Title: Reductions in exposures to simulated respiratory aerosols by a ceiling-mounted HEPA air filtration unit—Dataset description

Dataset Number:

Introduction

Supplemental air filtration can reduce indoor exposure to hazardous aerosols without requiring modifications to building heating, ventilation, and air conditioning (HVAC) systems. Portable air cleaners were widely used during the COVID-19 pandemic, but they can have drawbacks including noise, space obstruction, and electrical cord safety considerations. Built-in air filtration units are an alternative to provide supplemental air filtration. We conducted a case study of a HEPA air filtration unit installed in the ceiling of a conference room using radial laminar flow or square cone ceiling air supply diffusers. A respiratory aerosol simulator exhaled aerosol particles (0.3 to 10 µm), and the particle concentrations were measured in the personal breathing zones of three breathing simulators representing a speaker and two meeting participants. For the speaker, using one square cone supply diffuser reduced inhalation exposure by 49% to 81% while using two square supply diffusers reduced exposure by 68% to 93%. For the participants, the exposures were reduced by 23% to 64% with one square supply diffuser and 58% to 86% with two square supply diffusers. Results when using the radial supply air diffusers were more variable and more dependent on the simulator layouts. Combining the use of cloth face masks on all simulators with the ceiling unit reduced the speaker's exposure by 87% to 99% and the participants' exposures by 84% to 97%. In most cases the ceiling air filtration unit provided protection against simulated respiratory aerosol particles comparable to that seen previously with portable air cleaners.

Data Collection Methods

1. Aerosol Particle Generation
    a. 5% w/v KCl aerosolized via single jet Collison nebulizer, dried, and neutralized.
2. Simulator airflows
    a. Cyclic breathing at 15 L/min
3. Aerosol Particle Measurement
    a. The room was purged of aerosol particles as much as possible before starting the experiments.
    b. Optical particle sizers (OPS; Model 3330, TSI) alongside the mouth of each breathing simulator measured the aerosol concentration by continuously drawing an aerosol sample at 1 L/min.
    c. The optical particle sizers reported the aerosol particle number concentration (# particles/cm^3) at 1 Hz in 16 logarithmically spaced size bins from 0.3 to 10 µm.
    d. Data was collected for 60 minutes after the source began exhaling aerosol particles.

Citation

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