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# NUS, NTU scientists and doctors develop new way to detect COVID-19 viral RNA in the air

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Dr Irvan Luhung of NTU's Singapore Centre for Environmental Life Sciences Engineering with the COVID-19 air sampling device. (Photo: NTU SCELSE)

SINGAPORE: Scientists and doctors from the National University of Singapore and Nanyang Technological University have developed a way to detect SARS-CoV-2 RNA in the air in indoor settings.

SARS-CoV-2 RNA refers to the nucleic acid coding for the COVID-19 virus.

The team, comprising scientists and doctors from NTU's Singapore Centre for Environmental Life Sciences Engineering (SCELSE) and NUS' Yong Loo Lin School of Medicine, trialled the method in two inpatient wards at a hospital caring for active COVID-19 patients.

The study found that their air surveillance approach produced a "higher detection rate" of environmental virus RNA, compared to surface swab samples collected in the same area, said NUS and NTU in a joint news release on Friday (Oct 8).

The study demonstrated the detection of viral RNA in the air, which is the "strength" of the device and method, said Professor Paul Tambyah, deputy director of NUS Medicine's Infectious Diseases Translational Research Programme.

"If we can put it in a place where we think that there's no COVID patients, then if you find viral RNA, then that's like doing a swab PCR for 30 people. Instead of doing a swab PCR for 30 people you're doing it just through one filter. And then you can know what are the targeted precautions that you need to take," he added.

Between February and May 2020, the team conducted the study in two hospital wards - a naturally ventilated open-cohort ward and a mechanically ventilated isolation ward.

After the COVID-19 outbreak across migrant worker dormitories last year, patients were moved to open cohort wards from single isolation rooms, and conducting the study in these wards was “much closer to what happens in the real world”, said Prof Tambyah.

“And so this was something like what we thought would happen, say if a family of infected people got on board an aeroplane, or a group of presymptomatic people walked into a conference hall for a meeting,” said Prof Tambyah, who is also President of Asia Pacific Society of Clinical Microbiology and Infection.

“The key was to find out if we could find live virus in the air. And even if we didn’t, to see whether these devices can be used to detect the virus in a public place, so that we wouldn’t need to go on a blanket lockdown or travel ban or even potential quarantine,” he added.

Beyond identifying whether there was an infected person in the room or setting, the device can help to make the assessment if the level of SARS-CoV-2 RNA is too high and generates an infection risk, said Professor Stephan Schuster, deputy centre director of SCELSE.

“Of course what we want to create is ventilation situations where it is always too low for people to be at risk.”

## HOW THE METHOD WORKS

In the wards, air sampling devices were deployed in combination with an “ultra-low biomass analysis approach” developed by the team from NTU’s SCELSE.

This approach was necessary because in ventilated indoor settings with a large air change rate, it can be “difficult” to detect a viral agent in the air, said NUS and NTU in the press release.

Air change rate refers to how often the air in a room is replaced by outdoor air. For example, the air change rate in a hospital isolation ward can be up to 14 times an hour.



Dr Irvan Luhung from NTU's Singapore Centre for Environmental Life Sciences Engineering with the air sampling devices. (Photo: NTU SCELSE)

The device is heavy but “not terribly big”, and it can be discreetly placed in a variety of locations with or without airflow to take samples, said Associate Professor David Allen, who is also with the Infectious Diseases Translational Research Programme at NUS.

The RNA that was successfully extracted from the air samples was then subjected to real-time quantitative reverse transcription polymerase chain, which has the same sensitivity as the one used for standard COVID-19 polymerase chain reaction (PCR) test samples, the press release read.

“What we found was that ... the higher flow rate improved our detection, and that we could detect the virus, most certainly, particularly when we were closer to patients,” said Assoc Prof Allen, who is also an infectious diseases clinician with the National University Health System (NUHS).

“The sampling of air was more successful than sampling of the surface. And there may be several explanations of that, but one certainly is that it's because it's more prevalent in the air than on surfaces.”

However, both air and surface samples found a high prevalence of the virus in areas that were visited by many of the patients, like the toilets, he added.

From the study's findings, healthcare workers should continue to use personal protective equipment when in proximity to COVID-19 patients, especially earlier in their illness or just before they fall ill, when they have a higher likelihood of shedding the virus, said Assoc Prof Allen.

With further evaluation, this method could be a “useful adjunct” to real-time screening locations for the virus, he added.

“Currently our turnaround time for PCR can be a little delayed but there's a lot of more rapid diagnostics in evolution that may come to become more routinely useful that may give us an answer in 30 minutes whether there's RNA, or even shorter.”

The number of devices needed for surveillance depends on the size of the space and ventilation rate, said Dr Irvan Luhung, SCELSE senior research fellow and co-lead author of the study.

For example, in a home environment with a regular air-conditioning unit, one device is probably enough. But highly ventilated settings like a hospital or bigger spaces like restaurants could need more, he added.

The study found that the furthest distance they could detect the virus at was up to 6m, said Dr Luhung. “So you can think of it as a radius of how many samplers you want to deploy in the space.”

*Source: CNA/hw(ac)*