



COVID-19

Post-COVID Conditions: CDC Science

How CDC is using science to learn more about Post-COVID Conditions (or Long COVID)

Updated Mar. 31, 2023

For the General Public: [Long COVID \(Post-COVID Conditions\)](#)

CDC is analyzing healthcare data, partnering with clinicians, and working with researchers to learn more about Post-COVID Conditions (Long COVID).

Post-COVID Conditions (PCC, or Long COVID) are a wide range of new, returning, or ongoing health problems people can experience four or more weeks after first being infected with the virus that causes COVID-19.

What CDC Is Doing to Learn about Post-COVID Conditions

CDC and partners are doing research on Post-COVID Conditions in a variety of populations and settings. These partnerships are essential for expanding the base of evidence needed for addressing Post-COVID Conditions. CDC and its partners are working to:

- **Characterize and assess Post-COVID Conditions** to estimate both the risk of experiencing Post-COVID Conditions and the numbers of people experiencing these conditions by demographic group.
 - **Identify risk factors** to better understand how to prevent Post-COVID Conditions.
 - **Identify groups disproportionately affected** by Post-COVID Conditions.
 - **Assess the burden (health and financial costs)** of Post-COVID Conditions.
- **Identify successful interventions** to prevent and lessen the effect of Post-COVID Conditions. This research includes
 - Assessing if COVID vaccinations reduce the occurrence of Post-COVID Conditions, and
 - Promoting equity in healthcare access and utilization for people with Post-COVID Conditions.
- **Disseminate clinical guidance and other education materials** for healthcare providers, patients, and the public to improve understanding of Post-COVID Conditions.

Science at CDC

Scientific articles and manuscripts about COVID-19 and Post-COVID Conditions

[MMWR COVID-19 Reports](#)

[CDC Scientific Publications on COVID-19](#)

CDC and partners are collecting and analyzing information about Post-COVID Conditions and health problems through several public health activities, including

- Prospective cohort studies that observe people over time,
- Sentinel surveillance to collect information from select public health sources on cases of Post-COVID Conditions,
- Medical chart abstraction to collect data on the health and medical care of patients with Post-COVID Conditions,
- Analyses of electronic healthcare data and large patient databases,
- State and national health surveys, and
- Evaluation of models of care.

Inclusion of data and analyses of Post-COVID Conditions by race/ethnicity, age, sex, and other factors are a CDC priority.

Related Research

Select examples of research on Post-COVID Conditions conducted by CDC and partners

Prospective Cohort Studies ^

[FindCOVID](#)

Follows cases in children and adults infected with the virus that causes COVID-19 and their household members to measure initial clinical presentation, viral shedding, transmission, immune response, and on-going symptoms from the time of infection up to 12 months.

Population: Children and adults

Partner: University of California, San Francisco (UCSF)

Immune Response to SARS-CoV-2 among patients in Louisiana

Follows cases in patients recovering from COVID-19 to assess longer term clinical and immunity related outcomes up to one year after the beginning of the illness. Follows a subgroup of cases in COVID-19 patients hospitalized for severe COVID-19 illness for one year following hospital admission.

Population: Adults, with a focus on persons at higher risk for severe COVID-19

Partner: Tulane University School of Medicine, Infectious Diseases

[Applied Research to Address the Coronavirus \(COVID-19\) Emerging Public Health Emergency](#)

Follows cases in participants who report on daily symptoms, testing, care seeking, and vaccination. Conducts monthly testing for antibodies to the virus that causes COVID-19 and analysis of electronic health records to assess ongoing clinical diagnoses, for a minimum of six months.

Population: Adults identified by the University of Maryland and Medstar Health in the mid-Atlantic area, Wake Forest University and Atrium Health System in the North Carolina area, Tulane University, and the University of Mississippi

Partner: [COVID-19 Community Research Partnership](#) , [Vysnova Partners](#) 

COVID-19 within American Indian Communities at High Risk in the Southwest U.S.

Follows people who are infected with the virus that causes COVID-19 for up to 12 months to assess the development and duration of symptoms, complications from infection, and immune response over time.

Population: Navajo and White Mountain Apache communities

Partner: Johns Hopkins University, Bloomberg School of Public Health, Center for American Indian Health

Longitudinal Study of COVID-19 Antibody Response in Children in Seattle, WA

Follows cases in children and adolescents (up to 18 years old) who test positive for the virus that causes COVID-19, to assess the development and duration of the immune response, symptoms, and complications over time, for up to two years.

Population: Children and adolescents

Partner: University of Washington; Seattle Children's Hospital

COVID: Research on COVID Long-Term Illness, Effects, and Risk Factors (COVID-RELIEF)

Tracks electronic health records of patients who test positive and negative for the virus that causes COVID-19 and documents symptoms and medical conditions for an average of 2 years after infection. A subgroup of patients who previously tested positive for COVID-19 provides self-reported data on health and biospecimens to investigate genetic and other risk factors for delayed recovery.

Population: Adults receiving care in a university health system

Partner: University of Washington, Seattle, WA

COVID-19: Understanding the Post-Viral Phase (COVID-UPP)

Assesses participants' health over time using surveys and, for a subset of participants, using physical exams and medical tests to compare differences and similarities with [myalgic encephalomyelitis/chronic fatigue syndrome \(ME/CFS\)](#). Adults who tested positive for the virus that causes COVID-19 and continue to have symptoms more than three months after infection are compared with those who fully recovered.

Population: Adults, with a focus on Hispanic or Latino persons who tested positive for the virus that causes COVID-19 and continue to have symptoms more than three months after infection

Partner: Nova Southeastern University, Fort Lauderdale, FL

Support for Patients With SARS-CoV-2 Infections Registry (INSPIRE)

Follows cases in adults who test positive for COVID-19 and a comparison group of adults who test negative for SARS-CoV-2 every 3 months for up to 18 months. Participants complete detailed surveys, including information on social determinants of health, and provide linked electronic health information.

Population: Adults tested for SARS-CoV-2 infection

Partners: Rush University, Yale University, Jefferson Medical, University of Washington, UCLA, UCSF, UT Southwestern, UT Houston

Tracking of Patients with Ongoing Symptoms



COVID – Standardized Evaluation of Long-term Effects (COVID-SELECT)

Collects information from patients at risk of or who have Post-COVID Conditions about their health through online questionnaires, with follow up on their health one year later. Information will be used to identify and describe those who have long-term symptoms after having COVID and whose results on routine medical tests and physical examination are

normal.

Population: Adults from a demographically diverse population receiving care in a large, integrated health system in northern and central California

Partners: [Public Health Foundation Enterprises, Inc](#) ; [California Emerging Infections Program](#) ; Kaiser Permanente Northern California, Oakland, CA

Medical Chart Abstraction

Multi-Site Study of Post-COVID Conditions (MPCC)

Collects health data to describe the health and medical care of patients at clinics designed for Post-COVID care to help classify types of Post-COVID health problems and care needed and highlight unmet needs for care in other medical settings.

Population: Adult patients receiving care in Post-COVID clinics at participating medical centers through September 30, 2021

Partners: Rainmaker Strategic Solutions, LLC; University of Texas Southwestern Medical Center; Dallas, TX; Creighton University Medical Center, Omaha, NE; Mt. Sinai Health System, New York, NY

Electronic Healthcare Data and Patient Databases

Post-COVID Conditions among Patients Seen in Outpatient Settings – American Family Cohort

Analyzes electronic health record data from COVID-19 patients seen at over 800 primary care and family medicine practices to assess frequency of new symptoms and conditions among patients with COVID-19 diagnosis compared with patients with other respiratory diagnoses. Study will assess Post-COVID Conditions by race/ethnicity, age, sex, geography (urban/rural), and indices of social vulnerability.

Population: Children and adults

Partner: [American Board of Family Medicine](#) ; Stanford University Center for Population Health Sciences

Post-COVID Conditions among Patients Seen in Outpatient and Inpatient Settings – PCORnet

Analyzes electronic health record data from COVID-19 patients seen in ambulatory, emergency department, and hospital settings in 40 U.S. healthcare systems to assess frequency of new symptoms and conditions among patients who tested positive for the virus that causes COVID-19 compared with patients who tested negative.

Population: Children and adults

Partner: [PCORnet, the National Patient-Centered Clinical Research Network](#)

Frequency of and Risk Factors for Post-COVID Conditions – Various Healthcare Data Sources

Analyzes several large healthcare data sources to provide estimates of new symptoms and conditions following COVID-19 diagnosis in outpatient and inpatient settings by patient demographic and clinical characteristics.

Population: Children and adults

Data Sources: [Cerner HealthDataLab](#) , [HealthVerity](#) , Premier Healthcare Database Special COVID-19 Release

Health Surveys

National Health Interview Survey

Collects information about symptoms of Post-COVID Conditions through a cross-sectional household survey to estimate the national prevalence of Post-COVID Conditions.

Population: Adults and children

Data Source: [National Center for Health Statistics, CDC](#)

Behavioral Risk Factor Surveillance System

Collects information about symptoms of Post-COVID Conditions through a survey to produce state/territorial-level estimates of prevalence.

Population: Adults

Data Source: [National Center for Chronic Disease Prevention and Health Promotion, CDC](#); participating state and territorial health departments

Multi-state Long Covid Survey

Surveyed adults who tested positive for SARS-CoV-2 for self-reported acute and Post-COVID Conditions lasting four weeks or more to estimate prevalence of Post-COVID Conditions and identify demographic and disease-specific risk factors for developing Post-COVID Conditions.

Population: Adults who tested positive for the virus that causes COVID-19 in Maine, Wisconsin, New York, and New Jersey




Partners: State health departments

Models of Care

[Long COVID and Fatiguing Illness Recovery Program \(LC&FIRP\)](#)

Evaluates whether educational interventions for primary healthcare providers through a distance-learning platform improves health outcomes of patients with Post-COVID Conditions and other complex chronic conditions with similar symptoms, such as [myalgic encephalomyelitis/chronic fatigue syndrome \(ME/CFS\)](#) and other post-infectious fatiguing illnesses.

Population: Adults who are uninsured, with lower incomes, and who are medically underserved

Partners: [Family Health Centers of San Diego \(FHCS\), San Diego, California](#) ; [Project ECHO, Albuquerque, NM](#) ; [University of Washington Post-COVID Clinic Rehabilitation and Recovery, Seattle, WA](#) ; [University of Colorado, Denver, CO](#); [ATA Health Strategies, Washington, DC](#)

Sentinel Surveillance

Tracking the Burden, Distribution, and Impact of Post COVID-19 Conditions in Diverse Populations for Children, Adolescents, and Adults (Track PCC)

TrackPCC is a multi-year sentinel surveillance project that will investigate the burden and impact of Post-COVID Conditions (PCC) in diverse populations within the United States. TrackPCC entails both passive and active surveillance and long-term follow-up of cohorts in collaboration with public health, academic, and healthcare partners.

As part of passive surveillance, TrackPCC investigators will collect information at four surveillance sites from electronic health records of patients who test positive for SARS-CoV-2 infection for up to five years to estimate incidence of symptoms and conditions occurring after SARS-CoV-2 infection. Every quarter, new cohorts of patients who tested positive for SARS-CoV-2 will be added to the surveillance system, and those who previously tested positive will be followed for the development of PCC symptoms and conditions.

As part of active surveillance, TrackPCC investigators will survey a sample of patients who test positive for SARS-CoV-2 from the four surveillance sites for on-going symptoms 3 months after infection and then every 6 months for up to 18 months. This will provide estimates of the prevalence of symptoms that continue for more than three months after COVID-19 illness and provide information on symptom duration, severity of symptoms, impact on day-to-day activities, and associated health disparities.

Population: Children and adults who test positive for SARS-CoV-2 infection

Partners: Abt Associates, Indiana University, Temple University, University of Arizona, and Comagine Health (Collaborative: Boise State University, Utah Health Information Network, and Bronx Regional Health Information Organization)

How can I Participate in Long COVID Research?

The National Institutes of Health (NIH) created the RECOVER Initiative, a research project that aims to understand how people recover from a COVID-19 infection and why some people do not fully recover and develop Long COVID or post-acute sequelae of SARS-CoV-2 (PASC). Anyone can participate in the RECOVER project, including those who have COVID-19 now, had COVID-19 before, or never had COVID-19. People of all races and ethnicities, genders, ages, and locations will be included in the research project to better understand how Long COVID affects people.

To learn more, including enrollment, visit the [RECOVER webpage](#) .

Clinical Outreach and Communication Activity (COCA) Calls

The purpose of COCA continuing education opportunities is to increase clinicians' knowledge of threats to the public's health and provide information on clinical evaluation management strategies to address these threats. COCA continuing education is free. Learn about receiving [continuing education \(CE\) credit for COCA calls](#).



Featured Webinars

May 5, 2022: [Evaluating and Supporting Patients Presenting with Cognitive Symptoms Following COVID](#)

September 30, 2021: [Evaluating and Supporting Patients Presenting with Fatigue Following COVID-19](#)

June 17, 2021: [Evaluating and Caring for Patients with Post-COVID Conditions](#)

January 28, 2021: [Treating Long COVID: Clinician Experience with Post-Acute COVID-19 Care](#)

[More COCA Calls/Webinars](#)

CDC Publications

CDC is publishing the results of studies aimed at better understanding Post-COVID Conditions and how best to support people experiencing Post-COVID Conditions and health problems.

Select CDC publications on Post-COVID Conditions and related topics:

Prospective Cohort Studies

- O’Laughlin KN, Thompson M, Hota B, Gottlieb M, Plumb ID, Chang AM, Wisk LE, Hall AJ, Wang RC, Spatz ES, Stephens KA, Huebinger RM, McDonald SA, Venkatesh A, Gentile N, Slovis BH, Hill M, Saydah S, Idris AH, Rodriguez R, Krumholz HM, Elmore JG, Weinstein RA, Nichol G; INSPIRE Investigators. [Study protocol for the Innovative Support for Patients with SARS-CoV-2 Infections Registry \(INSPIRE\): A longitudinal study of the medium and long-term sequelae of SARS-CoV-2 infection.](#) *PLoS One.* 2022 Mar 3;17(3) [↗](#) .
- Han JH, Womack KN, Tenforde MW, Files DC, Gibbs KW, Shapiro NI, Prekker ME, Erickson HL, Steingrub JS, Qadir N, Khan A, Hough CL, Johnson NJ, Ely EW, Rice TW, Casey JD, Lindsell CJ, Gong MN, Srinivasan V, Lewis NM, Patel MM, Self WH; Influenza and Other Viruses in the Acutely Ill (IVY) Network. [Associations between persistent symptoms after mild COVID-19 and long-term health status, quality of life, and psychological distress.](#) *Influenza Other Respir Viruses.* 2022 Mar 28 [↗](#) .

Analysis of Electronic Healthcare Data

- Hernandez-Romieu AC, Leung S, Mbanya A, Jackson BR, Cope JR, Bushman D, Dixon M, Brown J, McLeod T, Saydah S, Datta D, Koplan K, Lobelo F. [Health Care Utilization and Clinical Characteristics of Nonhospitalized Adults in an Integrated Health Care System 28-180 Days After COVID-19 Diagnosis – Georgia, May 2020-March 2021.](#) *MMWR Morb Mortal Wkly Rep.* 2021 Apr 30;70(17):644-650.
- Hernandez-Romieu AC, Carton TW, Saydah S, Azziz-Baumgartner E, Boehmer TK, Garret NY, Bailey LC, Cowell LG, Draper C, Mayer KH, Nagavedu K, Puro JE, Rasmussen SA, Trick WE, Wanga V, Chevinsky JR, Jackson BR, Goodman AB, Cope JR, Gundlapalli AV, Block JP. [Prevalence of Select New Symptoms and Conditions Among Persons Aged Younger Than 20 Years and 20 Years or Older at 31 to 150 Days After Testing Positive or Negative for SARS-CoV-2.](#) *JAMA Netw Open.* 2022 Feb 1;5(2) [↗](#) .
- Barrett CE, Koyama AK, Alvarez P, Chow W, Lundeen EA, Perrine CG, Pavkov ME, Rolka DB, Wiltz JL, Bull-Otterson L, Gray S, Boehmer TK, Gundlapalli AV, Siegel DA, Kompaniyets L, Goodman AB, Mahon BE, Tauxe RV, Remley K, Saydah S. [Risk for Newly Diagnosed Diabetes >30 Days After SARS-CoV-2 Infection Among Persons Aged <18 Years – United States, March 1, 2020-June 28, 2021.](#) *MMWR Morb Mortal Wkly Rep.* 2022 Jan 14;71(2):59-65.
- Chevinsky JR, Tao G, Lavery AM, Kukielka EA, Click ES, Malec D, Kompaniyets L, Bruce BB, Yusuf H, Goodman AB, Dixon MG, Nakao JH, Datta SD, MacKenzie WR, Kadri SS, Saydah S, Giovanni JE, Gundlapalli AV. [Late Conditions Diagnosed 1-4 Months Following an Initial Coronavirus Disease 2019 \(COVID-19\) Encounter: A Matched-Cohort Study Using Inpatient and Outpatient Administrative Data-United States, 1 March-30 June 2020.](#) *Clin Infect Dis.* 2021 Jul 15;73(Suppl 1):S5-S16 [↗](#) .

Health Surveys

- Wanga V, Chevinsky JR, Dimitrov LV, Gerdes ME, Whitfield GP, Bonacci RA, Nji MAM, Hernandez-Romieu AC, Rogers-Brown JS, McLeod T, Rushmore J, Lutfy C, Bushman D, Koumans E, Saydah S, Goodman AB, Coleman King SM, Jackson BR, Cope JR. [Long-Term Symptoms Among Adults Tested for SARS-CoV-2 – United States, January 2020-April 2021.](#) *MMWR Morb Mortal Wkly Rep.* 2021 Sep 10;70(36):1235-1241.

Electronic Medical Chart Abstraction

- Rogers-Brown JS, Wanga V, Okoro C, Brozowsky D, Evans A, Hopwood D, Cope JR, Jackson BR, Bushman D, Hernandez-Romieu AC, Bonacci RA, McLeod T, Chevinsky JR, Goodman AB, Dixon MG, Lutfy C, Rushmore J, Koumans E, Morris SB,

Thompson W. Outcomes Among Patients Referred to Outpatient Rehabilitation Clinics After COVID-19 diagnosis – United States, January 2020-March 2021. *MMWR Morb Mortal Wkly Rep.* 2021 Jul 9;70(27):967-971. Erratum in: *MMWR Morb Mortal Wkly Rep.* 2021 Aug 20;70(33):1126. PMID: 34237048; PMCID: PMC8312758.

Commentary

- Saydah SH, Brooks JT, Jackson BR. Surveillance for Post-COVID Conditions Is Necessary: Addressing the Challenges with Multiple Approaches. *J Gen Intern Med.* 2022 Feb 15:1–3 [↗](#) .
- Datta SD, Talwar A, Lee JT. A Proposed Framework and Timeline of the Spectrum of Disease Due to SARS-CoV-2 Infection: Illness Beyond Acute Infection and Public Health Implications. *JAMA.* 2020 Dec 8;324(22):2251-2252 [↗](#) .

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