Doctors design tool to predict rapid COVID-19 decline

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Two Yale emergency physicians have designed a tool to help clinicians better identify COVID-19 patients whose condition is likely to worsen rapidly and who will need intensive care within 24 hours.

The tool, which uses predictive modeling, is called the COVID-19 severity index and is available online. To use it, emergency room doctors input just three patient parameters: rate of breathing, oxygen level, and the amount of oxygen required from a nasal cannula, a device used to deliver supplemental oxygen. A study describing the development and validation of the COVID severity index is available as a preprint on MedRxiv and has been submitted for peer review.

"This tool is designed for the very early stage of care, when healthcare workers are making decisions about where a patient is placed in the hospital," said Dr. Andrew Taylor, an attending physician in Yale New Haven Hospital's emergency department who helped design it.

A hallmark of COVID-19 has been the disease's unpredictability, said Dr. Adrian Haimovich, a resident physician in the hospital's emergency department and co-lead author of the study with Neal Ravindra, a postdoctoral fellow in internal medicine (section of cardiovascular medicine) and the department of computer science. People who may not seem dangerously sick when admitted for treatment "become much sicker in the hospital and require escalating care," he said.

Often, admitted patients with COVID-19 who experience a sharp decline in health must be moved quickly to another part of the hospital, Haimovich said. This exposes additional healthcare workers to the virus and requires the use of added resources, including multiple rooms and protective equipment. Also, he said, research shows that admitted patients who are later moved to an intensive care unit "have worse outcomes" than patients who are not transferred.

As part of a large, interdisciplinary team of physicians and researchers, Haimovich and Taylor sought to design a tool that could help doctors doing early examinations of COVID-19 patients identify which patients seemed most likely to get much sicker within 24 hours, and should be

sent directly to intensive care.

To develop the COVID severity index, the research team used data from 1,000 adults who tested positive for COVID-19 and who were treated at nine Yale New Haven Health System emergency departments from March 1 to April 22. Patients who met the criteria for critical respiratory illness within the first four hours were excluded.

To determine which patient attributes would best predict rapid decline, researchers applied various machine learning methods to patient demographics and clinical data collected in the first four hours after admittance.

Over 12% of the patients in the study worsened rapidly after hospitalization—a decline that could be predicted using the three parameters related to respiratory function.

"Going in, we thought we were going to need a lot more variables, but we were able to make this prediction using a few parameters, all in the respiratory area," he said. "This translates well to future implementation in electronic health records."

The doctors are planning a multi-institution study to further validate the index. They have made the experimental version available now. Taylor said its simplicity means it could be easily adopted by emergency departments.

Across healthcare teams, Haimovich said, there's "a daily process of innovation" happening in response to COVID-19 "that's both exhilarating and exhausting."

More information: Adrian Haimovich et al. Development and validation of the COVID-19 severity index (CSI): a prognostic tool for

early respiratory decompensation, (2020). DOI: 10.1101/2020.05.07.20094573