POWER OF PROVIDERS

Peer to Peer knowledge sharing webinar series

Washington State Department of HEALTH

Continuing Medical Education

- CME is available for attending the webinar or watching the recording.
- If you are watching in a group setting, please make sure you register for the webinar and complete the evaluation as an individual to receive CME credit.
- Accreditation Statement - This activity has been planned and implemented in accordance with the accreditation requirements and policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint providership of the Federation of State Medical Boards, Washington Medical Commission and the Washington State Department of Health. The Federation of State Medical Boards is accredited by the ACCME to provide continuing medical education for physicians.
- Credit Designation Statement - The Federation of State Medical Boards designates this live activity for a maximum of 1.0 *AMA PRA Category 1 Credit*™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

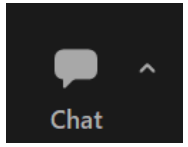
Faculty and Staff Disclosures

- This webinar is not funded by any commercial entity.
- As an organization accredited by the ACCME, the Federation of State Medical Boards (FSMB) requires that the content of CME activities and related materials provide balance, independence, objectivity, and scientific rigor. All faculty, planners, and others in a position to control continuing medical education content participating in an accredited continuing education activity are required to disclose all financial relationships with ineligible companies. Ineligible companies are organizations whose primary business is producing, marketing, selling, re-selling, or distributing healthcare products used by or on patients. Faculty (authors, presenters, speakers) are encouraged to provide a balanced view of therapeutic options by utilizing either generic names or other options available when utilizing trade names to ensure impartiality.

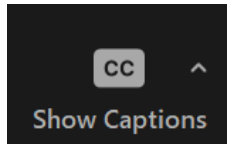
Faculty and Staff Disclosures

- All faculty members are asked to disclose all financial relationships they have had in the past 24 months with ineligible companies regardless of the potential relevance of each relationship to the education and of the amount. The FSMB has implemented a mechanism to identify and resolve all conflicts of interest prior to the activity. The intent of this policy is to identify potential conflicts of interest so participants can form their own judgments with full disclosure of the facts. Participants will be asked to evaluate whether the speaker's outside interests reflect a possible bias in the planning or presentation of the activity.
- The speakers, course director, authors, and planners have no relevant financial relationships with ineligible companies to disclose.
- This educational activity may contain discussion of published and/or investigational uses of agents that are not approved by the U.S. Food and Drug Administration. For additional information about approved uses, including approved indications, contraindications, and warnings, please refer to the prescribing information for each product, or consult the Physicians' Desk Reference.

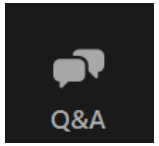
Zoom Housekeeping



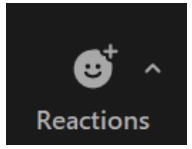
- Disabled for participants
- Information will be shared here



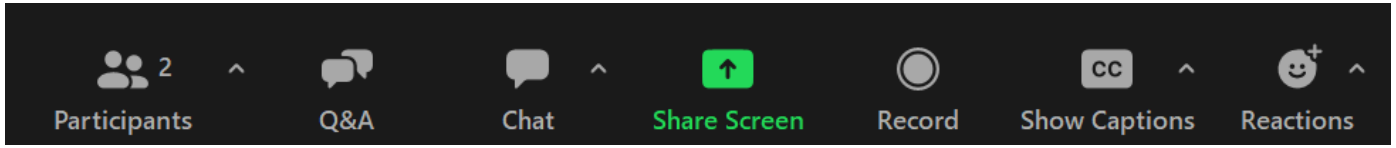
- Click to enable automatic closed captions



- Submit questions to presenter



- Click top-right arrow to hide participant reactions



About the Power of Providers Initiative

- Support and equip health care providers to serve as trusted sources of COVID-19 vaccine information for their patients and their communities
- Respond to member requests for resources
- Work together to increase vaccine rates across the state

Provider Commitment: SAVE

SEEK: Seek your patients' COVID-19 vaccine status

ASK/EDUCATE: If your patient isn't vaccinated, ask them about the vaccine and offer education if they are unsure

VACCINATE: Provide patient with a COVID-19 vaccine or a referral to a location that provides them

EMPOWER: Empower patients to share their vaccine status with their community

Who can join POP?

Current Membership

- 4,500+ individuals
- 400 health care organizations
- 90 different health care roles
- Over 20 partnering health care associations

Any health care provider who engages with the people they serve about COVID-19 vaccinations is eligible—the ability to educate and refer is as important as administering the vaccine!

Visit our website to learn more at doh.wa.gov/joinpop. Fill out the member signup form to join the initiative.

Current Resources

POP Shop

- Webpage to order free patient handouts, posters, discussion guides, other materials

Biweekly e-newsletter

- New resources, timely and relevant updates for members
- Featuring POP member stories in Provider Spotlights

POP en Español

- Updates, links, fact sheets, other resources for providers serving Spanish-speaking populations

doh.wa.gov/popesp

Current Opportunities

Provider Advisory Group

- Multi-disciplinary group of POP members who inform and help guide our work

Peer-to-Peer webinars

- Learn about topics related to COVID vaccine from speakers who work in health care
- To learn about upcoming topics, register, and view recordings, visit doh.wa.gov/pop

Member engagement

- POP staff are available and engaged in conversations with providers across the state to learn about your experiences, challenges, and feedback for DOH

Peer-to-Peer Webinars

- Health care providers share expertise and knowledge with one another
- DOH provides meeting space only, not content

Upcoming webinars include:

- **October 18th:** COVID-19 Disaster Cascade Recovery Updates
- **November 3rd :** Vaccine Fatigue – Addressing the Elephant in the Room

Today's Presenter

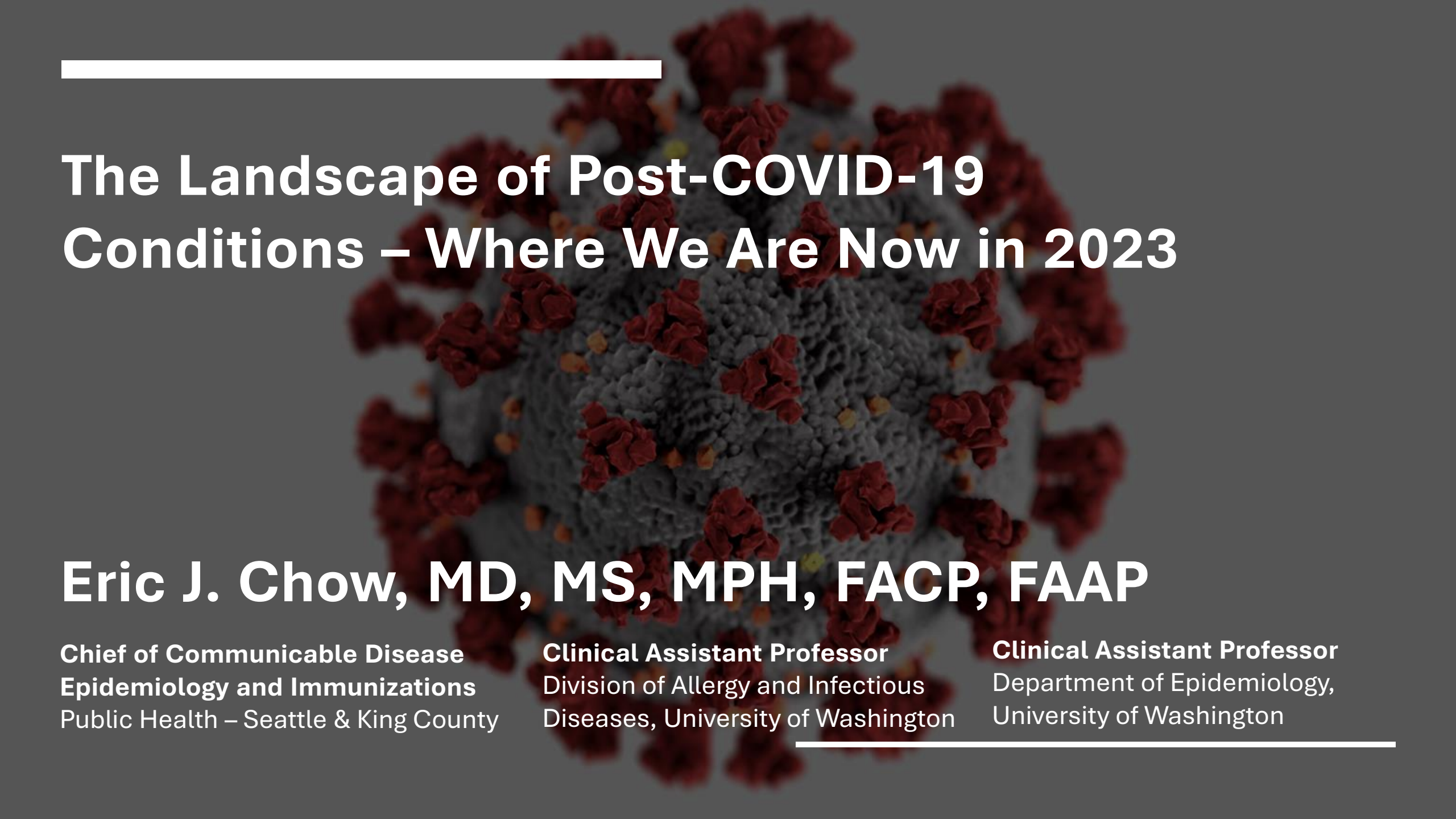
Dr Eric J. Chow, MD, MS, MPH

- Chief of Communicable Disease Epidemiology and Immunization for Public Health – Seattle & King County.
- Clinical Assistant Professor in the Division of Allergy and Infectious Diseases and in the Department of Epidemiology. At University of Washington.
- Helped characterize the initial cases of multi-system inflammatory syndrome in children in the United States.
- His peer reviewed publications and research interests focus on community respiratory virus epidemiology, extra-pulmonary manifestations of respiratory viruses and emerging infectious diseases.

Thank you for joining us and being part of the Power of Providers!

powerofproviders@doh.wa.gov
https://doh.wa.gov/pop/
(360) 236-2662

Washington State Department of HEALTH



The Landscape of Post-COVID-19 Conditions – Where We Are Now in 2023

Eric J. Chow, MD, MS, MPH, FACP, FAAP

Chief of Communicable Disease Epidemiology and Immunizations
Public Health – Seattle & King County

Clinical Assistant Professor
Division of Allergy and Infectious Diseases, University of Washington

Clinical Assistant Professor
Department of Epidemiology, University of Washington

I have no disclosures to report.

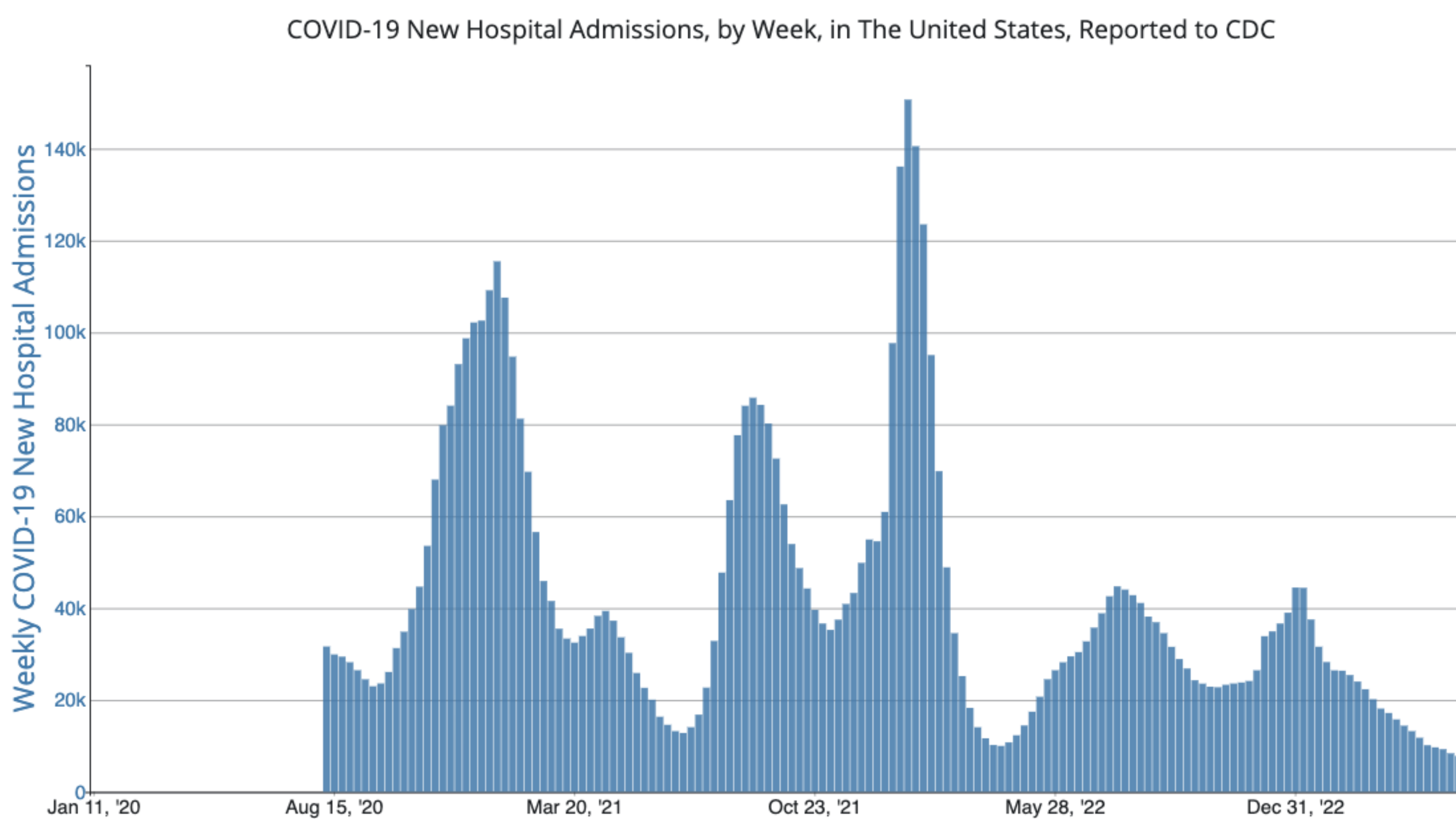
Objectives

1. Review updates to case definitions and naming of post-COVID-19 conditions.

2. Describe the known epidemiology and pathophysiology of post-COVID-19 conditions.

3. Recognize clinical features associated with post-COVID-19 conditions.

4. Summarize clinical management considerations in patients with post-COVID-19 conditions.


COVID-19 New Hospital Admissions, by Week, in The United States, Reported to CDC
Weekly COVID-19 New Hospital Admissions
140k
120k
100k
80k
60k
40k
20k
0
Jan 11, '20
Aug 15, '20
Mar 20, '21
Oct 23, '21
May 28, '22
Dec 31, '22

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

>103,000,000
confirmed cases of COVID-19
(as of February 2023)

Hospitalizations

Deaths

https://covid.cdc.gov/covid-data-tracker/#datatracker-home

>103,000,000

confirmed cases of COVID-19
(as of February 2023)

6,209,122

Hospitalizations

(as of July 2023)

Deaths

https://covid.cdc.gov/covid-data-tracker/#datatracker-home

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

>103,000,000
confirmed cases of COVID-19
(as of February 2023)

6,209,122
Hospitalizations
(as of July 2023)

1,134,710
Deaths
(as of July 2023)

https://covid.cdc.gov/covid-data-tracker/#datatracker-home

“I am one of the lucky ones. I never needed a ventilator…But 27 days later, I still have lingering pneumonia. I use two inhalers, twice a day. I can’t walk more than few blocks without stopping”

~ *Mara Gay, New York Times Editorial Board Member*

https://www.nytimes.com/2020/05/14/opinion/coronavirus-young-people.html

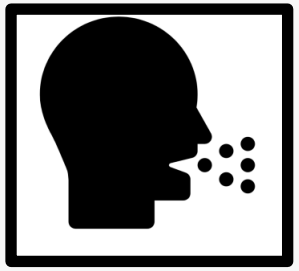
Characterized by over 200 symptoms have been reported.

Fatigue

Shortness of breath

Chest pain or palpitations

Anosmia



Cough

Dizziness or balance issues

Headache

Insomnia or sleep disturbances

Depression or anxiety

Also includes: fever, joint pain, change in libido, cognitive difficulties, GI issues, menstrual cycle irregularities

”...Under reasonable assumptions given the data available, long Covid could account for 15% of the nations... unfilled jobs.”

Bach K. Is 'long Covid' worsening the labor shortage? Accessed July 18, 2023. https://www.brookings.edu/articles/is-long-covid-worsening-the-labor-shortage/

“Approximately 18% of workers with Long COVID… could not return to work for more than 1 year”

– New York State Insurance Fund

https://ww3.nysif.com/en/footerpages/column1/aboutnysif/nysif_news/2023/20230124longcovid

>335,000,000

US Population
(as of July 2023)

https://www.census.gov/popclock/

>335,000,000

US Population
(as of July 2023)

>103,000,000

confirmed cases of COVID-19
(as of February 2023)

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

https://covid.cdc.gov/covid-data-tracker/#datatracker-home

>335,000,000
US Population
(as of July 2023)

60-70%
has had COVID-19

>103,000,000
confirmed cases of COVID-19
(as of February 2023)

https://www.webmd.com/covid/news/20220802/havent-had-covid-yet-wanna-bet
https://www.cdc.gov/mmwr/volumes/71/wr/mm7117e3.htm?s_cid=mm7117e3_w

>335,000,000
US Population
(as of July 2023)

60-70%
has had COVID-19

~200,000,000-238,000,000
have had COVID-19

>103,000,000
confirmed cases of COVID-19
(as of February 2023)

>335,000,000
US Population
(as of July 2023)

60-70%
has had COVID-19

~200,000,000-238,000,000
have had COVID-19

Assume
~10%
Experience post-COVID-19 conditions

>103,000,000
confirmed cases of COVID-19
(as of February 2023)

>335,000,000
US Population
(as of July 2023)

60-70%
has had COVID-19

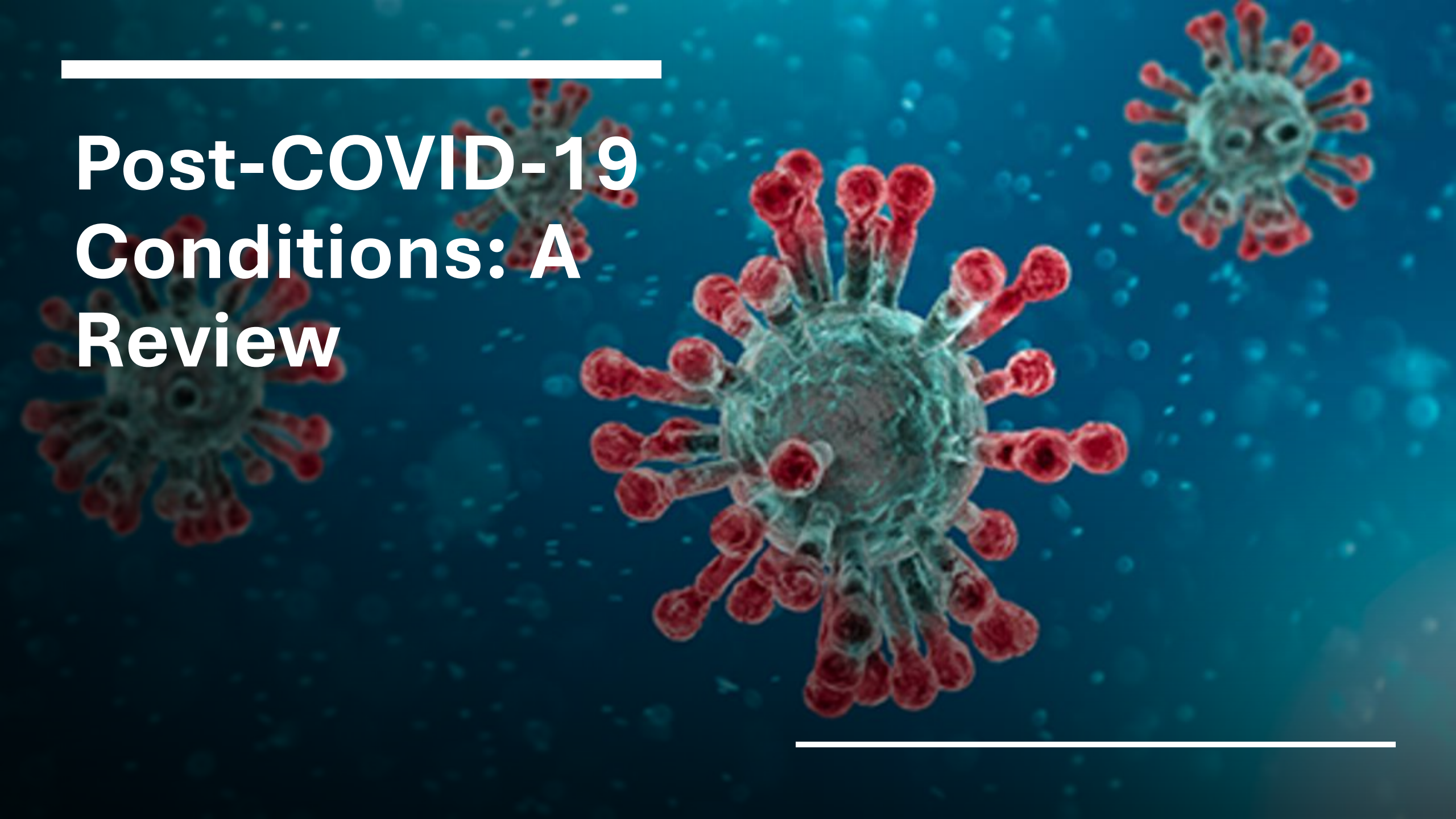
~200,000,000-238,000,000
have had COVID-19

>103,000,000
confirmed cases of COVID-19
(as of February 2023)

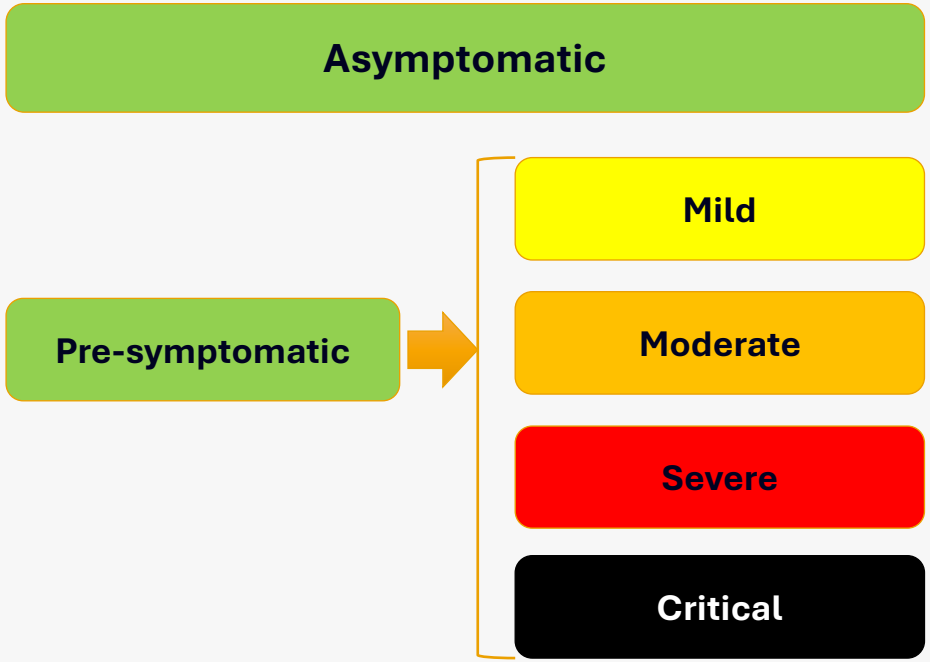
Assume
~10%
Experience post-COVID-19 conditions

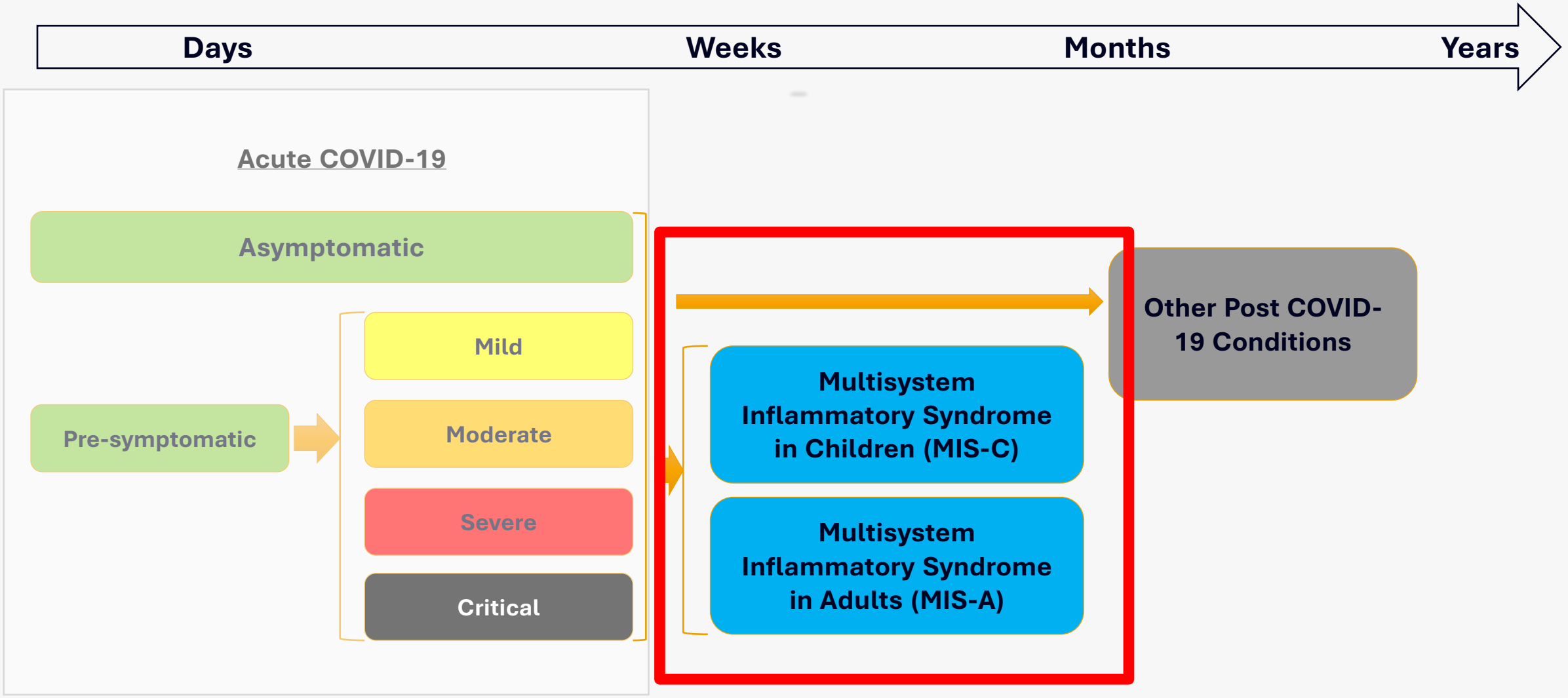
~20,000,000-24,000,000
have had a post-COVID-19 condition

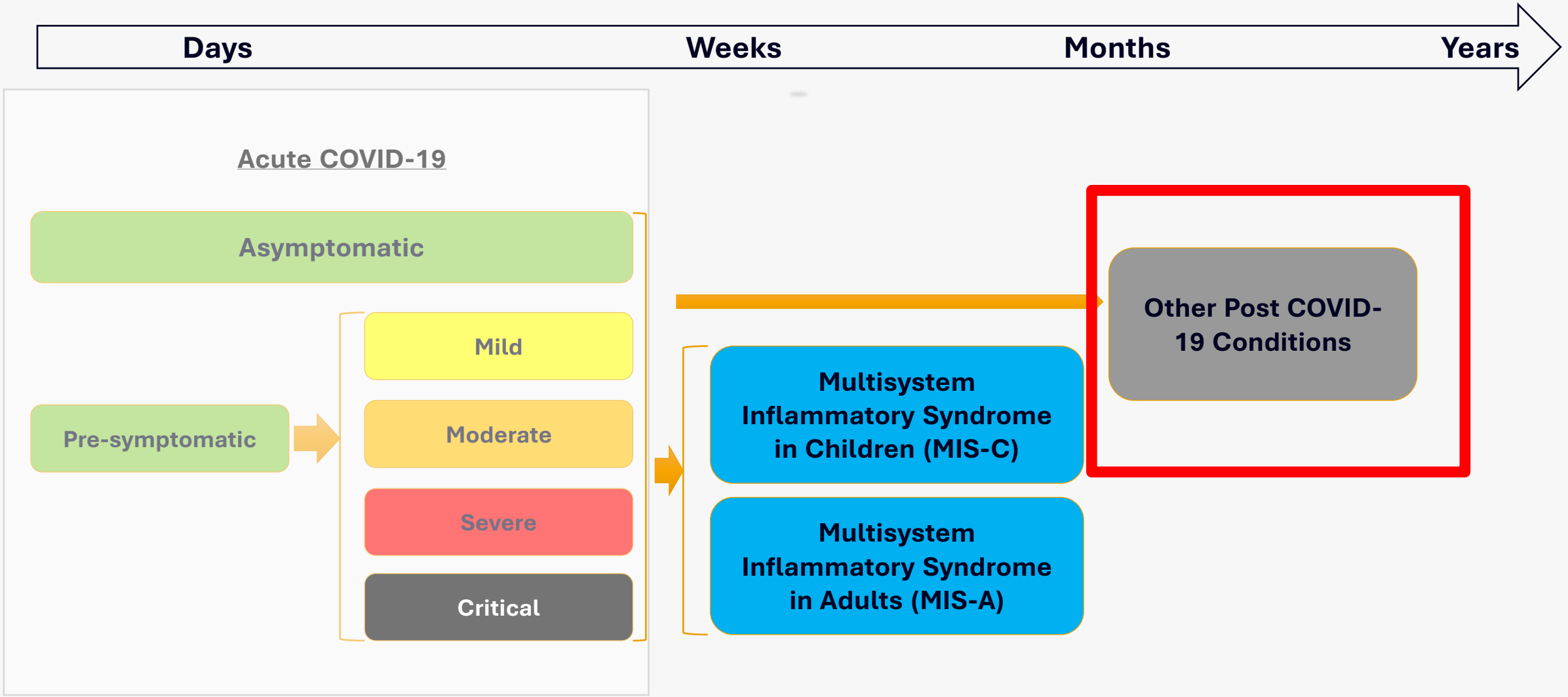
Post-COVID-19 Conditions: A Review

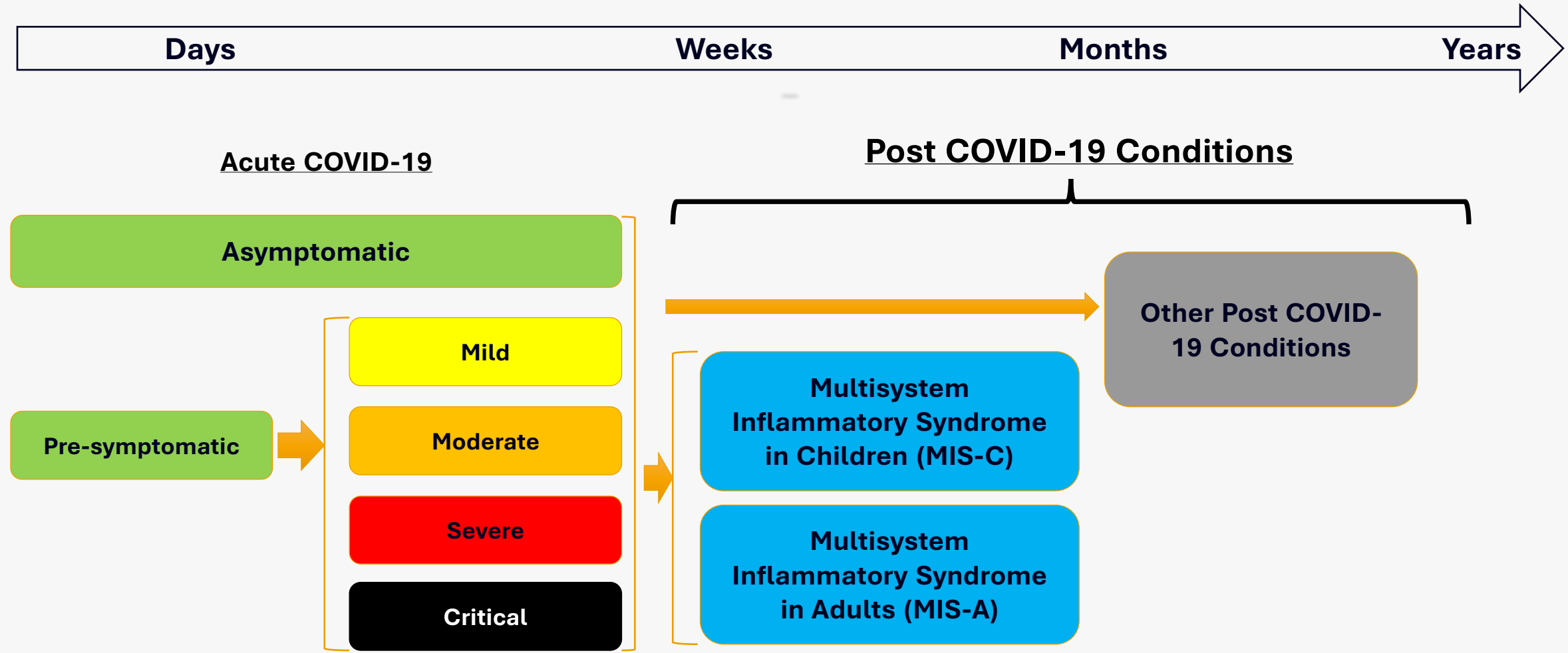


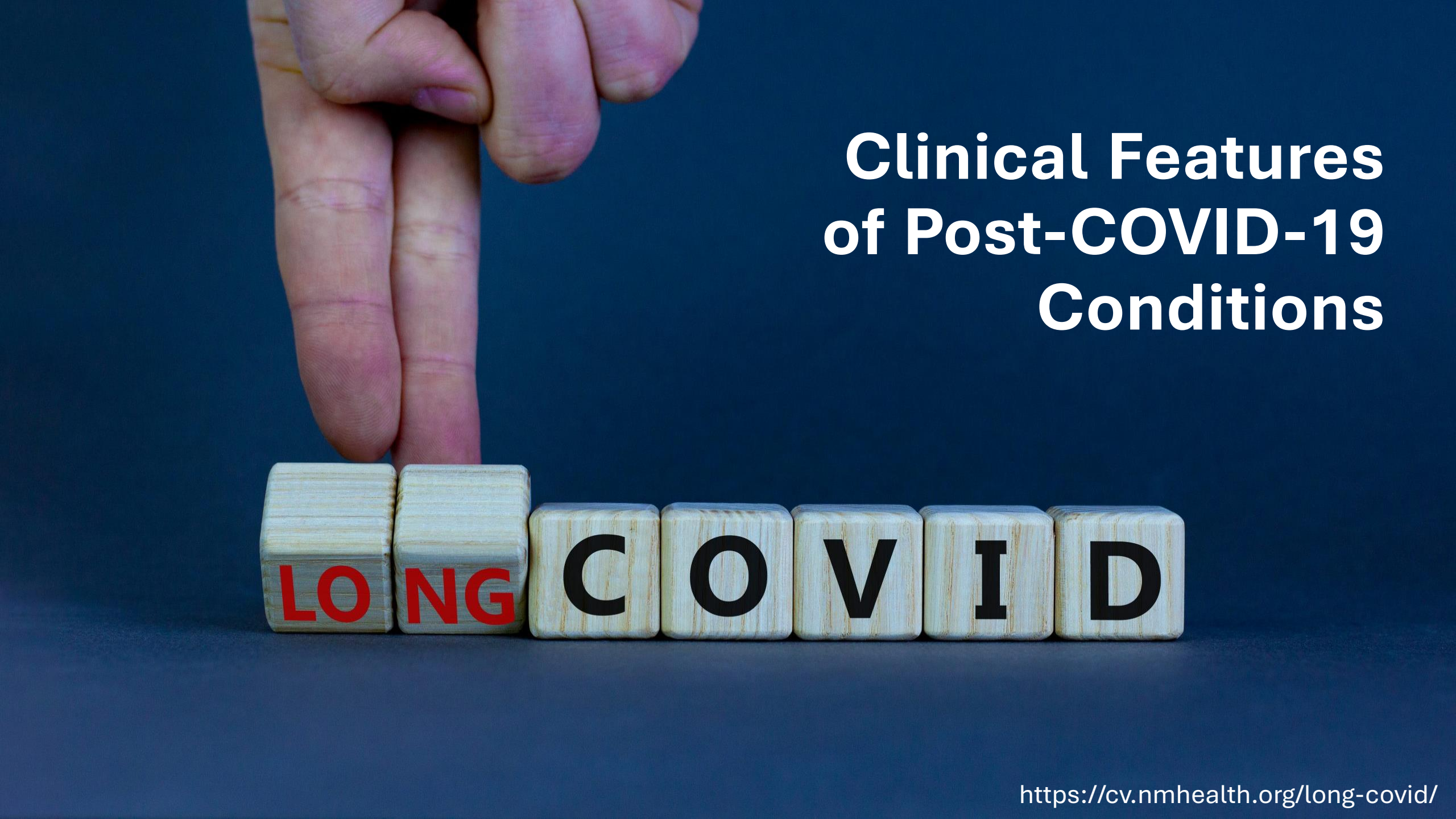
Acute COVID-19




Days
Weeks
Months
Years
Acute COVID-19
Asymptomatic
Pre-symptomatic
Mild
Moderate
Severe
Critical
Multisystem Inflammatory Syndrome in Children (MIS-C)
Multisystem Inflammatory Syndrome in Adults (MIS-A)
Other Post COVID-19 Conditions


Days
Weeks
Months
Years
Acute COVID-19
Asymptomatic
Pre-symptomatic
Mild
Moderate
Severe
Critical
Multisystem Inflammatory Syndrome in Children (MIS-C)
Multisystem Inflammatory Syndrome in Adults (MIS-A)
Other Post COVID-19 Conditions


Days
Weeks
Months
Years
Acute COVID-19
Post COVID-19 Conditions
Asymptomatic
Pre-symptomatic
Mild
Moderate
Severe
Critical
Other Post COVID-19 Conditions
Multisystem Inflammatory Syndrome in Children (MIS-C)
Multisystem Inflammatory Syndrome in Adults (MIS-A)



Clinical Features of Post-COVID-19 Conditions

https://cv.nmhealth.org/long-covid/

The Many Presentations of Post-COVID-19 Conditions.

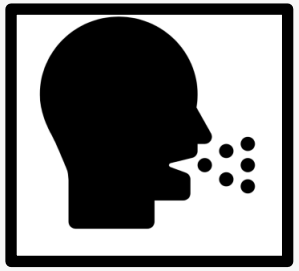
Persistent or New Symptoms and Conditions

Fatigue

Shortness of breath

Chest pain or palpitations

Anosmia



Cough

Dizziness or balance issues

Headache

Insomnia or sleep disturbances

Depression or anxiety

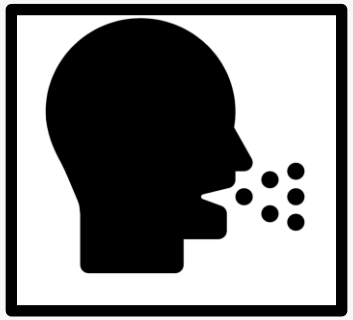
Also includes: fever, joint pain, change in libido, cognitive difficulties, GI issues, menstrual cycle irregularities

At the Mayo Multidisciplinary Clinic for Post-COVID-19 Conditions:

80%
Fatigue

59%
Neurological
Complaints

49%
Shortness
of breath



15%
Cough

Increased Risk for New Health Conditions

Morbidity and Mortality Weekly Report

Post-COVID Conditions Among Adult COVID-19 Survivors Aged 18–64 and ≥65 Years — United States, March 2020–November 2021

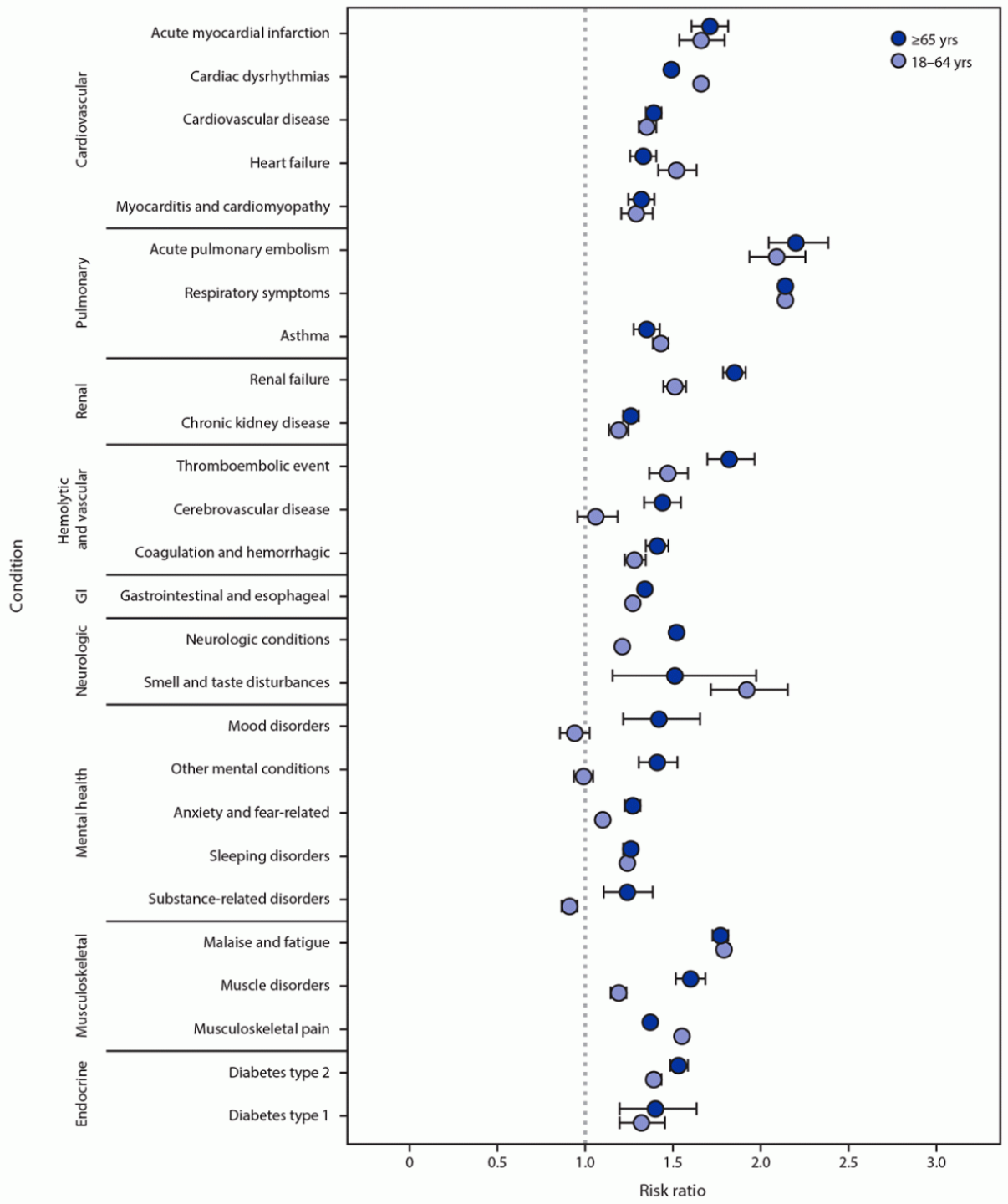
Lara Bull-Otterson, PhD[1]; Sarah Baca[1,2]; Sharon Saydah, PhD[1]; Tegan K. Boehmer, PhD[1]; Stacey Adjei, MPH[1]; Simone Gray, PhD[1]; Aaron M. Harris, MD[1]

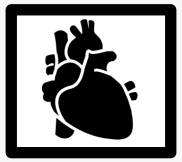
Morbidity and Mortality Weekly Report

Post–COVID-19 Symptoms and Conditions Among Children and Adolescents — United States, March 1, 2020–January 31, 2022

Lyudmyla Kompaniyets, PhD[1]; Lara Bull-Otterson, PhD[1]; Tegan K. Boehmer, PhD[1]; Sarah Baca[1,2]; Pablo Alvarez, MPH[1,2]; Kai Hong, PhD[1]; Joy Hsu, MD[1]; Aaron M. Harris, MD[1]; Adi V. Gundlapalli, MD, PhD[1]; Sharon Saydah, PhD[1]

Health Conditions in Adults



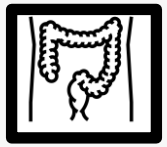


Acute Cardiovascular Events

Acute Pulmonary Events

Kidney Disease

Hematologic Diseases



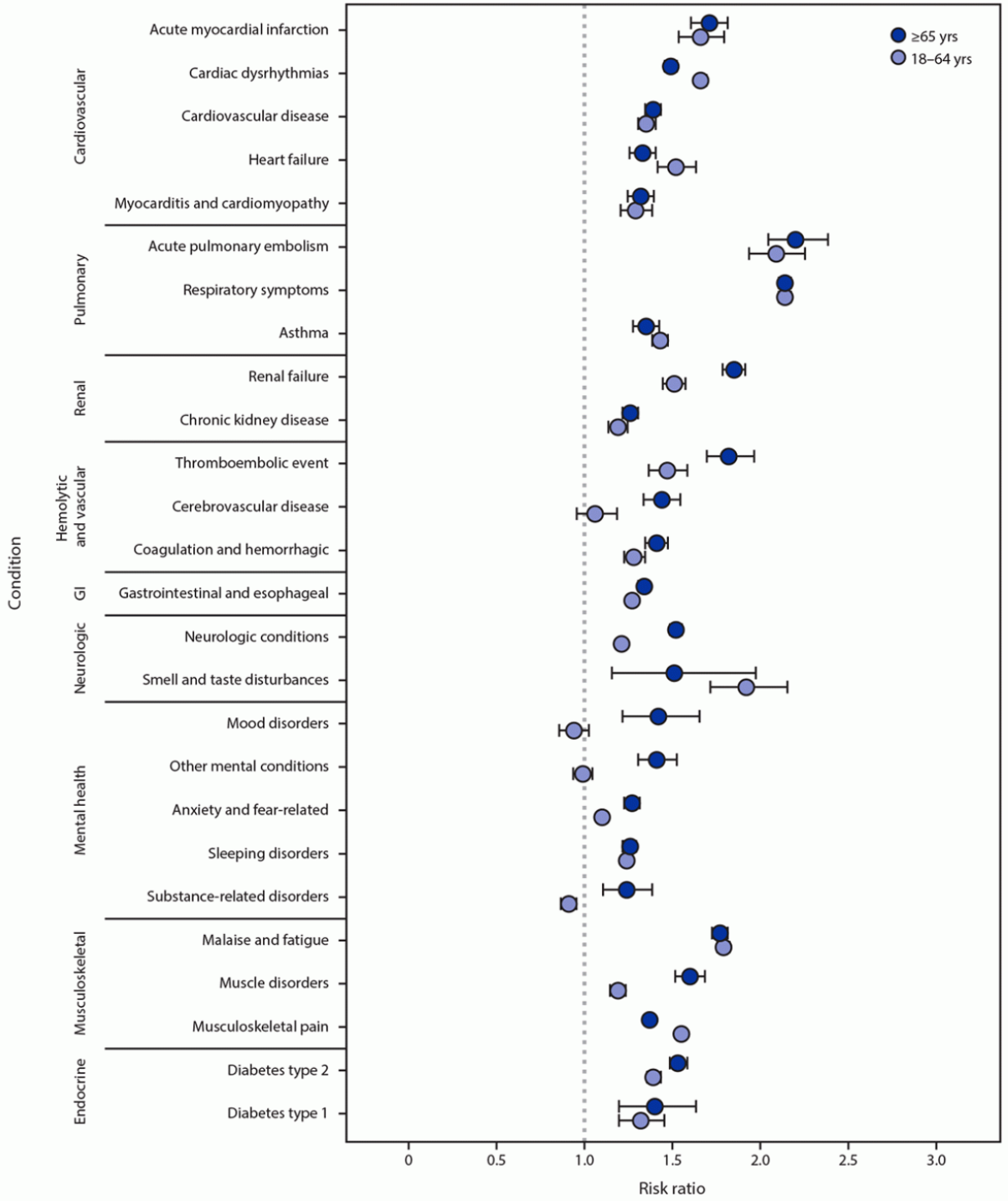
Gastrointestinal Disorders

Neurologic Disorders

Mental Health Disorders

Musculoskeletal/Rheumatic Disorders

Endocrine Disorders



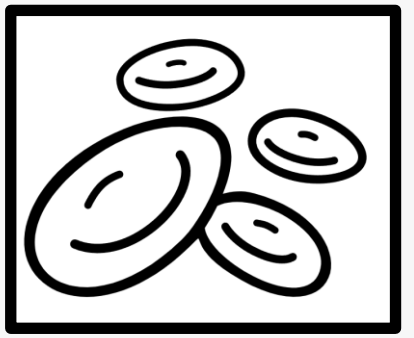
Myalgic encephalomyelitis or chronic fatigue syndrome

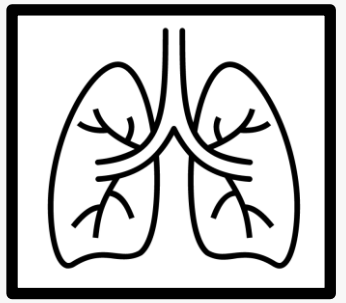
Dysautonomia or postural orthostatic tachycardia syndrome

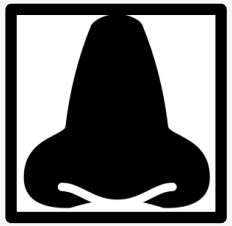
Health Conditions in Children

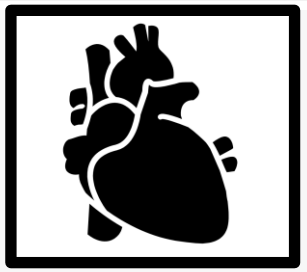
TABLE 3. Adjusted hazard ratios of selected potential post–COVID-19 symptoms and conditions among children and adolescents aged 2–17 years with and without COVID-19, by age group — HealthVerity medical claims database, United States, March 1, 2020–January 31, 2022

Outcome	Adjusted hazard ratio (95% CI)*		
	Aged 2–4 yrs	Aged 5–11 yrs	Aged 12–17 yrs
Symptom			
Smell and taste disturbances	1.22 (0.70–2.15)	0.94 (0.83–1.07)	1.23 (1.16–1.31)†
Circulatory signs and symptoms	1.17 (1.12–1.23)†	1.11 (1.08–1.13)†	1.04 (1.02–1.06)†
Malaise and fatigue	1.13 (1.05–1.22)†	1.08 (1.05–1.12)†	1.03 (1.01–1.04)†
Musculoskeletal pain	1.16 (1.10–1.21)†	1.06 (1.04–1.07)†	1.00 (0.99–1.01)
Dizziness and syncope	1.08 (0.90–1.29)	1.03 (0.99–1.08)	1.00 (0.98–1.02)
Gastrointestinal and esophageal disorders	1.15 (1.10–1.20)†	1.02 (1.00–1.04)†	0.97 (0.95–0.99)†
Sleeping disorders	0.99 (0.93–1.06)	0.89 (0.86–0.92)†	0.91 (0.89–0.94)†
Respiratory signs and symptoms	1.07 (1.04–1.10)†	0.93 (0.92–0.94)†	0.88 (0.87–0.89)†
Symptoms of mental conditions	1.03 (0.97–1.10)	0.92 (0.90–0.95)†	0.89 (0.86–0.91)†
Condition			
Acute pulmonary embolism	—§	—§	2.03 (1.61–2.56)†
Myocarditis and cardiomyopathy	2.39 (1.57–3.65)†	2.84 (2.39–3.37)†	1.66 (1.48–1.88)†
Venous thromboembolic event	—§	2.69 (1.73–4.19)†	1.52 (1.22–1.91)†
Acute and unspecified renal failure	1.52 (1.07–2.14)†	1.38 (1.16–1.63)†	1.27 (1.15–1.40)†
Type 1 diabetes	1.01 (0.57–1.78)	1.31 (1.13–1.53)†	1.20 (1.09–1.33)†
Coagulation and hemorrhagic disorders	1.47 (1.20–1.80)†	1.28 (1.15–1.43)†	1.10 (1.03–1.19)†
Type 2 diabetes	1.24 (0.85–1.81)	1.14 (1.02–1.28)†	1.18 (1.11–1.24)†
Cardiac dysrhythmias	1.44 (1.22–1.70)†	1.23 (1.14–1.32)†	1.12 (1.08–1.17)†
Cerebrovascular disease	1.66 (0.85–3.23)	1.14 (0.79–1.64)	1.18 (0.93–1.48)
Chronic kidney disease	0.86 (0.54–1.36)	1.04 (0.83–1.31)	1.12 (0.96–1.31)
Asthma	1.12 (1.07–1.18)†	1.02 (1.00–1.05)†	0.96 (0.94–0.98)†
Muscle disorders	0.87 (0.77–0.98)†	0.86 (0.82–0.91)†	0.96 (0.93–0.99)†
Neurological conditions	0.98 (0.93–1.04)	0.96 (0.93–0.98)†	0.91 (0.89–0.93)†
Anxiety and fear-related disorders	0.91 (0.83–1.00)	0.86 (0.83–0.88)†	0.84 (0.82–0.85)†
Mood disorders	0.82 (0.62–1.08)	0.73 (0.69–0.77)†	0.80 (0.77–0.83)†

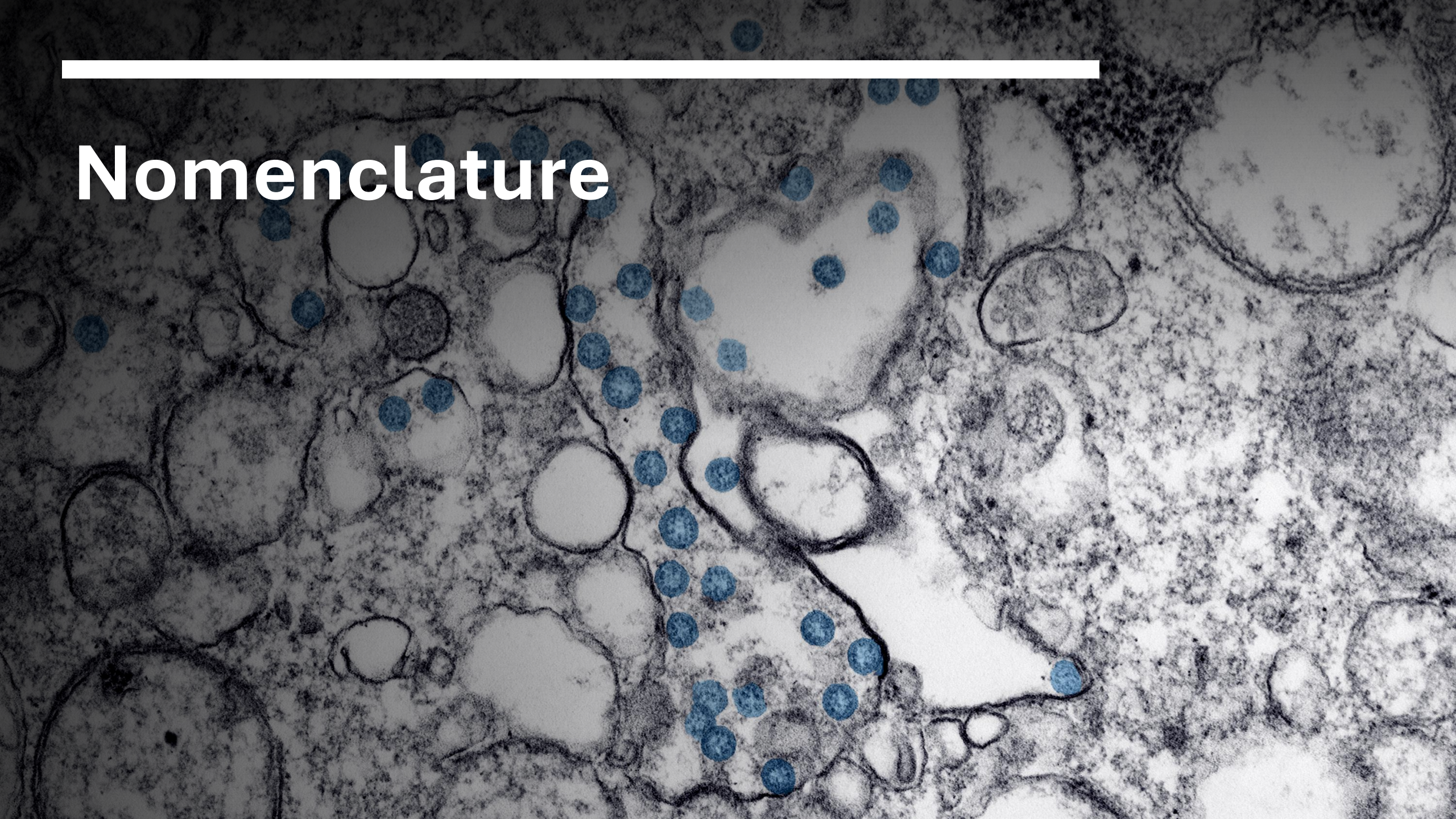








Nomenclature



A Diagnosis by Many Names

Long COVID	Post-COVID-19 Condition	Post-COVID-Conditions	Post-acute sequelae of SARS-CoV-2 Infection (PASC)
Persistent Symptoms or COVID-19 Consequences	Ongoing symptomatic COVID-19	Post-COVID-19 syndrome	U09.9 Post-COVID-Condition, unspecified

https://www.covid.gov/assets/files/National-Research-Action-Plan-on-Long-COVID-08012022.pdf

Long COVID

Post-COVID-19 Conditions (PCC)

Post-Acute Sequelae of SARS-CoV-2 Infection (PASC)

U09.9 Post-COVID Condition, unspecified

Post-COVID-19 Syndrome

Long COVID

Post-COVID-19 Conditions (PCC)

Post-Acute Sequelae of SARS-CoV-2 Infection (PASC)

U09.9 Post-COVID Condition, unspecified

Post-COVID-19 Syndrome

- Patient driven by lived experience
- More commonly used in lay language
- Includes signs, symptoms, sequelae that persist or occur after acute COVID-19 experienced by individuals
- Progressive or relapse-remitting

https://www.sciencedirect.com/science/article/pii/S0277953620306456?via%3Dihub

Long COVID

Post-COVID-19 Conditions (PCC)

Post-Acute Sequelae of SARS-CoV-2 Infection (PASC)

U09.9 Post-COVID Condition, unspecified

Post-COVID-19 Syndrome

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

World Health Organization

IDSA
Infectious Diseases Society of America

- Used by the medical, scientific, and public health communities
- Equivalent to “Long COVID” including direct and indirect effects of the virus
- Physical and mental health consequences present 4+ weeks after acute infection

Long COVID

Post-COVID-19 Conditions (PCC)

Post-Acute Sequelae of SARS-CoV-2 Infection (PASC)

U09.9 Post-COVID Condition, unspecified

Post-COVID-19 Syndrome

National Institutes of Health

- Term used in NIH funded research studies such as RECOVER Study
- Focusing on the direct effects of the virus
- Persistent, relapsing or new symptoms or health effects after acute SARS-CoV-2 infection (present 4+ weeks after infection); definition evolving over time

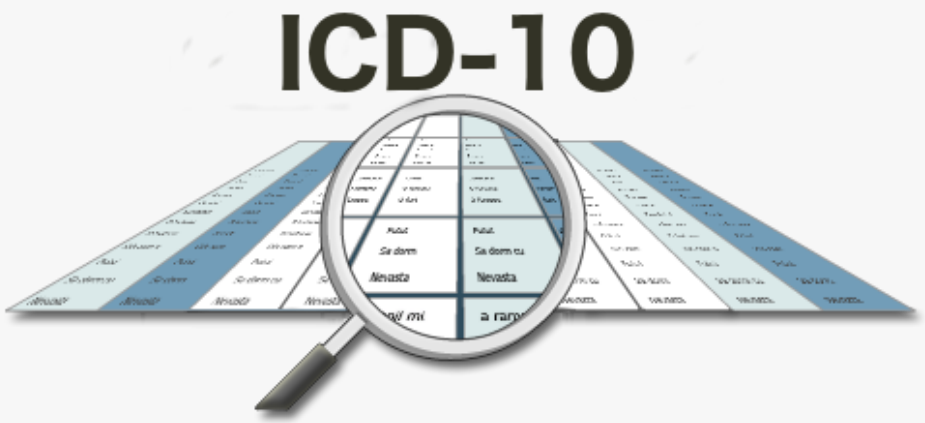
Long COVID

Post-COVID-19 Conditions (PCC)

Post-Acute Sequelae of SARS-CoV-2 Infection (PASC)

U09.9 Post-COVID Condition, unspecified

Post-COVID-19 Syndrome



- International Classification of Diseases (ICD)-10 code
- No definition but establishes a link with COVID-19
- Not for acute COVID-19 unless in a setting of reinfection AND condition related to prior infection

Long COVID

Post-COVID-19 Conditions (PCC)

Post-Acute Sequelae of SARS-CoV-2 Infection (PASC)

U09.9 Post-COVID Condition, unspecified

Post-COVID-19 Syndrome

NICE
National Institute for Health and Care Excellence

- UK based organization
- Differentiates between “Long COVID” and Post-COVID-19 syndrome (the latter is a subset of the former)
- Distinguishes between symptoms that are persistent after acute COVID-19 and symptoms/conditions that are new

Case Definitions

“Long COVID is broadly defined as signs, symptoms and conditions that continue or develop after initial COVID-19 or SARS-CoV-2 infection.

The signs, symptoms and conditions are present four weeks or more after the initial phase of infection; may be multisystemic; and may present with a relapsing-remitting pattern and progression or worsening over time with the possibility of severe and life-threatening events even months or years after infection.

Long COVID is not one condition. It represents many potentially overlapping entities, likely with different biological causes and different sets of risk factors and outcomes.”

~ U.S. Department of Health and Human Services 2022

EnSpark Consulting. 2023. What We Heard: Engagement Report for National Academies of Sciences, Engineering, and Medicine Committee on Examining the Working Definition for Long COVID. Washington, DC.

NATIONAL ACADEMIES

Sciences
Engineering
Medicine

Health consequences (physical and mental) that can be present 4 or more weeks after infection with SARS-CoV-2

OR

Instances in which there is a lack of return to a usual state of health following acute COVID-19

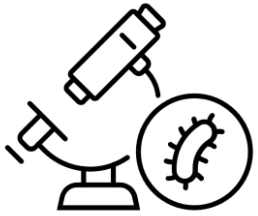
https://www.cdc.gov/coronavirus/2019-ncov/hcp/clinical-care/post-covid-conditions.html

A clinical case definition of post-COVID-19 condition by a Delphi consensus

Joan B Soriano, Srinivas Murthy, John C Marshall, Pryanka Relan, Janet V Diaz, on behalf of the WHO Clinical Case Definition Working Group on Post-COVID-19 Condition

Multi-specialty Clinicians

COVID-19 Survivors

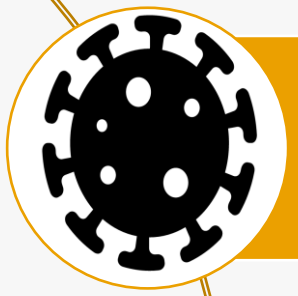


Researchers

Policymakers

Representation From All WHO Regions and World Bank Income Levels

Definition of a post-COVID-19 condition:



History of probable or confirmed SARS-CoV-2 infection

Symptoms usually present at 3 months from onset of COVID-19 lasting at least 2 months

Cannot be explained by an alternative diagnosis

Notable symptom characteristics:

- Impact the everyday function of the individual

Notable symptom characteristics:

- Impact the everyday function of the individual
- Can be new following recovery from acute COVID-19 or carry over from the initial infection

Notable symptom characteristics:

- Impact the everyday function of the individual
- Can be new following recovery from acute COVID-19 or carry over from the initial infection
- May fluctuate or relapse over time

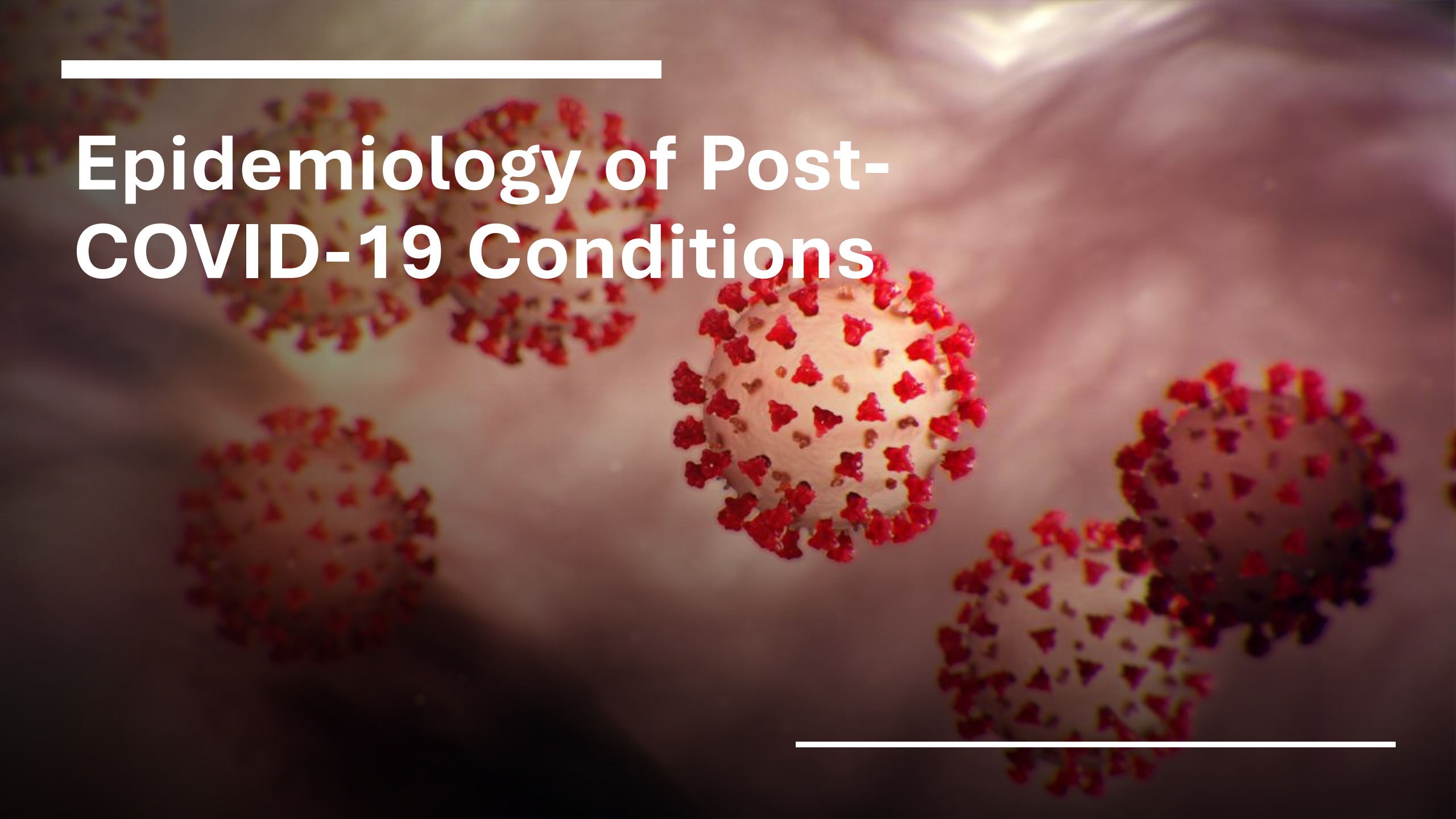
Notable symptom characteristics:

- Impact the everyday function of the individual
- Can be new following recovery from acute COVID-19 or carry over from the initial infection
- May fluctuate or relapse over time
- No minimum number of symptoms required for the diagnosis

Notable symptom characteristics:

- Impact the everyday function of the individual
- Can be new following recovery from acute COVID-19 or carry over from the initial infection
- May fluctuate or relapse over time
- No minimum number of symptoms required for the diagnosis
- A separate definition for children has been developed

Epidemiology of Post-COVID-19 Conditions



Persistence of somatic symptoms after COVID-19 in the Netherlands: an observational cohort study

Aranka V Ballering, Sander K R van Zon, Tim C olde Hartman, Judith G M Rosmalen, for the Lifelines Corona Research Initiative*

Post-COVID-19 condition occurs in **1 in 8 adults** with COVID-19 in the general population.

Morbidity and Mortality Weekly Report

Post-COVID Conditions Among Adult COVID-19 Survivors Aged 18–64 and ≥65 Years — United States, March 2020–November 2021

Lara Bull-Otterson, PhD[1]; Sarah Baca[1,2]; Sharon Saydah, PhD[1]; Tegan K. Boehmer, PhD[1]; Stacey Adjei, MPH[1]; Simone Gray, PhD[1]; Aaron M. Harris, MD[1]

Approximately **1 in 5 adults (18-64 years)** and **1 in 4 older adults (≥65 years)** had a health condition that may be related to previous SARS-CoV-2 infection.

Prevalence and risk factors of post-COVID-19 condition in adults and children at 6 and 12 months after hospital discharge: a prospective, cohort study in Moscow (StopCOVID)

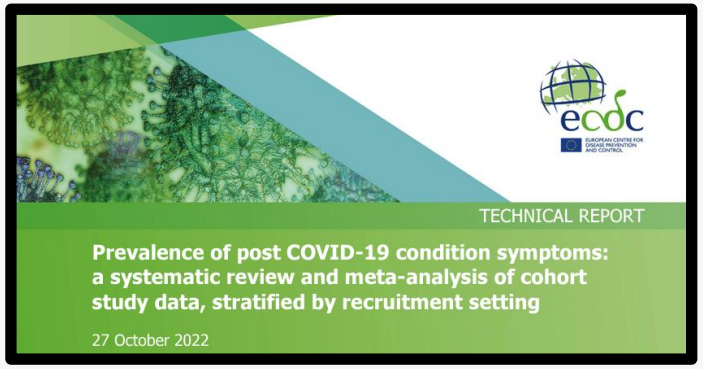
Ekaterina Pazukhina[1,21], Margarita Andreeva[31], Ekaterina Spiridonova[31], Polina Bobkova[31], Anastasia Shikhaleva[31], Yasmin El-Taravi[31], Mikhail Rumyantsev[31], Aysylu Gamirova[31], Anastasiia Bairashevskaia[3], Polina Petrova[3], Dina Baimukhambetova[3], Maria Pikuza[3], Elina Abdeeva[3], Yulia Filippova[3], Salima Deunezhewa[3], Nikita Nekliudov[3], Polina Bugaeva[3], Nikolay Bulanov[4], Sergey Avdeev[5], Valentina Kapustina[6], Alla Guekht[7,8], Audrey DunnGalvin[3,9], Pasquale Comberiati[10], Diego G. Peroni[10], Christian Apfelbacher[11], Jon Genuneit[12], Luis Felipe Reyes[13,14], Caroline L. H. Brackel[15,16], Victor Fomin[17], Andrey A. Svistunov[17], Peter Timashev[18], Lyudmila Mazankova[19], Alexandra Miroshina[20], Elmira Samitova[19,20], Svetlana Borzakova[8,21], Elena Bondarenko[3], Anatoliy A. Korsunskiy[3], Gail Carson[22], Louise Sigfrid[22], Janet T. Scott[23], Matthew Greenhawt[24], Danilo Buonsenso[25,26,27], Malcolm G. Semple[28,29], John O. Warner[30], Piero Olliaro[22], Dale M. Needham[31,32,33], Petr Glybochko[17], Denis Butnaru[17], Ismail M. Osmanov[8,20†], Daniel Munblit[3,7,30*†] and Sechenov StopCOVID Research Team

Prevalence of post-COVID-19 conditions estimated to be **1 in 3 adults** and **1 in 10 children** who were hospitalized with COVID-19.

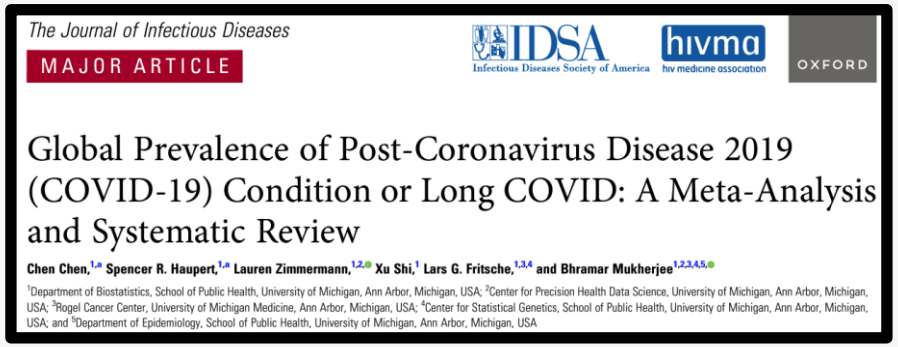
Physical and mental health 3 months after SARS-CoV-2 infection (long COVID) among adolescents in England (CLoCk): a national matched cohort study

Terence Stephenson, Snehal M Pinto Pereira, Roz Shafran, Bianca L de Stavola, Natalia Rojas, Kelsey McOwat, Ruth Simmons, Maria Zavala, Lauren O'Mahoney, Trudie Chalder, Esther Crawley, Tamsin J Ford, Anthony Harnden, Isobel Heyman, Olivia Swann, Elizabeth Whittaker, CLoCk Consortium, Shamez N Ladhani

Among non-hospitalized adolescents aged 11-17 years, there were **13.2% more individuals** reporting symptoms and **14% more reporting ≥3 symptoms** at 3 months among those with COVID-19 compared to those without.



Prevalence of any post COVID-19 condition symptom was estimated to be **51% among community setting cohorts**.



Estimated global prevalence of post-COVID-19 conditions estimated to be **43%** among those with prior SARS-CoV-2 infection.

15% of US adults reported ever having long COVID; **28% of adults with previous COVID-19** reported ever having long COVID

Among adult study participants first infected on or after December 1, 2021 and enrolled within 30 days of infection, **10% were PASC positive at 6 months**.

10-30% of non-hospitalized cases

50-70% of hospitalized cases

10-12% of vaccinated cases

Age

Age

- People of all ages are at risk for post-COVID-19 conditions

Age

- People of all ages are at risk for post-COVID-19 conditions
- Highest percentages of diagnoses between ages 36 and 50 years

Age

- People of all ages are at risk for post-COVID-19 conditions
- Highest percentages of diagnoses between ages 36 and 50 years
- Risk appears higher in older age groups with similar acute disease severity

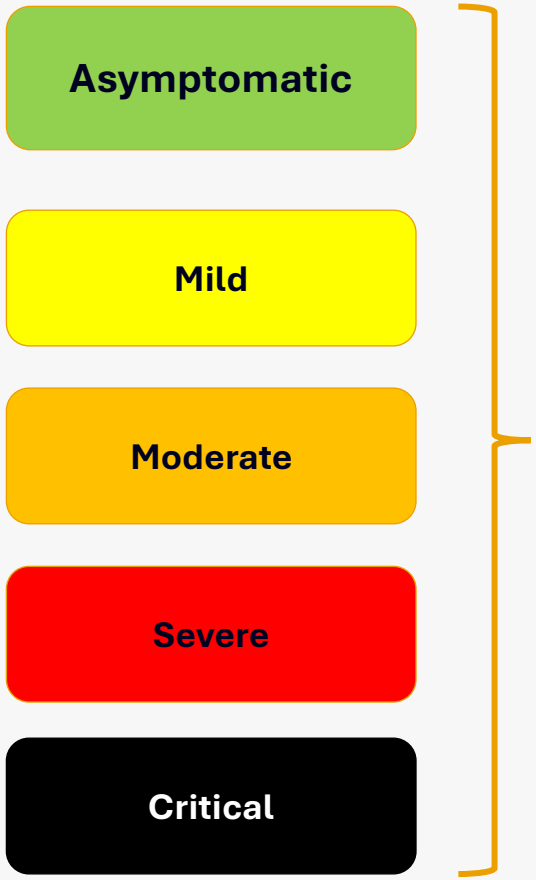
Age

- People of all ages are at risk for post-COVID-19 conditions
- Highest percentages of diagnoses between ages 36 and 50 years
- Risk appears higher in older age groups with similar acute disease severity
- Age is intertwined with risk of acute COVID-19 which also influences risk of post-COVID-19 conditions

Acute COVID-19

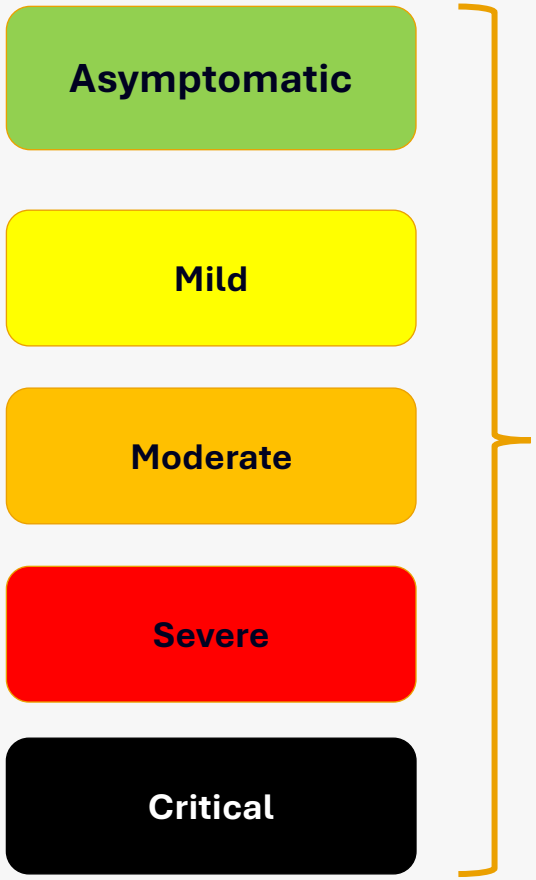
- Asymptomatic
- Mild
- Moderate
- Severe
- Critical

Acute COVID-19



- People with all acute disease severities are at risk for post-COVID-19 conditions including those who had asymptomatic or mild infection.

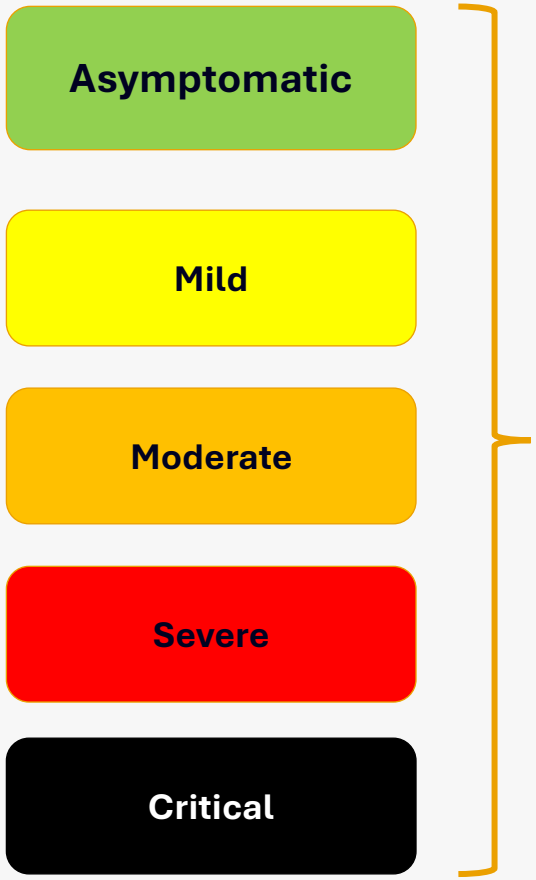
Acute COVID-19



- People with all acute disease severities are at risk for post-COVID-19 conditions including those who had asymptomatic or mild infection.

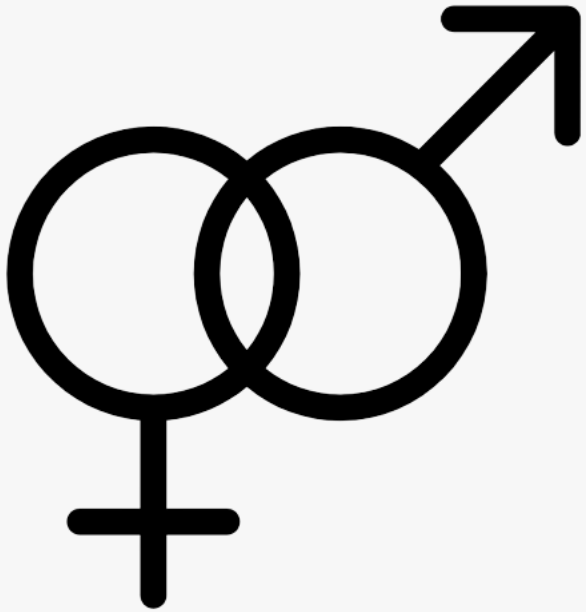
- Most cases are in individuals with mild infection given the proportion of people with non-severe acute infection.

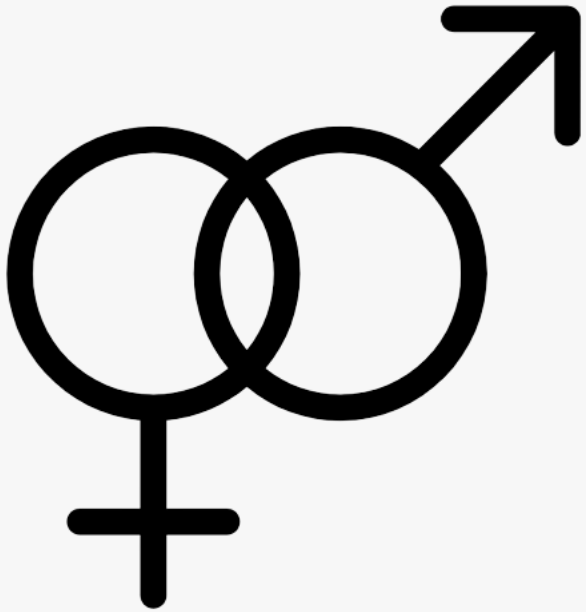
Acute COVID-19



- People with all acute disease severities are at risk for post-COVID-19 conditions including those who had asymptomatic or mild infection.
- Most cases are in individuals with mild infection given the proportion of people with non-severe acute infection.
- However, people with more severe acute COVID-19 are more at risk for post-COVID-19 conditions.


Alpha
September 2020
Delta
October 2020
Gamma
November 2020
Beta
May 2020
Omicron
November 2021





Prevalence of described cases appears to be higher in women

There are likely racial and ethnic disparities.

Morbidity and Mortality Weekly Report

Trends in Racial and Ethnic Disparities in COVID-19 Hospitalizations, by Region — United States, March–December 2020

Sebastian D. Romano, MPH[1]; Anna J. Blackstock, PhD[1]; Ethel V. Taylor, DVM[1]; Suad El Burai Felix, MPH[1]; Stacey Adjei, MPH[1]; Christa-Marie Singleton, MD[1]; Jennifer Fuld, PhD[1]; Beau B. Bruce, MD, PhD[1]; Tegan K. Boehmer, PhD[1]

Annals of Internal Medicine

REVIEW

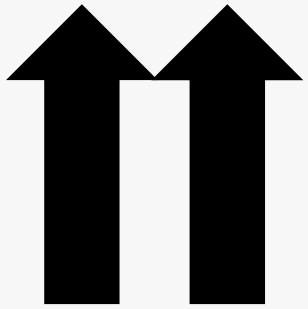
Racial and Ethnic Disparities in COVID-19–Related Infections, Hospitalizations, and Deaths

A Systematic Review

Katherine Mackey, MD, MPP; Chelsea K. Ayers, MPH; Karli K. Kondo, PhD; Somnath Saha, MD, MPH; Shailesh M. Advani, MD, MPH; Sarah Young, MPH; Hunter Spencer, DO; Max Rusek, MD; Johanna Anderson, MPH; Stephanie Veazie, MPH; Mia Smith, MPH; and Devan Kansagara, MD, MCR

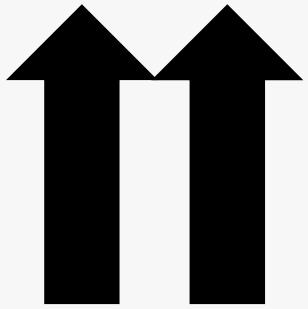
When compared to White populations, Black and Hispanic populations have:

When compared to White populations, Black and Hispanic populations have:

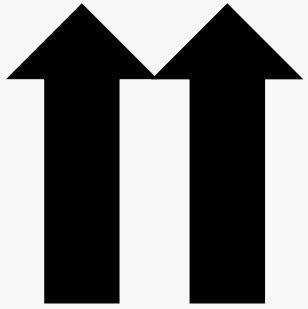


Rates of SARS-CoV-2 infections

When compared to White populations, Black and Hispanic populations have:



Rates of SARS-CoV-2 infections



Risk of hospitalization due to COVID-19

Racial/Ethnic Disparities in Post-acute Sequelae of SARS-CoV-2 Infection in New York: an EHR-Based Cohort Study from the RECOVER Program

Dhruv Khullar, MD, MPP[1,2], Yongkang Zhang, PhD[1], Chengxi Zang, PhD[1], Zhenxing Xu, PhD[1], Fei Wang, PhD[1], Mark G. Weiner, MD[1], Thomas W. Carton, PhD[3], Russell L. Rothman, MD, MPP[4], Jason P. Block, MD, MPH[5], and Rainu Kaushal, MD, MPH[1]

[1]Department of Population Health Sciences, Weill Cornell Medicine, New York, NY, USA; [2]Department of Medicine, Weill Cornell Medicine, New York, NY, USA; [3]Louisiana Public Health Institute, New Orleans, LA, USA; [4]Institute for Medicine and Public Health, Vanderbilt University Medical Center, Nashville, TN, USA; [5]Department of Population Medicine, Harvard Pilgrim Health Care Institute, Harvard Medical School, Boston, MA, USA.

Racial/Ethnic Disparities in Post-acute Sequelae of SARS-CoV-2 Infection in New York: an EHR-Based Cohort Study from the RECOVER Program

Dhruv Khullar, MD, MPP[1,2], Yongkang Zhang, PhD[1], Chengxi Zang, PhD[1], Zhenxing Xu, PhD[1], Fei Wang, PhD[1], Mark G. Weiner, MD[1], Thomas W. Carton, PhD[3], Russell L. Rothman, MD, MPP[4], Jason P. Block, MD, MPH[5], and Rainu Kaushal, MD, MPH[1]

[1]Department of Population Health Sciences, Weill Cornell Medicine, New York, NY, USA; [2]Department of Medicine, Weill Cornell Medicine, New York, NY, USA; [3]Louisiana Public Health Institute, New Orleans, LA, USA; [4]Institute for Medicine and Public Health, Vanderbilt University Medical Center, Nashville, TN, USA; [5]Department of Population Medicine, Harvard Pilgrim Health Care Institute, Harvard Medical School, Boston, MA, USA.

Black and Hispanic populations had different odds of developing specific post-COVID-19 symptoms compared to white individuals.

ORIGINAL ARTICLE—CME

PM&R

Race, ethnicity, and utilization of outpatient rehabilitation for treatment of post COVID-19 condition

Claudia B. Hentschel MD[1] | Benjamin A. Abramoff MD[2] | Timothy R. Dillingham MD[2] | Liliana E. Pezzin PhD JD[3]

Black population had a lower utilization of outpatient rehabilitation services despite similar incidence of post COVID-19 conditions.

And what about COVID-19 vaccinations?

[redacted]

Risk factors and disease profile of post-vaccination SARS-CoV-2 infection in UK users of the COVID Symptom Study app: a prospective, community-based, nested, case-control study

Michela Antonelli, Rose S Penfold, Jordi Merino, Carole H Sudre, Erika Molteni, Sarah Berry, Liane S Canas, Mark S Graham, Kerstin Klaser, Marc Modat, Benjamin Murray, Eric Kerfoot, Liyuan Chen, Jie Deng, Marc F Österdahl, Nathan J Cheetham, David A Drew, Long H Nguyen, Joan Capdevila Pujol, Christina Hu, Somesh Selvachandran, Lorenzo Polidori, Anna May, Jonathan Wolf, Andrew T Chan, Alexander Hammers, Emma L Duncan, Tim D Spector, Sebastien Ourselin*, Claire J Steves*

nature medicine

ARTICLES

https://doi.org/10.1038/s41591-022-01840-0

Check for updates

OPEN

Long COVID after breakthrough SARS-CoV-2 infection

Ziyad Al-Aly[1,2,3,4,5] ✉, Benjamin Bowe[1,2] and Yan Xie[1,2,6]

JAMA | Original Investigation

Development of a Definition of Postacute Sequelae of SARS-CoV-2 Infection

Tanayott Thaweethai, PhD; Sarah E. Jolley, MD, MS; Elizabeth W. Karlson, MD, MS; Emily B. Levitan, ScD; Bruce Levy, MD; Grace A. McComsey, MD; Lisa McCorkell, MPP; Girish N. Nadkarni, MD, MPH; Sairam Parthasarathy, MD; Upinder Singh, MD; Tiffany A. Walker, MD; Caitlin A. Selvaggi, MS; Daniel J. Shinnick, MS; Carolin C. M. Schulte, PhD; Rachel Atchley-Challenner, PhD; RECOVER Consortium Authors; Leora I. Horwitz, MD; Andrea S. Foulkes, ScD; for the RECOVER Consortium

Clinical Infectious Diseases

MAJOR ARTICLE

IDSA Infectious Diseases Society of America | hivma hiv medicine association | OXFORD

Prevalence of Post-Coronavirus Disease Condition 12 Weeks After Omicron Infection Compared With Negative Controls and Association With Vaccination Status

Mayssam Nehme,[1] Pauline Vetter,[2,3,4] François Chappuis,[5,6] Laurent Kaiser,[2,3,4] and Idris Guessous;[1,6] for the CoviCare Study Team[a]

[1]Division of Primary Care Medicine of the Geneva University Hospitals, Geneva, Switzerland; [2]Division of Infectious Diseases, Geneva University Hospitals, Geneva, Switzerland; [3]Geneva Center for Emerging Viral Diseases, Geneva University Hospitals, Geneva, Switzerland; [4]Division of Laboratory Medicine, Laboratory of Virology, Geneva University Hospitals, Geneva, Switzerland; [5]Division of Tropical and Humanitarian Medicine, Geneva University Hospitals, Geneva, Switzerland; and [6]Faculty of Medicine, University of Geneva, Geneva, Switzerland

Association Between BNT162b2 Vaccination and Long COVID After Infections Not Requiring Hospitalization in Health Care Workers

Survivors of COVID-19 may present with long-lasting symptoms.[1] Some factors have been associated with the development of post-COVID conditions (also referred to as "long COVID"),[2] including hospitalization.[3] A study of older US veterans showed 15% reduction of long COVID after vaccination; however, study limitations included the low number of women and suboptimal vaccination schedules.[4]

Supplemental content

A Summary of the Findings:

1. COVID-19 vaccination is associated with a reduction in risk of post-COVID-19 conditions in a dose response fashion.

2. Proportion of individuals with post-COVID-19 conditions was lower among fully vaccinated than unvaccinated participants before and during Omicron circulation

3. To protect against post-COVID-19 conditions, a layered approach combining COVID-19 vaccination and non-pharmaceutical interventions to prevent SARS-CoV-2 infection in the first place is needed.

Staying up-to-date with COVID-19 vaccinations is recommended.

Post-COVID-19 Conditions After Reinfection?

nature medicine

Article

https://doi.org/10.1038/s41591-022-02051-3

Acute and postacute sequelae associated with SARS-CoV-2 reinfection

Received: 12 June 2022

Accepted: 23 September 2022

Benjamin Bowe[1,2], Yan Xie[1,2] & Ziyad Al-Aly[1,2,3,4,5]

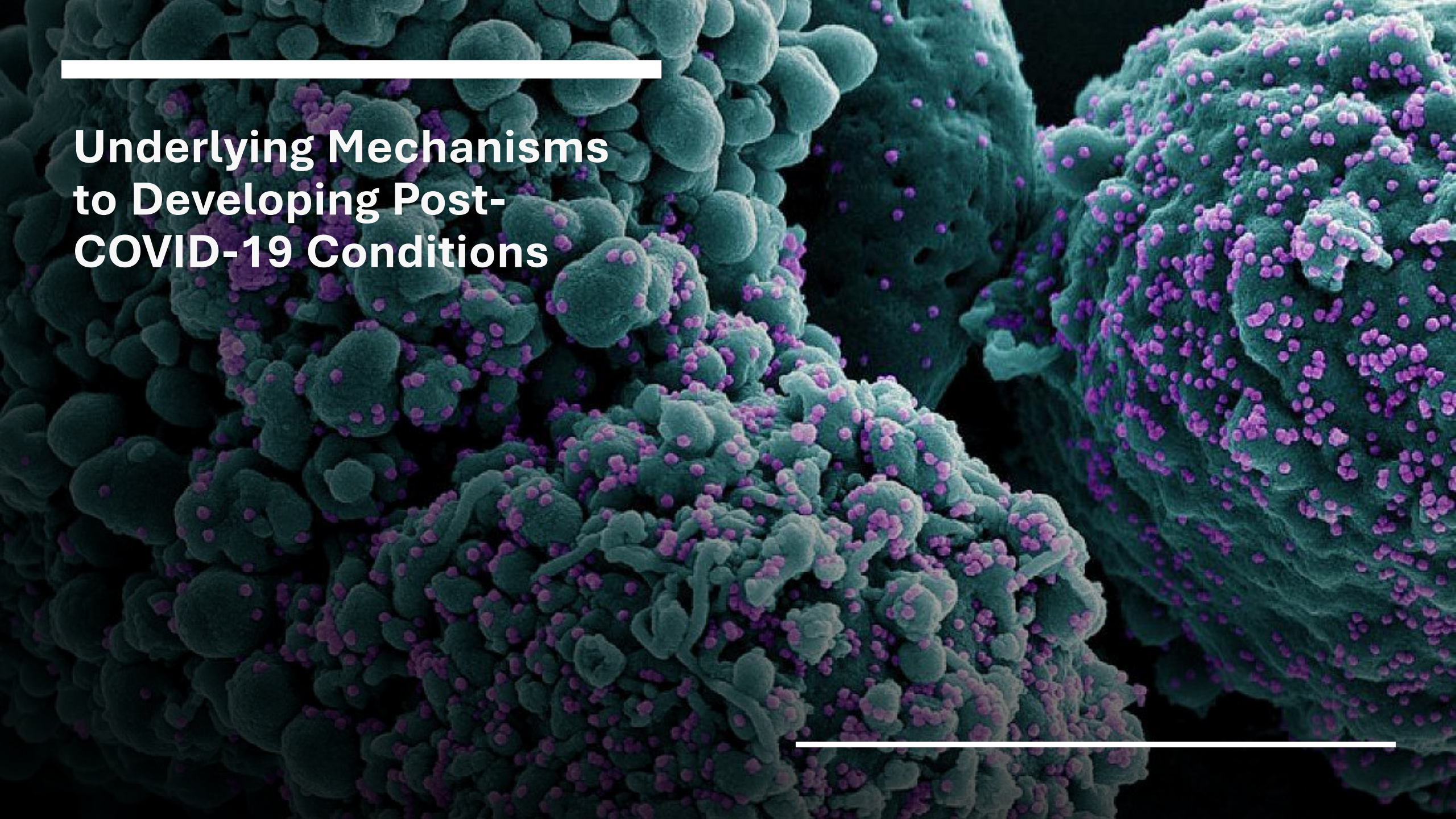
JAMA | Original Investigation

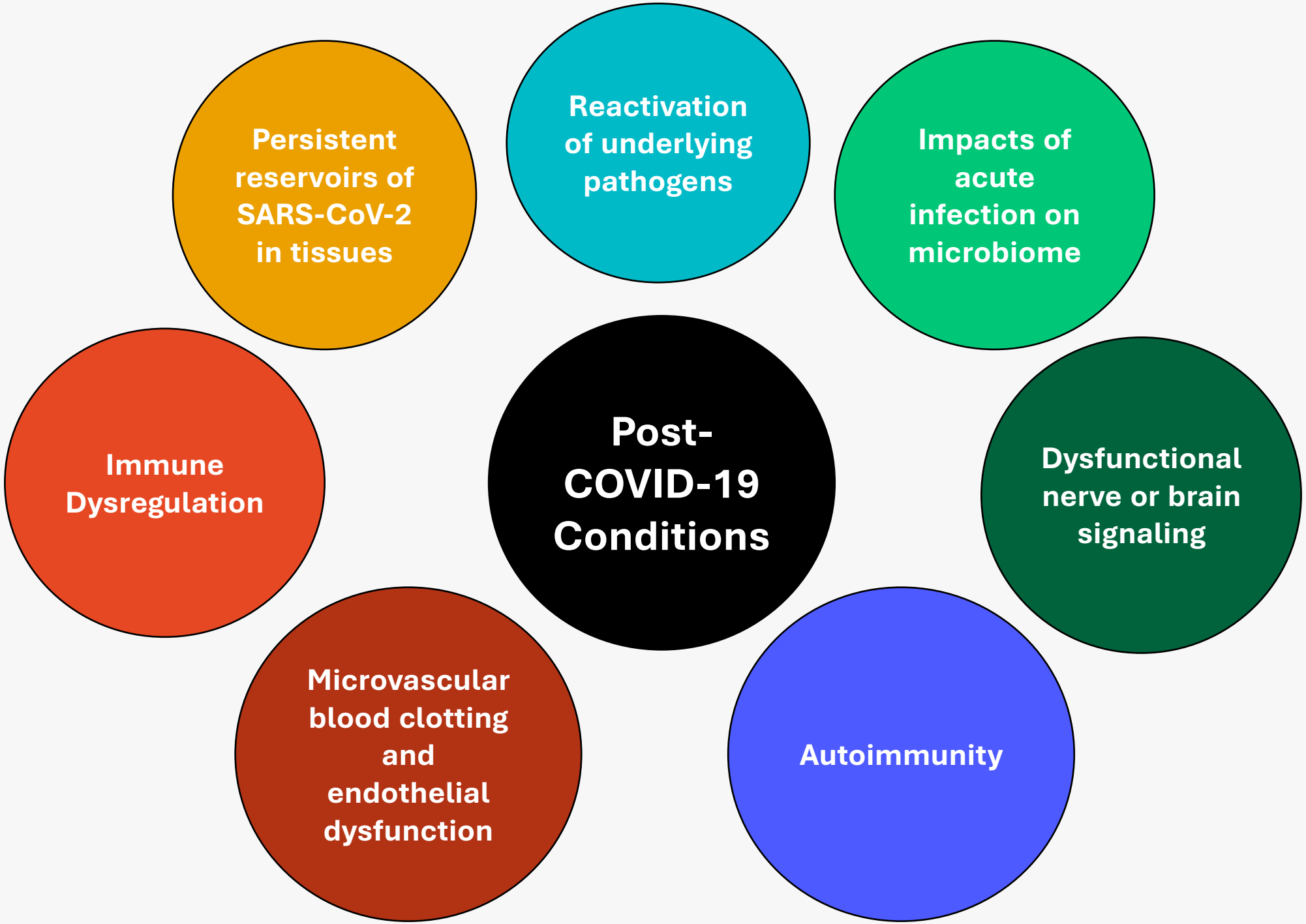
Development of a Definition of Postacute Sequelae of SARS-CoV-2 Infection

Tanayott Thaweethai, PhD; Sarah E. Jolley, MD, MS; Elizabeth W. Karlson, MD, MS; Emily B. Levitan, ScD; Bruce Levy, MD; Grace A. McComsey, MD; Lisa McCorkell, MPP; Girish N. Nadkarni, MD, MPH; Sairam Parthasarathy, MD; Upinder Singh, MD; Tiffany A. Walker, MD; Caitlin A. Selvaggi, MS; Daniel J. Shinnick, MS; Carolin C. M. Schulte, PhD; Rachel Atchley-Challenner, PhD; RECOVER Consortium Authors; Leora I. Horwitz, MD; Andrea S. Foulkes, ScD; for the RECOVER Consortium

- **SARS-CoV-2 reinfection associated with higher risk of sequelae**
- **Cumulative risk of post-COVID-19 conditions increases with the total number of infections**

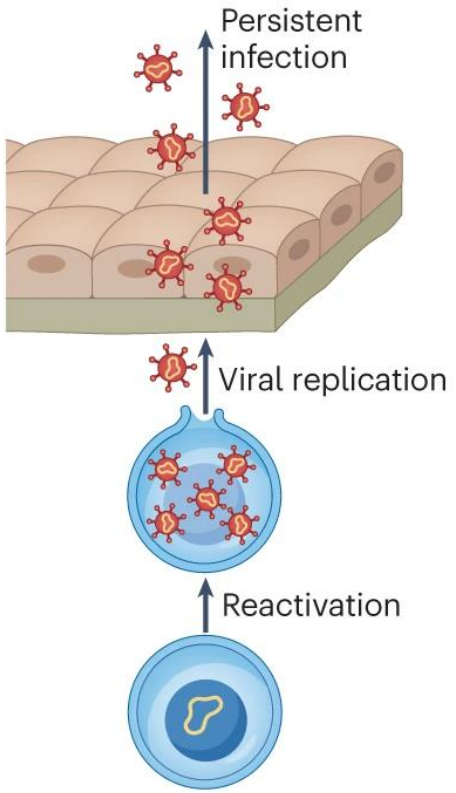
Underlying Mechanisms to Developing Post-COVID-19 Conditions




Persistent reservoirs of SARS-CoV-2 in tissues
Reactivation of underlying pathogens
Impacts of acute infection on microbiome
Immune Dysregulation
Post-COVID-19 Conditions
Dysfunctional nerve or brain signaling
Microvascular blood clotting and endothelial dysfunction
Autoimmunity

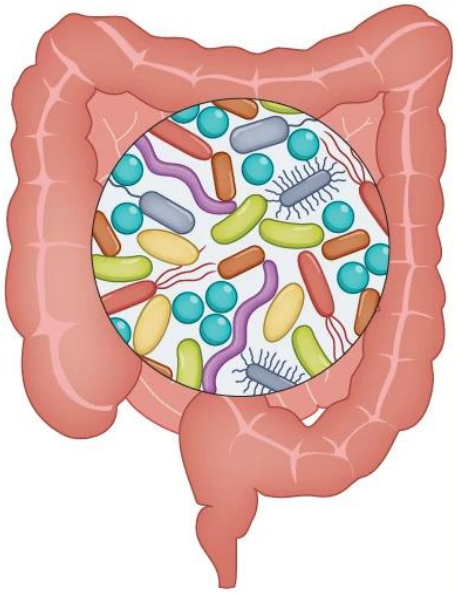
[redacted]

Immune dysregulation



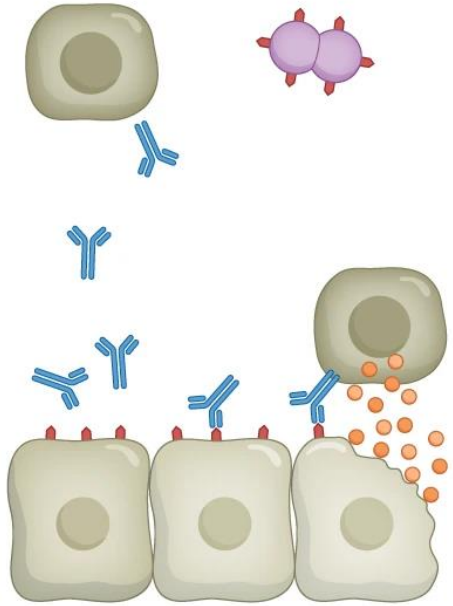
Immune dysregulation, with or without reactivation of underlying pathogens, including herpesviruses such as EBV and HHV-6

Microbiota dysbiosis



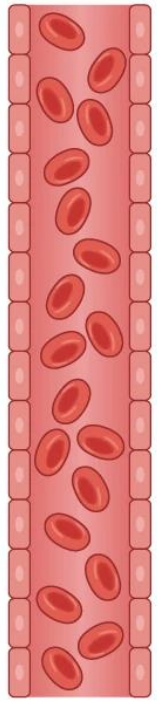
Impacts of SARS-CoV-2 on the microbiota and virome (including SARS-CoV-2 persistence)

Autoimmunity and immune priming



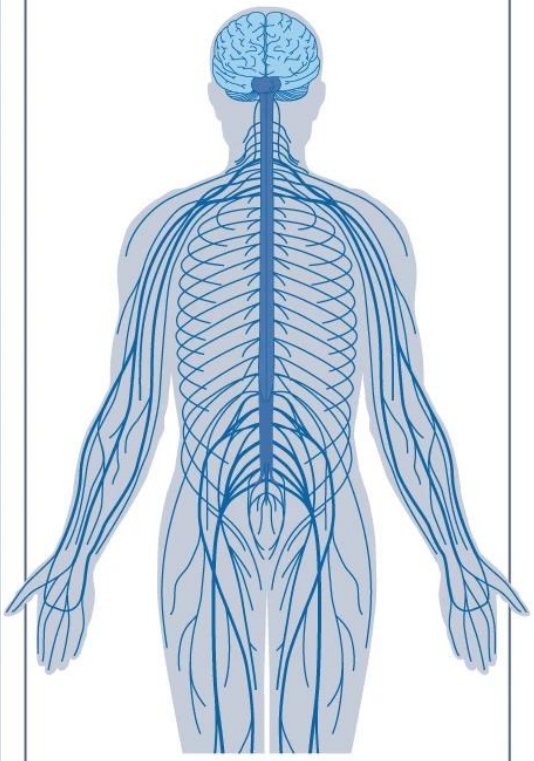
Autoimmunity and primed immune cells from molecular mimicry

Blood clotting and endothelial abnormalities



Microvascular blood clotting with endothelial dysfunction

Dysfunctional neurological signalling



Dysfunctional signalling in the brainstem and/or vagus nerve

https://www.nature.com/articles/s41579-022-00846-2/figures/3

The New York Times

New Research Hints at 4 Factors That May Increase Chances of Long Covid

If further study confirms the findings, they could lead to ways to prevent and treat the complex condition.

Cell

CellPress
OPEN ACCESS

Article

Multiple early factors anticipate post-acute COVID-19 sequelae

Yapeng Su,[1,2,3,28,*] Dan Yuan,[1,4,28] Daniel G. Chen,[1,5,28] Rachel H. Ng,[1,4] Kai Wang,[1] Jongchan Choi,[1] Sarah Li,[1] Sunga Hong,[1] Rongyu Zhang,[1,4] Jingyi Xie,[1,6] Sergey A. Kornilov,[1] Kelsey Scherler,[1] Ana Jimena Pavlovitch-Bedzyk,[7] Shen Dong,[8] Christopher Lausted,[1] Inyoul Lee,[1] Shannon Fallen,[1] Chengzhen L. Dai,[1] Priyanka Baloni,[1] Brett Smith,[1] Venkata R. Duvvuri,[1] Kristin G. Anderson,[3,9] Jing Li,[7] Fan Yang,[10] Caroline J. Duncombe,[11] Denise J. McCulloch,[12] Clifford Rostomily,[1] Pamela Troisch,[1] Jing Zhou,[13] Sean Mackay,[13] Quinn DeGottardi,[14] Damon H. May,[14] Ruth Taniguchi,[14] Rachel M. Gittelman,[14] Mark Klinger,[14] Thomas M. Snyder,[14] Ryan Roper,[1] Gladys Wojciechowska,[1,15]

Cases

Mild

Moderate

Severe

Cases

Mild

Moderate

Severe

Healthy Controls

Acute Infection

2-3 months after symptom onset

Cases

Mild

Moderate

Severe

Healthy Controls

Acute Infection

Plasma multi-omics

SARS-CoV-2 RNAemia & other virus viremia

Single cell multi-omics

Symptom surveys & EHR

Autoantibodies & SARS-CoV-2 antibodies

2-3 months after symptom onset

Cases

Mild

Moderate

Severe

Healthy Controls

Acute Infection

Plasma multi-omics

SARS-CoV-2 RNAemia & other virus viremia

Single cell multi-omics

Symptom surveys & EHR

Autoantibodies & SARS-CoV-2 antibodies

2-3 months after symptom onset

Cases

Mild

Moderate

Severe

Several possible PASC symptoms

Healthy Controls

Acute Infection

Plasma multi-omics

SARS-CoV-2 RNAemia & other virus viremia

Single cell multi-omics

Symptom surveys & EHR

Autoantibodies & SARS-CoV-2 antibodies

2-3 months after symptom onset

Cases

Mild

Moderate

Severe

Several possible PASC symptoms

Healthy Controls

Acute Infection

Plasma multi-omics

SARS-CoV-2 RNAemia & other virus viremia

Single cell multi-omics

Symptom surveys & EHR

Autoantibodies & SARS-CoV-2 antibodies

2-3 months after symptom onset

Cases

Mild

Moderate

Severe

Several possible PASC symptoms

Healthy Controls

Pre-existing Type 2 Diabetes

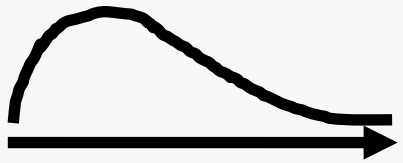
SARS-CoV-2 RNAemia at Acute Infection

EBV Viremia at Acute Infection

Auto-antibodies During Acute Infection

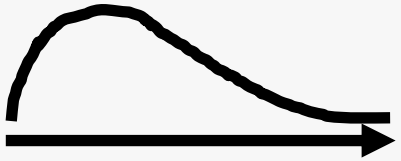
Additional Findings

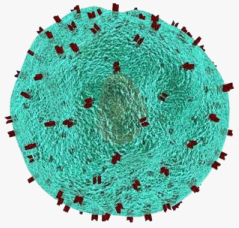
Additional Findings



- **Markers of post-COVID-19 conditions are mostly present at time of acute infection and many are no longer detectable at the time of diagnosis.**

Additional Findings

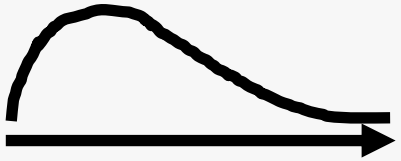




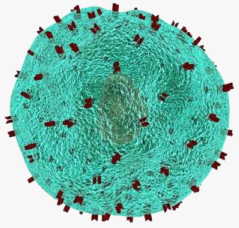
- **Markers of post-COVID-19 conditions are mostly present at time of acute infection and many are no longer detectable at the time of diagnosis.**

- **Specific T-cell subpopulations are associated with specific post-COVID-19 conditions (e.g. gastrointestinal symptoms).**

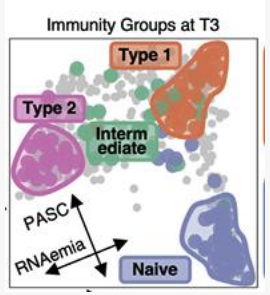
Additional Findings



- **Markers of post-COVID-19 conditions are mostly present at time of acute infection and many are no longer detectable at the time of diagnosis.**



- **Specific T-cell subpopulations are associated with specific post-COVID-19 conditions (e.g. gastrointestinal symptoms).**



- **Distinct immune endotypes or “signatures” at the time of post-COVID-19 condition were present with various expressions of immune cell sub-types.**

Article

SARS-CoV-2 is associated with changes in brain structure in UK Biobank

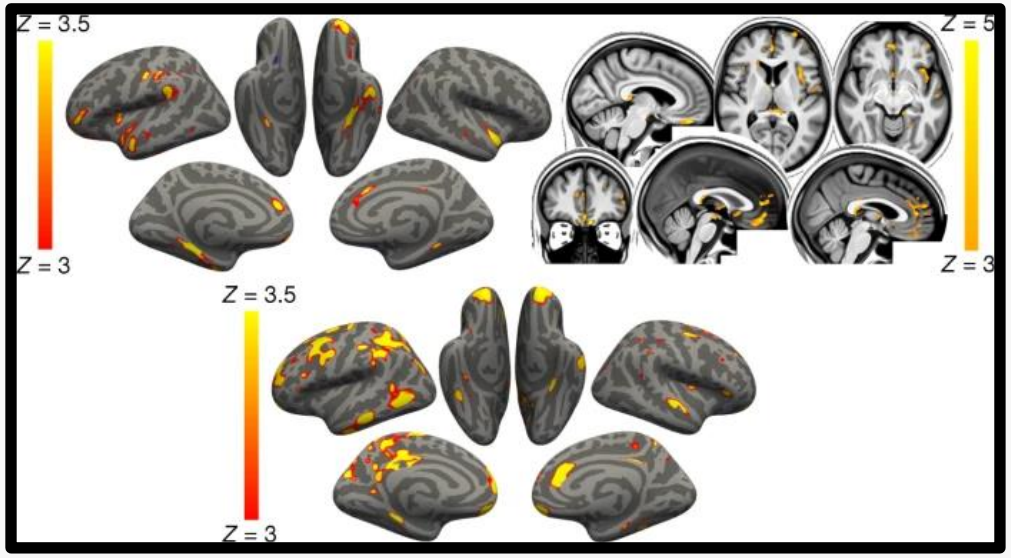
https://doi.org/10.1038/s41586-022-04569-5

Received: 19 August 2021

Accepted: 21 February 2022

Published online: 7 March 2022

Gwenaëlle Douaud[1]✉, Soojin Lee[1], Fidel Alfaro-Almagro[1], Christoph Arthofer[1], Chaoyue Wang[1], Paul McCarthy[1], Frederik Lange[1], Jesper L. R. Andersson[1], Ludovica Griffanti[1,2], Eugene Duff[1,3], Saad Jbabdi[1], Bernd Taschler[1], Peter Keating[4], Anderson M. Winkler[5], Rory Collins[6], Paul M. Matthews[7], Naomi Allen[6], Karla L. Miller[1], Thomas E. Nichols[8] & Stephen M. Smith[1]

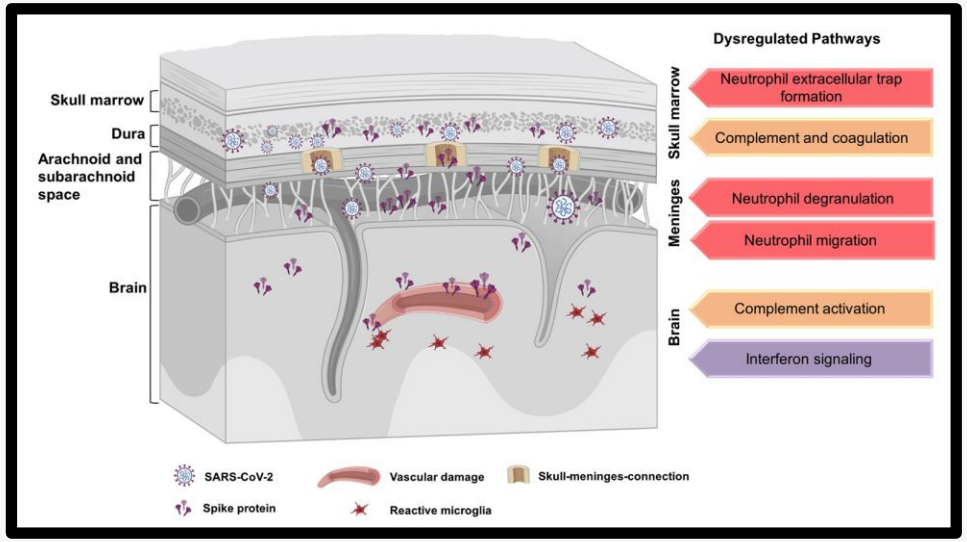


Compared to match controls, people who recovered from COVID-19 had:

- Loss of gray matter
- Markers of tissue damage in primary olfactory cortex
- Reduction in overall brain size
- Greater cognitive decline

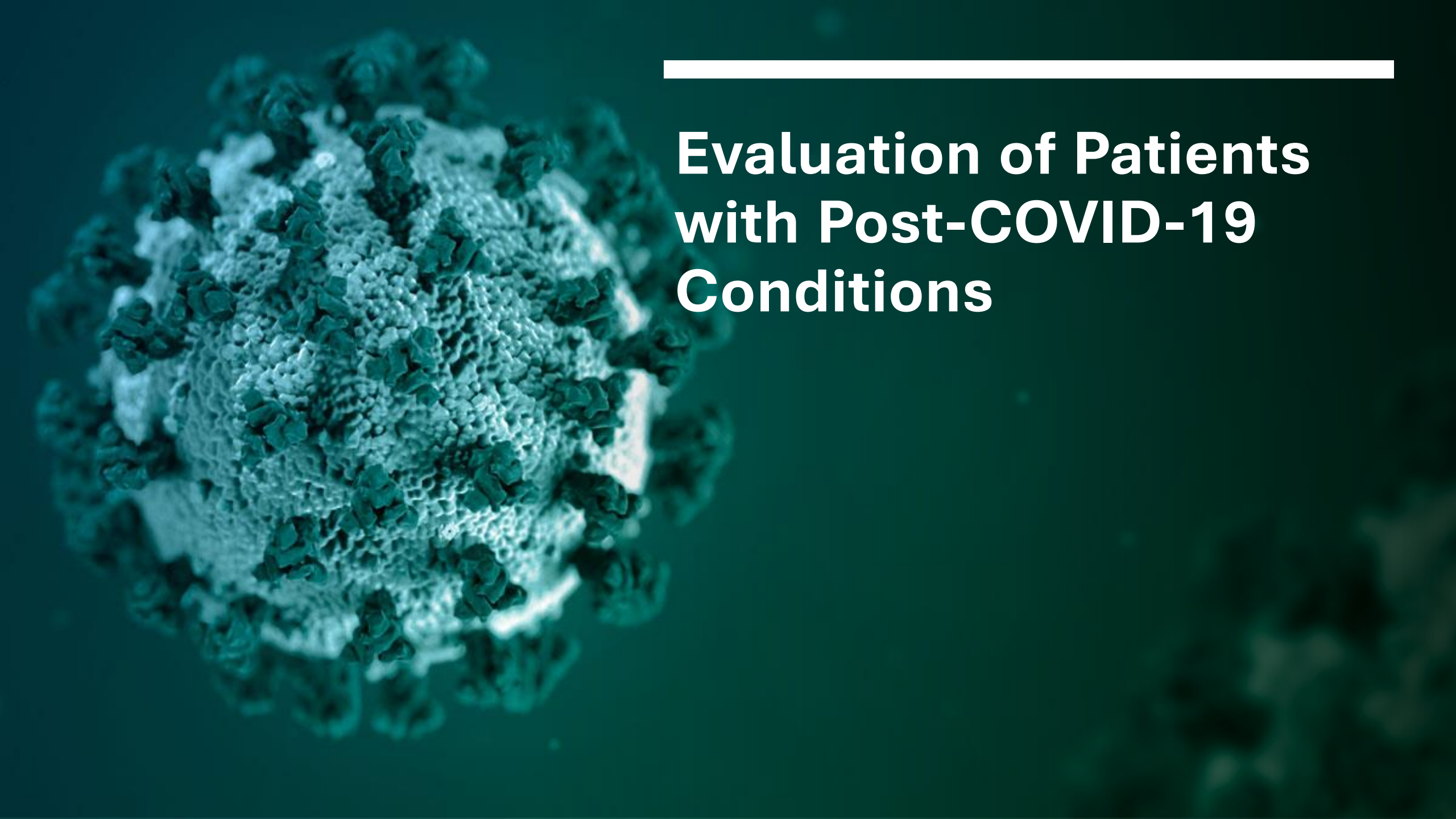
SARS-CoV-2 Spike Protein Accumulation in the Skull-Meninges-Brain Axis: Potential Implications for Long-Term Neurological Complications in post-COVID-19

Zhouyi Rong[1,2,15]†, Hongcheng Mai[1,2,15]†, Saketh Kapoor[1]†, Victor G. Puelles[3,4,13,14], Jan Czogalla[3,4], Julia Schädler[5], Jessica Vering[5], Claire Delbridge[6], Hanno Steinke[7], Hannah Frenzel[7], Katja Schmidt[7], Özüm Sehnaz Caliskan[9], Jochen Martin Wettengel[10], Fatma Cherif[11], Mayar Ali[1,16], Zeynep Ilgin Kolabas[1,2,16], Selin Ulukaya[1], Izabela Horvath[1,17], Shan Zhao[1], Natalie Krahmer[9], Sabina Tahirovic[11], Ali Önder Yildirim[12],Tobias B. Huber[3,4], Benjamin Ondruschka[3,5], Ingo Bechmann[7], Gregor Ebert[8], Ulrike Protzer[10], Harsharan Singh Bhatia[1,2], Farida Hellal[1,2], Ali Ertürk[1,2*]



Evaluation of patients who died from non-COVID-19 related causes but had COVID-19 previously:

- SARS-CoV-2 spike protein had accumulated along skull-meninges and brain tissue; spike protein found to be pro-inflammatory
- No other virus parts found
- These results **cannot** be extrapolated to vaccines

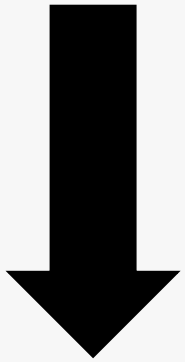


Evaluation of Patients with Post-COVID-19 Conditions

When evaluating a patient in clinic for a post-COVID-19 condition...

determining where to start can feel daunting.

There is currently no gold standard approach to evaluation.



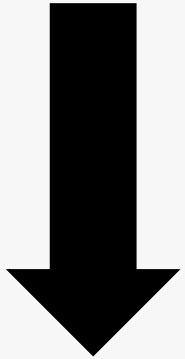
Validate

Targeted Evaluations

Evaluate for life threatening conditions

Rehabilitation

Validate



Targeted Evaluations

Evaluate for life threatening conditions

Rehabilitation

Validate

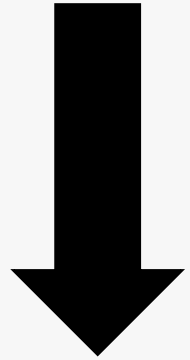
Targeted Evaluations

Evaluate for life threatening conditions

Rehabilitation

Validate

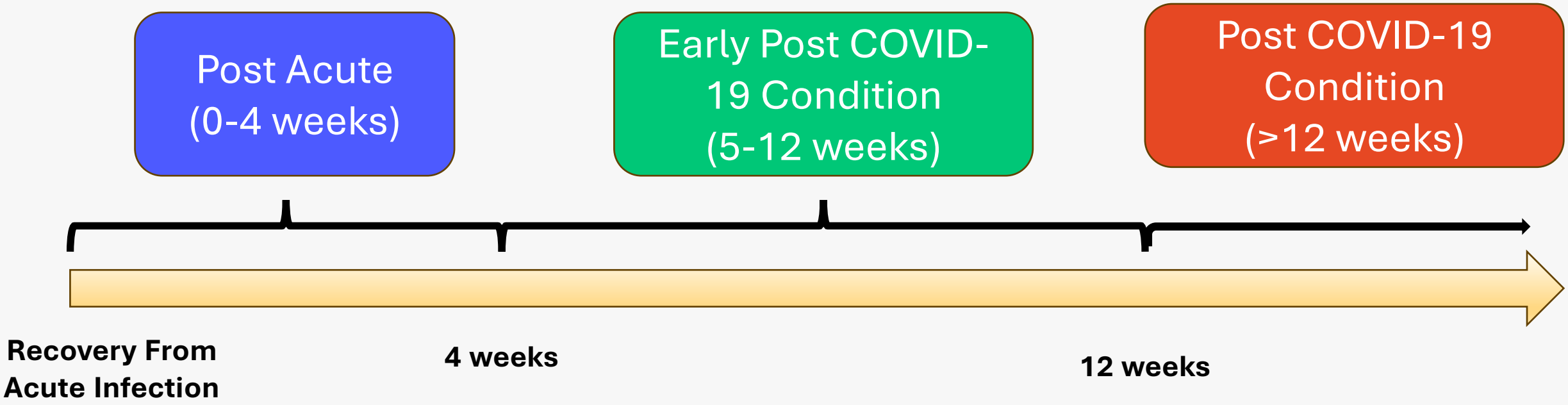
Targeted Evaluations



Evaluate for life threatening conditions

Rehabilitation

Thinking about acute infection recovery in phases.



60-day Outcomes Among Patients Hospitalized with COVID-19

- Early in the pandemic before vaccines and current subvariants
- 12.6% were discharged to skilled nursing or rehabilitation facility
- 6.7% died within 60 days (10.4% of those requiring ICU)
- 15.1% were re-hospitalized

https://www.aafp.org/news/health-of-the-public/20180219nchsdepression.html

Invite patients to tell their story.

Important history details:

1. Acute COVID-19 history
2. Symptom onset and duration
3. Impact on daily activities

Evaluate for life threatening conditions and common actionable diagnoses.

Understanding the implications of broad testing

- Increased risk of incidental findings
- Patient anxiety about abnormal results without clinical significance
- Risk/harm associated with invasive or radiologic procedures
- Cost and time to the patient for appointments and workup

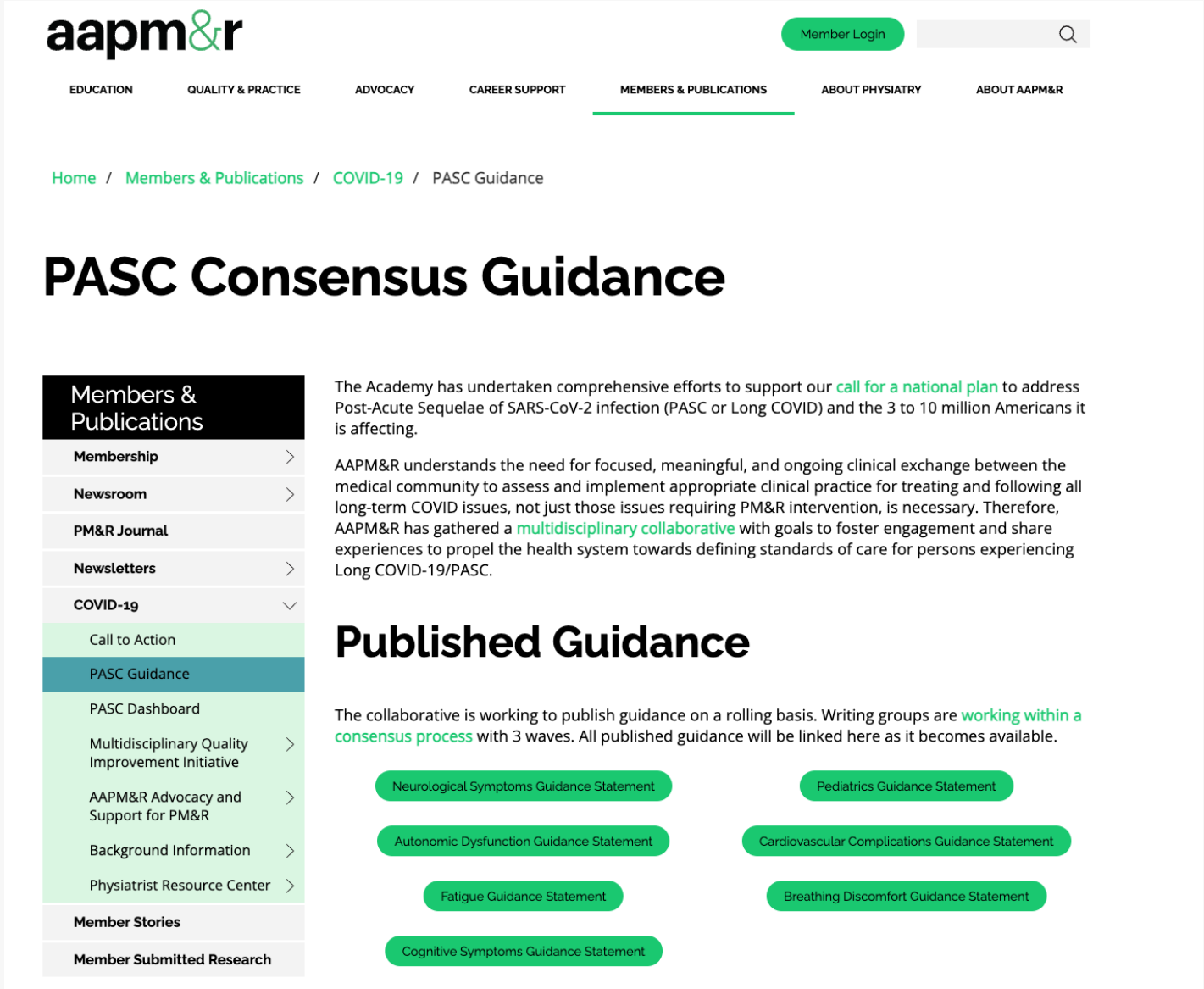
- There is no definitive single or collective tests to diagnose post-COVID-19 conditions

- SARS-CoV-2 testing may be warranted to rule out re-infection.

- May consider expanded testing for those with symptoms beyond 12 weeks

Decision to not do additional testing or the absence of abnormal findings should not lead to dismissal of patient's symptoms.

Symptom and Diagnosis Focused Management



- Neurological Symptoms
- Automatic Dysfunction
- Fatigue
- Cognitive Symptoms
- Cardiovascular Complications
- Breathing Discomfort
- Pediatrics

Evaluating and Supporting Patients with Long COVID in Returning to Work

Print

Evaluating and Supporting Patients with Long COVID in Returning to Work

Clinician Outreach and Communication Activity (COCA) Call

Thursday, June 15, 2023

- **Low and slow**
- **Gradual increases**
- **Titrated work hours**

- **Holistic support and validation of symptoms** is a key aspect of care; this can include referral to patient support services such as social work where needed

- **Holistic support and validation of symptoms** is a key aspect of care; this can include referral to patient support services such as social work where needed

- **Support groups** can help people connect who are affected by similar conditions

- **Holistic support and validation of symptoms** is a key aspect of care; this can include referral to patient support services such as social work where needed

- **Support groups** can help people connect who are affected by similar conditions

- **Management with pharmaceutical medications or supplements** can be beneficial if indicated for the specific illness.

- **Holistic support and validation of symptoms** is a key aspect of care; this can include referral to patient support services such as social work where needed

- **Support groups** can help people connect who are affected by similar conditions

- **Management with pharmaceutical medications or supplements** can be beneficial if indicated for the specific illness.

- **Structural racism and healthcare disparities can impact marginalized communities**
  - Individuals with disabilities
  - People experiencing homelessness or people in correctional facilities
  - Individuals with substance use disorders

- **Holistic support and validation of symptoms** is a key aspect of care; this can include referral to patient support services such as social work where needed

- **Support groups** can help people connect who are affected by similar conditions

- **Management with pharmaceutical medications or supplements** can be beneficial if indicated for the specific illness.

- **Structural racism and healthcare disparities can impact marginalized communities**
  - Individuals with disabilities
  - People experiencing homelessness or people in correctional facilities
  - Individuals with substance use disorders

- **Removing barriers** to accessing care including the availability of telehealth visits to those with internet access

Summary:

- **Post-COVID-19 conditions include symptoms, conditions or syndromes that are associated with a history of SARS-CoV-2 infection and impact ability to perform daily activities.**

- **Post-COVID-19 conditions affect individuals of all ages and may disproportionately impact certain groups due to disparities in SARS-CoV-2 infection.**

- **Longitudinal assessments of patients with SARS-CoV-2 infection suggest that pre-existing health conditions and immune related changes are associated with post-COVID-19 conditions.**

- **Evaluate patients with a possible post-COVID-19 condition beginning with a comprehensive history and physical.**

Summary:

- **Consider testing that would provide actionable results; absence of tests or abnormal results does not negate the symptoms experienced by the patient.**
- **Further testing should consider the duration of symptoms, medical urgency of evaluation, and risk/benefits of the workup.**
- **Staying up to date with recommended vaccinations and preventing reinfection are key approaches to reducing risk of post-COVID-19 conditions**
- **A multi-layered strategy integrated into our routine activities to prevent infections is the best way forward in reducing risk of long term sequelae**

Questions?

Eric J. Chow, MD, MS, MPH
Chief of Communicable Disease Epidemiology and Immunizations
Public Health – Seattle & King County
erchow@kingcounty.gov

Acknowledgements – Noun Project

- Virus by Nanda Bean
- Medication by Webtechops LLP
- Syringe by Bartama Graphic
- Doctor by Wilson Joseph
- Group of People by Oksana Letysheva
- Globe by Nick Novell
- Microscope by N. Style
- Timeline by Adrien Coquet
- Family by TukTuk Design
- Gender by Three Six Five
- Hospital by iconcheese
- Sneeze by Akhmad Taufiq
- Adult by Alexander Gruzdev
- Thermometer by Vectors Point
- Abdominal pain by Prosymbols
- Heart by Academic Technologies
- Pancreas by Suncheli Project
- Eye by Vectors Market
- Headache by b farias
- Rash by Delwar Hossain
- Exhaustion by Gan Khoon Lay
- Chest pain by Gan Khoon Lay
- Shortness of breath by Gan Khoon Lay
- Nose by Xinh Studio
- Cough by Asep Yopie Hardi Noer
- Depression by Narakorn Chanchittakarn
- Dizzy by Gan Khoon Lay
- Insomnia by Ayub Irawan
- Lungs by Karina
- Kidneys by Mello
- Colon by Turkkub
- Brain by Cedric Villain
- Joint by Vectors Market
- Red Blood Cells by Lucas Helle
- Doctor by Delwar Hossain
- Medical Chart by H Alberto Gongora
- Stethoscope by Minh Do
- Consider by Hyemm.work
- Laboratory Test by Shaharea
- Medication by Webtechops LLP
- Step by Step by Adrien Coquet

Additional Resources

- CDC timeline of COVID-19 events: https://www.cdc.gov/museum/timeline/covid19.html
- World Health Organization clinical case definition of post COVID-19 condition by Delphi Consensus: https://www.who.int/publications/i/item/WHO-2019-nCoV-Post_COVID-19_condition-Clinical_case_definition-2021.1
- National Institute for Health and Care Excellence (NICE) Long COVID-19 Guidelines: https://www.nice.org.uk/guidance/ng188/resources/covid19-rapid-guideline-managing-the-longterm-effects-of-covid19-pdf-51035515742
- European Centre for Disease Prevention and Control systematic review of post COVID-19 condition prevalence: https://www.ecdc.europa.eu/sites/default/files/documents/Prevalence-post-COVID-19-condition-symptoms.pdf
- Department of Health and Human Services: Services and Supports for Longer-Term Impacts of COVID-19: https://www.covid.gov/assets/files/Services-and-Supports-for-Longer-Term-Impacts-of-COVID-19-08012022.pdf
- Department of Health and Human Services: National Research Action Plan on Long COVID: https://www.covid.gov/assets/files/National-Research-Action-Plan-on-Long-COVID-08012022.pdf
- COVID.gov: What is Long COVID?: https://www.covid.gov/longcovid/definitions
- Infectious Disease Society of America: Post-COVID Conditions: https://www.idsociety.org/covid-19-real-time-learning-network/disease-manifestations--complications/post-covid-syndrome

Additional Resources

- CDC: Post-COVID Conditions: Information for Healthcare Providers: https://www.cdc.gov/coronavirus/2019-ncov/hcp/clinical-care/post-covid-conditions.html
- CDC: Post-COVID Conditions: CDC Science: https://www.cdc.gov/coronavirus/2019-ncov/hcp/clinical-care/post-covid-science.html
- CDC Datasets: Post-COVID Conditions: https://data.cdc.gov/NCHS/Post-COVID-Conditions/gsea-w83j
- Kaiser Family Foundation: Long COVID: What do the Latest Data Show? https://www.kff.org/policy-watch/long-covid-what-do-latest-data-show/#:~:text=As%20of%20January%2016%2C%202023%2C%2015%25%20of%20all%20adults,are%20no%20longer%20reporting%20symptoms.
- CDC COCA Call: Evaluating and Supporting Children and Adolescents Presenting with Post-COVID Conditions:https://emergency.cdc.gov/coca/calls/2023/callinfo_022323.asp
- CDC COCA Call: Evaluating and Supporting Patients Presenting with Cardiovascular Symptoms Following COVID: https://emergency.cdc.gov/coca/calls/2022/callinfo_092022.asp
- CDC COCA Call: What Clinicians Need to Know about Multisystem Inflammatory Syndrome in Children: https://emergency.cdc.gov/coca/calls/2022/callinfo_021022.asp
- CDC COCA Call: Updates on Multisystem Inflammatory Syndrome in Children (MIS-C): Epidemiology, Case Definition, and COVID-19 Vaccination: https://emergency.cdc.gov/coca/calls/2022/callinfo_120822.asp

Additional Resources

- CDC COCA Call: Evaluating and Supporting Patients Presenting with Cognitive Symptoms Following COVID: https://emergency.cdc.gov/coca/calls/2022/callinfo_050522.asp
- CDC COCA Call: Evaluating and Supporting Patients Presenting with Fatigue Following COVID-19: https://emergency.cdc.gov/coca/calls/2021/callinfo_093021.asp
- CDC COCA Call: Evaluating and Caring for Patients with Post-COVID Conditions: https://emergency.cdc.gov/coca/calls/2021/callinfo_061721.asp
- CDC COCA Call: Treating Long COVID: Clinician Experience with Post-Acute COVID-19 Care: https://emergency.cdc.gov/coca/calls/2021/callinfo_012821.asp
- CDC COCA Call: Evaluating and Supporting Patients with Long COVID in Returning to Work: https://emergency.cdc.gov/coca/calls/2023/callinfo_061523.asp

References

1. Davis HE, Assaf GS, McCorkell L, et al. Characterizing long COVID in an international cohort: 7 months of symptoms and their impact. *EClinicalMedicine*. Aug 2021;38:101019. doi:10.1016/j.eclinm.2021.101019
2. Bach K. Is 'long Covid' worsening the labor shortage? Accessed July 18, 2023. https://www.brookings.edu/articles/is-long-covid-worsening-the-labor-shortage/
3. Vanichkachorn G, Newcomb R, Cowl CT, et al. Post-COVID-19 Syndrome (Long Haul Syndrome): Description of a Multidisciplinary Clinic at Mayo Clinic and Characteristics of the Initial Patient Cohort. *Mayo Clin Proc*. Jul 2021;96(7):1782-1791. doi:10.1016/j.mayocp.2021.04.024
4. Department of Health and Human Services. National Research Action Plan on Long COVID. Accessed July 18, 2023. https://www.covid.gov/assets/files/National-Research-Action-Plan-on-Long-COVID-08012022.pdf
5. Callard F, Perego E. How and why patients made Long Covid. *Soc Sci Med*. Jan 2021;268:113426. doi:10.1016/j.socscimed.2020.113426
6. EnSpark Consulting. What We Heard: Engagement Report for National Academies of Sciences, Engineering, and Medicine Committee on Examining the Working Definition for Long COVID. Accessed July 18, 2023. https://www.nationalacademies.org/documents/embed/link/LF2255DA3DD1C41C0A42D3BEF0989ACAECE3053A6A9B/file/DD8E87E8161DD0ED2EA0625D300E9C2F72CC0AAE9038?noSaveAs=1
7. Soriano JB, Murthy S, Marshall JC, Relan P, Diaz JV, Condition WHOCCDWGoP-C-. A clinical case definition of post-COVID-19 condition by a Delphi consensus. *Lancet Infect Dis*. Apr 2022;22(4):e102-e107. doi:10.1016/S1473-3099(21)00703-9

References

8. Ballering AV, van Zon SKR, Olde Hartman TC, Rosmalen JGM, Lifelines Corona Research I. Persistence of somatic symptoms after COVID-19 in the Netherlands: an observational cohort study. *Lancet*. Aug 6 2022;400(10350):452-461. doi:10.1016/S0140-6736(22)01214-4

9. Bull-Otterson L, Baca S, Saydah S, et al. Post–COVID Conditions Among Adult COVID-19 Survivors Aged 18–64 and ≥65 Years — United States, March 2020–November 202. *MMWR Morbidity and Mortality Weekly Report*. 2022;71(21):713-717.

10. Pazukhina E, Andreeva M, Spiridonova E, et al. Prevalence and risk factors of post-COVID-19 condition in adults and children at 6 and 12 months after hospital discharge: a prospective, cohort study in Moscow (StopCOVID). *BMC Med*. Jul 6 2022;20(1):244. doi:10.1186/s12916-022-02448-4

11. European Centre for Disease Prevention and Control. Prevalence of post COVID-19 condition symptoms: a systematic review and meta-analysis of cohort study data, stratified by recruitment setting. Accessed February 26, 2023. https://www.ecdc.europa.eu/sites/default/files/documents/Prevalence-post-COVID-19-condition-symptoms.pdf

12. Chen C, Haupert SR, Zimmermann L, Shi X, Fritsche LG, Mukherjee B. Global Prevalence of Post-Coronavirus Disease 2019 (COVID-19) Condition or Long COVID: A Meta-Analysis and Systematic Review. *J Infect Dis*. Nov 1 2022;226(9):1593-1607. doi:10.1093/infdis/jiac136

13. Burns A. Kaiser Family Foundation. Long COVID: what do the latest data show? Accessed July 19, 2023. https://www.kff.org/policy-watch/long-covid-what-do-latest-data-show/

14. Thaweethai T, Jolley SE, Karlson EW, et al. Development of a Definition of Postacute Sequelae of SARS-CoV-2 Infection. *JAMA*. Jun 13 2023;329(22):1934-1946. doi:10.1001/jama.2023.8823

References

15. Davis HE, McCorkell L, Vogel JM, Topol EJ. Long COVID: major findings, mechanisms and recommendations. *Nat Rev Microbiol*. Mar 2023;21(3):133-146. doi:10.1038/s41579-022-00846-2

16. Boyton RJ, Altmann DM. The immunology of asymptomatic SARS-CoV-2 infection: what are the key questions? *Nat Rev Immunol*. Dec 2021;21(12):762-768. doi:10.1038/s41577-021-00631-x

17. Khullar D, Zhang Y, Zang C, et al. Racial/Ethnic Disparities in Post-acute Sequelae of SARS-CoV-2 Infection in New York: an EHR-Based Cohort Study from the RECOVER Program. *J Gen Intern Med*. Apr 2023;38(5):1127-1136. doi:10.1007/s11606-022-07997-1

18. Akinbami LJ, Kruszon-Moran D, Wang CY, et al. SARS-CoV-2 Serology and Self-Reported Infection Among Adults - National Health and Nutrition Examination Survey, United States, August 2021-May 2022. *MMWR Morb Mortal Wkly Rep*. Dec 2 2022;71(48):1522-1525. doi:10.15585/mmwr.mm7148a4

19. Bonifacio LP, Csizmar VNF, Barbosa-Junior F, et al. Long-Term Symptoms among COVID-19 Survivors in Prospective Cohort Study, Brazil. *Emerg Infect Dis*. Mar 2022;28(3):730-733. doi:10.3201/eid2803.212020

20. Hentschel CB, Abramoff BA, Dillingham TR, Pezzin LE. Race, ethnicity, and utilization of outpatient rehabilitation for treatment of post COVID-19 condition. *PM R*. Nov 2022;14(11):1315-1324. doi:10.1002/pmrj.12869

21. Antonelli M, Penfold RS, Merino J, et al. Risk factors and disease profile of post-vaccination SARS-CoV-2 infection in UK users of the COVID Symptom Study app: a prospective, community-based, nested, case-control study. *Lancet Infect Dis*. Jan 2022;22(1):43-55. doi:10.1016/S1473-3099(21)00460-6

References

22. Azzolini E, Levi R, Sarti R, et al. Association Between BNT162b2 Vaccination and Long COVID After Infections Not Requiring Hospitalization in Health Care Workers. *JAMA*. Aug 16 2022;328(7):676-678. doi:10.1001/jama.2022.11691

23. Al-Aly Z, Bowe B, Xie Y. Long COVID after breakthrough SARS-CoV-2 infection. *Nat Med*. Jul 2022;28(7):1461-1467. doi:10.1038/s41591-022-01840-0

24. Nehme M, Vetter P, Chappuis F, Kaiser L, Guessous I, CoviCare Study T. Prevalence of Post-Coronavirus Disease Condition 12 Weeks After Omicron Infection Compared With Negative Controls and Association With Vaccination Status. *Clin Infect Dis*. May 3 2023;76(9):1567-1575. doi:10.1093/cid/ciac947

25. Romano SD, Blackstock AJ, Taylor EV, et al. Trends in Racial and Ethnic Disparities in COVID-19 Hospitalizations, by Region - United States, March-December 2020. *MMWR Morb Mortal Wkly Rep*. Apr 16 2021;70(15):560-565. doi:10.15585/mmwr.mm7015e2

26. Mackey K, Ayers CK, Kondo KK, et al. Racial and Ethnic Disparities in COVID-19-Related Infections, Hospitalizations, and Deaths : A Systematic Review. *Ann Intern Med*. Mar 2021;174(3):362-373. doi:10.7326/M20-6306

27. Bowe B, Xie Y, Al-Aly Z. Acute and postacute sequelae associated with SARS-CoV-2 reinfection. Nature Medicine; 2022.

28. Kompaniyets L, Bull-Otterson L, Boehmer TK, et al. Post-COVID-19 Symptoms and Conditions Among Children and Adolescents - United States, March 1, 2020-January 31, 2022. *MMWR Morb Mortal Wkly Rep*. Aug 5 2022;71(31):993-999. doi:10.15585/mmwr.mm7131a3

References

29. Stephenson T, Pinto Pereira SM, Shafran R, et al. Physical and mental health 3 months after SARS-CoV-2 infection (long COVID) among adolescents in England (CLoCk): a national matched cohort study. *Lancet Child Adolesc Health*. Apr 2022;6(4):230-239. doi:10.1016/S2352-4642(22)00022-0

30. Stephenson T, Allin B, Nugawela MD, et al. Long COVID (post-COVID-19 condition) in children: a modified Delphi process. *Arch Dis Child*. Jul 2022;107(7):674-680. doi:10.1136/archdischild-2021-323624

31. Su Y, Yuan D, Chen DG, et al. Multiple early factors anticipate post-acute COVID-19 sequelae. *Cell*. Mar 3 2022;185(5):881-895 e20. doi:10.1016/j.cell.2022.01.014

32. Douaud G, Lee S, Alfaro-Almagro F, et al. SARS-CoV-2 is associated with changes in brain structure in UK Biobank. *Nature*. Apr 2022;604(7907):697-707. doi:10.1038/s41586-022-04569-5

33. Chopra V, Flanders SA, O'Malley M, Malani AN, Prescott HC. Sixty-Day Outcomes Among Patients Hospitalized With COVID-19. *Ann Intern Med*. Apr 2021;174(4):576-578. doi:10.7326/M20-5661

Extra Slides

[redacted]

Original research

OPEN ACCESS

Long COVID (post-COVID-19 condition) in children: a modified Delphi process

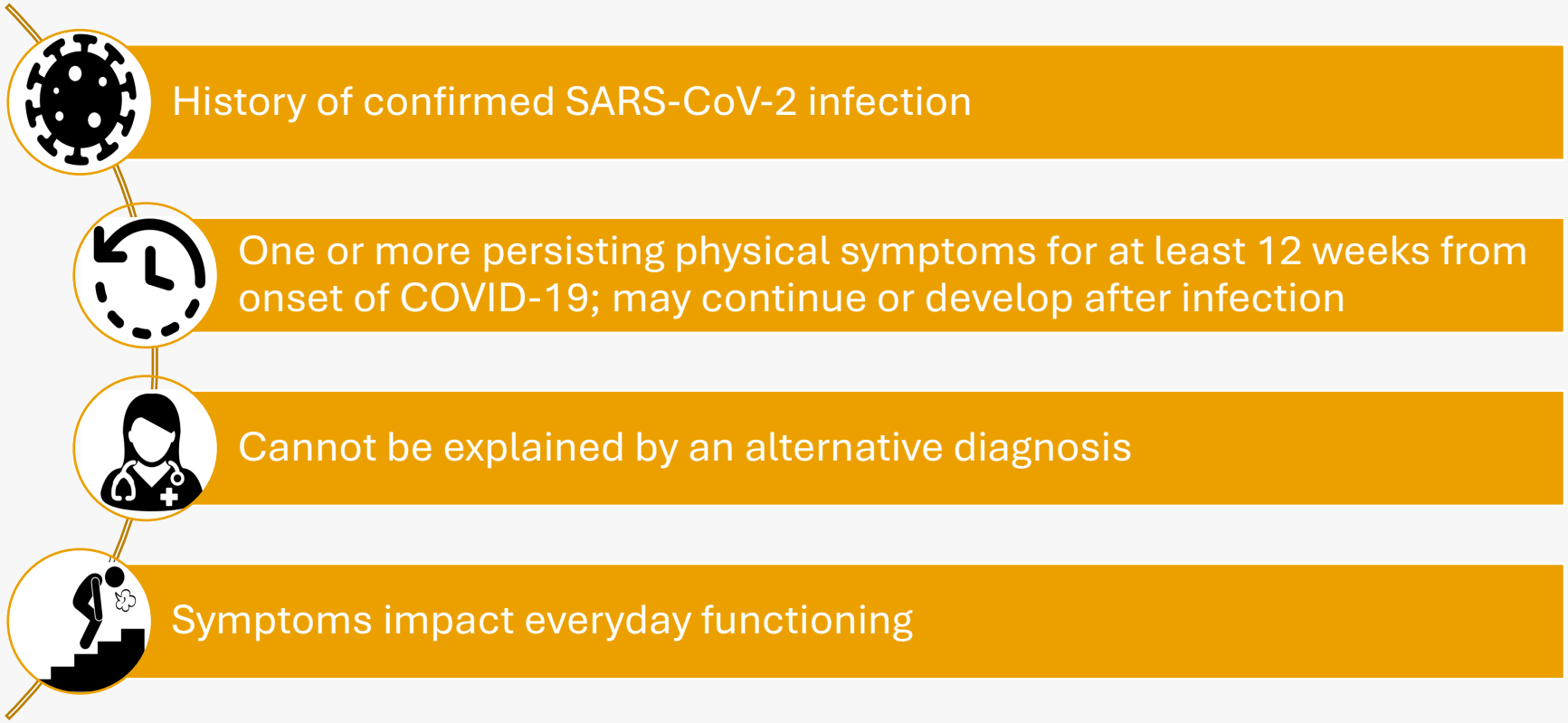
Terence Stephenson ,[1] Benjamin Allin,[2] Manjula D Nugawela,[1] Natalia Rojas,[1] Emma Dalrymple,[1] Snehal Pinto Pereira ,[3] Manas Soni,[4] Marian Knight ,[2] Emily Y Cheung,[1] Isobel Heyman ,[1] CLoCk Consortium, Roz Shafran[1]

Original research

OPEN ACCESS

Long COVID (post-COVID-19 condition) in children: a modified Delphi process

Terence Stephenson ,[1] Benjamin Allin,[2] Manjula D Nugawela,[1] Natalia Rojas,[1] Emma Dalrymple,[1] Snehal Pinto Pereira ,[3] Manas Soni,[4] Marian Knight ,[2] Emily Y Cheung,[1] Isobel Heyman ,[1] CLoCk Consortium, Roz Shafran[1]



NICE National Institute for Health and Care Excellence

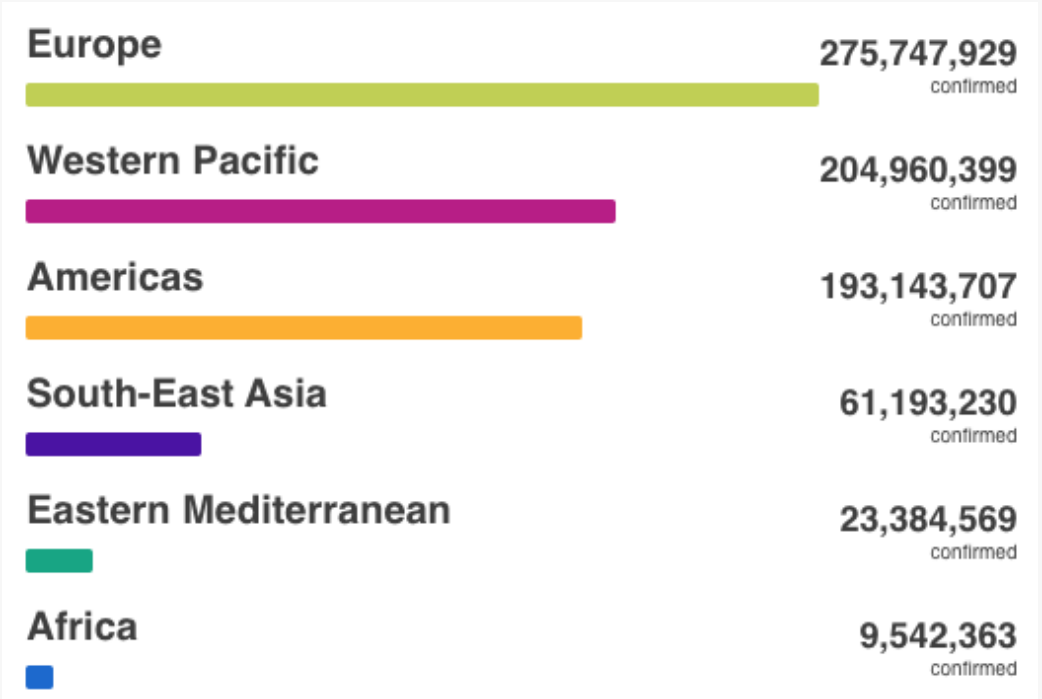
- **Post-COVID-19 Syndrome**
  - Signs and symptoms that develop during or after an infection consistent with COVID-19, continue for more than 12 weeks and are not explained by an alternative diagnosis
  - It usually presents with clusters of symptoms, often overlapping, which can fluctuate and change over time and can affect any system in the body
  - May be considered before 12 weeks while the possibility of an alternative underlying disease is also being assessed
- **“Long COVID” includes**
  - Ongoing symptomatic COVID-19 (from 4-12 weeks), AND
  - Post-COVID-19 syndrome (12 weeks or more)

https://www.nice.org.uk/guidance/ng188/resources/covid19-rapid-guideline-managing-the-longterm-effects-of-covid19-pdf-51035515742

World Health Organization

>767,000,000

confirmed cases of COVID-19
(as of July 2023)



https://covid19.who.int/

>335,000,000

US Population
(as of July 2023)

>103,000,000

confirmed cases of COVID-19
(as of February 2023)

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

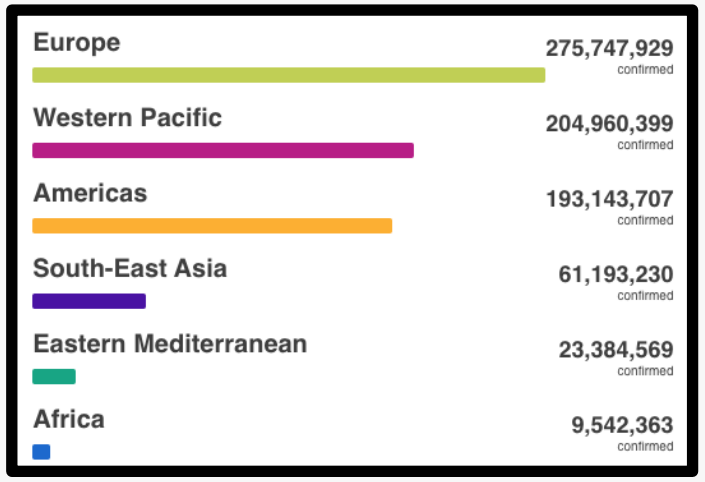
- Case counts are not an accurate assessment of community burden
- Changes in testing behavior and decreased access to testing
- Ending of WHO and US federal government PHE changed reporting requirements
- CDC seroprevalence study suggest that 78% of adults and older adolescents have had infection by December 2022

https://covid.cdc.gov/covid-data-tracker/#datatracker-home

https://covid.cdc.gov/covid-data-tracker/#nationwide-blood-donor-seroprevalence-2022

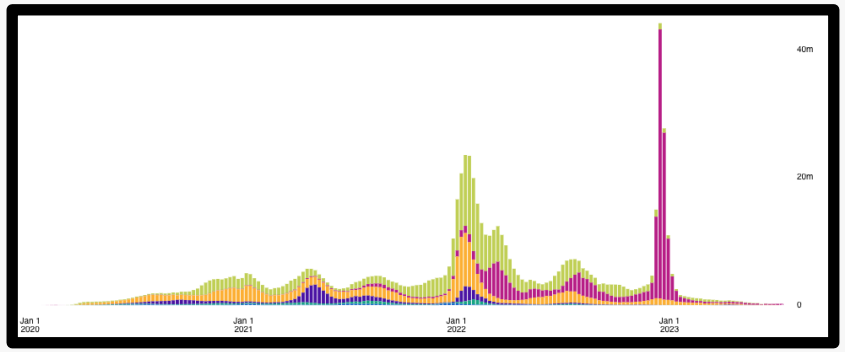
- Higher prevalence of post-COVID-19 conditions in Asia (51%) than in Europe (44%) or USA (31%)

Chen C, Haupert SR, Zimmermann L, Shi X, Fritsche LG, Mukherjee B. Global Prevalence of Post-Coronavirus Disease 2019 (COVID-19) Condition or Long COVID: A Meta-Analysis and Systematic Review. *J Infect Dis*. Nov 1 2022;226(9):1593-1607. doi:10.1093/infdis/jiac136



- Higher prevalence of post-COVID-19 conditions in Asia (51%) than in Europe (44%) or USA (31%)*

*This may be due, in part, to reporting and testing biases.



Chen C, Haupert SR, Zimmermann L, Shi X, Fritsche LG, Mukherjee B. Global Prevalence of Post-Coronavirus Disease 2019 (COVID-19) Condition or Long COVID: A Meta-Analysis and Systematic Review. *J Infect Dis*. Nov 1 2022;226(9):1593-1607. doi:10.1093/infdis/jiac136

- Higher prevalence of post-COVID-19 conditions in Asia (51%) than in Europe (44%) or USA (31%)
- Symptoms reported for post-COVID-19 conditions appears similar among studies done outside of the US

Chen C, Haupert SR, Zimmermann L, Shi X, Fritsche LG, Mukherjee B. Global Prevalence of Post-Coronavirus Disease 2019 (COVID-19) Condition or Long COVID: A Meta-Analysis and Systematic Review. *J Infect Dis*. Nov 1 2022;226(9):1593-1607. doi:10.1093/infdis/jiac136

Table 1a. Basic diagnostic laboratory testing to consider for patients with post-COVID conditions

Category	Laboratory Tests
Blood count, electrolytes, and renal function	Complete blood count with possible iron studies to follow, basic metabolic panel, urinalysis
Liver function	Liver function tests or complete metabolic panel
Inflammatory markers	C-reactive protein, erythrocyte sedimentation rate, ferritin
Thyroid function	TSH and free T4
Vitamin deficiencies	Vitamin D, vitamin B12

Table 1b. Specialized diagnostic laboratory testing to consider for patients with post-COVID conditions

Category	Laboratory Tests
Rheumatological conditions	Antinuclear antibody, rheumatoid factor, anti-cyclic citrullinated peptide, anti-cardiolipin, and creatine phosphokinase
Coagulation disorders	D-dimer, fibrinogen
Myocardial injury	Troponin
Differentiate symptoms of cardiac versus pulmonary origin	B-type natriuretic peptide

https://www.cdc.gov/coronavirus/2019-ncov/hcp/clinical-care/post-covid-conditions.html