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TRANSMISSION OF SARS-COV-2

Quantifying transmission risk of SARS-CoV-2 in different situations

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SARS-CoV-2 is transmitted mainly through short and long range airborne transmission.[1 2] The omicron variant shows faster transmission and greater vaccine escape than previous variants.[3] Further measures are needed to contain transmission.

In 2020 we argued in The BMJ that "rigid safe distancing rules are an oversimplification based on outdated science."[4] We produced risk charts for SARS-CoV-2 transmission incorporating multiple variables: indoors versus outdoors (and level of ventilation if indoors), room occupancy (low or high), time spent together (short or long), vocalisation (silent, speaking, shouting, or singing), and masking (yes or no).

We have now developed a mathematical model to quantify further these relative risks with updated data.[5] Our model, which assumes a single enclosed space in which virus containing aerosols exhaled by a single infected human mix rapidly, is based on models developed for infectious disease spread through the air (such as measles[6]). It takes account of the disease specific emission rate of virus carrying particles, the increase in emission of viral particles with vocalisation and exercise, room volume, room occupancy (assumed to be stable and continuous), rate of particle removal either naturally (through, for example, opening windows) or mechanically (through, for example, replacement with outdoor air or filtration), and the efficiency with which virus carrying particles penetrate masks.

Details of these calculations are published in the technical paper.[5] One of the attack rate charts from the resultant model is reproduced in a linked table (https://docs.google.com/document/d/1BWWCpUWiPIlntWRFfPwqBSa1Z777KFIl/edit), with an interactive risk calculator made available online (http://tinyurl.com/COVID-Tables).[7]

Findings strongly affirm the validity of the low, medium, and high risk social situations set out in our original paper in *The BMJ*,[4] with the addition of exercise whereby heavy breathing greatly increases both viral emission and viral intake. The model, however, does not account for all variables—notably, overlapping breathing zones between individuals and known airflow heterogeneity indoors.[8]

As transmission escalates despite vaccination, fuelled by shedding from asymptomatic carriers,[9] we should note the perils of mixing unmasked in crowded and under-ventilated indoor spaces, especially when singing or exercising. When prevalence decreases after the current wave, more activities will become low risk.

Competing interests: None declared.

Full response at: https://www.bmj.com/content/370/bmj.m3223/rr-28.

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