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Exhaled viruses and particles during acute upper respiratory infection

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Abstract

Background

Respiratory virus infection affects millions of humans every year, having a large economic and societal impact. The current study aims to investigate the particle size distribution, concentration, and viral RNA of exhaled aerosols from approximately 150 participants.

Methods

Subjects with recent onset of respiratory infection breathed, vocalized, and coughed into a funnel collection setup feeding the exhaled aerosols to instruments for collecting particles and measuring CO₂, H₂O, and dry particle size and concentration (0.3-20 µm). Collected particles were analysed by qPCR for virus gene detection. After the subject recovered from the infection, the experiments were repeated. An infectivity assay of exhaled samples is planned for spring 2026.

Results

At time of writing, 17 subjects performed the first visit while infected, and 12 subjects also did the healthy return visit. Preliminary data on particle concentration during early virus infection of the 2 first subjects indicate very low particle emissions during breathing, 500-5000 particles/L during vocalization, and 2000-4000 particles/L while coughing. Of 11 analysed nasopharynx samples, 64% had a rhinovirus/enterovirus infection, and 57% of those exhaled detectable levels of rhinovirus/enterovirus RNA.

Conclusion

During the COVID-19 pandemic we learned that aerosol transmission contributed to disease transmission of SARS-CoV-2, especially in the early phase. It is likely that other acute respiratory infections also can spread through aerosol transmission, which would have implications for infection prevention strategies throughout society. The outcomes from this study will contribute to a better understanding of acute respiratory infections' ability to spread via aerosol transmission.