

# Scientists identify the order of COVID-19's symptoms

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USC researchers have found the likely order in which COVID-19 symptoms first appear: fever, cough, muscle pain, and then nausea, and/or vomiting, and diarrhea.

Knowing the order of COVID-19's symptoms may help patients seek care promptly or decide sooner than later to self-isolate, the scientists say. It also may help doctors rule out other illnesses, according to the study led by doctoral candidate Joseph Larsen and his colleagues with faculty advisors Peter Kuhn and James Hicks at the USC Michelson Center for Convergent Bioscience's Convergent Science Institute in Cancer.

Recognizing the order of symptoms also could help doctors plan how to treat patients, and perhaps intervene earlier in the disease.

"This order is especially important to know when we have overlapping cycles of illnesses like the flu that coincide with infections of COVID-19," said Kuhn, a USC professor of medicine, biomedical engineering, and aerospace and mechanical engineering. "Doctors can determine what steps to take to care for the patient, and they may prevent the patient's condition from worsening."

"Given that there are now better approaches to treatments for COVID-19, identifying patients earlier could reduce hospitalization time," said Larsen, the study's lead author.

Fever and cough are frequently associated with a variety of respiratory illnesses, including Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS). But the timing and symptoms in the upper and [lower gastrointestinal tract](#) set COVID-19 apart.

"The upper GI tract (i.e., nausea/vomiting) seems to be affected before the lower GI tract (i.e., diarrhea) in COVID-19, which is the opposite from MERS and SARS," the scientists wrote.

The authors predicted the order of symptoms this spring from the rates

of [symptom](#) incidence of more than 55,000 confirmed [coronavirus](#) cases in China, all of which were collected from Feb. 16-Feb. 24, 2020, by the World Health Organization. They also studied a dataset of nearly 1,100 cases collected from Dec. 11, 2019 through Jan. 29, 2020, by the China Medical Treatment Expert Group via the National Health Commission of China.

To compare the order of COVID-19 symptoms to influenza, the researchers examined data from 2,470 cases in North America, Europe and the Southern Hemisphere, which were reported to health authorities from 1994 to 1998.

The [scientific findings](#) were published Thursday in the journal *Frontiers in Public Health*.

"The order of the symptoms matter. Knowing that each [illness](#) progresses differently means that doctors can identify sooner whether someone likely has COVID-19, or another illness, which can help them make better treatment decisions," Larsen, the lead author, said.

**More information:** Joseph R. Larsen et al, Modeling the Onset of Symptoms of COVID-19, *Frontiers in Public Health* (2020). [DOI: 10.3389/fpubh.2020.00473](#)

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