The identification of the novel coronavirus SARS-CoV-2 in December 2019 has led to a growing and continually evolving body of knowledge about the virus and the disease it causes, COVID-19.

In peer-reviewed literature and public discussion, persistent symptoms are being reported among COVID-19 survivors, including individuals who initially experience a mild acute illness. These persistent symptoms pose new challenges to patients, healthcare providers, and public health practitioners. The natural history of SARS-CoV-2 infection and COVID-19 is a current area of investigation, and the prevalence, type, duration, and severity of persistent symptoms following resolution of acute SARS-CoV-2 infection, as well as risk factors associated with their development, are currently being studied.

While older patients may have an increased risk for severe disease, young survivors, including those physically-fit prior to SARS-CoV-2 infection, have also reported symptoms months after acute illness (1, 2, 11). Research is underway to differentiate symptoms of a prolonged course of COVID-19 illness from sequelae following resolution of acute SARS-CoV-2 infection, achieve consensus on the time period at which to define the post-acute and long-term phases of COVID-19, and distinguish health effects exclusively related to infection with SARS-CoV-2 from consequences of procedures and treatments required for care of persons with severe disease of any etiology.

Characterization of the etiology and pathophysiology of late sequelae is underway, and may reflect organ damage from the acute infection phase (17), manifestations of a persistent hyperinflammatory state (27, 31), ongoing viral activity associated with a host viral reservoir (16), or an inadequate antibody response (30). Factors in addition to acute disease that may further complicate the picture include physical deconditioning (10) at baseline or after a long disease course (29), pre-COVID-19 comorbidities (18), and psychological sequelae following a long or difficult disease course (31) as well as those relating to lifestyle changes due to the pandemic (9). Likely, the persistent sequelae of COVID-19 represent multiple syndromes resulting from distinct pathophysiological processes along the spectrum of disease.

Though there is limited information on late sequelae of COVID-19, reports of persistent symptoms in persons who recovered from acute COVID-19 illness have emerged (5, 6, 7, 12, 13, 28). The most commonly reported symptoms include fatigue, dyspnea, cough, arthralgia, and chest pain (1, 3, 5, 13, 16, 18, 28). Other reported symptoms include cognitive impairment,
depression, myalgia, headache, fever, and palpitations. More serious complications appear to be less common but have been reported. These complications include:

- Cardiovascular: myocardial inflammation, ventricular dysfunction
- Respiratory: pulmonary function abnormalities
- Renal: acute kidney injury
- Dermatologic: rash, alopecia
- Neurological: olfactory and gustatory dysfunction, sleep dysregulation, altered cognition, memory impairment
- Psychiatric: depression, anxiety, changes in mood

Post-COVID-19 care centers are opening at academic medical centers in the United States, bringing together multidisciplinary teams to provide a comprehensive and coordinated treatment approach to COVID-19 aftercare. The National Institutes of Health have published interim guidelines for the medical management of COVID-19, including a section on persistent symptoms or illnesses after recovery from acute COVID-19. These guidelines will be updated as new information emerges. Survivor support groups are connecting individuals, providing support, and sharing resources with survivors and others affected by COVID-19. Multi-year studies will be crucial in elucidating longer-term sequelae. CDC continues active investigation into the full spectrum of COVID-19 to establish a more complete understanding of the natural history of SARS-CoV-2 infection and COVID-19 related illnesses, which can inform care strategies as well as the public health response to this virus.

**Ongoing research**


**References**


