Immediate Release

App Determines COVID-19 Disease Severity Using Artificial Intelligence, Biomarkers

COVID-19 Severity Score, Built with Data from China and New York City, Can Help Clinicians Identify the Most At-Risk Patients

BROOKLYN, New York, Friday, June 5, 2020 – A new mobile app can help clinicians determine which patients with the novel coronavirus (COVID-19) are likely to have severe cases. Created by researchers at NYU College of Dentistry, the app uses artificial intelligence (AI) to assess risk factors and key biomarkers from blood tests, producing a COVID-19 "severity score."

Current diagnostic tests for COVID-19 detect viral RNA to determine whether someone does or does not have the virus—but they do not provide clues as to how sick a COVID-positive patient may become.

The study, "Clinical decision support tool and rapid point-of-care platform for determining disease severity in patients with COVID-19," led by John T. McDevitt, Ph.D., professor of chemical and biomolecular engineering at the NYU Tandon and of biomaterials at the NYU College of Dentistry, appears in *Lab on a Chip*, a journal of the Royal Society of Chemistry.

"Identifying and monitoring those at risk for severe cases could help hospitals prioritize care and allocate resources like ICU beds and ventilators," said McDevitt. "Likewise, knowing who is at low risk for complications could help reduce hospital admissions while these patients are safely managed at home."

"We want doctors to have both the information they need and the infrastructure required to save lives. COVID-19 has challenged both of these key areas."

Creating a Severity Score

Using data from 160 hospitalized COVID-19 patients in Wuhan, China, the researchers identified four biomarkers measured in blood tests that were significantly elevated in patients who died versus those who recovered: C-reactive protein (CRP), myoglobin (MYO), procalcitonin (PCT), and cardiac troponin I (cTnI). These biomarkers can signal complications that are relevant to COVID-19, including acute inflammation, lower respiratory tract infection, and poor cardiovascular health.

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The researchers then built a model using the biomarkers as well as age and sex, two established risk factors. They trained the model using a machine learning algorithm, a type of AI, to define the patterns of COVID-19 disease and predict its severity. When a patient's biomarkers and risk factors are entered into the model, it produces a numerical COVID-19 severity score ranging from 0 (mild or moderate) to 100 (critical).

The model was validated using data from 12 hospitalized COVID-19 patients from Shenzhen, China, which confirmed that the model's severity scores were significantly higher for the patients that died versus those who were discharged.

As New York City emerged as the epicenter of the pandemic, the researchers further validated the model using data from more than 1,000 New York City COVID-19 patients. To make the tool available and convenient for clinicians, they developed a mobile app that can be used at point-of-care to quickly calculate a patient's severity score.

A Clinical Decision Support Tool

The app has been retrospectively evaluated in the Family Health Centers at NYU Langone in Brooklyn, which serve more than 102,000 patients each year as one of the nation's largest Federally Qualified Health Center networks.

"Real time clinical decision support tools for COVID-19 can be extremely helpful, particularly in the outpatient setting, to help guide monitoring and treatment plans for those at greatest risk," said Isaac P. Dapkins, MD, chief medical officer for the Family Health Centers at NYU Langone and a co-author on the *Lab on a Chip* study.

After optimizing the clinical utility of the app at the Family Health Centers at NYU Langone in May, the researchers aim to roll it out nationwide in the coming weeks. It is possible that the COVID-19 severity score could be integrated with electronic health records, thereby providing clinicians with actionable information at an early stage for those diagnosed with COVID-19.
"We hope this tool can help identify those at high risk for adverse outcomes and reduce the health disparities present with COVID-19," said Larry K. McReynolds, executive director for the Family Health Centers at NYU Langone.

Building on Innovations in Testing

The COVID-19 severity score leverages a model McDevitt previously developed to predict outcomes for patients with cardiac disease. Cardiac health is one of several priorities of McDevitt's lab, which creates point-of-care diagnostic systems that can be programmed to test for oral cancer, cardiac disease, and now COVID-19 biomarkers.

The diagnostic system uses small, non-invasive samples—such as swabs of saliva or drops of blood from a fingertip—which are added to credit card-sized cartridges armed with bio-nano-chips pioneered by McDevitt. The cartridge is inserted into a portable analyzer that simultaneously tests for a range of biomarkers, with results available in less than half an hour.

Because this technology is currently used for research and informational purposes only, the COVID-19 app can be used with existing laboratory tests and requires oversight by an authorized clinician. However, over the next few months, McDevitt's laboratory, in partnership with SensoDx, a company spun out of his lab, plans to develop and scale the ability to test a drop of blood for COVID-19 severity biomarkers—similar to how a person with diabetes tests their blood sugar—and produce a severity score on the spot.

"With COVID-19, point-of-care testing, coupled with a decision support system, could improve how clinicians triage patients—and potentially improve their outcomes, particularly for those who need more immediate and aggressive care," said McDevitt.

In addition to McDevitt's research group at NYU College of Dentistry, the study involved collaborators from NYU Grossman School of Medicine, NYU Tandon — including Ph.D. student Deniz Vurmaz, Zhongnan Hospital of Wuhan University, and Latham BioPharm Group. The app was developed by McDevitt's laboratory and OraLiva, a company founded by McDevitt, and is available for both Apple and Android devices. The app is designated for use by authorized clinicians and is not intended for general use by patients.

About the New York University Tandon School of Engineering
The NYU Tandon School of Engineering dates to 1854, the founding date for both the New York University School of Civil Engineering and Architecture and the Brooklyn Collegiate and Polytechnic Institute (widely known as Brooklyn Poly). A January 2014 merger created a comprehensive school of education and research in engineering and applied sciences, rooted in a tradition of invention and entrepreneurship and dedicated to furthering technology in service to society. In addition to its main location in Brooklyn, NYU Tandon collaborates with other schools within NYU, one of the country's foremost private research universities, and is closely connected to engineering programs at NYU Abu Dhabi and NYU Shanghai. It operates Future Labs focused on start-up businesses in downtown Manhattan and Brooklyn and an award-winning online graduate program. For more information, visit http://engineering.nyu.edu*.*

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