Researchers break down the COVID-19 diagnostic arsenal

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Clinical research on COVID-19 has boomed in the 18 months since the disease first appeared. Countless papers have looked at the topic from almost every possible angle, including methods of detection.

For a new paper published in the journal *Clinical Microbiology Reviews,*

a team of researchers led by Concordia engineers sifted through hundreds of papers on COVID-19 detection tools and technologies. They wanted to categorize and understand what exists, what is lacking and what can be improved. The result is a thorough assessment of the field citing almost 600 separate papers that cover an extensive body of literature.

"The upsurge of publications and new technologies in a very short time made it very difficult to follow for anyone interested in the topic," says the study's primary investigator and lead author Hamid Tali, a Ph.D. student in the Department of Chemical and Materials Engineering.

"Our study looks at these technologies' performance characteristics, their challenges and the gaps in our current knowledge and future directions. We describe the lessons learned throughout the pandemic on the diagnostics of this virus, which will be helpful in the case of a future pandemic."

The authors believe that the paper provides a rich "one-stop shop" resource for people interested in the topic, including experts in clinical microbiology and non-experts who want to know more about different methods.

"Having such a comprehensive review on this gigantic subject in a single place is of great value as it will significantly save time from researchers. It will help them grasp the state-of-the-art technologies in this area as fast as possible, get inspired and directed about current challenges and better define their research objectives," Tali adds.

Sana Anbuhi, an assistant professor of chemical and materials engineering, is the paper's senior author. She and Jason LeBlanc of Dalhousie University are the corresponding authors. Zubi Sadiq and Oyejide Oyewunmi of Concordia and Carolina Camargo, Bahareh

Nikpour, Narges Armanfard and Selena Sagan of McGill University are co-authors.

ASSURED is the goal

The authors point out that the explosion of detection techniques and tools—some of questionable quality—came from the need to expand testing rapidly while supply chains were disrupted by the virus's global spread. Some techniques are more accurate; others are more affordable. Some require sophisticated lab equipment; others do not.

The World Health Organization's internationally recognized ASSURED criteria for point-of-care diagnostic devices helped them assess the various tests being used. The acronym stands for affordable, sensitive, specific, user-friendly, rapid and robust, equipment-free and deliverable to end users. This helped the researchers determine the strengths and weaknesses of the existing diagnostic tools.

"Some sensors are sensitive and specific, meaning they detect the presence of COVID-19 but they are not user-friendly or need bulky machinery and highly trained people to operate it," Anbuhi explains. She says the most effective tools in use now are nucleic acid amplification tests, which are highly effective at detecting ribonucleic acid (RNA).

Engineers for health

The researchers hope that identifying current weaknesses in our diagnostic tools will help avoid the need of adopting drastic measures like lockdowns and shuttering the economy when the next pandemic emerges.

"We hope that this will help guide researchers toward an ideal device

that can be used by anyone, anywhere at a very low cost," Tali says.

Finally, the authors note that engineers rarely publish a paper in a journal for clinical microbiologists.

"The diagnostics of COVID-19 is an interdisciplinary subject. And so writing a comprehensive review required collaboration across four different research groups, each with its own area of expertise."

Provided by Concordia University