The Dispersion of Micron-Sized Aerosolized Particles Under Variable Air Environments: Implications in Respiratory Disease Transmission

Watchmaker, Max (School: University School of Milwaukee)

Micron-sized aerosols which are the dominant mechanism of spread for influenza and tuberculosis are implicated as the likely mode of transmission for COVID-19. This study examines whether aerosolized micron-sized droplets typical of the size which carries COVID-19 will remain suspended for sufficient time to spread in a classroom and whether measures such as open windows or exhaust fans will reduce their concentration. This study utilized a custom-built HEPA (high-efficiency particulate air) filter/fan to scrub suspended particles from the environment. A triangular pyramid of 3 mirrors mounted to a rotating platform swept a 532nm continuous laser beam across an arc of 120 degrees. A jet nozzle designed to generate micron-sized particles aerosolized a glycerin/water solution at a student desk in the second row of the classroom. A Nikon D7100 DSLR camera was used to obtain images (f3.5, 6-second exposure) at 30 second timed intervals for 5 minutes for each of four different air conditions (still air, room air-conditioning running, window exhaust fan on, windows open). Study results demonstrate that particles spread widely in still air as well as with forced-air room air-conditioning running. Particle levels were statistically reduced by 70% ($p<.01$) when the exhaust fan was running and reduced by 94% ($p<.01$) when windows were opened compared with when windows were closed and air-conditioning was running. This study demonstrates that straightforward and readily implemented measures to reduce particle concentration in an indoor environment may help reduce transmission of respiratorily spread diseases and might be applicable during the current waves of variant strains, seasonal influenza, and future novel viruses.

Awards Won:
Third Award of $1,000