Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

COVID-19 transmission—up in the air

Design Cells/SPL

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For more on **SARS-CoV-2 transmission by fomites** see **Correspondence** *Lancet Infect Dis* 2020; published online Sept 20. https://doi.org/10.1016/S1473-3099(20)30678-2

For more on **airborne transmission and aerodynamic behavior** see https://science.sciencemag.org/content/370/6514/303.2

For more on **particle sizes of infectious aerosols** see **Viewpoint** in *Lancet Respir Med* 2020; **8:** 914–24

For more on the **WHO advice for the public** see https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public

For the **statement on airborne transmission of COVID-19** see https://academic.oup.com/cid/advance-article/doi/10.1093/cid/ciaa939/5867798

For more on the **CDC brief on potential airborne transmission** see https://www.cdc.gov/coronavirus/2019-ncov/more/scientific-brief-sars-cov-2.html

For more on **CDC guidance of face masks on public transport** see https://www.cdc.gov/quarantine/masks/mask-travel-guidance.html

As we approach the end of 2020, and a year since the outbreak of COVID-19 began, cases are increasing again. We have learnt a lot about SARS-CoV-2 and our ability to test for and manage COVID-19 has improved, but ongoing debate remains about how SARS-CoV-2 is transmitted.

Respiratory viruses are transmitted in three main ways. First, contact transmission, where someone comes into direct contact with an infected person or touches a surface that has been contaminated. Second, through droplet transmission of both large and small respiratory droplets that contain the virus, which would occur when near an infected person. Third, through airborne transmission of smaller droplets and particles that are suspended in the air over longer distances and time than droplet transmission.

During the initial stages of the pandemic there was concern about surface transmission. However, latest research suggests that this is unlikely to be a major route of transmission as although SARS-CoV-2 can persist for days on inanimate surfaces, attempts to culture the virus from these surfaces were unsuccessful.

Infection control guidelines have stated that most respiratory virus transmission occurs from large infected droplets produced by coughing, sneezing, and breathing in close proximity to another person. This understanding has led to social distancing being the cornerstone of public health advice, but confusion exists as to the safe distance required between people to reduce transmission with the WHO suggesting 1 m and the CDC and NHS saying 2 m. For social distancing to be effective, infective respiratory particles would need to fall to the ground or be in low enough concentrations at 2 m from the source to not cause transmission. Studies and guidelines have historically used a threshold of 5 μm to differentiate between large and small particles, but researchers are now suggesting that a size threshold of 100 μm better differentiates aerodynamic behaviour of particles, and particles that would fall to the ground within 2 m are likely to be 60–100 μm in size. Investigators have also measured particle sizes of infectious aerosols and have shown that pathogens are most commonly found in small particle aerosols (<5 μm), which are airborne and breathable.

Initially it was thought that airborne transmission of SARS-CoV-2 was unlikely, but growing evidence has highlighted that infective microdroplets are small enough to remain suspended in the air and expose individuals at distances beyond 2 m from an infected person. This knowledge is also corroborated by investigation of spread of cases between people who were not in direct or indirect contact, suggesting that airborne transmission was the most likely route. In July, over 200 scientists published a statement calling for international bodies to recognise the potential for airborne spread of COVID-19 as they were concerned that people would not be fully protected by adhering to the current recommendations.

On Oct 5, 2020, the CDC updated their COVID-19 webpage to say that there is growing evidence that COVID-19 infection can occur from airborne exposure to the virus under certain circumstances. Cases of transmission from people more than 2 m apart have occurred but in enclosed spaces with poor ventilation, and typically with extended exposure to an infected person of more than 30 min. The CDC have been clear to point out that most infections are spread through close contact and that airborne transmission is not the primary route of transmission.

Whether droplet or airborne transmission is the main route, the risk of infection is known to be much lower outside where ventilation is better. As winter approaches in the northern hemisphere, the opportunity to socialise and exercise outdoors becomes more challenging and concerns are growing over the increased risk of transmission of COVID-19. Public health guidance now needs to advise people how to navigate risk in indoor settings and wearing facemasks is becoming mandatory in many countries for travelling on public transport, indoor shopping, and gatherings. Facemasks and shields offer protection from larger droplets but their effectiveness against airborne transmission is less certain. Advice on spending time indoors should also focus on improved ventilation and avoiding crowded spaces.

As 2021 draws near, people are getting tired of the disruption the pandemic has brought to their lives and their willingness to adhere to strict rules and lockdowns might wane. As cases of COVID-19 increase globally, we need to more fully understand the transmission routes. It is crucial that we embrace new research and do not rely on recommendations based on old data so that clearer and more effective infection control guidance can be provided in the face of pandemic fatigue.

■ *The Lancet Respiratory Medicine*