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## Chapter

# Post-COVID-19 and Mental Health

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## Abstract

Beginning with its emergence in Wuhan, China, in December 2019, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), a pandemic that causes COVID-19, has spread and left profound consequences on the lives and health of people around the world. Although most patients who have COVID-19 recover after two to six weeks, research shows that 10–30% of people who have had COVID-19, even with a mild clinical picture, remain with persistent symptoms that have a devastating effect on their quality of life. These symptoms, which most often include fatigue, shortness of breath, chest pain, headache, and cognitive dysfunction, but also others that generally have an impact on everyday functioning, are recognized as a clinical condition called post-COVID syndrome (long COVID). In addition to physical disabilities in people recovering from COVID-19, mental health problems have also been observed, including problems with concentration (“brain fog”), anxiety, depression, sleep disorders, and symptoms of post-traumatic stress disorder (PTSD). In this chapter, we provide a comprehensive review of the current scientific findings identifying post-COVID conditions and their relationship with mental health status.

**Keywords:** long-term effects of COVID-19, mental health, post-COVID

## 1. Introduction

The emergence of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) caused a devastating pandemic. COVID-19, which stands for Coronavirus Disease 2019, is an infectious disease that can affect people of all ages in many ways. Most people infected with SARS-CoV-2 develop mild to moderate disease with viral replication confined mainly to the upper respiratory tract. However, acute respiratory distress syndrome (ARDS) can develop when a virus from the upper respiratory tract spreads to the lungs and produces viral pneumonia and lung damage. When severe, it impairs the body’s capacity to maintain vital oxygen levels in the blood, which can result in a number of body system failures and even lead to death [1]. Old age, obesity, and being male are well-established risk factors for severe outcomes of the COVID-19. Various preexisting conditions are also associated with an increased risk. For example, common comorbidities associated with an increased risk of death include hypertension, heart failure, cardiac arrhythmia, diabetes, renal failure, and chronic lung disease [1–3].

The aforementioned infectious disease COVID-19 has rapidly affected mortality worldwide. Globally, till today, there have been 632 million confirmed cases of COVID-19, including 6.5 million deaths, reported to the World Health Organization (WHO) [4].

Although most patients who have COVID-19 recover after two to six weeks, research shows that 10–30% of people who have had COVID-19, even with a mild clinical picture, remain with persistent symptoms that have a devastating effect on their quality of life. These symptoms, which most often include fatigue, shortness of breath, chest pain, headache, and cognitive dysfunction, but also others, which generally have an impact on everyday functioning, are recognized as a clinical condition called post-COVID syndrome (long COVID) [5].

In addition to physical disabilities in people recovering from COVID-19, mental health problems have also been observed, including problems with concentration (“brain fog”), anxiety, depression, sleep disorders, and symptoms of post-traumatic stress disorder (PTSD) [6].

In this chapter, we provide a comprehensive review of the current scientific findings identifying post-COVID conditions and the relationship with mental health status.

## **2. Post-COVID-19 conditions**

Although respiratory symptoms make up the majority of COVID-19’s clinical presentation due to the SARS-CoV-2 infection, other conditions like pulmonary (such as pneumonia or dyspnea with exertion), gastrointestinal (such as anorexia or diarrhea), neurological (such as headache, anosmia, or dizziness), or even cardiac ones (such as ischemia, arrhythmias, or myocarditis) may also manifest. It is now well established that nearly a third of patients worldwide will have persistent symptoms for weeks and months, sometimes up to a year after being diagnosed with COVID-19 [7]. These results, particularly for patients who had severe symptoms and spent many weeks in intensive care, are comparable to the recovery from SARS in 2003. But COVID-19 is different because a large portion of those who do not need to be hospitalized seem to relapse, persist, or manifest new symptoms months after the initial infection [8].

When SARS-CoV and MERS-CoV outbreaks occurred in the past, people who recovered from these viral illnesses were left with lingering symptoms like extreme fatigue, a lower quality of life, protracted shortness of breath, and behavioral health issues. These symptoms have put a significant burden on the local health-care systems where the outbreak occurred. Similarly, despite scientific evidence that SARS-CoV-2 replication stops four weeks after the commencement of infection (on the basis of sampling viral isolates from the respiratory tract, not the nasopharyngeal/oropharyngeal sample), a collection of distinct clinical symptoms known as post-COVID-19 syndrome has been reported in a minority of patients who have recovered from COVID-19 caused by SARS-CoV-2 [9]. A meta-analysis including 4828 post-COVID-19 patients showed that symptoms and post-acute sequelae of SARS-CoV-2 can persist for weeks to months after the infection [10].

Persistent symptoms after the COVID-19 illness are called long-term COVID or post-acute sequelae of COVID-19. Some individuals who have contracted the virus that causes COVID-19 may go on to develop post-COVID conditions (PCC) or long COVID as a result of their infection. Long-haul COVID, post-acute COVID-19,

post-acute sequelae of SARS CoV-2 infection (PASC), long-term effects of COVID, and chronic COVID are only a few of the terms used to describe post-COVID problems [11].

The hallmark of post-acute COVID-19 syndrome is the continuation of clinical symptoms for longer than four weeks following the beginning of acute symptoms [9]. The term “post-COVID conditions” was created by the Center for Disease Control (CDC) to characterize health issues that last longer than four weeks after getting COVID-19. The following conditions fall under this category: multi-organ COVID-19 effects, impacts of COVID-19 treatment/hospitalization, and extended COVID or persistent post-COVID syndrome (PPCS) [9].

Clinically, “long covid” is characterized by symptoms such as weariness, dyspnea, exhaustion, brain fog, headache, persistent loss of smell or taste, cough, sadness, low fever, palpitations, dizziness, muscle and joint pain, and autonomic dysfunction [9, 12].

The multi-organ effects of COVID-19 include clinical manifestations involving the cardiovascular, pulmonary, renal, and neuropsychiatric organ systems, although the duration of these multi-organ effects is unclear [9, 13].

The long-term “effects of treatment or hospitalization for COVID-19” are similar to other severe infections. These include post-intensive care syndrome (PICS), which consists of impairment of cognition, psychological health, and physical function in an intensive care unit survivor. It can also include muscle weakness, problems with thinking and judgment, and symptoms of PTSD. Many patients with these complications caused by COVID-19 recover over time [9, 14].

In addition to morbidity and mortality in the acute phase, post-acute health problems and consequences have also been recorded in persons who have survived COVID-19. According to the review, up to 80% of patients with COVID-19 continue to complain of health problems after the acute infection and more than 50 side effects have been reported [15]. Post-acute COVID-19 was categorized as follows by Nalbandian et al. based on the severity of symptoms following COVID-19 infection: After the initial acute episode, subacute or persistent COVID-19 symptoms can last up to 12 weeks, and chronic or post-COVID syndrome symptoms start to show up after that. This should not, however, be attributed to a different diagnosis [16].

A large observational cohort study from 38 US hospitals assessed the outcomes of 1250 COVID-19 survivors 60 days after hospital discharge using medical record abstraction and telephone surveys. During the study period, 6.7% of patients died, while 15.1% of patients required readmission. Out of a total of 488 patients who completed the telephone survey, 32.6% of patients reported persistent symptoms including 18.9% with new or worsening symptoms. In this study, 159 individuals reported experiencing cardiopulmonary symptoms (e.g. cough or dyspnea), including 92 who experienced new or worsening symptoms and 65 who experienced irreversible loss of taste or smell. Fifty-eight patients reported new or deteriorating difficulties carrying out their everyday tasks. Among the 195 patients who had jobs prior to being admitted to the hospital, 117 were able to go back to work, while 78 were unable to do so due to continued health issues or job loss. Almost half of all patients (238 of 488) reported being emotionally affected by their health, and 28 sought mental health care after discharge [17].

Similar findings were obtained in studies conducted in Europe. In a population-based prospective cohort study conducted in Spain to determine post-COVID-19 complications and risk factors among patients six months after SARS-CoV-2 infection, in a sample of 484 patients, it was shown that 160 patients (33.1%) experienced at least one post-COVID-19 problem after six months, and 47 of them (29.5%) sought



medical help. Hair loss, exhaustion, loss of taste or smell, and headache were the most prevalent long-lasting effects. The complication's risk factors included female gender, age over 35 years, current smoker, and exposure to COVID-19. A third of patients had persistent symptoms compatible with long-term COVID-19 syndrome [18]. In 143 patients who were discharged from the hospital after recovering from acute COVID-19 at a median time of up to 60 days following the onset of symptoms, a post-acute outpatient clinic established in Italy revealed that 87.4% of patients had persistent symptoms. The most frequently reported symptoms were fatigue (53.1%), dyspnea (43.4%), joint pain (27.3%), and chest pain (21.7%), and 55% of patients continued to experience three or more symptoms. In this study, a decline in quality of life was noted in 44.1% of patients [19]. Also, a study conducted in Brazil confirmed the impact of COVID-19 on worsening health-related quality of life and mental health in COVID-19 patients three months after hospital discharge, compared to that before the onset of COVID-19 symptoms [20].

Other studies have reported similar findings. Results of a prospective follow-up study of 110 survivors in the United Kingdom, 8–12 weeks after hospital admission [21], and 277 survivors in Spain, 10–14 weeks after the disease onset [22], as well as survey studies of 100 UK COVID-19 survivors, 4–8 weeks after discharge [23], and 120 patients discharged from a hospital in France, 100 days after admission [24], showed that fatigue, dyspnea, and psychological distress, such as PTSD, anxiety, depression, and loss of concentration and sleep disorders, observed in approximately 30% or more of study participants at follow-up.

### **3. Post-COVID-19 conditions and mental health**

Of the diverse constellation of symptoms that make up post-COVID-19, some are found in the mental health arena. Neurological and psychiatric symptoms include fatigue, weakness after exertion, cognitive complaints, sensorimotor symptoms, headaches, insomnia, depression, and PTSD [25]. The mechanisms involved in post-COVID-19 development and the factors influencing recovery from COVID-19 are still at an early stage. Current hypotheses include psychological factors, inflammatory and immune responses, and physical deconditioning [26, 27].

Human coronaviruses (including SARS-CoV and MERS-CoV) are one of several groups of viruses thought to be potentially neurotropic. It has been observed from previous outbreaks that respiratory coronaviruses can penetrate the brain and cerebrospinal fluid, permeating the central nervous system in less than a week, and can then be detected in the cerebrospinal fluid [28]. The perturbation of the immune system caused by the infection could cause psychopathology, and psychiatric consequences have also been observed after previous outbreaks of the coronaviruses. The spread of the pandemic caused by the SARS-CoV-2 virus could be associated with psychiatric implications. Cognitive difficulties are symptomatic features of all psychological disorders [16].

In one cohort study examining the cognitive profile after infection with COVID-19, it was found that 34.3% of patients had cognitive complaints after infection with COVID-19. Patients with headache, anosmia, dysgeusia, diarrhea, and those requiring oxygen therapy had lower scores on subtests of memory, attention, and executive function compared to asymptomatic patients. Patients with headache and clinical hypoxia had lower scores in the global cognitive index, while higher scores in anxiety and depression were found in patients with cognitive complaints. Emotional stress,

such as anxiety, depression, and insomnia, can play a role in subjective cognitive complaints. These findings emphasize the importance of early detection of anxiety and depression in order to avoid later neuropsychological impairments in patients with COVID-19 [8].

Cognitive impairment with or without fluctuations, including brain fog, which may manifest as difficulty with concentration, memory, receptive language, and/or executive function, has been observed in patients with COVID-19 [29–31]. Post-COVID brain fog in critically ill patients with COVID-19 may develop from mechanisms such as deconditioning or PTSD. However, reports of COVID-19-induced brain fog following mild COVID-19 illness suggest that dysautonomia may also contribute. Finally, long-term cognitive impairment is well recognized in the post-critical phase of the disease, occurring in 20–40% of patients discharged from intensive care units [31–34].

Numerous studies have been published on mental health of people around the world during the COVID-19 pandemic reporting varying rates of mental health problems. Findings from extensive scientific literature indicate that the outbreak of the COVID-19 pandemic increased the prevalence of mental health problems by a massive 25%, worldwide [35].

A large body of evidence suggests that there is a mixed but significant increase in mental health problems among general population [36–40], but also among other specific populations, such as patients with preexisting chronic health conditions [41–43], patients with preexisting severe mental disorders [44–47], and alcohol addicts [48–50]. Also, an increased prevalence of anxiety and depression symptoms was noted in the population of health-care workers during the pandemic [51], with psychological distress and insomnia [52], as well as physical and mental exhaustion and burnout [53–56].

Individuals with COVID-19 experience a range of psychiatric symptoms that persist or occur months after the initial infection [57].

In a study conducted in Italy on a sample of 402 people who recovered from COVID-19, the psychopathological impact of COVID-19 on survivors was examined taking into account the effect of clinical and inflammatory predictors. It showed that one month after hospitalization, a significant proportion of patients self-rated in the psychopathological range: 28% for PTSD, 31% for depression, 42% for anxiety, 20% for symptoms of obsessive-compulsive disorder (OCD), and 40% for insomnia. Approximately 56% of COVID-19 survivors were positive in at least one of the domains assessed for psychiatric sequelae (PTSD, depression, anxiety, insomnia, and obsessive-compulsive symptomatology). Patients with a previously confirmed psychiatric diagnosis showed increased scores on most psychopathological measures [58].

One systematic review included peer-reviewed studies reporting on neuropsychiatric symptoms at post-acute or later time points after COVID-19 infection and in control groups where available. The total number of subjects was 18,917 patients and the average duration of follow-up after recovery from COVID-19 was 77 days. The quality of the studies was mostly moderate. The most common neuropsychiatric symptom was sleeping disturbance (total prevalence = 27.4%), followed by fatigue (24.4%), objective cognitive impairment (20.2%), anxiety (19.1%), and PTSD (15.7%). Two studies in the review compared COVID-19 patients with controls and found that COVID-19 patients had higher levels of mental health symptoms. Based on hospitalization status, infection severity, or length of follow-up, there was no difference in the prevalence of mental health problems among COVID-19 patients across the studies in the review [59].

There are numerous obstacles in the literature to date regarding the mental health aspects of the post-COVID-19 condition, including the dearth of studies with active control groups for attributing COVID-19 illness symptoms, the lack of consensus on the term “post-COVID-19 condition,” and diverse participant selection criteria [60].

In addition to seriously affecting mental health and well-being of people around the world, the COVID-19 pandemic has also raised concerns about increased suicidal behavior. Factors that may increase suicidal risk during a pandemic, especially in vulnerable groups (such as people with a previous history of psychiatric disorder, people over 65, people who have already attempted suicide, COVID-19 frontline health-care workers, people infected with the coronavirus, and people who are recovering from COVID-19, as well as people whose family member or friend died of COVID-19), are social isolation; anxiety; fear of infection; prolonged stress; job insecurity and unemployment; and access to food, education, and health care in the non-COVID system [61, 62].

The few available studies on the mental status of patients with COVID-19 provide us with preliminary information about how psychiatric symptoms associated with COVID-19 develop and change. During the hospital stay, a significantly high proportion of patients reported depression (60.2%), anxiety (55.3%) [63], and PTSD (96.2%) [64]. Liu et al. [65] found that the prevalence rate of clinically significant depression, anxiety, and PTSD symptoms in COVID-19 patients after hospital discharge was 19%, 10.4%, and 12.4%, which is a significant drop compared to the findings of the previously mentioned studies. The adverse effects of COVID-19 on mental health are evident after discharge from hospital, with sleep difficulties highlighted as a central issue. Also, Liu et al. pointed out that perceived discrimination is a central predictor of mental illness and that preventing and addressing the social stigma associated with COVID-19 can be crucial for improving the mental health of recovered patients [65].

High rates of mental health problems, especially anxiety, depression, suicidal behavior, and PTSD, have been reported in general population and after previous coronavirus epidemics, regardless of infectious status [66, 67]. One study conducted in South Korea on a sample of patients quarantined for suspected or confirmed MERS-CoV found that 40% of patients were given a psychiatric diagnosis while in the hospital and that 70.8% of confirmed patients who survived the illness displayed psychiatric symptoms, including hallucinations and psychosis. None of the individuals who had MERS-CoV that was suspected but not yet confirmed displayed any symptoms suggesting a possible viral mechanism underlying psychiatric disorders, a dose-response effect, or a greater psychological effect of receiving a confirmed diagnosis of respiratory disease [68]. A study involving 90 cases with SARS-CoV similarly showed high levels of psychological distress with 59% diagnosed with psychiatric disorders and a continued prevalence of 33% at thirty-month follow-up. The severity of psychological symptoms was found to be related to disease severity and functional impairment [69, 70].

Several long-term health complications in previous coronavirus infections are well documented. A review that included 34 studies and aimed to assess physical and mental health after problems with COVID-19, with a follow-up period longer than one month after discharge or after the onset of symptoms, showed that the most frequently reported mental health problems were anxiety (ranging from 6.5% to 63%), depression (4–31%), and PTSD (12.1–46.9%). Patients and people admitted to critical care noted higher levels of exhaustion, pain, anxiety, and depression. Up to three months following COVID-19, a general decline in quality of life was observed.



Up to three months following COVID-19, various physical and mental health issues were present, according to this review. Findings indicate the necessity of thorough evaluation and rehabilitation following COVID-19 to improve the quality of life [71].

Sleep problems are another prominent post-COVID-19 mental health problem, especially insomnia, which has been observed in both the acute and chronic stages of the disease [24, 72–74]. Other studies have also suggested that sleep problems are a central complication perceived among COVID-19 survivors [65, 75, 76]. Sleep difficulties, anxiety, and depression were present in approximately one-quarter of patients at six-month follow-up after acute COVID-19 in a study conducted in China [77].

Clinically significant depression and anxiety have been reported in approximately 30–40% of patients following COVID-19, similar to patients with previous severe SARS, starting in 2002, and MERS, starting in 2012 [78–81]. Clinically significant PTSD symptoms have been reported in approximately 30% of COVID-19 patients requiring hospitalization and may occur early during acute infection or months later [58, 81].

An analysis of a large-scale data set that included 62,354 patients who survived COVID-19 from 54 health-care organizations in the United States estimated that between days 14 and 90 following diagnosis, there were 18.1% first-time and recurrent cases of psychiatric disorder. More significantly, it revealed that among a subset of 44,759 patients without a history of psychiatric illness, the estimated overall probability of developing a new psychiatric illness within 90 days of a COVID-19 diagnosis was 5.8% (anxiety disorder = 4.7%; mood disorder = 2%; insomnia = 1.9%; dementia (among those under 65 years) = 1.6%). All these values were significantly higher than in the corresponding control cohorts of patients diagnosed with influenza and other respiratory infections. Survivors of COVID-19 appear to be at increased risk for psychiatric sequelae, and a psychiatric diagnosis may be an independent risk factor for COVID-19 [82].

The prevalence of mental health issues varies significantly across studies, which may be a result of variations in the measures used to assess these outcomes as well as regional variations in the influence of cultural or spiritual beliefs on attempts to manage the psychological impact of coronavirus disease [83].

Although higher rates of psychiatric symptoms can be expected in the general population after a pandemic due to exposure to traumatic life events such as death of friends and relatives, loss of income, fear, and general psychological distress, within this group there may also be individuals whose cognitive and psychological disorders are directly related with brain changes caused by the coronavirus. For this reason, the question can be raised as to how the mentioned group will respond to standard treatment, for example, antidepressants, anxiolytics, and cognitive therapies [30].

Treatments such as cognitive-behavioral psychotherapy (CBT) are recommended for various psychiatric manifestations of the post-COVID condition, such as chronic fatigue syndrome [84]. However, face-to-face cognitive-behavioral psychotherapy is a time-intensive treatment and the question is how applicable it is during the pandemic due to various government restrictions that include physical and social distancing to prevent further spread of the virus [85]. Despite this, new modern ways of digital communication can enable effective support in the form of rehabilitation services provided through information and communication technologies, especially in the situation of an infectious disease pandemic and among COVID-19 survivors [86–88]. Computer-based interventions target improvement of physical and emotional functioning in patients with chronic pain and functional somatic syndromes [89]. Internet-delivered cognitive behavioral therapy (I-CBT) has been reported to



be an effective and efficient treatment for psychiatric problems and musculoskeletal symptoms, compared to waiting lists or usual care settings, and may be equivalent to traditional (face-to-face) forms of provision [90–92].

Therefore, telehealth (telerehabilitation and telepsychiatry) could be considered as a follow-up treatment in an effort to prevent long-term physical and mental health complications in post-COVID-19 patients [93].

#### **4. Mental health issues in the post-COVID-19 era**

Evidence suggests that there is a significant increase in mental health problems among general population and vulnerable groups. Previous major public health crises have shown that more than half of the population developed mental health problems and needed mental health intervention [94].

In the post-pandemic era, it may be difficult to identify mental disorders etiologically related to COVID-19 (e.g. cytokine storm anxiety) due to the lack of specific diagnostic or screening tools. Due to limited scientific understanding of the link between COVID-19 and mental health so far, post-pandemic preparedness is difficult. Clinicians, researchers, and policymakers are expected to be prepared for these mental health issues in terms of assessment, interventions, and models of care in the post-pandemic era [94].

Given the global scale of the pandemic, it is clear that health-care needs for patients affected by the effects of COVID-19 will continue to grow for the foreseeable future. Meeting this challenge will require leveraging existing and developing new health-care models and interdisciplinary collaboration to improve both the physical and mental health of COVID-19 survivors in the long term [95].

Data reporting mental health consequences of coronavirus infection, especially long-term, are needed to improve treatment, mental health-care planning, and preventive measures during the COVID-19 pandemic. It is necessary to conduct active medical monitoring of patients post-COVID-19, and since post-COVID-19 physical and mental health problems that can reduce the quality of life can persist for three months or longer after the illness, early examination and comprehensive planning of rehabilitation of patients may be needed to effectively prevent and manage post-COVID-19 complications, which could reduce economic and clinical health consequences and prevent long-term disability [96].

#### **5. Conclusions**

SARS-CoV-2 outbreak can be considered a unique mental health disaster. Most studies have reported psychological and neuropsychological problems (anxiety and depression, PTSD, sleep problems, and cognitive problems) post-COVID-19, even in people without previously diagnosed mental health problems. PTSD is the most prevalent long-term post-COVID psychiatric condition, followed by depression and anxiety disorders.

Aside from causing physical illness, SARS-CoV-2 also has long-term negative effects on mental health. The crucial question of what causes these mental health issues cannot be precisely answered based on the information now available. They could result from the virus's direct effects on the brain and central nervous system, but they could also be brought on by the stress of being hospitalized with a disease

that is poorly understood in the midst of widespread social anxiety or by experiences like witnessing the deaths of other patients in the hospital, or family members. It is quite reasonable to conclude that psychological symptoms resulting from infection with the coronavirus last much longer than the physical symptoms of the disease.

The results of conducted scientific research on the connection between the post-COVID-19 state and mental health emphasize the need to increase the readiness and competence of health workers in detecting and managing the psychological consequences of future comparable outbreaks of infectious diseases. It is clear that care for patients with COVID-19 does not end at hospital discharge, and currently, health-care professionals caring for acute COVID-19 survivors have a key role in recognizing, carefully documenting, investigating, and managing ongoing or new symptoms, as well as monitoring of organ-specific complications that developed during an acute illness.

Ultimately, additional research is needed regarding the long-term impact of COVID-19 on mental health.

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