

Alternatives to minimised airborne transmission of COVID-19 in enclosed environments

Aim:

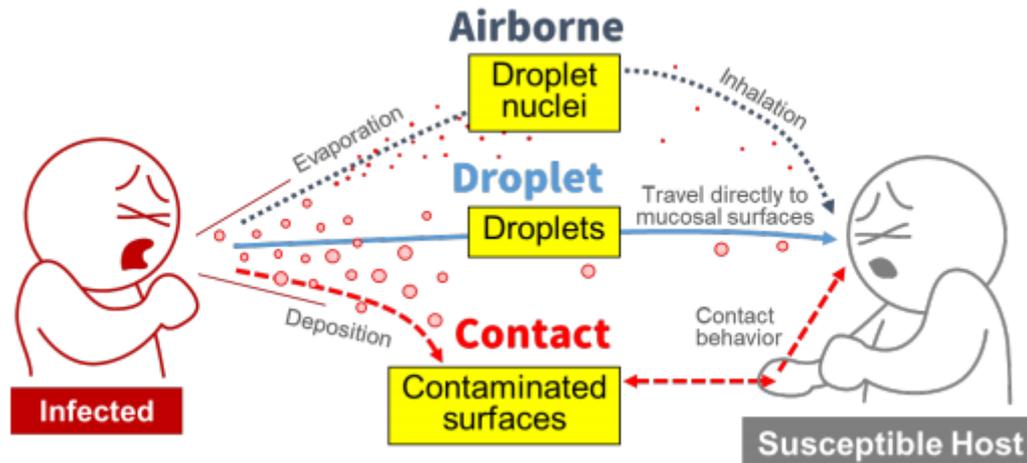
lower the overall environmental concentrations of airborne pathogens (small airborne micro-droplets, commonly referred to as “aerosols”) and reduce the spread of infection by the airborne route (Morawska et al., 2020).

Disclaimer:

This summary has been made to report essential information to facilitate a safe return to research in the area of Human Movement Analysis. It is intended to offer a guidance regarding best practices in practical assessment procedures performed in the Lab, with the aim to minimize the risk of exposure of COVID-19 for participants and researchers involved. Furthermore, the information here reported has been retrieved from different international entities as The World Health Organization (WHO), The European Centre for Disease Prevention and Control (ECDC), The US Centers for Disease Control and Prevention (CDC), The Federation of European Heating, Ventilation and Air Conditioning Associations (REHVA), The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) based on the available scientific knowledge of COVID-19 available. And it has no intention to substitute any current policy imposed by your current Government and/or Institution.

Acknowledgment:

This document was developed as a 3DAHM initiative in collaboration with the Interuniversity Centre of Bioengineering of the Human Neuromusculoskeletal System, in the person of Dr. Amaranta Orejel Bustos.



Notes: The image describes the three possible modes of transmission regarding the novel coronavirus: droplet infection, contact infection, and airborne infection. From “Role of ventilation in the control of the COVID-19 infection: Emergency presidential discourse”, by The Society of Heating, Air-Conditioning and Sanitary Engineers of Japan, p.3 (https://www.aij.or.jp/jpn/databox/2020/20200323_Eng_final.pdf). Copyright 2020 by SHASE.

How to reduce the risks of airborne transmission?

In addition to the PPE and administrative controls as measures to mitigate COVID-19 transmission risks in buildings, also recommendations for ventilation solutions as the main ‘engineering controls’ are important, especially in enclosed environments. In this regard, ASHRAE (The American Society of Heating, Refrigerating, and Air-conditioning Engineers), REHVA (Federation of European Heating, Ventilation and Air Conditioning Associations) and SHASE (The Society of Heating, Air-Conditioning and Sanitary Engineers of Japan) have been updated to address the spread of COVID-19.

For detailed information on the recommended building-related measures, click in the following links:

ASHRAE	https://www.ashrae.org/File%20Library/About/Position%20Documents/Airborne-Infectious-Diseases.pdf https://www.ashrae.org/file%20library/technical%20resources/covid-19/guidance-for-re-opening-buildings.pdf
REHVA	https://www.rehva.eu/activities/covid-19-guidance/rehva-covid-19-guidance
SHASE	https://www.aij.or.jp/jpn/databox/2020/20200323_Eng_final.pdf

The **REHVA** guidance provides temporary, easy-to-organise measures that can be implemented in buildings that are in use during or after the epidemic with normal or reduced occupancy rates. It summarizes the main evidence and conclusions by The European Centre for Disease Prevention and Control (ECDC) guidance for public health authorities in EU/EEA countries and the UK on the ventilation of indoor spaces in the context of COVID-19. Furthermore, it provides building services related precautions depending on HVAC (Heating, Ventilation, and Air Conditioning) or plumbing systems related factors to minimize the spread of COVID-19.

Summary of the 15 recommendations that can be applied in existing buildings at a relatively low cost to reduce the number of cross-infections indoors.

1. Provide adequate ventilation of spaces with outdoor air
2. Switch ventilation on at nominal speed at least 2 hours before the building opening time and set it to lower speed 2 hours after the building usage time
3. At nights and weekends, do not switch ventilation off, but keep systems running at a lower speed
4. Open windows regularly (even in mechanically ventilated buildings)
5. Keep toilet ventilation in operation 24/7
6. Avoid open windows in toilets to maintain the right direction of ventilation
7. Instruct building occupants to flush toilets with closed lid
8. Switch air handling units with recirculation to 100% outdoor air
9. Inspect heat recovery equipment to be sure that leakages are under control
10. Adjust fan coil settings to operate so that fans are continuously on
11. Do not change heating, cooling and possible humidification setpoints
12. Carry out scheduled duct cleaning as normal (additional cleaning is not required)
13. Replace central outdoor air and extract air filters as normal, according to the maintenance schedule
14. Regular filter replacement and maintenance works shall be performed with common protective measures including respiratory protection
15. Introduce an IAQ sensor network that allows occupants and facility managers to monitor that ventilation is operating adequately.

WHO | Summarized Ventilation Strategies for ensuring adequate ventilation in public buildings:

- Consider using natural ventilation (i.e., opening windows if possible and if it is safe to do so) to increase dilution of indoor air by outdoor air when environmental conditions and building requirements allow.
- Ensure adequate ventilation and increase total airflow supply to occupied spaces, if possible.
- If heating, ventilation and air conditioning (HVAC) systems are used, they should be regularly inspected, maintained and cleaned. Rigorous standards for installation and maintenance of

ventilation systems are essential to ensure that they are effective and safe. The same applies to monitoring the condition of filters.

- For mechanical systems increase the total airflow supply and the percentage of outdoor air, such as by using economizer modes of HVAC operations (potentially as high as 100%). First verify compatibility with HVAC system capabilities for both temperature and humidity control as well as compatibility with outdoor/indoor air quality considerations.
- Disable demand-control ventilation (DCV) controls that reduce air supply based on temperature or occupancy.
- Consider running the HVAC system at maximum outside airflow for 2 hours before and after times when the building is occupied, in accordance with the manufacturer's recommendations.

References:

Morawska L., Tang, J. W., Bahnfleth, W., Bluysen, P. M., Boerstra, A., Buonanno, G., Cao, J., Dancer, S., Floto, A., Franchimon, F., Haworth, C., Hogeling, J., Isaxon, C., Jimenez, J. L., Kurnitski, J., Li, Y., Loomans, M., Marks, G., Marr, L. C., Mazzeella, L., ... Yao, M. (2020). How can airborne transmission of COVID-19 indoors be minimised?. *Environment international*, 142, 105832. <https://doi.org/10.1016/j.envint.2020.105832>

REHVA, 2020. COVID-19 Guidance.

SHASE, 2020. Role of ventilation in the control of the COVID-19 infection: Emergency presidential discourse. The Society of Heating, Air-Conditioning and Sanitary Engineers of Japan (SHASE).

WHO reference number: WHO/2019-nCoV/Adjusting_PH_measures/Schools/2020. Retrieved from <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance-publications>