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## Coronavirus Ravages the Lungs. It Also Affects the Brain.

By Daniela Hernandez





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A patient in Japan had seizures. An airline worker ended up in a Detroit hospital, where doctors diagnosed her with a rare form of brain damage. Others reported auditory and visual hallucinations or losing their sense of smell and taste.

What they share: presumed or confirmed coronavirus infections.

As the number of confirmed Covid-19 cases worldwide reaches 2 million, clinicians are realizing the disease doesn't just ravage the lungs and hurt the heart. It also can, in a significant proportion of cases, affect the nervous system in myriad little-understood ways.

Through a growing number of papers, doctors around the globe are chronicling Covid-19's lesser-known neurological manifestations including brain inflammation, hallucinations, seizures, cognitive deficits and loss of smell and taste. It is unknown whether these are caused directly by the virus infiltrating the nervous system, or by the body's immune response to infection.

The hope is these reports could speed up diagnosis. Some patients say they were going out in public, potentially exposing others, due to lack of awareness of these symptoms. The reports could also open avenues of research that elucidate whether the virus gets into the brain, how long neurological symptoms might persist, and whether a full recovery can be expected.

In late March, while keeping quarantine, Dwantrina Russell noticed she couldn't smell the bleach she was using to sanitize her Houston bathroom. Since then, most of the 47-year-old business owner's symptoms of Covid-19, including fever and a violent cough, have receded. But she said she can only smell things like cleaning products or food if they are close by.

The range of effects could take decades to play out. Some epidemiological studies and lab experiments with other viruses suggest severe infections could set in motion molecular events that might increase the

## As Covid-19 cases mount, doctors are seeing patients who are experiencing symptoms like seizures, hallucinations and loss of smell and taste.

*"As we fight this illness, we're saving the lungs. We're saving the heart and we're saving the kidneys. But the brain is who we are," said Dr. Temes.*

risk of developing neurodegenerative disorders, like Alzheimer's or Parkinson's, many years later. The links are a matter of debate among neurologists and neuroscientists.

Last Friday, Chinese doctors published a study of 214 hospitalized patients in Wuhan showing that more than a third had neurologic symptoms. The most common included dizziness, headaches, impaired consciousness, skeletal-muscle injury and loss of smell and taste. The paper—published in the *Journal of the American Medical Association* and the largest to date on the disease's impact on normal nervous-system function—also documented rare, but more serious, effects including seizures and stroke, which occurs when a blood clot hits the brain.

"When this virus first came out, the general feeling was that there wasn't much in the way of neurological manifestations. This was a pulmonary process," said S. Andrew Josephson, chair of neurology at the University of California, San Francisco. "This article should open up everyone's eyes that this disorder affects the brain as well."

The novel coronavirus, called SARS-CoV-2, isn't the only virus known to affect the nervous system. Research in humans and animals has shown that non-coronaviruses such as HIV, measles and certain influenza strains can infect the brain or affect its function through inflammatory responses elsewhere in the body. Laboratory studies have shown that other coronaviruses can infect nerve cells.

Some neurologists hypothesize, based on results from animal studies, that the sometimes fatal breathing problems seen in severe Covid-19 cases might be in part due to direct infection and subsequent malfunction of the brainstem, which is involved in coordinating breathing.

"We are certainly on a learning curve in terms of understanding what the neurological manifestations would be" of SARS-CoV-2 infection, said Florian Thomas, chair of neurology at Hackensack University Medical Center in New Jersey.

On April 4, Cobain Schofield, a 25-year-old lighting technician based in Liverpool, said he realized that he couldn't smell a pungent brand of garlic bread he likes. He consulted government-run health sites, but these didn't list anosmia, the medical term for the condition, as a Covid-19 symptom, so he figured he was coronavirus-free.

Days later, he developed in his nose a "burning sensation while breathing," he

said, and a nurse at a nearby clinic told him several patients with confirmed Covid-19 diagnoses also had anosmia. He has been in quarantine since.

"Knowing now that I could have been spreading it, it's quite a horrible feeling," he said, adding that he had probably been experiencing anosmia for days before he noticed.

Whether a coronavirus infection affects the ability of receptors in the nasal cavity to detect odorants or the nerves that shuttle the odor-containing signals to the brain is unknown. Loss of smell and taste are common during other respiratory infections. (Much of what humans perceive as taste is related to smell.)

A growing number of hospitals are investigating antibody testing and blood plasma therapy as a way to combat the new coronavirus in sick patients. WSJ's Daniela Hernandez explains.

In the U.S. and elsewhere, policy makers and public-health officials have asked patients to avoid going to the hospital unless suspected Covid-19 symptoms like fever and cough don't improve, or if they have trouble breathing. Critical-care neurologists said the messaging should expand to make patients more aware of brain-related symptoms.

Symptoms like confusion, trouble speaking or numbness on one side of the body should also be red flags. Those symptoms can signal an impending stroke, which, if not treated within a certain time window, can lead to permanent brain damage, they said. Covid-19 patients are at higher risk of stroke due to the virus's impact on blood clotting.

For already hospitalized patients, doctors are running standard neurological exams that include low-tech tests like asking patients to follow simple commands, in conjunction with more high-tech diagnostics like brain imaging as needed, neurologists said.

Northwell Health, a health-care system in New York, plans to soon start using portable MRIs to monitor the brains of very sick patients, some of whom are sedated and on ventilators, according to Richard Temes, Northwell's director of neurocritical care.

The hospital system is also using another type of brain-monitoring test, known as an electroencephalogram, to ensure patients aren't having silent seizures, he said. Catching problems early increases the chances that patients' brains can fully recover.