

Effects of the COVID-19 pandemic on mental health and cognition after isolation and reassessment of remote care. A review article

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Abstract

This article comprehensively reviews existing literature about the consequences of social isolation after the COVID-19 pandemic on mental health and cognition. The objective is to provide useful information that will help to identify the lack of data on some side effects post-pandemic. In addition, the aim is to advocate for research, which leads to evidence of these abnormalities. A search was performed in the databases Pubmed/Medline, Scopus, Science Direct, and Web of Science, from the beginning of the COVID-19 pandemic to the present. The terms used were COVID-19, isolation, cognition, remote care, mental health, age, and technology. Finally, 51 articles were selected that coincided with the terms, objectives that were relevant to the work. In addition, the articles met the methodological and validity criteria provided by the databases. Some studies were found that report various degrees of affectation in brain functions in subjects who remained isolated during the severe acute respiratory syndrome coronavirus type 2 pandemic, whether they have been infected or not. From the analysis of the distinct studies, notable differences between countries according to their economic resources, housing conditions, age, the existence of comorbidities, and emerging intervention tools such as remote care, were some of the main factors that influenced the coping strategies of individuals who were confined. Furthermore, it is evident that there remains a critical need for research employing standardized and specialized neuropsychological tests to measure cognition accurately. In the same way, investigating the effectiveness of current intervention strategies and designing those that are appropriate for each population, given the specific characteristics of the comorbidity caused by the extraordinary situation experienced by the COVID-19 pandemic.

Keywords: COVID-19. Isolation. Cognition. Remote care. Mental health.

Efectos de la pandemia de COVID-19 en la salud mental y la cognición después del aislamiento y la reevaluación de la atención remota. Un artículo de revisión

Resumen

El presente artículo revisa lo descrito hasta la fecha acerca de las consecuencias del aislamiento social tras la pandemia por COVID-19 en la salud mental y la cognición, con la finalidad de proporcionar un bagaje de información útil en el encauce de acciones para la identificación de los posibles huecos en la información y la elaboración de investigaciones que ayuden

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a esclarecer las interrogantes aún existentes. Se realizó una búsqueda en las bases de datos Pubmed/Medline, Scopus, ScienceDirect, Web of Science, del inicio de la pandemia por COVID-19 a la actualidad, utilizando los términos COVID-19, aislamiento, cognición, atención remota, salud mental, edad y tecnología. Finalmente se seleccionaron 51 artículos que coincidían con los términos, objetivo y resultaban relevantes para nuestra revisión. Los hallazgos demuestran que el daño cerebral posterior a síndrome respiratorio agudo por coronavirus tipo 2, las implicaciones en la anatomía del SN por el aislamiento, la edad, diferencias entre países, los recursos económicos, las condiciones en la vivienda y las herramientas emergentes de intervención como la atención remota, son algunos de los factores que se destacaron en los estudios. Todavía falta la implementación de investigaciones que midan la cognición con pruebas neuropsicológicas estandarizadas y especializadas. Así mismo, falta por analizar exhaustivamente la aplicabilidad de estrategias de intervención ya existentes y diseñar intervenciones adecuadas a cada población dadas las características específicas de los daños causados por la situación extraordinaria vivida por la pandemia por COVID-19.

Palabras clave: COVID-19. Aislamiento. Cognición. Atención remota. Salud mental.

Effects of social isolation due to the COVID-19 pandemic on mental health and cognition

Humans present a social nature that, through evolution, increases the probability of survival. In contemporary group dynamics, interpersonal relationships are predominantly established through oral and written communication especially when the individual is unable to relate and suffers from social isolation. Several studies show that social deprivation produces mental and emotional dysfunction, without achieving conclusive results. It has been described that loneliness in humans negatively affects their mental health, with the consequent discerning decline¹.

The COVID-19 disease is caused by severe acute respiratory syndrome coronavirus type 2 (SARS-CoV-2) and induces different clinical manifestations, although the respiratory system is the main damage, affectations have been shown in other systems. The mental effects of social segregation depend on several factors such as age, gender, educational level, extension, and especially if this was forced or by own determination, as were the preventive measures imposed in the recent COVID-19 pandemic².

Although a wide variety of symptoms have been described and numerous sequelae continue to be identified to date, those that predominate during the acute phase are headache, fever, cough, shortness of breath, muscle pain, fatigue, anosmia, and ageusia. These symptoms can be of a different magnitude (mild or severe,) when these get worse, the blood oxygenation is reduced and the patient may require hospitalization and even intubation, in these conditions; abnormalities of the nervous system (NS) are also frequently presented³.

Because of the neurotropism of the virus, which reaches the brain most likely through the olfactory epithelium,

associated neurological signs have been reported in a great number of patients such as neuroinflammation, polyneuritis, autoimmune response, or cerebral affection behind systemic alterations⁴.

Many patients who suffer mild or severe COVID-19 do not fully recover from its sequelae for weeks or even months; most of their symptoms are related to the respiratory system, NS, and cognitive and psychiatric disorders⁵. However, several studies show the consequences of social seclusion after the COVID-19 pandemic and its relationship with alterations in mental and cognitive health. Therefore, the aim of this review was to systematically analyze information related to post-COVID mental and cognitive impairments.

Effects of isolation by COVID-19 pandemic on mental health

According to the World Health Organization, mental health is defined as “a state of well-being in which a person is aware of their own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to contribute to their community.” Considering this conceptualization, it is evident that COVID-19 has profoundly altered the healthy lifestyle that has been maintained for more than 70 years, impacting the physical, social, and mental health of patients⁶.

According to reports from the Pan American Health Organization in 2021, the pandemic generated a considerable increase in risk factors associated with suicide such as abuse, difficulties in accessing health services, and unemployment, among others. A year after the pandemic began, 50% of the people who responded to the World Economic Forum survey reported a worsening of their mental health. Furthermore, suicide is positioned as the third cause of death among young people aged 20-24 in America⁷.

In 2018 the suicide rate was 5.4/100 000 inhabitants meanwhile in 2021 was 10.9 men and 2.4 women/100 000 inhabitants, positioned as the year with the highest suicide rate during the pandemic⁸.

In a study carried out where events were analyzed before and after the pandemic, they found that emergency care due to the action of self-harm without necessarily aiming at death increased by 38.4% after the pandemic. The most common mechanism of damage was the ingestion of drugs and of these, benzodiazepines were the most used, finally, when they were not drugs, alcohol was the most used substance that caused toxic effects in individuals and the mixture with benzodiazepines was common. Moreover, it was men who most frequently resorted to toxic mechanisms⁹.

Young people were especially affected with very similar effects across various countries¹⁰ and among the most prevalent disorders were stress, anxiety, depression, and suicidal tendencies, especially within vulnerable population¹¹.

Since the onset of the pandemic, confinement and restricted social contact were implemented as preventive measures. This implied avoiding crowded places, discontinuing various leisure and work activities that involved contact with others, and maintaining physical distance between individuals. In response to these directives, people found themselves confined to their homes, which then transformed into multifunctional spaces for both recreation and work and this social behavior soon became a challenge¹².

The structural characteristics and spatial layout of residences wield a significant influence on the psychological well-being of their occupants. Inadequate housing characterized by small dimensions, availability of their services, or materials can negatively impact the emotional state of its residents. Moreover, factors such as overcrowding, or a prolonged period spent within confined spaces can exacerbate mental health issues. The confinement in unsuitable living conditions during the COVID-19 emergency has been associated with anxiety and depression^{13,14}.

Furthermore, overcrowding is strongly associated with psychiatric symptoms and interpersonal conflicts in children, youths, and adults, or between them. In addition to the heightened risk of infectious-contagious disease transmission, the confinement imposed by COVID-19 has increased intra-family conflicts, and at work, it has been related to less commitment and worse performance¹⁵. The situation in New York serves as a notable example of overcrowding since there is a disproportion

between the number of square meters available and the city's population¹⁶.

Social segregation prevention measures during the COVID-19 pandemic inadvertently extended the duration that people spent together in confined spaces, thereby unexpectedly increasing the likelihood of contagion within households. Moreover, there was the coexistence of several generations in the same home, many older adults were infected by the younger ones, and this senile population was highly vulnerable; they had the strongest death rate due to the severity of the infection. Social distance could not be established in reduced housing for economic reasons; an analysis which took as reference the zip code of different areas of New York revealed that overcrowding was related to the increased rate of infections and its consequences¹⁷.

An example of populated homes is precisely the city of New York, its overcrowding rate, that is, the housing units occupied by equal or < 1 person per room in 2013 alone, was 2 times higher than the average rate in the US¹⁸.

Overcrowding is a condition that increases the complexity of the challenge in mental health care, in penitentiary centers where prison inmates are more susceptible to viral contagion. A study was conducted in France, and the following measures were implemented: personnel restructuring, cancellation of voluntary psychiatric hospitalizations, prioritization of the most serious cases, and emphasis on hygiene procedures. A significant impact of confinement on this population was found; they showed symptoms of forced withdrawal from substances, anxiety, and decompensation of those patients whose follow-up was temporarily suspended¹⁹.

In a published cross-sectional study, they found that the probability of infection was highly variable depending on the building and the neighborhood, with the highest rates of infection being in those people who lived in houses with a greater number of people and, in contrast, the lowest possibility of infection was in buildings with high values where there was also more space for living²⁰.

An investigation in Italy through online surveys of more than 1000 subjects analyzed the relationship between the duration of forced isolation and the adequacy of the living space on mental health during the COVID-19 pandemic, considering the days of confinement, the regional level of infections and the quantity and quality of social contacts. The longer the isolation was the greater the mental-health problems, and the more affected person-to-person relationships²¹.

Influence of age during isolation due to COVID-19 on mental health

A total of 103 patients from various reference centers were analyzed after 7 days of confinement, 97 of them completed the self-applied Zung anxiety scale. Subsequently, the participants were divided into groups according to age, those patients under 35 years of age were more likely to present anxiety²².

In a retrospective study, conducted in Ireland, young people aged 18 and over who were in isolation or quarantine were analyzed. Questionnaires were applied to measure post-traumatic stress, perceived stigma, and depression. The control group was those in isolation and the case group were those in isolation or quarantine for COVID-19. The total sample consisted of 502 selected subjects, contacted telephonically for questionnaire responses, with age and duration of separation identified as primary factors. The depression questionnaire was significantly correlated with isolation time, the more time isolated, the greater the symptoms of depression. It was also found that women had higher scores in depression and post-traumatic stress.

Other factors such as pre-existing mental conditions, smoking, and the place where individuals remained during isolation or quarantine were significantly correlated with depression scores, although, symptoms of depression and anguish were present in the total sample, possibly due to the confinement there were higher anxiety and depression. Moreover, these two disorders were increased in the younger participants, alongside a concurrent presence of perceived discrimination²³.

In the initial months of the pandemic were established actions to contain its spread through social distancing, the effects of this quarantine were studied in adults aged 18 and older, employing an online questionnaire. Parameters such as time in isolation, level of compliance with established norms, whether isolation was mandatory or voluntary, presence of stressors, and coping strategies were assessed. A majority of the participants were confined following local regulations contacts, with approximately 35% voluntarily isolating themselves at the time of data collection. The minimum isolation time was just over 2 weeks, and the maximum was 1 month.

The results showed a significant relationship between age and the perception of isolation. This produced worse effects in the youngest, such as poor coping strategies and work-related stressors; those who lost their jobs or consumed psychoactive substances reported elevated levels of loneliness. In addition, when analyzing

physical exercise, this was not related to the degree of isolation; the level of satisfaction with life was significantly lower in those individuals who reported greater social detachment²⁴.

Throughout history, the study of behavior in other pandemics has found in several studies that children and adolescents are more susceptible to developing mental health problems such as depression, this is due to various factors, among which, are the central NS biological immaturity, a smaller repertoire of coping strategies and specifically during the pandemic, the lack of access to resources that they normally have in the school environment such as activities and mental health services. Furthermore, adolescents at the high school level are those who presented greater depressive symptoms²⁵. According to the 2022 Mental Worldwide State Report, it is young people between 18 and 24 years of age and adults over 65 years who have considerably lower mental well-being. Age was the factor founded with the most influence, surpassing others such as gender.

Effect of isolation due to COVID-19 pandemic and his illness on cognition

In a multinational study of 57 countries across Europe, America, Oceania, Africa, and, predominantly Asia, post-traumatic stress disorder (PTSD) after COVID-19 was assessed online using the Revised Impact of Events Scale. A group with PTSD symptoms was compared with another asymptomatic group and more than 900 valid answers were obtained, approximately 70% reported being in voluntary confinement, those who did not have a partner showed a higher incidence of PTSD symptoms, and also those older than low economic income. On the African, American, Oceanian, and European continents, a larger number of people with PTSD symptoms were found and the opposite was found in Asia. Those subjects to forced containment had a greater tendency to develop these symptoms, additionally, individuals with a higher educational level exhibited a lower risk²⁶.

In 2021, another global online study was conducted during the COVID-19 confinement, a questionnaire divided into two sections was applied, the first included sociodemographic data and questions about coping mechanisms and stressors, meanwhile the second included the 21-item depression, anxiety, and stress scale, also known as DASS-21. Almost 700 evaluations were collected, and more than half of the evaluated subjects showed signs of anxiety, stress, and depression.

It was also found that the duration of confinement and lack of exercise were associated with increased stress, anxiety, and depression, whereas the presence of the family reduced stress levels. On the other hand, in Canada (America), Pakistan (Asia), and the United Kingdom (Europe) higher levels of stress, anxiety, and depression were found²⁷.

Alzueta and Cols (2020), analyzed the impact of the COVID-19 pandemic and its social restrictions or quarantines on mental health in a global population of adults between April and May 2020. The DASS-21 questionnaires for depression were administered and tested for generalized anxiety disorder-7. In addition, participants were queried on sociodemographic data and other circumstances related to the conditions in which the pandemic was happening, such as infection with COVID-19 and severity of confinement. A four-level classification was established to understand the preventive measures implemented in each country, ranging from not following specific restrictions to severe limitations, such as complete house confinement. Participants were asked to report which of these levels they had been following up to the immediate week before the study.

The survey was disseminated on social networks and a digital platform was used to answer the questionnaires, from a total sample size of 9,083 individuals across 59 countries, 6,882 subjects were selected for analysis. The results demonstrated that engagement in activities was associated with a reduction in symptoms of depression but concurrently correlated with an increase in symptoms of anxiety. Depressive symptoms were associated with separation from family or close friends and difficulties adjusting to the home office²⁸.

Cognition allows the integration of information derived from both external and internal stimuli. Studies examining community segregation and its impact on cognitive and mental health levels have approached the subject from diverse perspectives including objective and subjective or perceived social isolation²⁹. Other studies have been based on various life stages childhood, adolescence, youth, adults, and finally, senescence. Many authors agree that the immature brain during childhood and adolescence is particularly vulnerable and might be a failure in personal relationships in adult life³⁰.

Electroencephalography has revealed elevation in theta waves in reactions against social rejection³¹, meanwhile functional magnetic resonance imaging (MRI) studies identified the areas related to these negative emotions: bilateral medial pre-frontal and posterior cingulate cortex, right pre-cuneus and ventrolateral pre-frontal cortex (Fig. 1)³².

Using functional MRI has revealed which social rejection shares somatosensory representations with physical pain and identified the following areas related to a variety of negative emotions such as hurt feelings, loneliness, jealousy, guilt, shame, and anxiety; these areas were bilateral medial pre-frontal and posterior cingulate cortex, the right pre-cuneus, and the ventrolateral pre-frontal cortex³².

Research focusing on the mental health effects of social restraint during adulthood and senescence allowed us to establish a correlation between age and the decrease in executive functioning. In addition, this population has a low frequency of visits, and their friendly relationships are reduced by physical deterioration and the loss of dead partners in old age³³. Gender is a variable that is considered to determine the degree of cognitive impairment, a study published in 2020 analyzed the relationship between social confinement on memory and these subjects showed that the greater the isolation, the greater was also the affectation of memory to age³⁴. Thus, it has been demonstrated that in old age, the risk of cognitive impairment is heightened and this deterioration occurs more rapidly when individuals are in a social isolated state³⁵. In a 4-year investigation, intellectual functions related to verbal fluency and memory processes were measured at the beginning of the study and 4 years later. The analysis aimed to discern relationships between segregation, the number of personal interactions, the perception of loneliness, educational level, and cognitive function, thus, the researchers concluded that feelings of loneliness and detachment were significantly associated with poorer cognitive functioning³⁶.

Actually, there are few studies on the awareness status after COVID-19; however, notable findings have been obtained. In the USA, they were examined hospitalized patients, revealing that a quarter of them presented problems with short-term memory³⁷. On the other hand, a study in the UK showed the neurological sequelae of COVID-19 with 26% of the sample manifesting dementia-like discerning symptoms³⁸. An investigation conducted in Italy showed a strong correlation between mental health stage with fatigue and executive function impairment. Individuals who had suffered SARS-CoV-2 infection exhibited poorer performance in cognition and more symptoms such as fatigue, mood, and cognition compared to uninfected individuals³⁹.

Although the findings are limited due to the ongoing nature of the pandemic, there is preceding information about the presence of cognitive alterations after acute infections of the respiratory system such as pneumonia

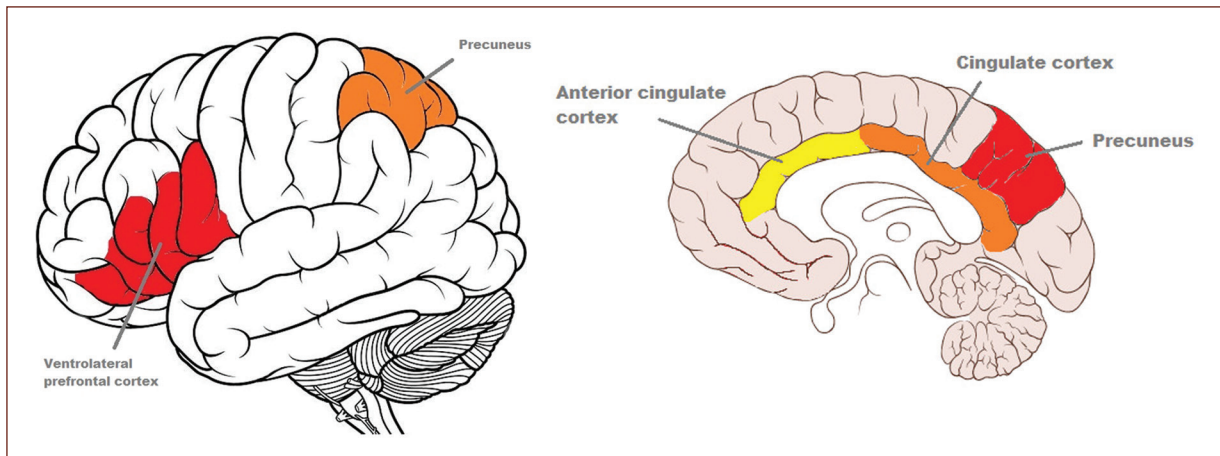


Figure 1. This figure shows the brain areas activated in fMRI studies of COVID-19 patients under isolation: the ventrolateral pre-frontal cortex, pre-cuneus, anterior cingulate cortex, and cingulate cortex in a left lateral view of the complete brain and a middle sagittal slice.

and acute respiratory distress syndrome, in COVID-19 the prolonged hypoxia accompanied by systemic damage and the viral neuroinflammation may explain these deficits⁴⁰. Therefore, there is a high risk that patients recovered from COVID-19 may experience neuropsychological alterations in executive functions and emotional state, with a strong negative impact on the quality of life and daily activities, therefore, it is crucial to provide treatment strategies to minimize these effects.

The effects on executive functions of the quarantined people positive for COVID-19 are poorly understood, however, Santangelo et al. showed that psychological symptoms and the appearance of cerebral alterations using a virtual platform that evaluated perceived failures in memory and attention, as well as resilience, styles of coping, depression, anger, and anxiety. The tests were diffused through social networks for 22 days, involving over 4,000 participants. Approximately 30% reported having perceived mental disorders at least once. Unemployed people reported a higher frequency of these alterations and resilience was identified as a crucial factor mediating symptoms of anger, depression, and cognitive alterations⁴¹.

Other studies have aimed to measure the impact of social restriction for COVID-19 on emotions and higher executive functions, even in uninfected individuals' whose significant deficits were identified⁴². Subjects with moderate cognitive impairment (MCI), confinement caused a deterioration in their daily instrumental activities⁴³. Meanwhile, in patients with diagnosed minor dementia, the pandemic prevented in-person cerebral stimulation therapies. Instead, new tools such as telecare were used, demonstrating the clinical value of technologies in such cases⁴⁴.

Impact of technology during isolation due to the COVID-19 pandemic: new lines of treatment

Generational gaps became more evident during the pandemic, the virtual environment was friendlier to young people and there were changes in the use of technological tools. A study with young people from different countries revealed an increase in the use of cell phones and social networks, as well as a decrease in sociability, which was replaced by an increase in communication through social networks. Sleeping hours increased and changed the resting schedule and heart rate, the younger spent more time in confinement, resulting in reduced physical activity^{45,46}.

Remote care was an emerging tool in the face of the health contingency, this allowed to alleviate some of the most urgent needs of the patients. Although the critical stage of COVID-19 has passed, the usefulness of this resource has been demonstrated, nevertheless; the online contact requires previous preparation. The need to avoid physical contact also made it possible to redefine therapeutic protocols, even in intensive care units, where personal interaction is very limited, moreover; remote care reduced the number of health workers for consultations⁴⁷.

During this pandemic, the concept of "Tele-health" emerged, and there was a need to use unconventional sites to provide care both virtually and by telephone, this extended beyond initial consultations to encompass follow-up appointments and even post-treatment releases. Consequently, the value of the telephone consultation to solve urgent situations was reevaluated,

and likewise, the importance of the virtual consultation. It was also shown that remote evaluation of psychiatric and cognitive alterations was possible, as well as data collection by questionnaires and interviews⁴⁸.

In the case of psychiatric patients and those with some cognitive alteration, one of the main challenges was to preserve the continuity of treatment, apart from maintaining favorable conditions in their accommodation. In the case of the pandemic, cerebral alterations have been identified both in those who were infected, as in their auxiliary, positive outcomes have been achieved for them with cognitive-behavioral therapy, this includes organization of the living space, home visits, and regular visits to COVID mental health units, which have specialized personal. In cases of hospitalized patients, family interaction must be online⁴⁹.

Although remote psychological intervention has already been successfully experimented with this new modality makes it necessary to legislate on the terms of confidentiality and privacy in a bidirectional manner⁵⁰. Much remains to be understood about the brain alterations induced by the COVID-19 virus and their long-term effects. Consequently, there is a need to propose the most suitable neuropsychological intervention based on comprehensive research.

Conclusion

After this review, factors were evidenced that enabled the identification of the most vulnerable population in the face of the secondary effects of the pandemic. They were young people, with a low level of education, who had to remain in overcrowded conditions due to the limited size of their homes and the necessity to adapt. Those who did not have the necessary resilience suffered affectation of their emotional state and their social and work performance.

Actually, in studies conducted in several countries aimed at identifying the sequelae caused by confinement post-pandemic, there was a consensus in which the greatest affectation occurred in the vulnerable population, either due to old age or the presence of comorbidities. In the same way, various studies demonstrated the persistence of lasting mental disorders, however; it is necessary to use more specific tools that allow defining the type of cognitive impairment, its severity, and particularly, its persistence and reversibility.

To better understand the long-term effects of COVID-19 on brain function, it will be necessary to conduct longitudinal studies tracking the cognitive evolution of patients who have experienced cognitive impairment. This

should involve using blood biomarkers to reveal any alterations of molecular mechanisms in living subjects and pathological analysis of homogenized brain tissue or immunocytochemical analysis of brain tissue sections in patients who have passed away.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study.

Confidentiality of data. The authors declare that no patient data appear in this article. Furthermore, they have acknowledged and followed the recommendations as per the SAGER guidelines depending on the type and nature of the study.

Right to privacy and informed consent. The authors declare that no patient data appear in this article.

Use of artificial intelligence for generating text. The authors declare that they have not used any type of generative artificial intelligence for the writing of this manuscript nor for the creation of images, graphics, tables, or their corresponding captions.

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