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Covid-19 has redefined airborne transmission

Improving indoor ventilation and air quality will help us all to stay safe

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Over a year into the covid-19 pandemic, we are still debating the role and importance of aerosol transmission for SARS-CoV-2, which receives only a cursory mention in some infection control guidelines.[1 2]

The confusion has emanated from traditional terminology introduced during the last century. This created poorly defined divisions between "droplet," "airborne," and "droplet nuclei" transmission, leading to misunderstandings over the physical behaviour of these particles.[3] Essentially, if you can inhale particles—regardless of their size or name—you are breathing in aerosols. Although this can happen at long range, it is more likely when close to someone, as the aerosols between two people are much more concentrated at short range, rather like being close to someone who is smoking.[4]

People infected with SARS-CoV-2 produce many small respiratory particles laden with virus as they exhale. Some of these will be inhaled almost immediately by those within a typical conversational "short range" distance (<1 m), while the remainder disperse over longer distances to be inhaled by others further away (>2 m). Traditionalists will refer to the larger short range particles as droplets and the smaller long range particles as droplet nuclei, but they are all aerosols because they can be inhaled directly from the air.[5]

Why does it matter? For current infection control purposes, most of the time it doesn't. Wearing masks, keeping your distance, and reducing indoor occupancy all impede the usual routes of transmission, whether through direct contact with surfaces or droplets, or from inhaling aerosols. One crucial difference, however, is the need for added emphasis on ventilation because the tiniest suspended particles can remain airborne for hours, and these constitute an important route of transmission.

If we accept that someone in an indoor environment can inhale enough virus to cause infection when more than 2 m away from the original source—even after the original source has left—then air replacement or air cleaning mechanisms become much more important.[6 7] This means opening windows or installing or upgrading heating, ventilation, and air conditioning systems, as outlined in a recent WHO document.[8] People are much more likely to become infected in a room with windows that can't be opened or lacking any ventilation system.

A second crucial implication of airborne spread is that the quality of the mask matters for effective protection against inhaled aerosols. Masks usually impede large droplets from landing on covered areas of the face, and most are at least partially effective against inhalation of aerosols. However, both high filtration efficiency and a good fit are needed to enhance protection against aerosols because tiny airborne particles can find their way around any gaps between mask and face.[9 10]

If the virus is transmitted only through larger particles (droplets) that fall to the ground within a metre or so after exhalation, then mask fit would be less of a concern. As it is, healthcare workers wearing surgical masks have become infected without being involved in aerosol generating procedures.[11 -13] As airborne spread of SARS-CoV-2 is fully recognised, our understanding of activities that generate aerosols will require further definition. Aerosol scientists have shown that even talking and breathing are aerosol generating procedures.[14 -16]

It is now clear that SARS-CoV-2 transmits mostly between people at close range through inhalation. This does not mean that transmission through contact with surfaces or that the longer range airborne route does not occur, but these routes of transmission are less important during brief everyday interactions over the usual 1 m conversational distance. In close range situations, people are much more likely to be exposed to the virus by inhaling it than by having it fly through the air in large droplets to land on their eyes, nostrils, or lips.[17] The transmission of SARS-CoV-2 after touching surfaces is now considered to be relatively minimal.[18 -20]

Improved indoor air quality through better ventilation will bring other benefits, including reduced sick leave for other respiratory viruses and even environmentally related complaints such as allergies and sick building syndrome.[21 22] Less absenteeism—with its adverse effect on productivity—could save companies significant costs,[23] which would offset the expense of upgrading their ventilation systems. Newer systems, including air cleaning and filtration technologies, are becoming ever more efficient.[24]

Covid-19 may well become seasonal, and we will have to live with it as we do with influenza.[25] So governments and health leaders should heed the science and focus their efforts on airborne transmission. Safer indoor environments are required, not only to protect unvaccinated people and those for whom vaccines fail, but also to deter vaccine resistant variants or novel airborne threats that may appear at any time. Improving indoor ventilation and air quality, particularly in healthcare, work, and educational environments, will help all of us to stay safe, now and in the future.

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