

Coronavirus - The Missing Conversation

On Ventilation, Air Conditioning, Humidity & New Technologies

By Ashak Nathwani AM

The bottom line: it may be the air we breathe, together with the surfaces we touch, that need to be kept clean.

On my doctors recommendation I took the Covid-19 test recently since I had a dry cough. The result was negative. During the waiting period for the results it was inevitable to be nervous and at the same time carry out more research on various aspects of Covid-19. I was more than aware of the readily available information on safe-distancing and good personal hygiene practices. Being an engineer, who has been in the air conditioning industry for over 40 years, I was, and continue to be, more than interested on the potential impacts of air conditioning and ventilation on Covid-19 and of potential additional measures that need be considered if there are positive or adverse impacts.

The more one looks into this insidious coronavirus the more questions arise. For example, whilst contact tracing has enabled the tracking of Covid-19 clusters and how it has spread, there are numerous mystery cases for which there appear to be no answers for as to how the individuals caught the virus. Has ventilation (or lack of) or air conditioning played a part? To answer these questions there needs to be an acknowledgement that there is an airborne component of the coronavirus in the form of aerosols.

Where are we on the airborne debate?

There is mounting evidence suggesting that coronavirus has an element that is airborne. Converging lines of evidence indicate that COVID-19 can pass from person to person via aerosols (tiny droplets less than 5 microns), which can remain in air for longer time frames. Kim Prather, an aerosol scientist at the University of California, San Diego, suggested the virus was being transmitted in a different way from how health authorities had assumed. “For an atmospheric chemist, which I am, the only way you get there is you put it in the air and everybody breathes that air,” says Prather, who joined the commentary. “That is the smoking gun.”

An article in the New York Times on Aug 11 2020 by [Apoorva Mandavilli](#) has a similar conclusion and is entitled: *‘A Smoking Gun’ - Infectious Coronavirus Retrieved From Hospital Air*. Quote taken from this publication states: “Research team at the University of Florida succeeded in isolating live virus from aerosols collected at a distance of seven to 16 feet from patients hospitalized with Covid-19 — farther than the six feet recommended in social distancing guidelines.” The findings, being vetted by peer reviewers, have

already caused something of a stir among scientists. “If this isn’t a smoking gun, then I don’t know what is,” Dr. Marr tweeted”.

A scientific publication in *Nature* by a team of experts from University of Nebraska Medical Center, National Strategic Research Institute, and United States Air Force School of Aerospace Medicine, also has a confirmation along similar lines. “During the initial isolation of 13 individuals with COVID-19 at the University of Nebraska Medical Center, we collected air and surface samples to examine viral shedding from isolated individuals. We detected viral contamination among all samples, supporting the use of airborne isolation precautions when caring for COVID-19 patients.”

We hear of many Covid related incidents involving people travelling on planes and buses. A case study quoted in various papers and journals is about a tour-bus passenger in Hunan province in China infecting 8 of the 49 people on the bus. One of those sat 4.5 meters away from the infected person and entered and exited the bus through a different door. “That excludes the possibility of contacting each other [being] in very close contact,” says Yang Yang, an epidemiologist at the University of Florida in Gainesville, who is co-authoring a report on the case. “I think there is enough evidence for us to be very concerned in indoor environments, especially in confined spaces,” he says.

With regards to confined spaces, there is anecdotal evidence that where indoor dining has been disallowed in restaurants and pubs there seem to have been a reduced number of reported Covid-19 cases.

Ventilation and Air Conditioning Implications.

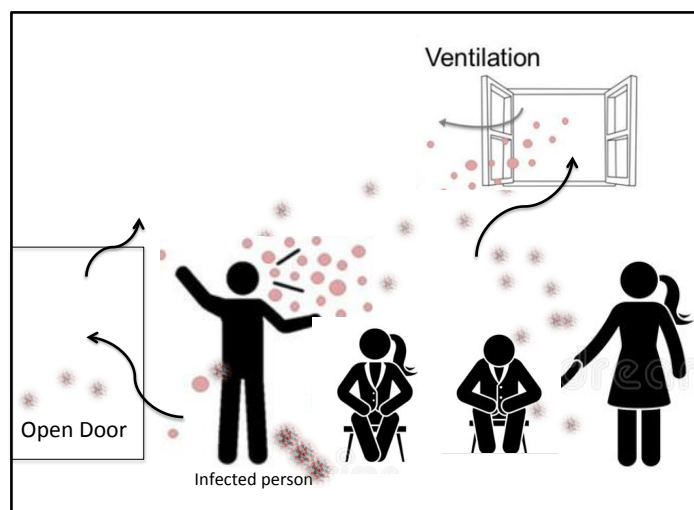
Closer to home, Director of the International Air Quality and Health Laboratory Professor Lidia Morawska from Queensland University of Technology (QUT) modeled the conditions in the rehearsal hall of the well documented case of the 61 members of the Skagit Valley Chorale gathering for a practice that lasted two and a half hours and in spite of taking all the precautions had 33 people contracting the disease resulting in 2 deaths. Morawska concluded that **inadequate ventilation**; the long exposure time and the singing were sufficient to explain the number of people who became infected.

In another situation, it appears that **air conditioning** may have played a part. Researchers used a tracer gas to show that aerosols carried on currents from an air-conditioning unit in a restaurant in Guangzhou, China, which was thought to have caused an outbreak affecting ten diners from three separate

families. None of the staff or patrons seated near other air-conditioning units was infected.

Indoor environments require ventilation to meet health codes. There is no doubt that air movement would have an impact on both the distance travelled by the airborne component of the virus as well as on the concentration levels if room air is re-circulated continuously and not diluted. Schools in particular "definitely present a challenge," says Barry Po, President of Connected Solutions for mCloud Technologies, a provider of cloud-based remote HVAC management. Many school buildings in the U.S. are old and poorly ventilated, which makes them prime locations for indoor transmission. This could also apply to some of the Aged Care and Nursing Homes.

One of the precautionary measures encouraged by ASHRAE is of increased ventilation. The following diagram shows a likely scenario with natural ventilation:

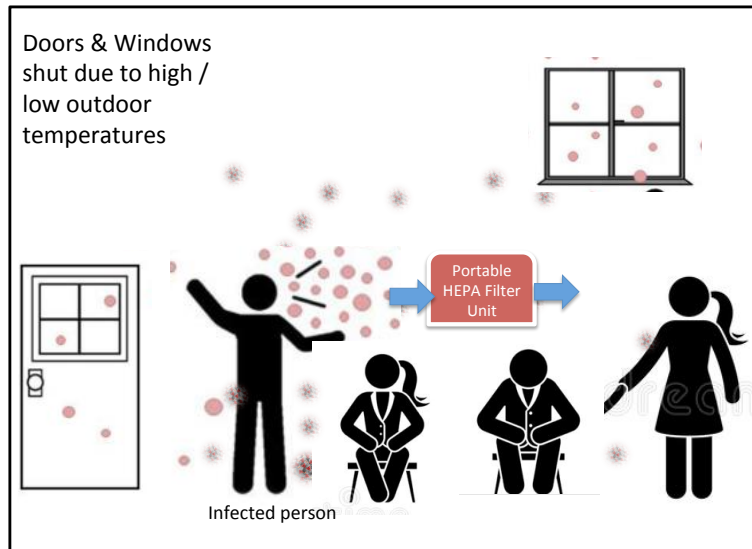


NATURAL VENTILATION
(MASK PROTECTION & SAFE DISTANCING ESSENTIAL)

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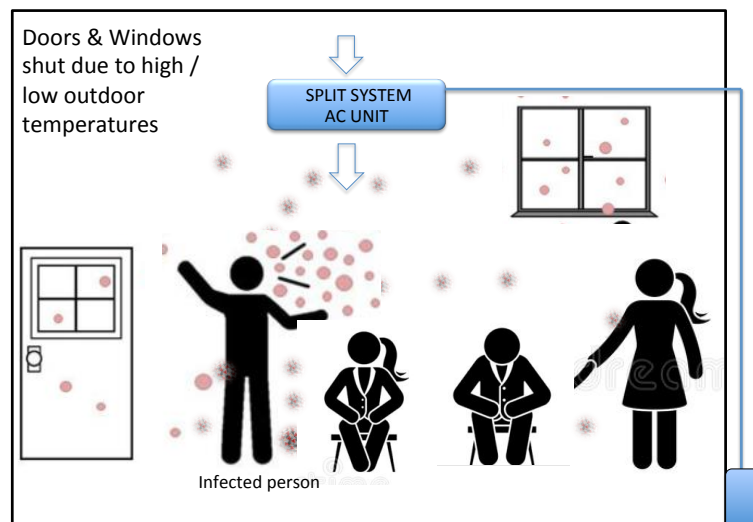
Where there is natural ventilation only and the doors and windows need to be shut due to high / low outdoor temperatures, the suggestion is to have a portable air purifier that incorporates HEPA quality air filters, to be placed in the room to clean the indoor environment on a continuous basis. For such units to be effective they need to be in operation during the gatherings, which means they need to be the quieter types.

Following diagram shows the likely application.



PORTABLE AIR PURIFIER – Potential Mitigation Strategy
 MASK PROTECTION & SAFE DISTANCING ESSENTIAL
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It is interesting to note that Professor Edward Nardell, from Harvard Medical School (HMS), who is also professor of environmental health and of immunology and infectious diseases at the Harvard T.H. Chan School of Public Health, has related climate change consequence resulting in hotter summers and colder winters, driving people indoors with reverse cycle type of air conditioning systems to breathe — and rebreathe — air that typically is little refreshed from outside. A diagrammatic version is shown below:



SPLIT SYSTEM AC UNIT WITH NO FRESH AIR INTAKE
 (MASK PROTECTION & SAFE DISTANCING ESSENTIAL)
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“States which are already using a lot of air conditioning because of high temperatures are also the places where there’s been greater increases in spread of COVID- 19, suggesting more time indoors as temperatures rise,”

Nardell said. “The same [thing] happens in winter time, with more time indoors.” .

It needs to be explained that where full fresh air is utilized to dilute the indoor air, there is higher energy consumption for cooling or heating this fresh air. However taking safety into account the extra expenditure is justifiable. One of the positives of the air conditioning system is that it provides an ability to arrest the virus in air filters with MERV rating of 13 or higher. It needs to be highlighted that for safety reasons, the cleaning or changing of the dirty (and possibly contaminated) air filter has to be carried out by trained technicians.

Humidity levels too play a role. Low humidity means the air is lighter and can carry the virus further than the safe distance requirements. With low indoor humidity the larger droplets can evaporate to become airborne. “During periods of low relative humidity, the public health system should anticipate an increased number of COVID-19 cases” according to Michael Ward from University of Sydney – Camden Campus, who has outlined in a research paper dated March 2020, the findings from evaluations carried out in NSW earlier this year. On the other hand, with higher humidity the denser moisture particles can ‘absorb’ the virus and settle on surfaces. This could be an explanation of virus clusters in meat handling plants that are fairly humid. The ideal humidity conditions to be maintained are between 40% and 60% RH as per ASHRAE.

As a member of a task team advising various organizations associated with re-opening of the premises for indoor gatherings, we have already implemented strategies involving use of full fresh air cycles, MERV 13 or higher air filters, rebalancing the air outlets to minimize any local high velocities and checking humidity levels to ensure they are within the required limits. These have been compiled using the advisory notes from ASHRAE – the international peak body on Air Conditioning and Ventilation. The team is presently investigating the use of new technologies as an additional safety measure together with the already established procedures involving maintenance of safe distance, wearing of masks and good hygiene practices.

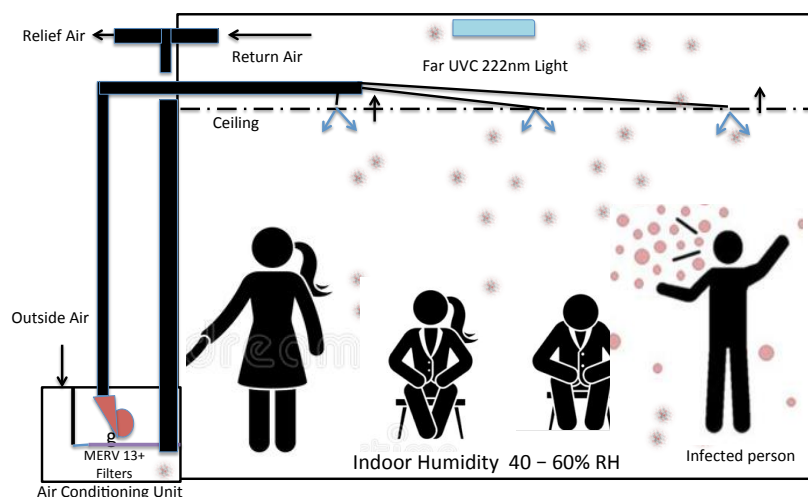
New Technologies - UVC 222 nm Lights

A more high-tech solution involves the use of specialized UV light to deactivate coronavirus in the air or on surfaces. Professor David Brenner of Columbia University demonstrated the ability of Far UVC 222 to kill 99.9% of coronavirus in a space, The details of the experiments are well documented in Scientific Reports under ‘Far-UVC light (222 nm) efficiently and safely inactivates airborne human coronaviruses’ published in *Nature* on 24th June 2020

Fred Maxik, the founder of Health Lighting, recommends Far UVC 222. Unlike the UVB rays in sunlight that can damage DNA and cause skin cancer, Far UVC 222 doesn't penetrate the human body. This is also detailed in publications by Steril Air – another supplier of UVC 222 lights. The Health system has been installed in Seattle's reopening Space Needle, as well as the practice facilities of the Miami Dolphins. "This is one of the only methodologies where we can continually clean a space in real time," says Maxik.

There is also the Marlaina's Mediterranean Kitchen, 20 minutes south of downtown Seattle where there are just two visible clues of the new UV disinfection system — a subtle glow of blue light above the black grates of the drop ceiling, and a hand-chalked sign at the door, proudly announcing to diners: "Coronavirus Disinfected Here!"

Combining the ASHRAE recommendations with this new technology, the following could be an additional precaution that could be considered:



CENTRAL AIR CONDITIONING SYSTEM WITH FULL FRESH AIR FACILITY
(MASK PROTECTION & SAFE DISTANCING ESSENTIAL)

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Conclusion: There is mounting evidence that a component of the coronavirus is airborne. From airflow and scientific perspectives there are also convincing researched demonstrations of the roles of ventilation and air conditioning with respect to potential transmission of Covid-19. There needs to be increased **conversation** on these topics to heighten the awareness with the aim of implementing appropriate measures.

The bottom line: it may be the air we breathe, together with the surfaces we touch, that need to be kept clean.