

COVID - 19

SARS-CoV-2

# Coronavirus (COVID-19)

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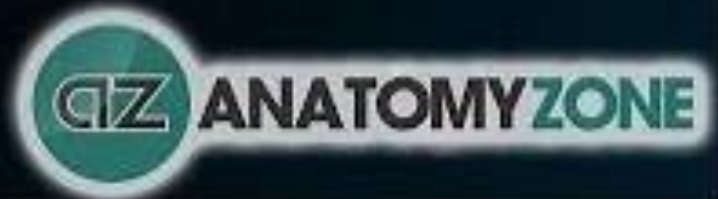


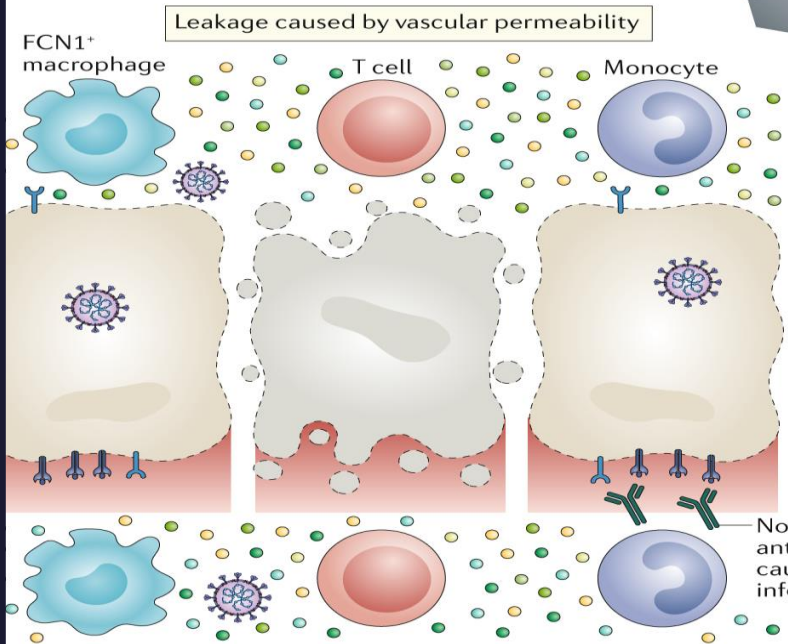
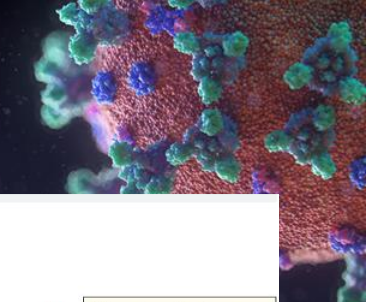
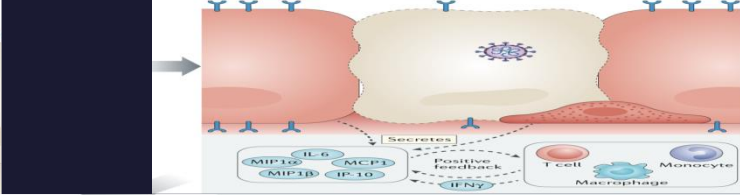
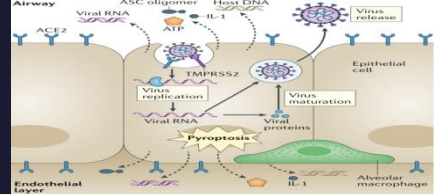
*Clinical Conditions*

COVID-19

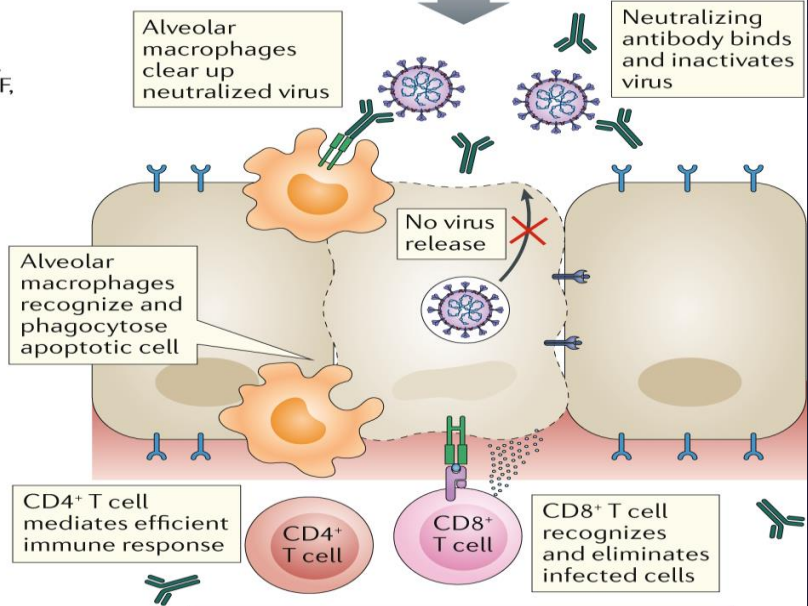


Viral Structure & Pathogenesis





Cytokine storm  
(IL-6, IP-10, IFN $\gamma$ ,  
IL-2, IL-10, G-CSF,  
MIP1 $\alpha$ , TNF)



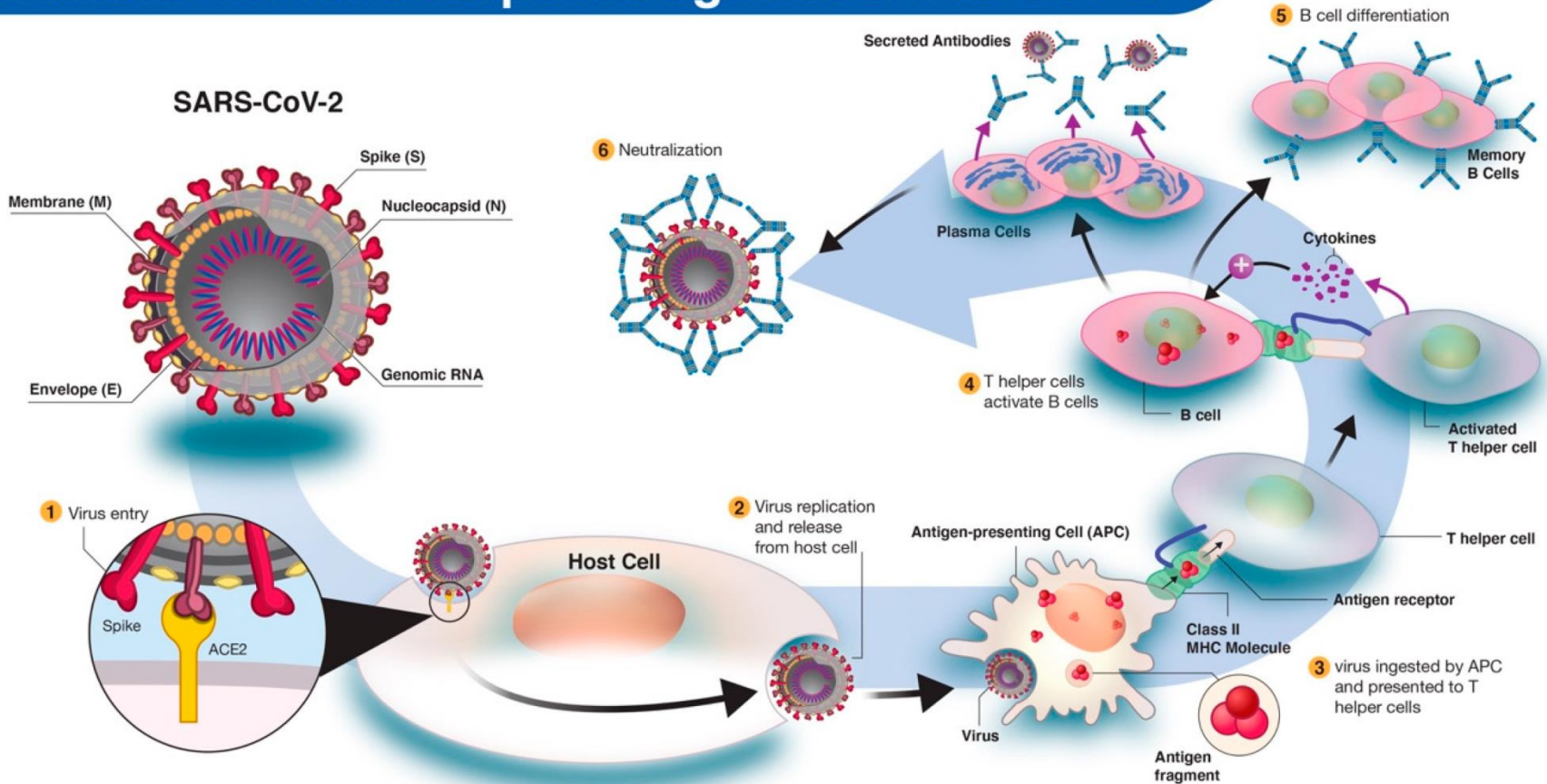
**Dysfunctional immune response**

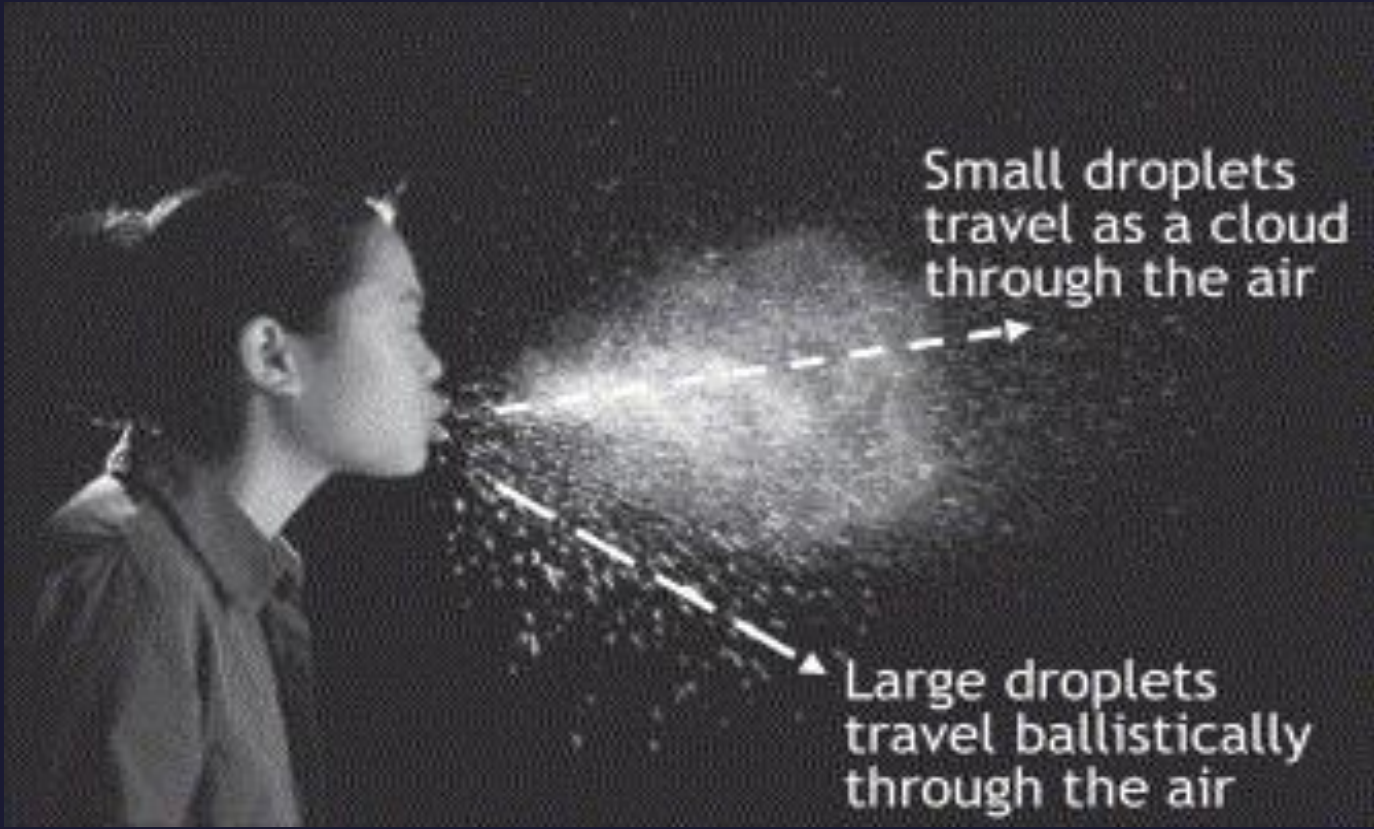
- Excessive infiltration of monocytes, macrophages and T cells
- Systemic cytokine storm
- Pulmonary oedema and pneumonia
- Widespread inflammation and multi-organ damage

**Healthy immune response**

- Infected cells rapidly cleared
- Virus inactivated by neutralizing antibodies
- Minimal inflammation and lung damage

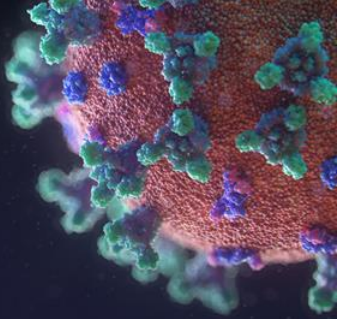
# Humoral immune response against SARS-CoV-2





Small droplets  
travel as a cloud  
through the air

Large droplets  
travel ballistically  
through the air



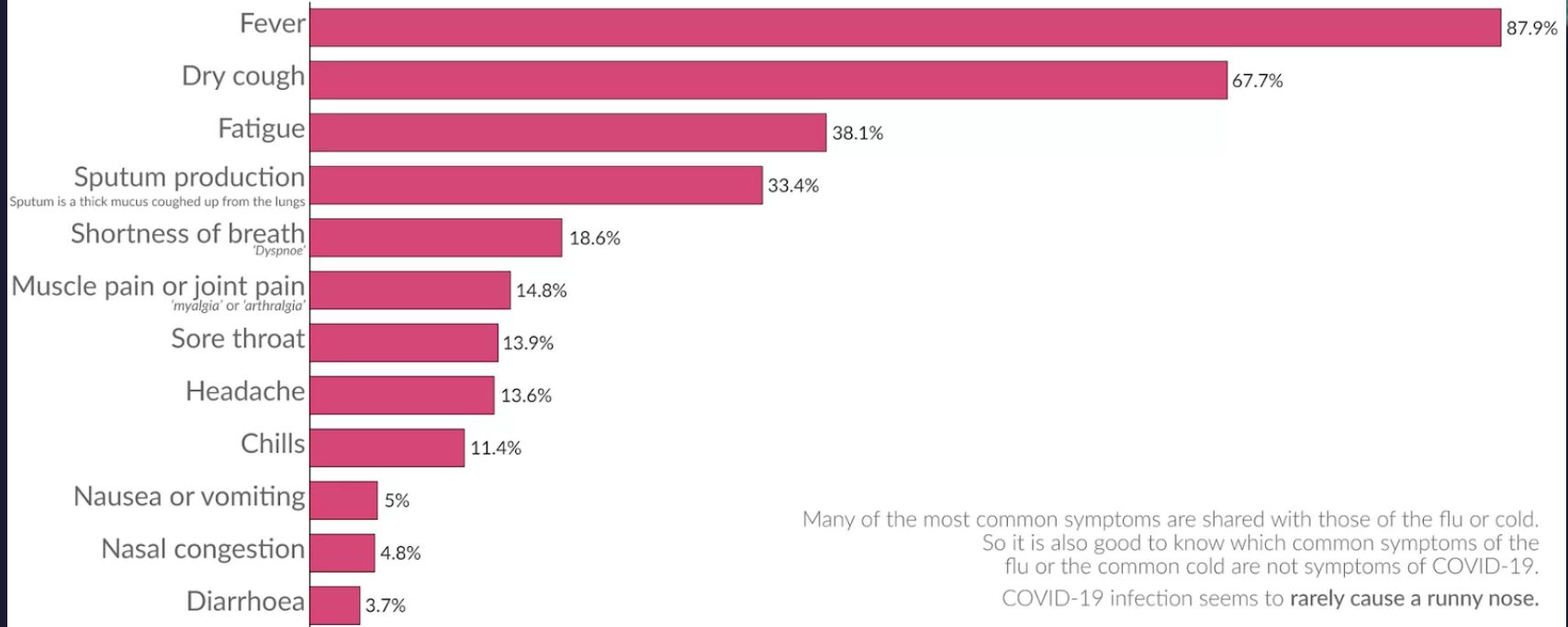
sneezing (40,000 droplets),  
coughing (3,000 droplets),  
or talking (about 600  
droplets per minute)

A flash photo of a human sneeze. Source: Tang et al., Journal of Hospital Science 2006

# The symptoms of coronavirus disease [COVID-19]

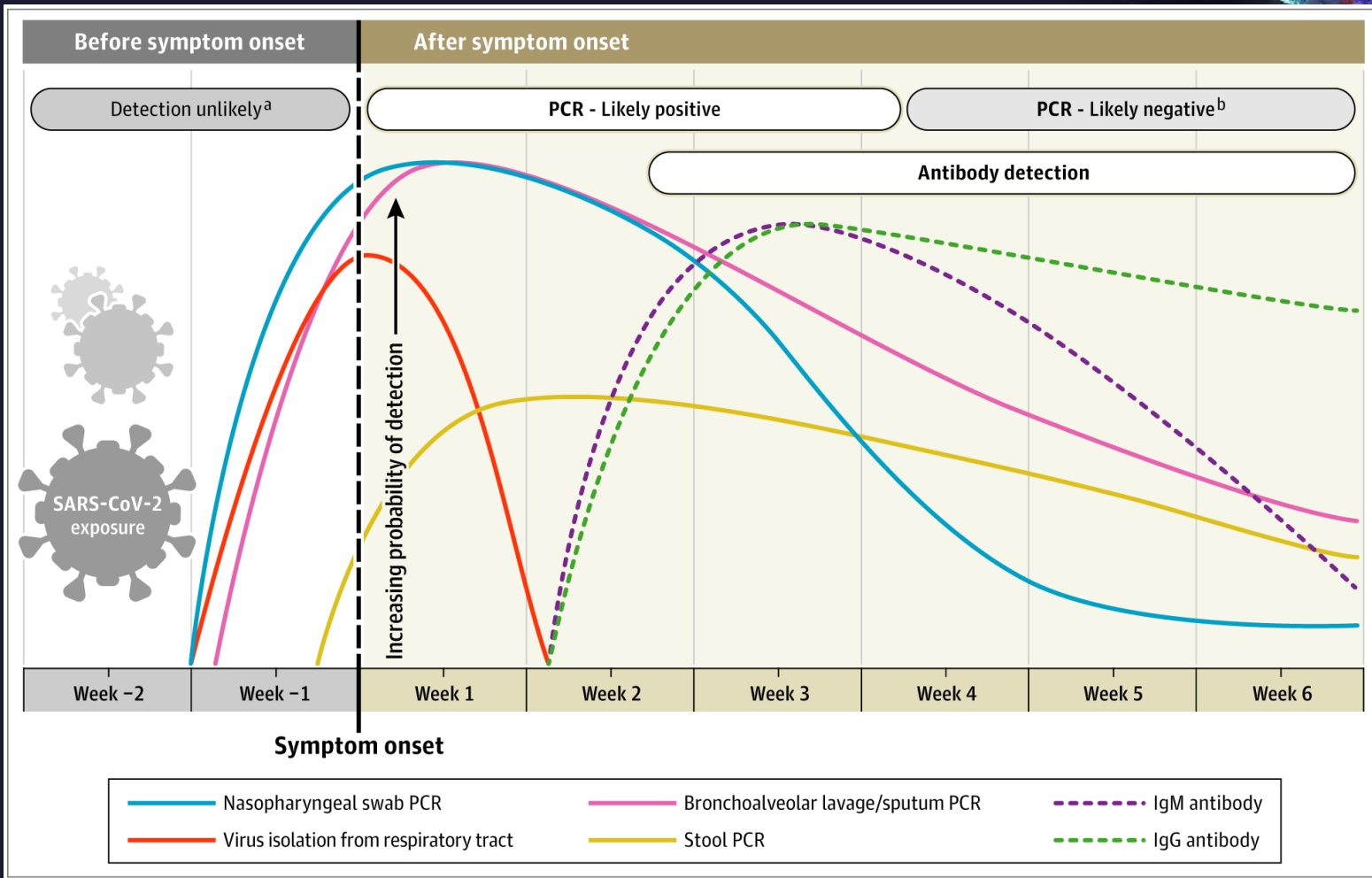
Our World  
in Data

The most common signs and symptoms of 55,924 laboratory confirmed cases of COVID-19.  
Reported from China in the period up to February 22, 2020

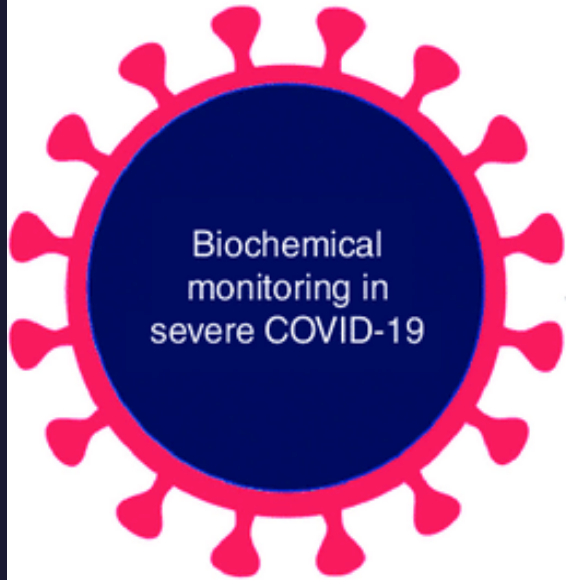


Many of the most common symptoms are shared with those of the flu or cold.  
So it is also good to know which common symptoms of the flu or the common cold are not symptoms of COVID-19.  
COVID-19 infection seems to **rarely cause a runny nose.**

Data source: World Health Organization (2020). Report of the WHO-China Joint Mission on Coronavirus Disease 2019 (COVID-19). Symptoms in fewer than 1% are not shown.  
OurWorldinData.org – Research and data to make progress against the world's largest problems. Licensed under CC-BY by the authors.







### Proinflammatory response consistent with cytokine storm



- WBC, neutrophil count
- Procalcitonin, CRP, ferritin, IL-6, ESR



- Lymphocyte count, eosinophil count, platelet count

### Progression to multi-organ damage/failure

#### Hepatic

- AST
- ALT
- GGT
- Total bilirubin
- LDH



#### Cardiac/COAG

- Troponin
- NT-proBNP
- Myoglobin
- CK-MB
- D-dimer
- Prothrombin time

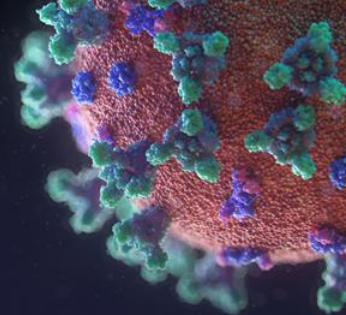
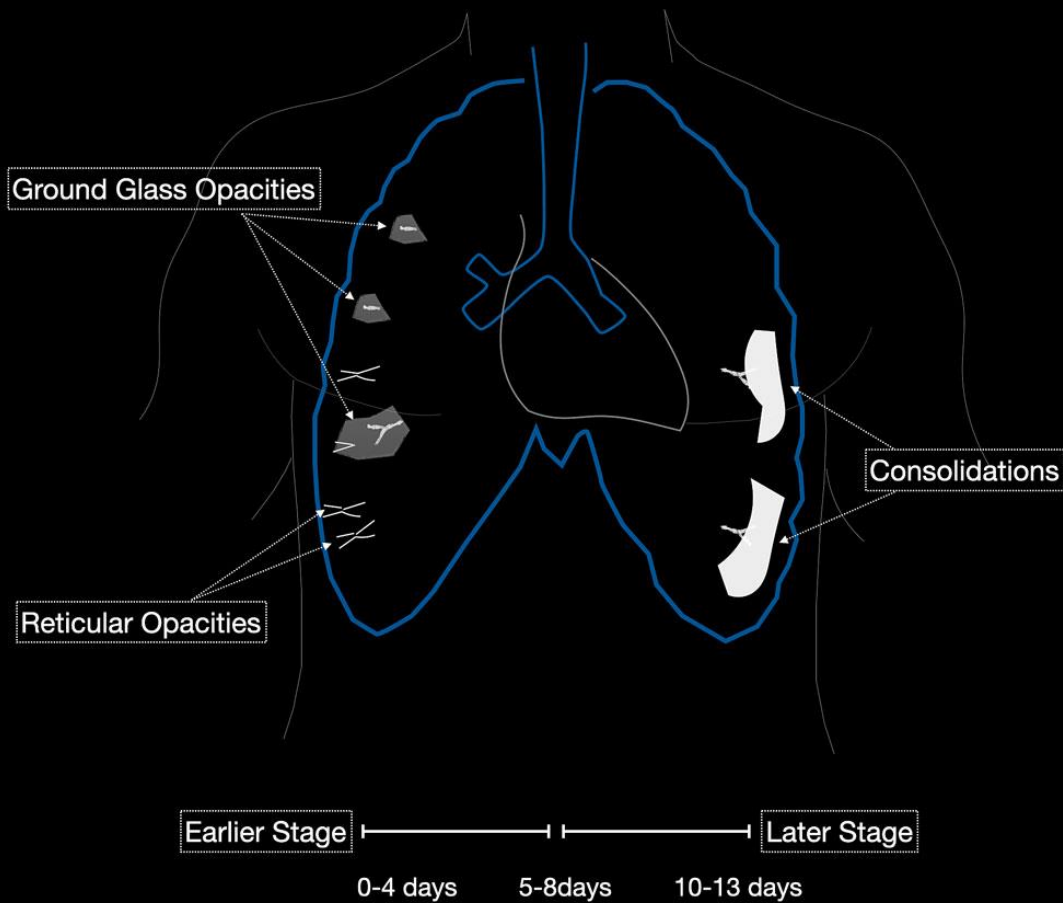


#### Renal

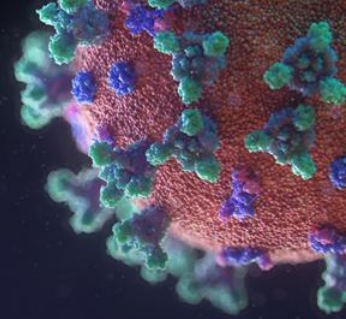
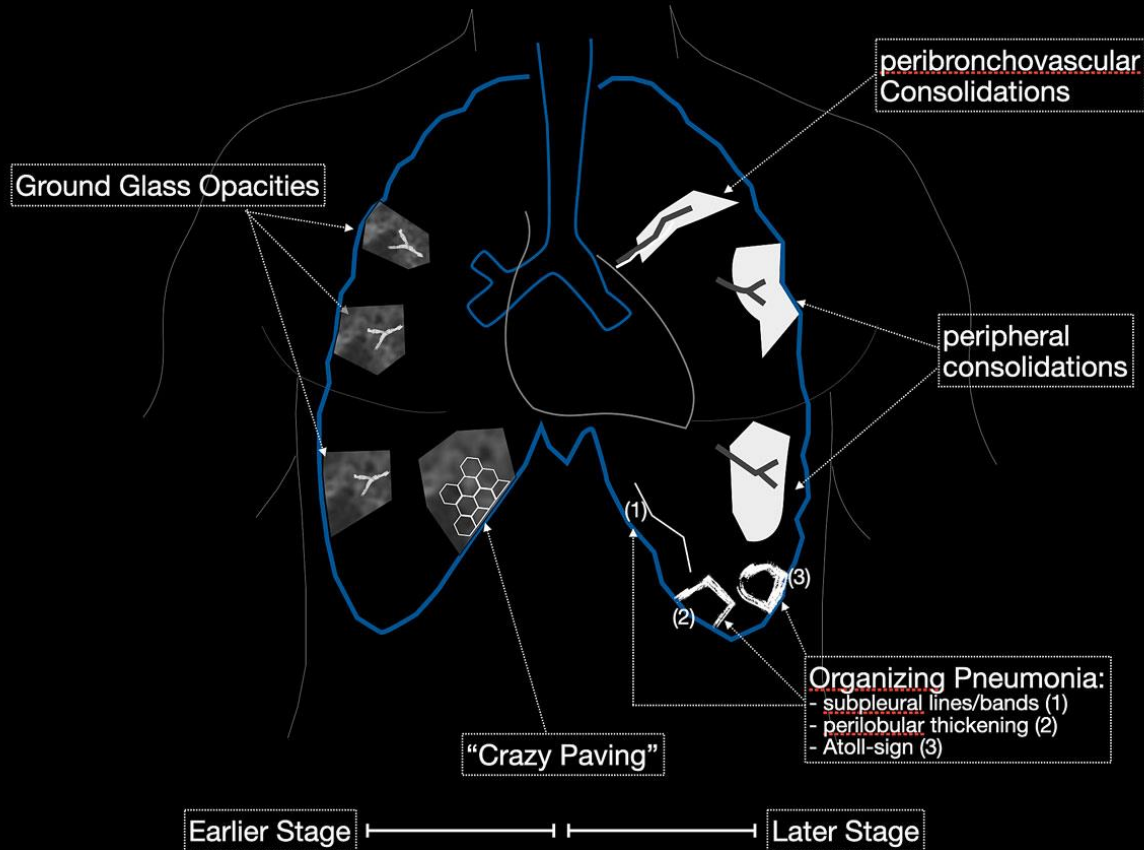
- Creatinine
- Blood urea nitrogen



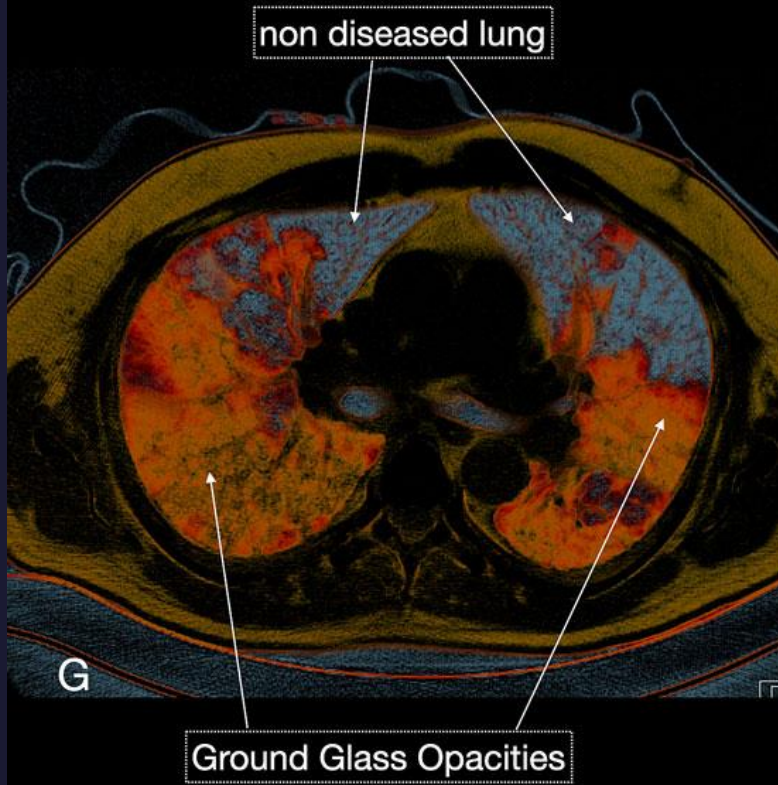
# COVID-19 typical Chest Xray findings schematic



# COVID-19 typical Chest CT findings schematic



Volume rendering image



3D Volume rendering image



**Table 3:** Chest computed tomography (CT) imaging patterns typical and atypical for COVID-19 pulmonary infections.

CT pattern type	Confidence for COVID-19	Description
<b>Classical COVID-19</b>	100%	Ground glass opacities: lower lobe, peripheral predominant, bilateral
		± Crazy paving
		± Peripheral consolidation (organising pneumonia)
		± Reverse halo / perilobular pattern (organising pneumonia)
<b>Probable COVID-19</b>	71–99%	Lower lobe predominant mix of bronchocentric and peripheral consolidations
		Reverse halo / perilobular pattern (organising pneumonia)
		Minimal ground glass opacities
<b>Intermediate COVID-19</b>	<70%	Not classical, probable or non-COVID type
		Clinical context is wrong or suggests alternative diagnosis (interstitial lung disease)
<b>Non-COVID-19</b>	70% confidence of alternative	Lobar pneumonia
		Cavitating infections
		Tree-in-bud / centrilobular nodularity
		Lymphadenopathy
		Pleural effusions
		Established pulmonary fibrosis

Thoracic Imaging in COVID-19 Infections. Guidelines British Society of Thoracic Imaging. Version 2. March 2020.

# Clinical management of COVID-19

Interim guidance  
27 May 2020



World Health  
Organization

- ✔ **We recommend patients with mild COVID-19 be given symptomatic treatment such as antipyretics for fever and pain, adequate nutrition and appropriate rehydration.**

## Remark:

Patients with risk factors for severe illness should be monitored closely, given the possible risk of deterioration. If they develop any worsening symptoms (such as light headedness, difficulty breathing, chest pain, dehydration, etc.), they should seek urgent care through the established COVID-19 care pathway. Caregivers of children with mild COVID-19 should monitor for signs and

- ✘ **We recommend against antibiotic therapy or prophylaxis for patients with mild COVID-19.**



**We recommend that patients with suspected or confirmed moderate COVID-19 (pneumonia) be isolated to contain virus transmission. Patients with moderate illness may not require emergency interventions or hospitalization; however, isolation is necessary for all suspect or confirmed cases.**



**We recommend for patients with suspected or confirmed moderate COVID-19, that antibiotics should not be prescribed unless there is clinical suspicion of a bacterial infection.**

**Remarks:**

1. Few patients with COVID-19 experience a secondary bacterial infection. A recent systematic review of patients hospitalized with COVID-19 reported only 8% were reported as experiencing bacterial/fungal co-infection during hospital admission (75).
2. Consider in older people, particularly those in LTCFs, and children < 5 years of age, to provide empiric antibiotic treatment for possible pneumonia (73, 74). As these patients are not hospitalized, treatment with Access antibiotics (such as co-amoxicillin) is adequate, instead of broad-spectrum antibiotics (Watch and Reserve antibiotics) (76).

Long-term Care Facilities



## 8. Management of severe COVID-19: severe pneumonia treatment



All areas where severe patients may be cared for should be equipped with pulse oximeters, functioning oxygen systems and disposable, single-use, oxygen-delivering interfaces (nasal cannula, Venturi mask, and mask with reservoir bag).

### Remarks:

1. Adults with emergency signs (obstructed or absent breathing, severe respiratory distress, central cyanosis, shock, coma and/or convulsions) should receive emergency airway management and oxygen therapy during resuscitation to target  $SpO_2 \geq 94\%$  (44, 79). Once the

Patients with COVID-19 should be treated cautiously with intravenous fluids; aggressive fluid resuscitation may worsen oxygenation, especially in settings where there is limited availability of mechanical ventilation (82). This applies to both children and adults.



## 9. Management of critical COVID-19: acute respiratory distress syndrome (ARDS)

The mortality in hospitalized and critically ill patients has varied substantially in different case series throughout the pandemic. The following recommendations are aligned with current international standards for management of all cause ARDS (3, 92).

The following recommendations pertain to adult and paediatric patients with mild ARDS who are treated with non-invasive or high-flow nasal oxygen (HFNO) systems.

- ❗ In selected patients with COVID-19 and mild ARDS, a trial of HFNO, non-invasive ventilation – continuous positive airway pressure (CPAP), bilevel positive airway pressure (BiPAP) may be used. Refer to Table 2 for definitions of mild, moderate and severe ARDS.

## 12. Antivirals, immunomodulators and other adjunctive therapies for COVID-19



We recommend that the following drugs not be administered as treatment or prophylaxis for COVID-19, outside of the context of clinical trials:

- Chloroquine and hydroxychloroquine (+/- azithromycin), including but not limited to:
- Antivirals, including but not limited to:
  - Lopinavir/ritonavir
  - Remdesivir
  - Umifenovir
  - Favipiravir
- Immunomodulators, including but not limited to:
  - Tocilizumab
  - Interferon- $\beta$ -1a
- Plasma therapy.

## Remarks:

1. Existing published literature on the agents listed above is mostly observational in nature, with few clinical trials; and does not provide high-quality evidence in favour of any of these agents. In addition, important side-effects have been described (122-131).
  - **Chloroquine and hydroxychloroquine +/- azithromycin:** each can cause QT prolongation and taken together can increase the risk of cardiotoxicity.
  - **Lopinavir/ritonavir:** the most common adverse effects are gastrointestinal.
  - **Remdesivir:** elevation of hepatic enzymes, GI complications, rash, renal impairment and hypotension.
  - **Umifenovir:** diarrhoea, nausea.
  - **Favipiravir:** QT interval prolongation.
  - **Interferon- $\beta$ -1a:** pyrexia, rhabdomyolysis.
  - **Tocilizumab:** URT infections, nasopharyngitis, headache, hypertension, increased alanine aminotransferase (ALT), injection site reactions.

# COVID-19 VACCINE TRACKER

Rapidly evolving, check back often.

Last updated: August 5, 2020 9:32 AM PST

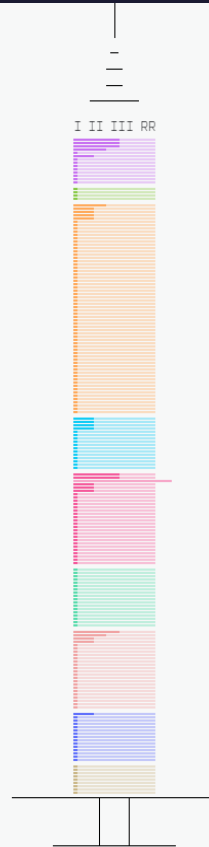
202  
vaccines are in development.

24  
are now in clinical testing.

The race to develop, approve, and manufacture a COVID-19 vaccine is fluid—and urgent.

How long will it take? Some say not long.

Let's put that into perspective.  
Scroll



## Leading Candidates

FARTHEST ALONG*	CLINICAL PHASE
Univ. of Oxford/AstraZeneca	III
Wuhan Inst./Sinopharm	III
Beijing Inst./Sinopharm	III
Sinovac/Instituto Butantan	III
Moderna	III
CanSino Biologics	II
Inst. of Medical Biology	II
BioNTech/Fosun/Pfizer	II
Imperial College London	I/II
Novavax	I/II

\*Ranked by entry into latest phase of development. Clinical phases move when it is publicly reported that the product has been dosed in a trial.

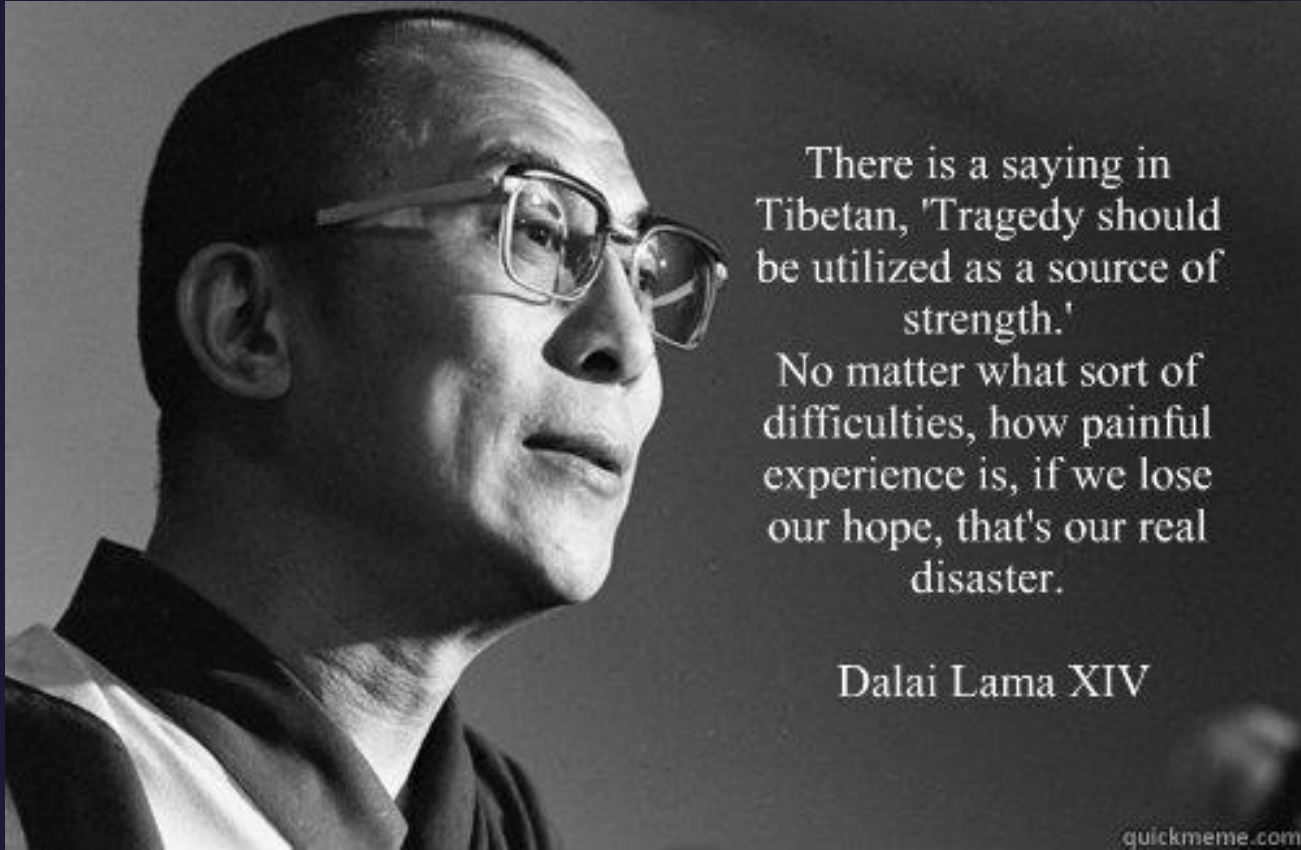
## > Key



Data sourced from  
[FasterCures](#), a center of the  
Milken Institute.



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storytelling company.



There is a saying in Tibetan, 'Tragedy should be utilized as a source of strength.'

No matter what sort of difficulties, how painful experience is, if we lose our hope, that's our real disaster.

Dalai Lama XIV

quickmeme.com