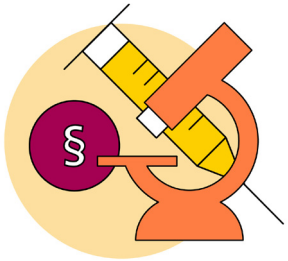

Airtracker: monitoring viral transmission in the classroom

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The COVID-19 pandemic, caused by the SARS-CoV-2 virus has brought back into focus the modes of transmission of respiratory viruses and how viral spread can be minimized by preventative measures. While this is a topic that is critical to society as a whole, surprisingly few studies have been conducted that address this subject area, in part due to difficulties in detecting air-borne viral particles. The SARS-CoV-2 virus, influenza viruses and other respiratory viruses are transmitted by exhaled, infectious droplets and there is growing evidence that long-range transmission by fine aerosols (respiratory particles < 5 µm) may play a role in SARS-CoV-2 viral particle spread, in addition to transmission via larger aerosols, more recently defined as respiratory particles > 100 µm[1,2].

Fine aerosols are thought to be particularly problematic for transmission as they persist in the air longer than larger aerosols, accumulating in indoor spaces. Fine aerosol transmission may be of particular relevance in confined spaces such as school classrooms, where individuals are often with poor ventilation. How high is the transmission of respiratory viruses in school classrooms? Does mask-wearing or air-cleaning impact this transmission rate? What are the effects of such intervention measures on the mental well-being of school students?

In January 2022, an MCID-funded project was initiated by a multi-disciplinary team of University of Bern researchers: Institute for Social and Preventive Medicine (ISPM), Department of Infectious Diseases (Inselspital Bern), Institute for Infectious Diseases (IFIK), and the Institute of Educational Science (IES). The aim of the project was to understand better the transmission of SARS-CoV-2 in school rooms and the extent to which schoolroom transmission is reduced by the wearing of masks and by air cleaners. Determining the extent to which such measures can reduce viral transmission is highly important. There is a strong wish for schools to be kept open even during periods of high viral transmission, with concerns that school closures can negatively impact student well-being and mental health, particularly in adolescents. Measures that are demonstrated to limit viral transmission while allowing students to continue in-person teaching may thus prove valuable in specific instances or as standard procedure during peaks of respiratory virus transmission.

The aim of this study, now entering a second phase of sampling, is to provide data to inform decision making by educational and public health authorities. Required ethical approval for this project was acquired before its commencement and students/parents gave their permission for involvement in the study, by way of providing saliva samples and being assessed for emotional well-being. All data collected was anonymized.

The project team collected data in two secondary schools over a seven-week study period. Epidemiological data were collected in five classes, and environmental and molecular data were collected in two classrooms. Data collected included confirmed/suspected cases of respiratory infections, air quality data (including CO2 levels and aerosol concentrations) and detection of viral particles in saliva and aerosol samples. The above parameters were assessed in conditions without any transmission prevention measures, as well as during a phase of government-mandated compulsory mask-wearing and in the presence of air cleaners.

The transmission model based on collected data revealed an average risk of becoming infected with SARS-CoV-2 in the school classes analysed of 3% during the mandated mask-wearing period compared to 14% when no intervention measures were in place, aside from regular window-opening. In the presence of air cleaners, the risk was reduced to 11%, reflecting a significant but modest effect of air cleaning on transmission. Molecular analysis of saliva and airborne samples detected SARS-CoV-2 throughout the study and occasionally other respiratory viruses. Aerosol and particle matter mass concentrations were significantly reduced by both mask wearing and air cleaning. These findings mirrored similar observations made in a previous artificial simulation study[3].

This data strongly suggests that both mask-wearing and air cleaning can reduce viral transmission in a classroom setting. While it is not proposed that such measures are adopted on a continuous basis in schools, this study suggests that the wearing of masks and cleaning of air in classrooms may be beneficial in periods of high viral transmission.

While this can be assessed to some degree by country-wide or more local data on current respiratory virus infection rates, an ideal situation would be the regular monitory of environmental factors in sentinel classrooms that may reveal poor air quality or even significant viral load in respiratory particles and would trigger adoption of prevention measures on a temporary basis. Results of this study will be submitted to a peer-reviewed journal and sampling is underway to provide a second dataset for further analysis.

An additional aspect of this MCID-funded project involves the assessment of the emotional well-being of school students during a pandemic situation and the associations of different control measures on this well-being status. This data, collected using a questionnaires on student habitual well-being in school and a series of standardized items assessing daily affective experiences, is currently being analysed. Preliminary results do suggest that student well-being was neither negatively affected by wearing masks nor air cleaning.

References

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