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Infectivity of exhaled SARS-CoV-2 aerosols is sufficient to transmit covid-19 within minutes

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Background

Exhaled SARS-CoV-2-containing aerosols contributed significantly to the rapid and vast spread of covid-19. However, quantitative experimental data on the infectivity of such aerosols is missing. Knowing the emission rates of infectious viruses from normal respiratory activities enables more accurate modelling of disease transmission in indoor environments.

Method

We collected the exhaled aerosols from breathing, talking and singing, respectively, from 38 individuals with covid-19 using a BioSpot (Aerosol Devices), and cultured the aerosol samples that contained detectable levels of SARS-CoV-2 RNA. In another setting we collected exhaled aerosols from one individual with covid-19 using a cascade impactor to determine the size distribution of SARS-CoV-2 RNA in aerosol. Then, we used the size distribution and the emission rates in an indoor air inhalation model to calculate the time needed to inhale one infectious dose.

Results

50% of the 38 individuals had detectable levels of SARS-CoV-2 RNA in the exhaled aerosol samples. From three individuals, six aerosol samples were culturable, of which five were successfully quantified using TCID₅₀. The source strength of the three individuals was highest during singing, when they exhaled 4, 36, or 127 TCID₅₀/s, respectively. Calculations with an indoor air transmission model showed that if an infected individual with this emission rate entered a room, a susceptible person would inhale an infectious dose within 6 to 37 min in a room with normal ventilation.

Conclusion

Our data show that exhaled aerosols from a single person can transmit covid-19 to others within minutes at normal indoor conditions.

Primary author: ALSVED, Malin (Lund university)

Co-authors: NYSTRÖM, Kristina (Sahlgrenska Academy, Gothenburg); THURESSON, Sara (Lund university); NYGREN, David (Lund university); PATZI-CHURQUI, Marianela (Sahlgrenska Academy, Gothenburg); HUSSEIN, Tareq (University of Helsinki); FRAENKEL, Carl-Johan (Lund university); MEDSTRAND, Patrik (Lund university); Prof. LÖNDAHL, Jakob (Lund university)

Presenter: ALSVED, Malin (Lund university)

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Moderators: Donald Milton and Lidia Morawska