Improving teaching and rehearsal environments to lower COVID-19 risks

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“Sitting ducks”

- High aerosol producing activity
- Smaller rooms (impacting ability to maintain safe distancing) with variable/unknown ventilation
- Common surfaces (doors, pianos, music stands) frequently touched
- Contact with multiple individuals per day
- Health history and hygiene habits of each person contacted differ (and may be unknown)

Environmental means to reduce risk

- Air changes per hour (ACH)
- Increasing fresh air
- HEPA filtration
- CO2 meters to track ventilation
- Air changes between lessons/rehearsals
- Lesson duration

Understanding the acronyms

- ACH – Air Changes per Hour
- HVAC - Heating, Ventilation, and Air Conditioning
- MERV - Minimum Efficency Reporting Value
- HEPA - High Efficiency Particulate Air filters
- ASHRAE - American Society of Heating, Refrigeration, and Air Conditioning Engineers
- CADR – Clean Air Delivery Rate
- CFM – Cubic Feet per Minute

Air Changes Per Hour

- Volume of air added to or removed from a space in one hour, divided by the volume of the space
- Higher is better – better dilution or removal of potential infectious aerosolized particles (all kinds – not just COVID-19), reducing exposure time (and therefore risk)
- "To reduce far-field airborne transmission of SARS-CoV-2 in small-volume indoor spaces…suggestions include targeting 4 to 6 air changes per hour, through any combination of the following: outdoor air ventilation; recirculated air that passes through a filter with at least a minimum efficiency rating value 13 (MERV 13) rating; or passage of air through portable air cleaners with HEPA (high-efficiency particulate air) filters."
  (Allen JG, Ibrahim AM. Indoor Air Changes and Potential Implications for SARS-CoV-2Transmission. *JAMA.* 2021;325(20):2112–2113. doi:10.1001/jama.2021.5053)

Fresh Air

- Opening windows – best option if possible
- Larger buildings – HVAC systems introduce fresh air and exhaust recirculated air on a percentage basis continuously
- Larger public buildings – recirculated air is filtered for particulate removal with no less than a MERV 8 filter (see ASHRAE standard 62.1-2019, section 5.9)
- Air change rate in public buildings is a mix of fresh and filtered air (equivalent air changes based on filter efficiency)

HEPA Filtration

- Filters meeting the HEPA standard must remove from the air that passes through at least 99.97% of particles with a diameter = 0.3 microns, with filtration efficiency increasing for particle diameters smaller and larger than 0.3 microns. HEPA filters capture pollen, dirt, dust, moisture, bacteria, smoke particles (0.2-2.0 microns), viruses (0.02-0.3 microns), and submicron liquid aerosols (0.02-0.5 µm). HEPA filters can capture some viruses and bacteria ≤0.3 µm.
- Can be a cost effective (and portable!) means to increase the equivalent ACH in a room
- See "What kind of HEPA filter unit do you need"
- Look at the Clean Air Delivery Rate (CADR) value for smoke to see how many cubic feet per minute (CFM) the unit can filter. Compare to room volume.

CO_2 Meters

- Doesn't tell you anything about potential viral load in a room, but can provide real-time info on ventilation in a studio
- Measures carbon dioxide levels in parts per million (current atmospheric level is ca. 420 ppm – see https://www.co2levels.org/)
- CO2 rises with (a) poor ventilation, (b) increased number of persons in a room, (c) increased physical activity level of persons in the room
- CDC recommends 800 ppm as a good threshold (see https://www.cdc.gov/coronavirus/2019-ncov/community/ventilation.html)

Air changes between lessons/rehearsals and lesson duration

- If at all possible, know your room air change rate
- At 6 ACH, one air change is 10 min
- After an unvaccinated singer, allow at least one air change (recall HEPA filtering can increase the effective number of ACH)
- Limit lesson lengths to 30 minutes if singer is unvaccinated (see recommendations in Stockman, et al https://scholar.colorado.edu/concern/file_sets/9s161736t)

Control what you can control

- Get vaccinated
- Continue all good hygiene habits – distancing, masking, hand cleaning, surface cleaning
- Relatively inexpensive environmental interventions
  - Opening windows! Free
  - HEPA units $100-$250
  - CO2 meters $100-$165
- Air changes between students and control lesson length
- Can make a marked difference in reducing risk
- Benefits teachers, collaborative pianists, vaccinated and unvaccinated persons with whom they come into contact

Thank you!

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