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# Airborne SARS-CoV-2

## Time for an indoor air revolution

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Debate over the exact mode of transmission of SARS-CoV-2 has been intense.[1] This is entirely reasonable, given that the mechanism of spread determines preventive and potentially lifesaving policies. But the choice between respiratory aerosol or droplet settled on short range droplets, which neatly circumvented any risk outside the fabled 2m zone.[1] This choice gave rise to social distancing, hand and surface hygiene, and masks, but not to improved indoor air quality.

And so the debate smoulders on, as Duval and colleagues (doi:10.1136/bmj-2021-068743) report from their linked systematic review supporting the role of long distance airborne transmission of SARS-CoV-2.[2] The review examined covid-19 transmission events in a variety of indoor community settings ranging from fitness facilities, offices, buses, and restaurants to choir venues and a church, but not hospitals, hospices, or care homes.[2-8] The inclusion of care home outbreaks might have strengthened overall findings, along with more recent studies detailing nosocomial clusters among vaccinated healthcare workers.[9 10]

Study selection was, of necessity, somewhat labile, because any outbreak inferring even the slightest possibility of contact or fomite transmission would have been excluded. This might explain the omission of notable community outbreaks,[11-13] including those where the virus almost certainly spread through sanitation systems in high rise flats.[14 15] This opportunistic transmission route is reminiscent of the notorious Amoy Gardens outbreak of SARS-1 in Hong Kong.[16]

SARS-CoV-2 survives in faeces, urine, and waste water, and aerosol transmission through interconnected sanitary drains (just as for SARS-1) needs further exploration.[17] Viral spread in toilet facilities might not feature in the literature, but that does not mean the risk should be ignored. Faecal aerosols might have played an important role in transmission during the covid-19 pandemic, especially as diarrhoea is common among infected patients and viral shedding persists in stool despite negative respiratory sample results.[17 18]

Arguably, Duval and colleagues' review should also have mentioned studies reporting aerosol transmission of SARS-CoV-2 between animals.[19-21] Given that similar studies on humans would never obtain ethical approval, these investigations—which virtually all support long distance aerosol spread, skilfully emulate the original work on tubercle transmission from the early 1960s.[22 23] This work was eventually accepted by the scientific community as evidence for airborne transmission of tuberculosis in humans—despite the fact that *Mycobacterium tuberculosis* has never been successfully cultured from air. It is hoped that SARS-CoV-2 and its proclivity for airborne transmission will be accepted a little quicker than it was for tuberculosis. Influenza might have to wait.[22]

Of course, some argue that reliance on observational events is poor science. But a role clearly exists for detailed epidemiology in respiratory outbreaks, simply because it provides empirical validation that aerosol transmission occurs, and in fact occurs extensively.[22] As Duval and colleagues surmise, there is a need to develop a new framework for evidence synthesis of outbreak investigations.[2 24 25] Either that, or more than a century of detailed epidemiological work identifying the cause of disease outbreaks and tracking the spread of notable pathogens must be ignored. After all, who would choose to inhabit the "control" environment in a randomised trial examining the protective effect of fresh air during an influenza outbreak?[26] It is laudable to seek solid scientific evidence, but when a disease spreads so rapidly, we really should not have to wait for randomised evidence that might never materialise.[27]

Just as the world woke up to a pandemic, a small group of determined scientists (including this author) appealed for consideration of airborne spread.[28] Their advice was summarily dismissed.[1] And so the group—in common with the pioneers of tuberculosis transmission—"provided an ingredient that scientists seldom mention: a mission to convince unbelievers."[29]

Now, the evidence presented in Duval and colleagues' review, tenuous as it is, validates the premise that tiny respiratory particles containing SARS-CoV-2 freely transmit throughout inadequately ventilated environments. That this small group of scientists have (almost) won their argument is of small consolation to those still experiencing the effects of covid-19. But through persistence and escalating independent evidence, better indoor air quality can be entertained for everyone in the future.[30] It is hoped that public health leaders will develop practical guidance and "tilt" people and places closer to safety.[31] Now, indeed, is the time for an indoor air revolution.[32 33]

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