
بسم الله الرحمن الرحيم

Coronaviruses

By

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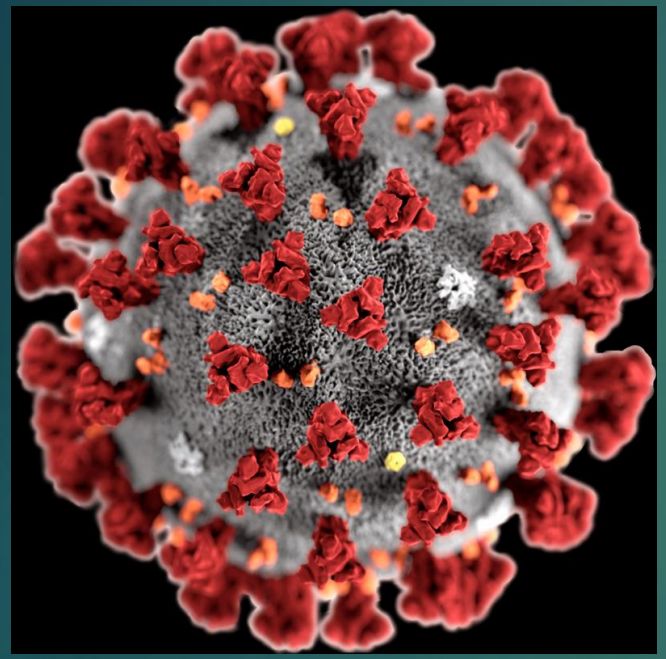
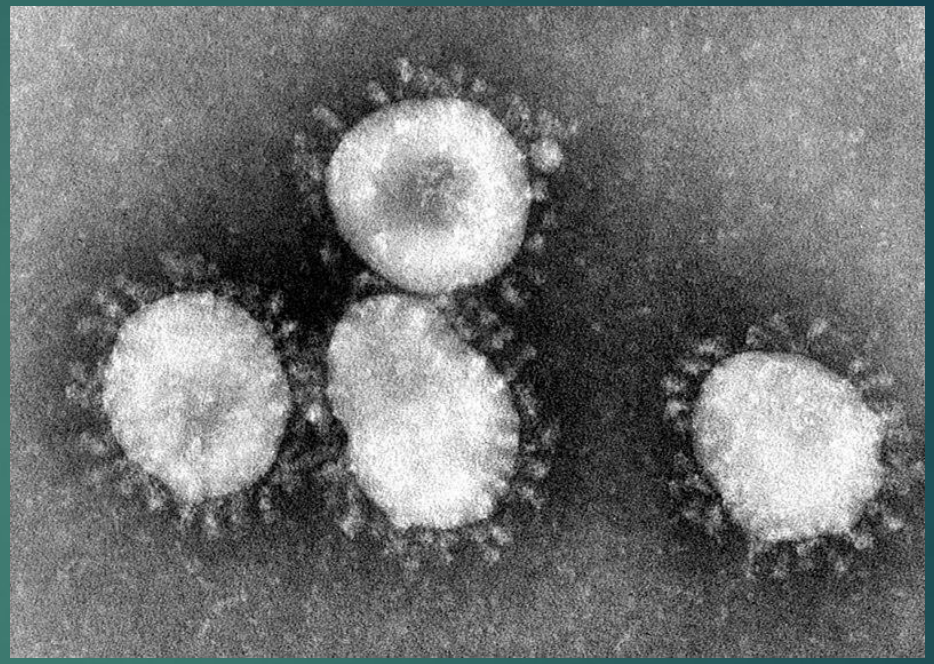
Introduction

- Coronaviruses (CoV) are a large family of viruses that cause illness ranging from the common cold to more severe disease requiring hospitalization.
- These viruses were named coronaviruses because by electron microscopy they have club-shaped surface projections that give them a crown-like appearance.





Causative agent

- Coronaviruses belong to *Coronaviridae* family.
- They are enveloped, single-stranded positive-sense RNA viruses with a genome of approximately 30 kb, the largest genome among RNA viruses.
- There are currently seven known strains of human coronaviruses.

Causative agent

- **The four common human coronaviruses (HCoV):**
  - **HCoV-229E**
  - **HCoV-OC43**
  - **HCoV-NL63**
  - **HCoV-HKU1**

- They are associated with relatively mild upper respiratory tract infections.
- They may cause 10-25% of episodes of common colds but are less frequently implicated in severe infections.
- Previous infection doesn't induce protective immunity.

Causative agent

- **Other human coronaviruses:**

- **SARS-CoV** (Severe acute respiratory syndrome-CoV).
- **MERS-CoV** (Middle East respiratory syndrome-CoV).
- **COVID-19 (SARS-CoV-2)** (Coronavirus disease 2019).

- They are involved in serious respiratory tract infections.

Epidemiology

- Coronaviruses are zoonotic, first discovered in the 1960s.
- They are circulating among animals, including bats, cats, camels and cattle.

Mode of transmission

- Coronaviruses usually spread from an infected person to others through:
  - Respiratory droplets produced when an infected person coughs or sneezes.
  - Close personal contact, like touching or shaking hands.
  - Touching an object or surface with the virus on it, then touching body parts before hands washing.

Clinical manifestations

1) Common coronaviruses:

- **Incubation period:** 2-4 days.

- 30% of patients are asymptomatic.
- Symptoms usually persist for about 1 week but sometimes for as long as 3 weeks.
- Previous infection does not induce protective immunity.

Clinical manifestations

1) Common coronaviruses:

- They are commonly associated with acute respiratory illnesses that are usually mild and consistent with the common cold but can also result in pneumonia, croup, bronchiolitis, and bronchitis.

Clinical manifestations

1) Common coronaviruses:

Clinical manifestations

2) SARS-CoV, MERS-CoV:

- **Incubation period:** 2-14 days.

- The illness ranges from asymptomatic infection to severe disease that requires hospitalization, with high mortality rate.
- In general, children had less severe illness than adults.

Clinical manifestations

2) SARS-CoV, MERS-CoV:

- The initial clinical manifestation include fever, malaise, cough, myalgias and arthralgias.
- Days after the onset of symptoms, lower respiratory tract symptoms of nonproductive cough and shortness of breath were noted.

Clinical manifestations

2) SARS-CoV, MERS-CoV:

- Patients who are severely ill have pneumonia that sometimes progresses to acute respiratory distress syndrome (ARDS) and multi-organ failure.
- Patients with MERS have gastrointestinal symptoms that include diarrhea, vomiting, and abdominal pain.

Clinical manifestations

2) SARS-CoV, MERS-CoV:

- **Chest radiograph:** radiologic evidence of pneumonia, and/or ARDS.
- **Laboratory findings:** elevated liver enzyme levels, thrombocytopenia, leucopenia and lymphopenia.

Clinical manifestations

3) COVID-19:

- **Incubation period:** 1-14 days (average 2-7 days).

- 1/3 of the patients are asymptomatic.

- In symptomatic patients:
  - 81% develop mild to moderate symptoms (up to mild pneumonia).
  - 14% develop severe symptoms (dyspnea, hypoxia, or more than 50% lung involvement on imaging).
  - 5% of patients suffer critical symptoms (respiratory failure, shock, or multiorgan dysfunction).

Clinical manifestations

3) COVID-19:

- People with the same infection may have different symptoms, and their symptoms may change over time.
- **Three common clusters of symptoms have been identified:**

1. **Respiratory symptom cluster:** cough, sputum, shortness of breath, and fever.

Clinical manifestations

3) COVID-19:

2. **Musculoskeletal symptom cluster:** muscle and joint pain, headache, and fatigue.
3. **Digestive symptoms cluster:** abdominal pain, vomiting, and diarrhea.

- **Ageusia** combined with **anosmia** is an association with COVID-19 and is reported in as many as 88% of symptomatic cases.

Clinical manifestations

3) COVID-19:

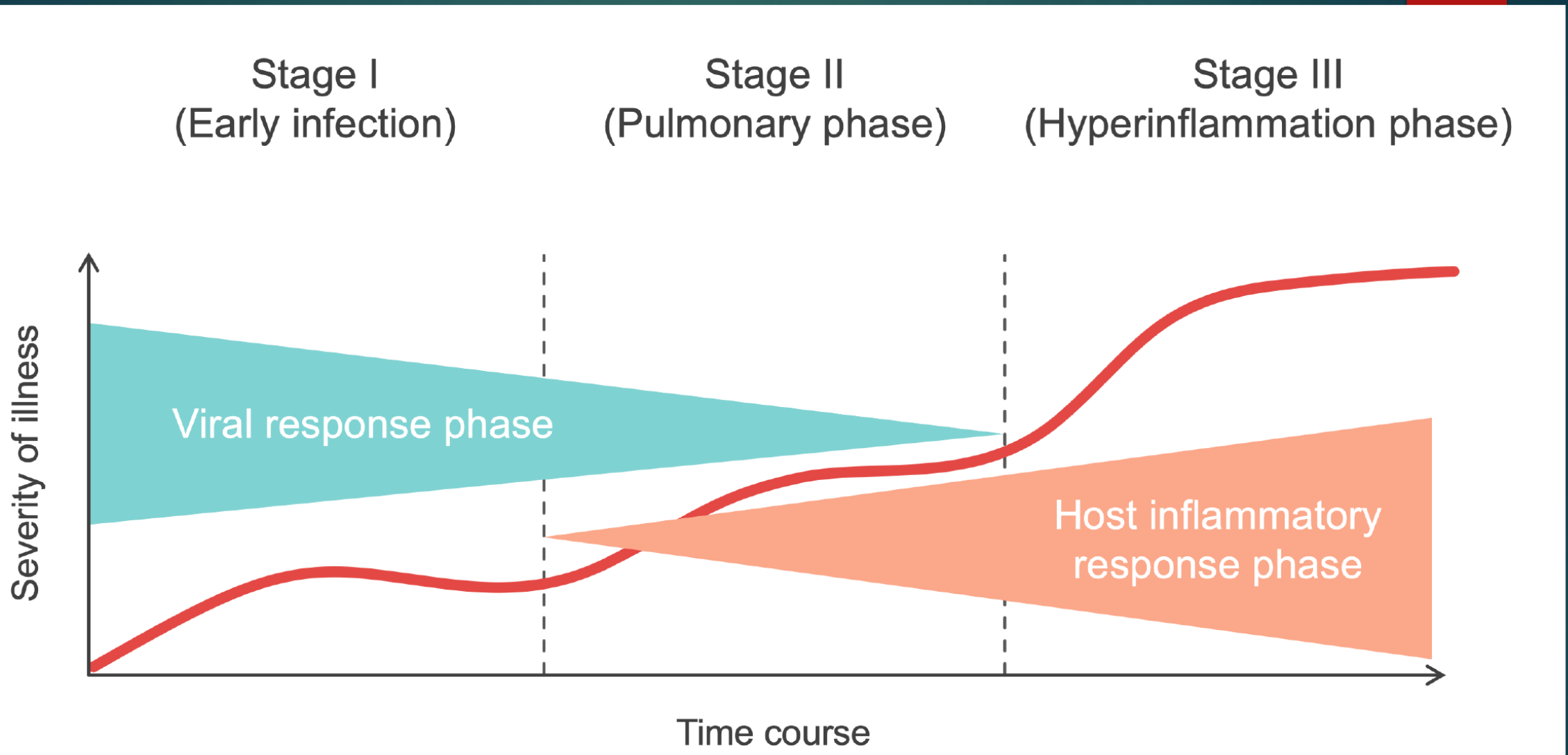
- Most people recover from the acute phase of the disease. However, some people continue to experience a range of effects for months after recovery **(long COVID)** and damage to organs has been observed.

Clinical manifestations

3) COVID-19:

- **Stages of COVID-19 infection:**

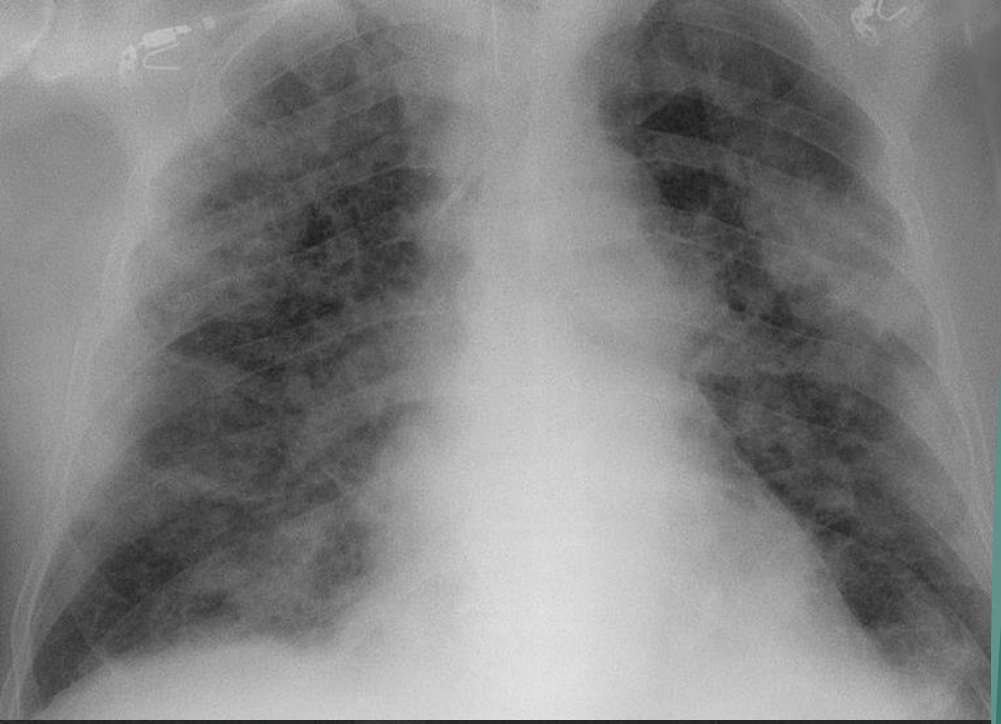
- **Stage I:** is the early infection phase during which the domination of upper respiratory tract symptoms is present.
- **Stage II:** is the pulmonary phase in which the patient develops pneumonia with all its associated symptoms; this stage is split with **Stage IIa** is without hypoxia and **Stage IIb** having hypoxia.
- **Stage III:** is the hyperinflammation phase, the most severe phase, in which the patient develops acute respiratory distress syndrome (ARDS), sepsis and multi-organ failure.


Stage I
(Early infection)
Stage II
(Pulmonary phase)
Stage III
(Hyperinflammation phase)
Severity of illness
Viral response phase
Host inflammatory
response phase
Time course

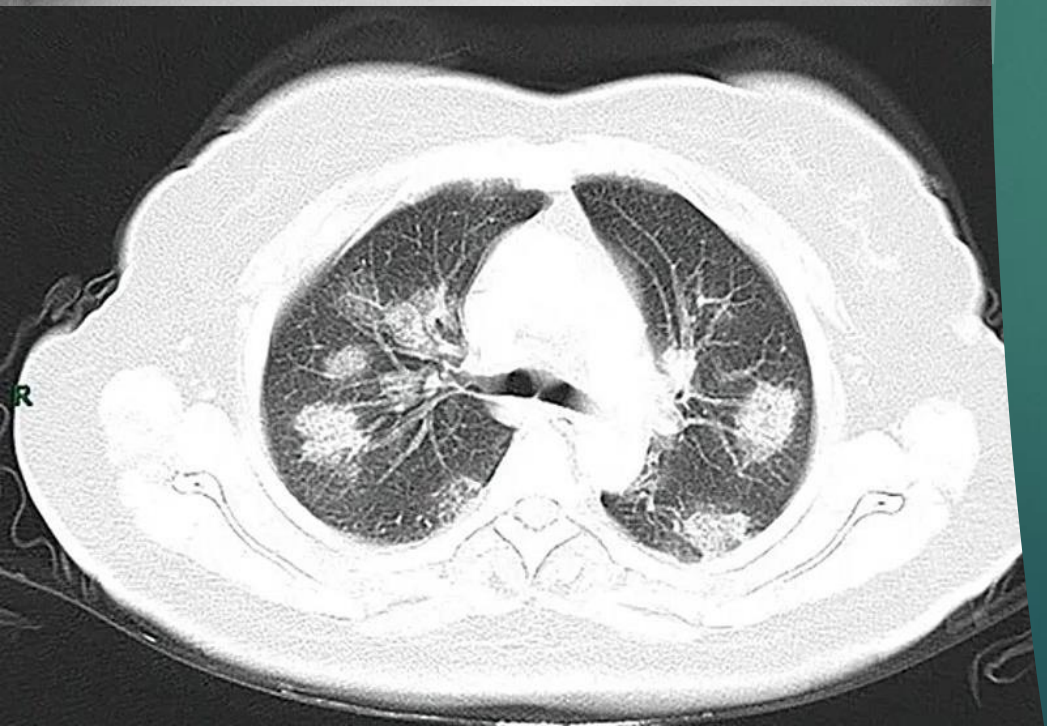
Clinical manifestations

3) COVID-19:

- **Chest radiograph:** radiologic evidence of pneumonia, and/or ARDS.
- **Laboratory findings:** lymphopenia, neutrophilia, elevated liver enzyme levels, high C-reactive protein (CRP) and ferritin levels.



- Chest X-ray showing COVID-19 pneumonia



- A CT scan shows COVID-19 lung lesions

Diagnosis

Type of coronavirus	Diagnostic test
Common coronaviruses	➢ **Usually not required.** ▪ PCR for detection of viral RNA. ▪ Detection of antibodies by ELISA.
SARS-CoV and MERS-CoV	▪ PCR for detection of viral RNA. ▪ Detection of viral antigens by ELISA or immunofluorescence. ▪ Detection of antibodies by immunofluorescence.
COVID-19	▪ PCR for detection of viral RNA. ▪ Detection of viral antigens. ▪ Detection of antibodies by ELISA.

Treatment (in general)

- There is **no virus-specific effective treatment**.
- **Treatment is mainly supportive, including:**
  - Rest.
  - Good hydration
  - Proper nutrition.
  - Analgesics and antipyretics.
  - Antibiotics if needed for bacterial superinfection.

Treatment (current COVID-19 pandemic)

- Patients with severe disease should be hospitalized and isolated. Supportive measures, including mechanical ventilation, oxygenation and steroids.
- Corticosteroids like **dexamethasone** have ultimately showed clinical benefit in treating COVID-19 with a slight reduction in mortality in hospitalized patients.
- **Budesonide** and **tocilizumab** have shown promising results in some patients but remain under investigation.

Treatment (current COVID-19 pandemic)

- **Remdesivir** has FDA approval for certain COIVD-19 patients.
- **Nirmatrelvir/ritonavir (Paxlovid)** significantly reduces the risk of serious illness or hospitalization in patients with mild to moderate symptoms who are in the risk groups.
- Therapy with **baricitinib**, **bamlanivimab/etesevimab**, and **casirivimab/imdevimab** has been found to reduce the number of hospitalizations, emergency room visits and deaths.
- **Favipiravir** and **nafamostat** have shown mixed results but are still in clinical trials in some countries.

Treatment (current COVID-19 pandemic)

- Convalescent plasma is proved to be ineffective.
- Several drugs have been investigated and found to be ineffective or unsafe and are thus not recommended for use including **interferon β-1a**, **colchicine**, **chloroquine**, **lopinavir/ritonavir**, **ruxolitinib**, and **baloxavir marboxil**.

Prevention

- **COVID-19 vaccines:**
  - **Some currently available vaccines for use:**

1. RNA vaccines (the Pfizer–BioNTech vaccine and the Moderna vaccine).
2. Conventional inactivated vaccines (Sinopharm COVID-19 vaccine, CoronaVac, Covaxin).
3. Viral vector vaccines (Sputnik V, the Oxford–AstraZeneca vaccine, Johnson & Johnson COVID-19 vaccine).
4. Peptide vaccine (EpiVacCorona).

Dose of some currently available vaccines

Vaccine	Doses	Interval	Efficacy	
			Mild/moderate	Severe
Pfizer–BioNTech vaccine	2	3-4 weeks	95%	Not reported
Moderna vaccine	2	4 weeks	94%	100%
Sinopharm COVID-19 vaccine	2	3-4 weeks	79%	100%
CoronaVac (Sinovac)	2	2 weeks	78%	100%
Covaxin	2	4 weeks	81%	Not reported
Sputnik V	2	3 weeks	92%	100%
Oxford–AstraZeneca vaccine	2	4-12 weeks	81%	100%
Johnson and Johnson COVID-19 vaccine	1	———	66%	85%
EpiVacCorona	2	3-4 weeks		

Side effects of COVID-19 vaccine

At injection site

- Pain
- Redness
- Swelling

General

- Fever
- Headache
- Malaise
- Myalgia
- Nausea
- Allergy

Post-vaccination embolic and thrombotic events:

- Are rare types of blood clotting syndromes that were initially observed in a number of people who had previously received the Oxford–AstraZeneca and Johnson & Johnson COVID-19 vaccines.
- Thrombosis associated with the COVID-19 vaccine may occur 4-28 days after its administration and mainly affects women under 55 years.
- Cerebral venous sinus thrombosis, splanchnic vein thrombosis, pulmonary embolism, DIC, and arterial thrombosis has been reported.

Prevention

- **General measures for prevention of CoV infection:**
  - Handwashing with soap and water for at least 20 seconds. An alcohol-based hand sanitizer may be used if soap and water are unavailable.
  - Individuals should avoid touching their eyes, nose, and mouth with unwashed hands.
  - Individuals should avoid close contact with sick people.
  - Sick people should stay at home (e.g., from work, school).

Prevention

- Coughs and sneezes should be covered with a tissue, followed by disposal of the tissue in the trash.
- Frequently touched objects and surfaces should be cleaned and disinfected regularly.
- Wear a disposable surgical face mask when around other people or in public and replace it every few hours.

Prevention

- **Preventive measures for health care providers:**

1. Wear a medical mask.
2. Wear eye protection (i.e., goggles or a face shield).
3. Wear a clean, nonsterile, long-sleeved gown; and gloves (some procedures may require sterile gloves).
4. Perform hand hygiene before and after contact with the person and his or her surroundings and immediately after removal of personal protective equipment.

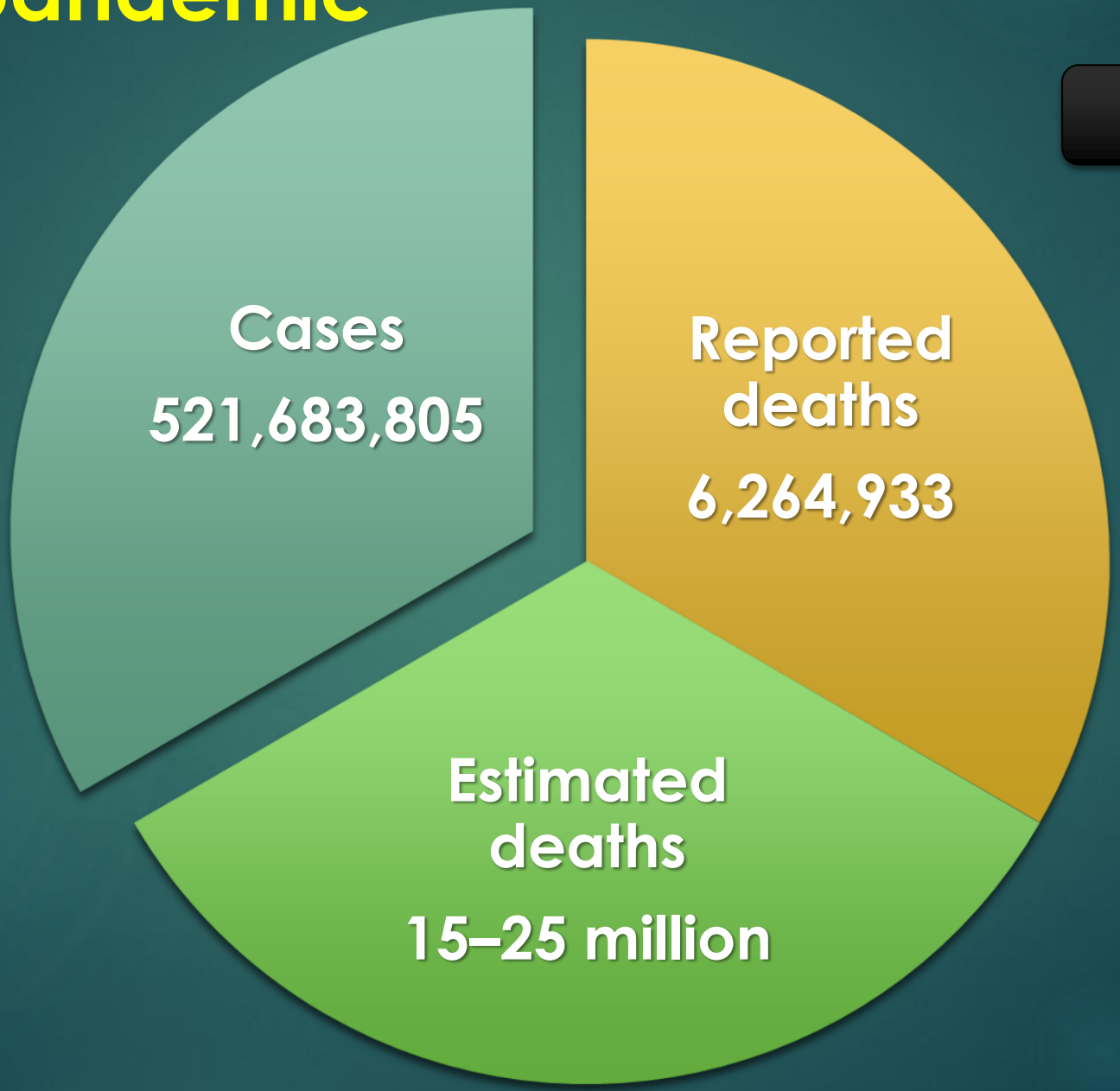
Prevention

- **For procedures which carry a risk of aerosolization, such as intubation, the WHO recommends that care providers also:**

5. Wear a particulate respirator.
6. Wear an impermeable apron.
7. Perform procedures in an adequately ventilated room.
8. Limit the number of persons present in the room to the minimum required for the person's care and support.

COVID-19 pandemic

17 May 2022



Coronavirus outbreaks

Outbreak	Cases	Deaths	Mortality rate
2003 SARS outbreak	8098	774	9.57%
2012 MERS outbreak	1029	452	43.93%
2015 MERS in South Korea	186	38	20.43%
2018 MERS outbreak	193	56	29.02%
COVID-19 pandemic	521,683,805	6,264,933	

MERS total number as of February 2022

2585 890 34.4%

17 May 2022

Khalid Khoury
12 hrs ·

بجد ربنا يجازيك كل خير على المعلومة .. انا لسا اليوم الصبح ضارب واحد بالشبشب 😈😈😈

Ahmad • أحمد الهاشمي
@ahmadh

هذا فيروس الكورونا، حفظوا شكله، انشرها لعلك تنقذ إنسانا.

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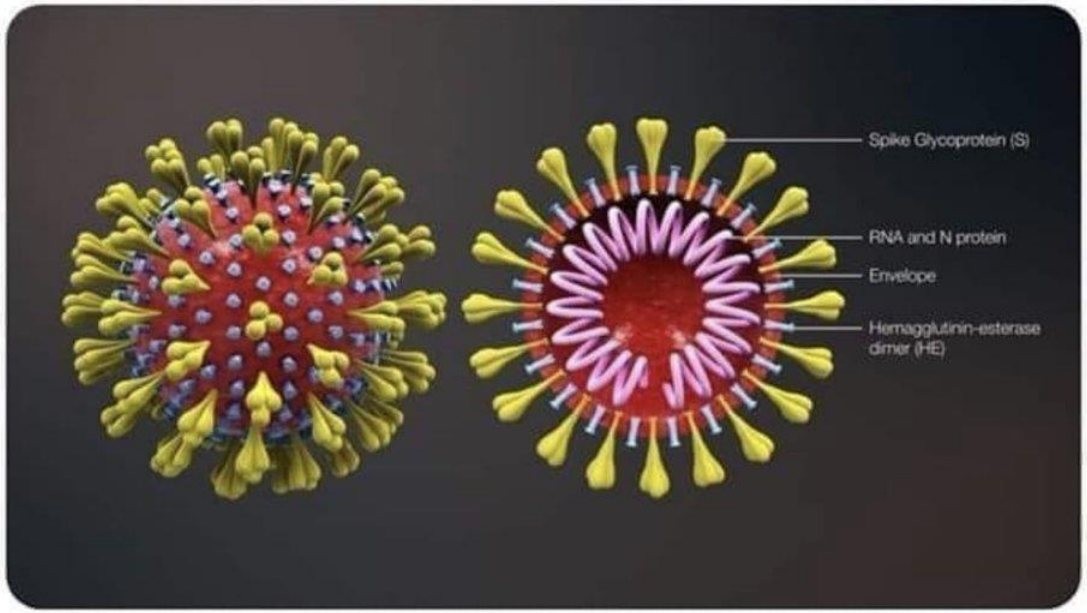

Thank you