

Air cleaners and pandemic preparedness

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Air cleaners and pandemic preparedness

The impact of air cleaning in Dutch primary schools: study design of the Clean Air for Everyone (CLAIRE) study

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Introduction

The SARS-CoV-2 pandemic increased awareness of airborne biological hazards, especially in high-occupancy environments like classrooms. Engineering interventions, such as increased ventilation and mobile air cleaners have been suggested to offer a solution to possibly reduce bio-aerosol levels and airborne transmission. While most studies focus on testing air cleaner efficacy in controlled environments with artificial aerosols, real-world data is limited. This study aims to evaluate the impact of air cleaners, equipped with two modes of action, on bio-aerosol levels in primary school classrooms.

Methods

A randomized controlled trial is conducted, with classrooms within a school as the randomization unit. At each school, sets of three classrooms with similar building characteristics are selected, and classrooms are randomly assigned to one of the three study regimes: 1) intervention with high efficiency particulate air (HEPA) filter air cleaners, 2) intervention with air cleaners using an alternative technology, and 3) no intervention (control). Eight brands of air cleaners are available, clean air delivery rate is determined prior to placement in a laboratory setting. Power calculations showed the need to include 13-20 schools with three repeated samples each. Airborne bio-aerosols are collected passively with electrostatic dust fall collectors (EDCs) attached to the ceiling. Samples are replaced every three weeks. Continuous monitoring of particulate matter (PM₁₀, PM_{2.5}, PM₁), CO₂, temperature and relative humidity is conducted with sensors. Student absenteeism is recorded, and parents are asked to report respiratory health of children before and during intervention via an online survey. Following DNA and RNA extraction of EDCs, levels of total 16S, *S. aureus*, *S. epidermis*, *S. salivarius*, *M. catarrhalis*, Influenza A/B and RSV are quantified by qPCR.

Results

Thus far, 75 classrooms across 12 primary schools were included, resulting in over 300 bio-aerosol measurements with on average two three-week intervention periods per classroom. Sensor measurements were easily implemented. Laboratory analysis has been started. Collecting information from parents has proven to be challenging, with limited responses.

Conclusion

The study design will allow to investigate impact of air cleaners on PM and bio-aerosol levels in real-life settings, taking variation over time and between schools into account. A second round of sampling will start in the fall of 2024.