

# COVID-19 Education Module 1

# COVID-19 Education Module

- This module is intended to provide the viewer with meaningful information relevant to both COVID-19 virus as well as the vaccination that is available.
- In this module, viewers may click on [any wording that is in blue and underlined](#) and it will take them directly to a reputable medical literature publication or evidence-based medicine website to allow for additional knowledge to be obtained
- This is intended to enhance the reader's knowledge of this global pandemic and the vaccines that are being used to combat it

# COVID-19 Education Modules

- These first 17 slides discuss
  - Coronavirus introduction
  - Coronavirus virology
  - Variants of COVID-19
  - COVID-19 symptoms, risk factors and testing
- The remaining 24 slides will discuss
  - COVID-19 management recommendations briefly
  - Vaccine development
  - mRNA vaccines
  - COVID-19 vaccine risks
  - AAMC and AACOM recommendations

# Introduction

- Coronaviruses are RNA viruses that have affected humans and animals for centuries
- At the end of 2019, there was a new coronavirus identified after spreading throughout China and other countries
- This virus was designated Severe Acute Respiratory Syndrome Coronavirus 2 ([SARS-CoV-2](#))
  - It is known as the Coronavirus disease of 2019 (COVID-19)

# Coronavirus Virology

- Like other viruses, SARS-CoV-2 evolves over time
  - Certain variants have garnered widespread attention because of their rapid emergence considered [variants of concern](#).
- In the United States, the proportions of circulating viruses that are variants of concern are detailed on the [CDC website](#).

# Variants- Delta

- **Delta (B.1.617.2 lineage)** — was first identified in India in December 2020 and has become the [most prevalent](#) variant there and in several other countries, including the United States and United Kingdom
- Data suggest that the Delta variant is highly transmissible
- An unpublished study of an outbreak in China suggested that it is much more contagious
- Several studies suggest that vaccinated individuals may still get a symptomatic infection with the variant but are **much less likely to have severe disease or hospitalization.**

# Other Variants

- **Alpha (B.1.1.7 lineage):** First identified in the UK in late 2020
  - Several studies had indicated that Alpha is approximately 50 to 75 percent [more transmissible](#) than previously circulating strains
- **Beta (B.1.351 lineage):** Identified in South Africa in late 2020
  - There are [several studies](#) that show the [neutralizing capabilities](#) of the COVID-19 vaccine to this variant
- **Gamma (P.1 lineage):** First [identified in Japan](#) in December 2020
  - It has [several mutations](#), raising concern about the potential for increased transmissibility and an impact on immunity
- **Epsilon (B.1.427 and B.1.429 lineages):** Identified in October 2020, [in Southern California](#)
  - by January 2021, the variant accounted for 35 percent of viral samples sequenced in California and had been identified in other countries

# Asymptomatic Infections

- The severity and clinical spectrum of COVID-19 ranges from asymptomatic to fatal illness
- The proportion of “asymptomatic” infections is uncertain
  - Due to different definitions of “asymptomatic” across studies and follow-up
  - As well, testing is often not performed on patients without symptoms
- Nevertheless, estimates suggest that up to 33% of infections are asymptomatic
- Two studies have shown objective clinical abnormalities even without symptoms (including CT changes and other imaging abnormalities)

# Symptom Severity for all Cases

- A [report of 72,314](#) cases showed the following symptom severity:
  - Mild disease (no or mild pneumonia): 81%
  - Severe disease (shortness of breath, low oxygen levels): 14%
  - Critical disease (respiratory failure, multi-organ failure): 5%
  - Case fatality rate was 2.3%
- The fatality rate (death rate) does not account for the full [burden of the disease](#), which includes mortality (deaths) from other conditions due to delayed care, overburdened health care systems and economic/social factors that affect health.

# Comorbidities in COVID-19

## Comorbidities the CDC classifies as risk factors for severe COVID-19\* [1,2]

1. Established and probable risk factors (comorbidities that have been associated with severe COVID-19 in at least 1 meta-analysis or systematic review [starred conditions], or in observational studies)

- Cancer\*
- Cerebrovascular disease\*
- Children with certain underlying conditions<sup>¶</sup>
- Chronic kidney disease\*
- COPD\* and other lung disease (including interstitial lung disease, pulmonary fibrosis, pulmonary hypertension)
- Diabetes mellitus, type 1\* and type 2\*
- Down syndrome
- Heart conditions (such as heart failure, coronary artery disease, or cardiomyopathies)\*
- HIV
- Neurologic conditions, including dementia
- Obesity\* (BMI  $\geq 30$  kg/m<sup>2</sup>) and overweight (BMI 25 to 29 kg/m<sup>2</sup>)
- Pregnancy\*
- Smoking\* (current and former)
- Sickle cell disease
- Solid organ or blood stem cell transplantation
- Substance use disorders
- Use of corticosteroids or other immunosuppressive medications

2. Possible risk factors (supported by mostly case series, case reports, or, if other study design, the sample size is small)

- Cystic fibrosis
- Thalassemia

3. Possible risk factors but evidence is mixed (comorbidities have been associated with severe COVID-19 in at least 1 meta-analysis or systematic review, but other studies had reached different conclusions)

- Asthma
- Hypertension
- Immune deficiencies
- Liver disease

COVID-19: coronavirus disease 2019; CDC: Centers for Disease Control and Prevention; COPD: chronic obstructive pulmonary disease; BMI: body mass index.

\* These comorbidities are associated with severe COVID-19 in adults of all ages. Risk of severe disease also rises steadily with age, with more than 80% of deaths occurring in adults older than age 65. People of color are also at increased risk of severe disease and death, often at a younger age, due to systemic health and social inequities.

<sup>¶</sup> Underlying medical conditions are also associated with severe illness in children, but evidence implicating specific conditions is limited. Children with the following conditions might be at increased risk for severe illness: medical complexity; genetic, neurologic, or metabolic conditions; congenital heart disease; obesity; diabetes; asthma or other chronic lung disease; sickle cell disease; immunosuppression.

### References:

1. Centers for Disease Control and Prevention. Underlying medical conditions associated with high risk for severe COVID-19: Information for healthcare providers. Available at: <https://www.cdc.gov/coronavirus/2019-ncov/hcp/clinical-care/underlyingconditions.html> (Accessed on April 5, 2021).
2. Centers for Disease Control and Prevention. Science brief: Evidence used to update the list of underlying medical conditions that increase a person's risk of severe illness from COVID-19. Available at: <https://www.cdc.gov/coronavirus/2019-ncov/hcp/clinical-care/underlying-evidence-table.html> (Accessed on April 5, 2021).

# Initial Symptoms and Presentation

- Most cases occur approximately 4 to 5 days after exposure
- The most common presenting symptoms include:
  - Cough in 50%
  - Fever in 43%
  - Muscle aches in 36%
  - Headache in 34%
  - Shortness of breath in 29%
  - Sore throat in 20%
  - Diarrhea in 19%
  - Loss of smell or taste, abdominal pain and rhinorrhea in fewer than 10% each
- Although smell or taste disorders are more common with COVID-19 than other viral illnesses, there are no specific symptoms or signs that are exclusive to COVID-19

# Complications from COVID-19

- Acute Respiratory Distress Syndrome (ARDS) is the major complication with [severe disease and can happen shortly after the onset of shortness of breath](#)
- Other complications include:
  - [Thromboembolic events](#) (blood clots)
  - [Acute cardiac injury](#) (heart-related problems)
  - [Neurologic conditions](#) (brain-related problems)
  - [Inflammatory conditions](#) (myocarditis and others)

# Persistent Symptoms

- How long it takes to recover can depend on many factors but typically ranges from 2 weeks to 2-3 months
  - The most common persistent symptoms are feeling tired, shortness of breath, chest pain and cough

Type, proportion, and duration of persistent COVID-19 symptoms\*

Persistent symptom ¶	Proportion of patients affected by symptom	Approximate time to symptom resolution Δ
<b>Common physical symptoms</b>		
Fatigue	15 to 87% [1,2,6,9,14]	3 months or longer
Dyspnea	10 to 71% [1,2,6-9,14]	2 to 3 months or longer
Chest discomfort	12 to 44% [1,2]	2 to 3 months
Cough	17 to 34% [1,2,9,12]	2 to 3 months or longer
Anosmia	10 to 13% [1,3-5,9,11]	1 month, rarely longer
<b>Less common physical symptoms</b>		
Joint pain, headache, sicca syndrome, rhinitis, dysgeusia, poor appetite, dizziness, vertigo, myalgias, insomnia, alopecia, sweating, and diarrhea	<10% [1,2,8,9,11]	Unknown (likely weeks to months)
<b>Psychologic and neurocognitive</b>		
Post-traumatic stress disorder	7 to 24% [6,10, 14]	6 weeks to 3 months or longer
Impaired memory	18 to 21% [6,15]	weeks to months
Poor concentration	16% [6]	Weeks to months
Anxiety/depression	22 to 23% [2,7,8,10, 12,13, 14]	Weeks to months
<b>Reduction in quality of life</b>	>50% [8]	Unknown (likely weeks to months)

COVID-19: coronavirus disease 2019.

\* These data are derived from an earlier period in the pandemic; information on patient recovery and persistent symptoms is evolving, and these figures may change as longer-term data emerge.

¶ More than a third of patients with COVID-19 experience **more than one** persistent symptom.

Δ Time course for recovery varies depending on premorbid risk factors and illness severity and may be shorter or longer than that listed. Hospitalized patients, and in particular critically ill patients, are more likely to have a more protracted course than those with mild disease.

References:

1. Carfi A, Bernabei R, Landi F, et al. Persistent Symptoms in Patients After Acute COVID-19. *JAMA* 2020; 324:603.
2. Xiong Q, Xu M, Li J, et al. Clinical sequelae of COVID-19 survivors in Wuhan, China: a single-centre longitudinal study. *Clin Microbiol Infect* 2020.
3. Hopkins C, Surda P, Whitehead E, Kumar BN. Early recovery following new onset anosmia during the COVID-19 pandemic - an observational cohort study. *J Otolaryngol Head Neck Surg* 2020; 49:26.
4. Cho RHW, To ZWH, Yeung ZWC, et al. COVID-19 Viral Load in the Severity of and Recovery From Olfactory and Gustatory Dysfunction. *Laryngoscope* 2020; 130:2680.
5. Meini S, Suardi LR, Busoni M, et al. Olfactory and gustatory dysfunctions in 100 patients hospitalized for COVID-19: sex differences and recovery time in real-life. *Eur Arch Otorhinolaryngol* 2020; 277:3519.
6. Halpin SJ, McIvor C, Whyatt G, et al. Postdischarge symptoms and rehabilitation needs in survivors of COVID-19 infection: A cross-sectional evaluation. *J Med Virol* 2020.
7. Bowles KH, McDonald M, Barrón Y, et al. Surviving COVID-19 After Hospital Discharge: Symptom, Functional, and Adverse Outcomes of Home Health Recipients. *Ann Intern Med* 2020.
8. Wong AW, Shah AS, Johnston JC, et al. Patient-reported outcome measures after COVID-19: a prospective cohort study. *Eur Respir J* 2020; 56.
9. Nehme M, Braillard O, Alcoba G, et al. COVID-19 Symptoms: Longitudinal Evolution and Persistence in Outpatient Settings. *Ann Intern Med* 2020.
10. Taquet M, Luciano S, Geddes JR, Harrison PJ. Bidirectional associations between COVID-19 and psychiatric disorder: retrospective cohort studies of 62 354 COVID-19 cases in the USA. *Lancet Psychiatry* 2020.
11. Logue J K; Franko N M; McCulloch D J; et al. Sequelae in Adults at 6 Months After COVID-19 Infection *JAMA Network Open*. 2021;4(2):e210830.

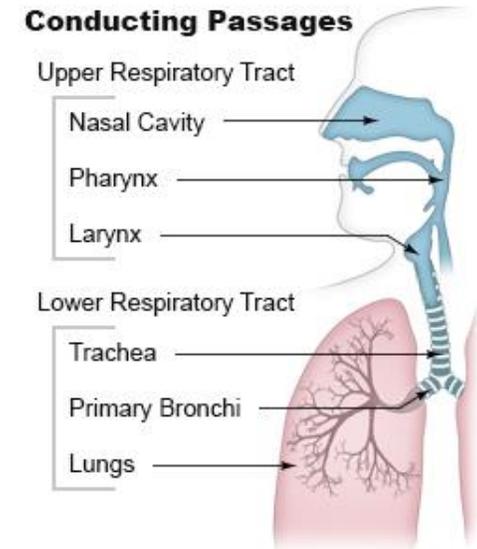
# Testing for COVID-19

- Although there are no specific clinical features to distinguish COVID-19 from other viruses that affect the respiratory tract, there are some features that should have a higher level of suspicion
  - New-onset fever and/or cough or shortness of breath
- It should also be considered with certain symptoms, such as: smell or taste disturbances, muscle aches or diarrhea
- The diagnosis cannot be made on symptoms alone. Test all symptomatic patients with suspected infection

# Testing in Asymptomatic Individuals

- Due to public health and infection control purposes, there are times to test people who do not have symptoms:
  - Following close contact with an individual with COVID-19
    - Test those non-vaccinated immediately after exposed
    - Observe for 5-7 days after last exposure and test both vaccinated and non-vaccinated persons who have been exposed
  - If living in a congregate facility that has an infection outbreak and vulnerable population (i.e. long-term care facilities, homeless shelters or detention centers)
  - Screening hospitalized patients (if the prevalence is >10% in the community)

- RT-PCR (reverse-transcription polymerase chain reaction), commonly called **PCR test**, is the preferred test for Covid-19
  - The RT-PCR is a Nucleic acid amplification test (NAAT) from the upper respiratory tract
- **Rapid** RT-PCR tests are an acceptable means of testing and are better than antigen testing.
  - Where access to PCR is limited or too costly, antigen testing may be used (but are less accurate and negatives may warrant further testing)



# Interpretation of Test Results

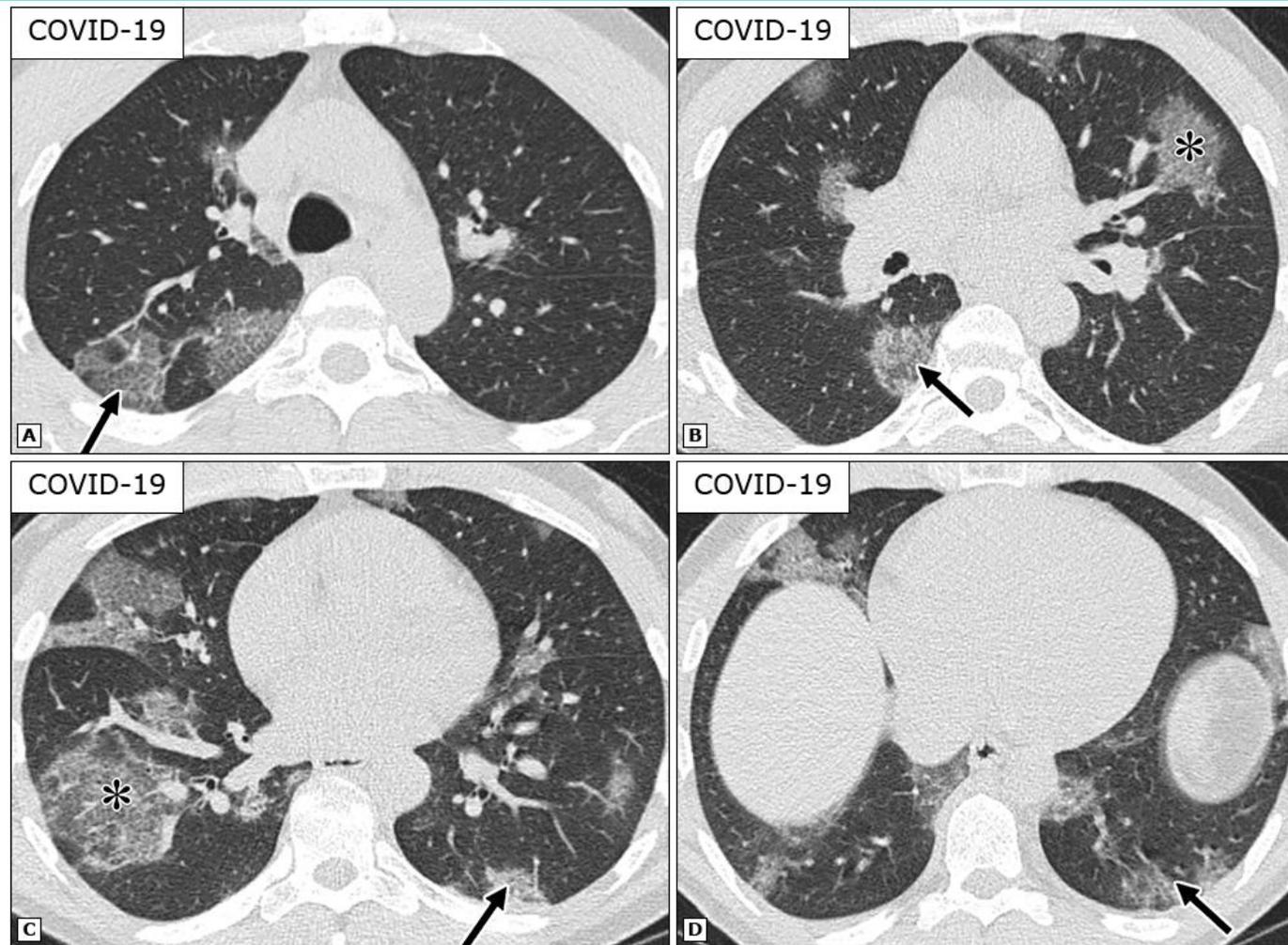
- Positive PCR result: generally confirms the diagnosis of COVID-19
  - Patients can have [detectable RNA](#) for weeks after the symptoms subside
    - [This does not indicate ongoing infectious state \(i.e. no longer contagious\)](#)
- A negative PCR result is generally sufficient to exclude COVID-19
  - However, if clinical suspicion remains high and it is important to know, it is suggested to repeat after 48 hours
- Indeterminate PCR result:
  - Can be considered positive and can be repeated if early in the disease process

# Are There Cases of Reinfection?

- Because of the possibility of maintaining a presence of COVID-19 in your body, a repeat PCR test does not prove reinfection
- The CDC suggests the [possibility of reinfection](#) in patients who:
  - Have a repeat positive PCR test after 90 days from their initial infection, regardless of symptoms
  - Have a repeat positive PCR test 45-89 days after the initial infection and have symptoms consistent with COVID-19
- COVID-19 vaccination does not change the results of a viral test, so a positive test cannot be attributed to the vaccine

# Laboratory Findings and Imaging

- Most additional laboratory testing is not needed unless a patient is potentially in need of hospitalization
- Chest radiographs (X-rays) may be normal in early or mild COVID-19 disease
- Chest CT may be more sensitive, but is not recommended for screening or diagnosis of COVID-19
  - Most common findings on Chest CT were ground-glass opacification (consistent with viral pneumonia) as seen in the next slide



Typical CT imaging features for COVID-19. Unenhanced thin-section axial images of the lungs in a 52-year-old man with a positive RT-PCR (A to D) show bilateral, multifocal rounded (asterisks) and peripheral GGO (arrows) with superimposed interlobular septal thickening and visible intralobular lines ("crazy-paving"). Routine screening CT for diagnosis or exclusion of COVID-19 is currently not recommended by most professional organizations or the United States Centers for Disease Control and Prevention.

COVID-19: coronavirus disease 2019; CT: computed tomography; RT-PCR: reverse-transcription polymerase chain reaction; GGO: ground-glass opacity.

From: Simpson S, Kay FU, Abbara S, et al. Radiological Society of North America Expert Consensus Document on Reporting Chest CT Findings Related to COVID-19: Endorsed by the Society of Thoracic Radiology, the American College of Radiology, and RSNA. *Radiology: Cardiothoracic Imaging* 2020; 2:2. Available at: <https://pubs.rsna.org/doi/full/10.1148/rvct.2020200152>. Copyright © 2020. The Authors. Reproduced under the terms of the [Creative Commons Attribution License 4.0](https://creativecommons.org/licenses/by/4.0/)