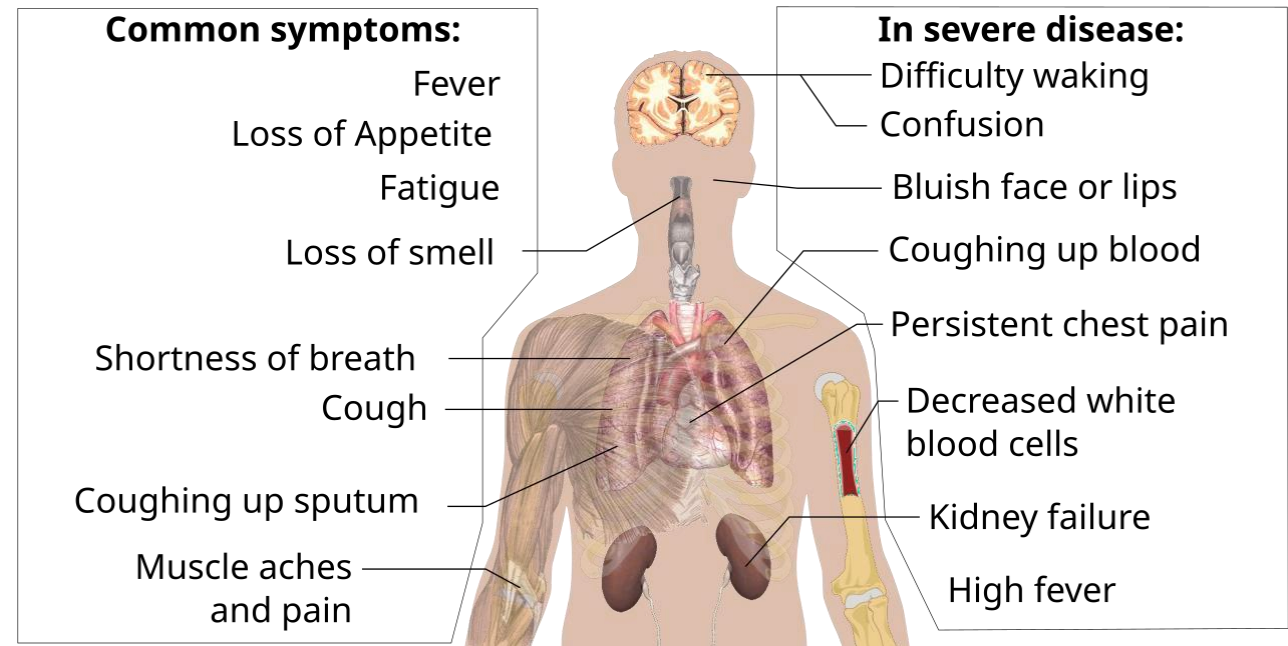
**Answer:**

C) Middle East Respiratory Syndrome (MERS-CoV); It often involves pneumonia and kidney failure, GI symptoms .



# COVID-19

- SARS-CoV-2, which emerged in 2019 and causes coronavirus disease 2019 (COVID-19)
- Fever, cough, loss of smell and taste, fatigue myalgia, diarrhea and GI symptoms



Feature	SARS	MERS	COVID-19
Causative Virus	SARS-CoV	MERS-CoV	SARS-CoV-2
Year Identified	2002	2012	2019
Primary Region of Outbreak	China, spread to other countries	Middle East (Saudi Arabia, UAE)	Worldwide
Reservoir Host	Bats	Bats	Bats
Intermediate Host	Civet cats	Camels	(uncertain)
Primary Mode	Respiratory droplets	Close contact with camels	Respiratory droplets, aerosols
Human-to-Human Transmission	Yes, but less efficient	Limited	Highly efficient
Community Spread	Moderate	Rare	Widespread
Incubation Period	2–10 days	2–14 days	2–14 days
Common Symptoms	Fever, cough, shortness of breath	Fever, cough, shortness of breath	Fever, cough, fatigue, shortness of breath, <b>loss of smell/taste</b>
Severe Symptoms	Pneumonia, acute respiratory distress	Pneumonia, kidney failure, ARDS	Pneumonia, ARDS, multi-organ failure
Case Fatality Rate (CFR)	~10%	~34%	~1–2% globally (varies by region/age)
Total Cases	~8,000	~2,600 (as of 2023)	>770 million (as of 2023)
Global Spread	Epidemic	Limited outbreaks	Pandemic
Vaccines	None	None	Multiple vaccines developed
Antiviral Treatments	Supportive care	Supportive care	Antiviral drugs (e.g., remdesivir)
Control Measures	Isolation, quarantine, masks	Isolation, contact with camels avoided	Masks, vaccines, social distancing

Family	Examples
Orthomyxoviridae	Influenza A, B, C, D
Coronaviridae	SARS-CoV, MERS-CoV, SARS-CoV-2
Paramyxoviridae	RSV, Parainfluenza, Metapneumovirus
Picornaviridae	Rhinovirus,
Adenoviridae	Adenoviruses
Reoviridae	Reoviruses
Herpesviridae	Cytomegalovirus (CMV)
Togaviridae	Rubella virus
Paramyxoviridae	Measles virus
Bunyaviridae	Hantaviruses

اللهم صلّ على نبينا محمد وعلى آله واصحابه أجمعين

### Additional sources

1. <https://youtu.be/sZrrtC7Pj6I?si=s2MqJsakBm2nqpr->

VERSIONS	SLIDE #	BEFORE CORRECTION	AFTER CORRECTION
V1→V2			
V2→V3			



امسح الرمز و شاركنا بأفكارك لتحسين أدائنا !!