November 24, 2020

Hon. Christine Elliott
Deputy Premier of Ontario, Ontario Minister of Health and Long-Term Care

Dr. David Williams, MD, MHSc, FRCPS
Chief Medical Officer of Health, Ministry of Health and Long-Term Care

Dr. Brian Schwartz, MD, MScCh
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Dear Hon. Christine Elliott, Dr. David Williams and Dr. Brian Schwartz,

We are a group of Ontario engineers, physicians and professionals who have been following the COVID-19 developments closely. We are deeply concerned by the recent increase in cases and hospitalizations in Ontario. We urge you to update the Province's COVID-19 guidelines, regulations and public communication to reflect the importance of ventilation and to better align with the Public Health Agency of Canada's recent acknowledgment of aerosol transmission.[1] With winter approaching, our activities are moving indoors and it is therefore imperative that public institutions, workplaces and individuals understand the risk of aerosol transmission as well as the actions that can be taken to combat it.

The rapid global spread of COVID-19 has sparked unprecedented cross-disciplinary research. Contributions from the fields of engineering, aerosol science, medicine and epidemiology are driving a paradigm shift in our understanding of aerosol transmission of respiratory viruses, including COVID-19. With this evolving science, the importance of monitoring and improving ventilation in our communities has become increasingly clear.

The September 28, 2020 report by Canada's Chief Science Advisor Expert Panel on COVID-19 summarizes high-yield short-term and long-term goals to reduce indoor transmission of COVID-19 and improve indoor air quality.[2] We believe that these recommendations need to be urgently adopted by public health authorities and disseminated to schools, businesses and to the public at large. It is clear from school and corporate pandemic policies and communications that the risk of aerosol transmission is not yet fully integrated. These policies focus on deep-cleaning and two-metre physical distancing, while overlooking ventilation and air filtration.

Current evidence supports the aerosol route as an important mode of transmission of COVID-19 (Appendix A). Virus-laden aerosols can infect susceptible contacts through shared room air, but they are also concentrated at close proximity – like smoke. Control strategies targeting close-proximity transmission, such as physical distancing and mask wearing (for protection of the wearer and source control), are well-established and remain critical to reduce aerosol transmission risk. For transmission in shared room air, however, ventilation and air filtration become even more important, as expelled aerosols from breathing, talking or exercising build up in poorly ventilated spaces. We know that many buildings and residences in our communities have substandard ventilation.

To reflect the current scientific evidence, we call on Ontario's public health leaders to:

- **Update COVID-19 guidance to reflect the risk of aerosol transmission of COVID-19**

- **Engage engineers and other ventilation specialists to develop clear ventilation standards for indoor institutions and integrate these standards into the reopening guidelines for businesses with a higher risk of aerosol transmission (restaurants, bars and gyms)**
- **Mandate and fund ventilation assessments and upgrades of essential public institutions such as schools and long-term care homes**
- **Promote strategies to reduce transmission risk in private homes and businesses through clear public health messaging and education**
    - Promoting indoor mask use even when distanced, routinely opening windows to refresh the air, regular HVAC maintenance and filter replacement, turning on available vented range hoods and bathroom exhaust fans
- **Recommend and deploy carbon dioxide (CO_2) monitors as a surrogate measure of adequate ventilation**
    - During a TB outbreak, CO_2 concentrations above 1000 PPM significantly increased the risk of becoming infected with TB.[3] Improving the building ventilation to a CO_2 concentration of 600 PPM stopped the outbreak in its tracks.
- **Promote portable air filtration (HEPA) units or low-cost homemade devices using MERV-13 filters and box fans**

Specific strategies to reduce indoor aerosol transmission of COVID-19 are adeptly summarized in Canada's Chief Science Advisor Expert Panel on COVID-19 bioaerosol report[2], the Occupational Safety and Health Administration (OSHA) Alert[4], and the Harvard TC Chan Risk Reduction Strategies for Reopening Schools Report.[5]

Experts warn that future respiratory viral pandemics are likely.[6] Investing in ventilation and indoor air quality now will save lives and prevent economic hardship in the future. Santé Quebec is actively updating their guidance on ventilation in schools and is rolling out short-term measures in schools across the province.[7] Internationally, Germany is investing €500m to improve ventilation systems in public buildings.[8] The Ontario public health "sanitary reformers" of the late 1800s led the way in overcoming water-borne diseases like cholera and typhoid fever through investments in sewer systems and water treatment plants.[9] We are certain that there were those who thought the task at hand was insurmountable. When the history of Ontario's response to COVID-19 is written, we hope that our province is once again viewed as a public health innovator.

Signed,

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APPENDIX A – EVIDENCE FOR AEROSOL SPREAD OF COVID-19

- We know that 96%, 99% and 94% of particles emitted while coughing, sneezing and speaking, respectively, are < 100 µm in size[10]
- We know that small liquid particles up to 100 µm in size can float in the air for minutes to hours before settling on surfaces and are thus, by definition, aerosols[11]
- We now accept that masks are beneficial for both source control and personal protection[12]
- We understand that COVID-19 is an overdispersed pathogen,[13-14] not unlike Mycobacterium tuberculosis (TB),[15] which also spreads through aerosols. Both pathogens propagate in clusters and through superspreading events, where one person infects many others. In the case of COVID-19, 10-20% of individuals may be responsible for 80% of transmission.[16]
- We have seen a clear increased risk of transmission in crowded, poorly ventilated spaces, and from activities that increase the production of aerosols (speaking, singing, shouting, heavy breathing) [17-18]
- Consistent with the fragile enveloped structure of coronaviruses, fomite transmission is not considered to be the primary mechanism of spread[16,19]
- COVID-19 genetic material has been harvested in ventilation systems[20] and ferret studies have demonstrated COVID-19 infections through the aerosol route[21]
- We now recognize that ventilation is an important factor in preventing the spread of COVID-19 indoors[22]

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