

VIRAL AEROSOL TRANSMISSION – FACT SHEET FOR PRE-K-12 SCHOOLS

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Summary

The SARS-CoV-2 virus that causes COVID-19 spreads through the air via small aerosol particles.¹ Aerosols linger in the air – like smoke – in small and poorly ventilated spaces. People inhale these aerosols and catch the virus. High-quality, well-fitting masks should be worn 100% of the time indoors unless additional intense mitigation efforts are in place to improve air quality. A “dream team” of international experts in viral transmission summarized practical mitigation techniques for schools in a recent video, with key points below.²

Masking Indoors

Masking

People who are unmasked indoors while contagious can transmit the virus to others who are in the room at that time or several hours later.^{2,3} High-quality, well-fitting masks reduce the risk that a contagious person will exhale virus into the air.⁴ Examples of high-quality masks include these: KN95, KF94, N95, N99, N100, P100.

Obstacles to Masking

Lunches, snacks, hydration, and other unmasked activities should be outdoors if possible.¹⁻⁴ Maintaining indoor masking 100% of the time may be impossible (e.g., naps) or impractical (e.g., lunch on rainy days). Thus, additional intense mitigation efforts are needed.

Intense Mitigation for Indoor Unmasked Activities

HVAC Systems

HVAC systems should be retrofitted to use MERV-13 or better filters.^{2,5} The goal is to reach 4-6 air changes per hour (ACH).^{2,5} Thermostats should be set to “on” rather than “auto” to maintain ventilation.

CO₂ Monitoring as a Proxy for Air Quality

CO₂ monitoring can be used to estimate the extent to which people are breathing each other’s exhaled air and, thus, at risk of breathing viral aerosols when unmasked with a contagious person.^{2,6-9} Portable CO₂ monitors, such as the Aranet4, can be used in populated areas to measure CO₂ levels. As a baseline, CO₂ levels outdoors are about 400 parts per million (ppm), so levels indoors >400 characterize exhalation-related risk. For example, relative to a room with CO₂ levels at 600 ppm (200 over baseline), a room with 800 ppm (400 over baseline) would have about twice the risk of viral transmission if people are unmasked. A room with 3,000 ppm would result in 13 times the risk of transmission. Levels >800 ppm suggest a potential HVAC problem that should be investigated. Dr. Hoerger has an Aranet4 and has been surprised by results on campus.

Air Filters to Improve Safety During Meals and Naps

Unmasked activities should be outside where feasible.¹⁻³ Where infeasible, windows and doors should be opened wide.^{1,2,3,10} HEPA filters should be used nearby unmasked activities because the filters catch the virus, supplementing HVAC systems.^{1,2,11,12} Do-It-Yourself (DIY) air filters, such as the popular Corsi-Rosenthal box, have outperformed \$900 HEPA filters at less than 10% of the cost.¹³ Several K-12 schools have built large fleets of Corsi-Rosenthal boxes for classrooms and indoor cafeterias.¹⁴⁻¹⁹ At least 3 Corsi-Rosenthal boxes are already on the Tulane campus, and they are an excellent science project for children.

Key References

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SUPPLEMENTAL FIGURES

Visual Depiction of Airborne Viral Transmission

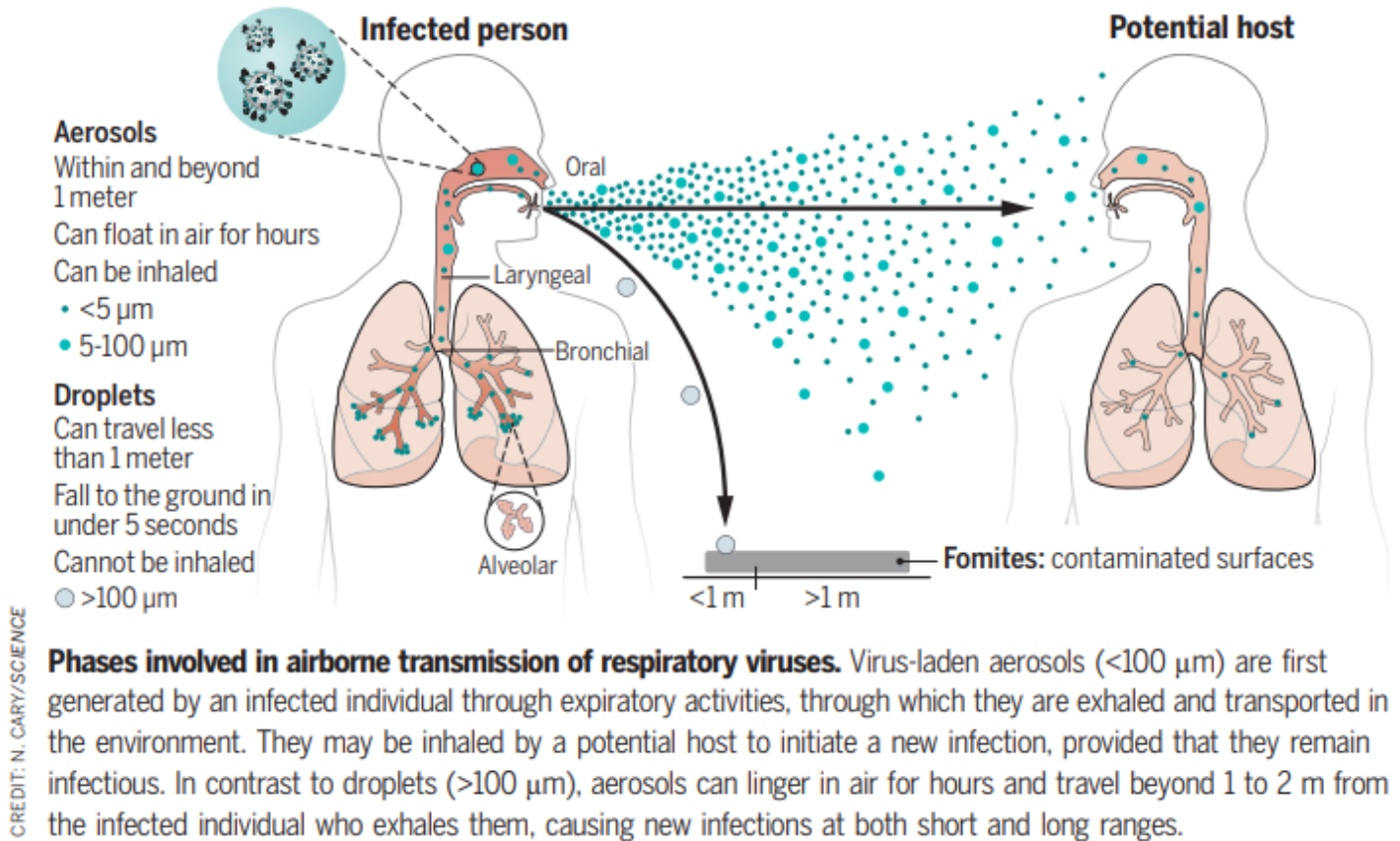


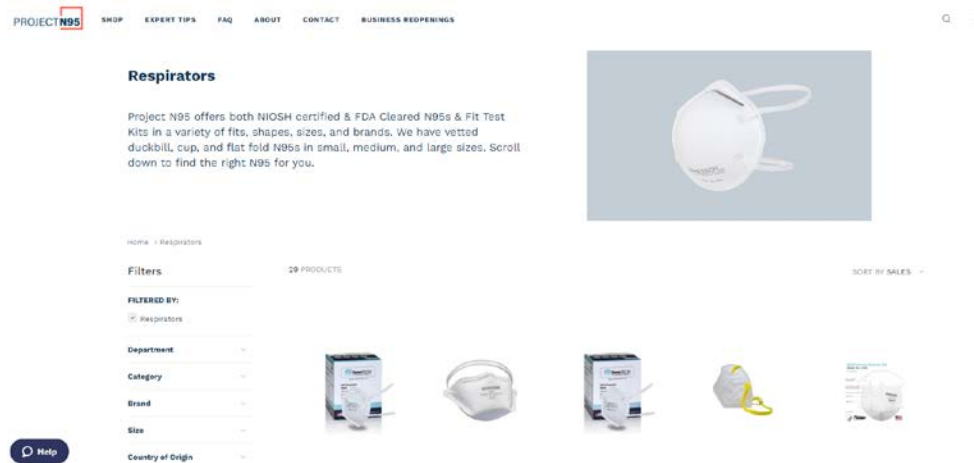
Figure from Wang et al. (2021)² available via [sci19.com](https://www.sci19.com)

High-Quality Masks

Adult N95s

Project N95 sells small-batch high-quality N95 masks for adults. Additionally, it can be less expensive at times to order directly from manufacturers (e.g., Aegle) if they offer free shipping or bulk order discounts. An Aegle foldable N95 sell for about \$1 each typically.

<https://shop.projectn95.org/respirators/>



Example Options for Young Children

Vida sells FDA-registered KN95 masks for kids. If the straps are tightened, they can fit children as young as 2-3 years old.

<https://shopvida.com/>



Flomask makes an elastomeric (elastic, well-fitted headband) mask with N100 equivalent filtration for children ages 2-12.

<https://flomask.com/>



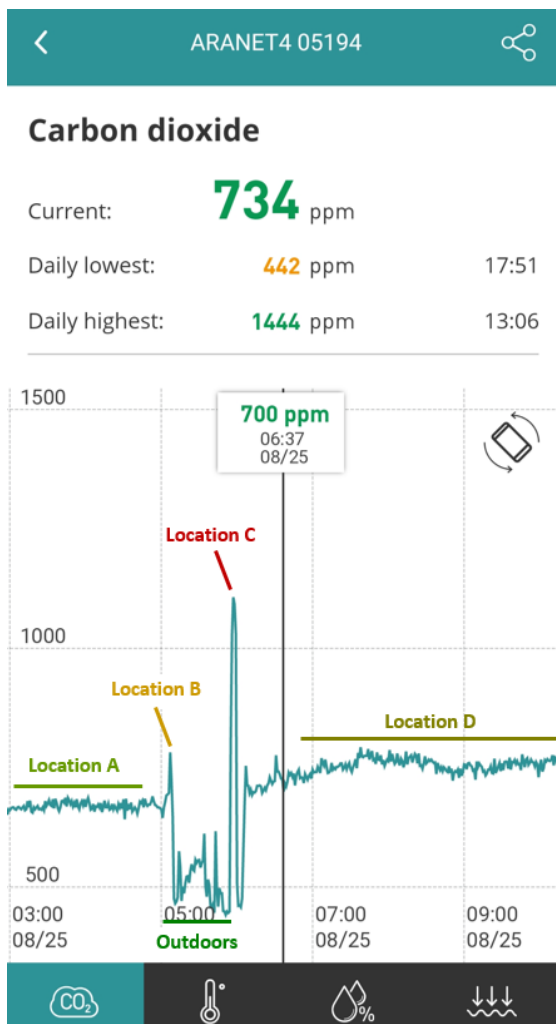
CO₂ Monitoring

Aranet4 Device

<https://www.amazon.com/Aranet4-Home-Temperature-Ink-Configuration/dp/B07YY7BH2W>

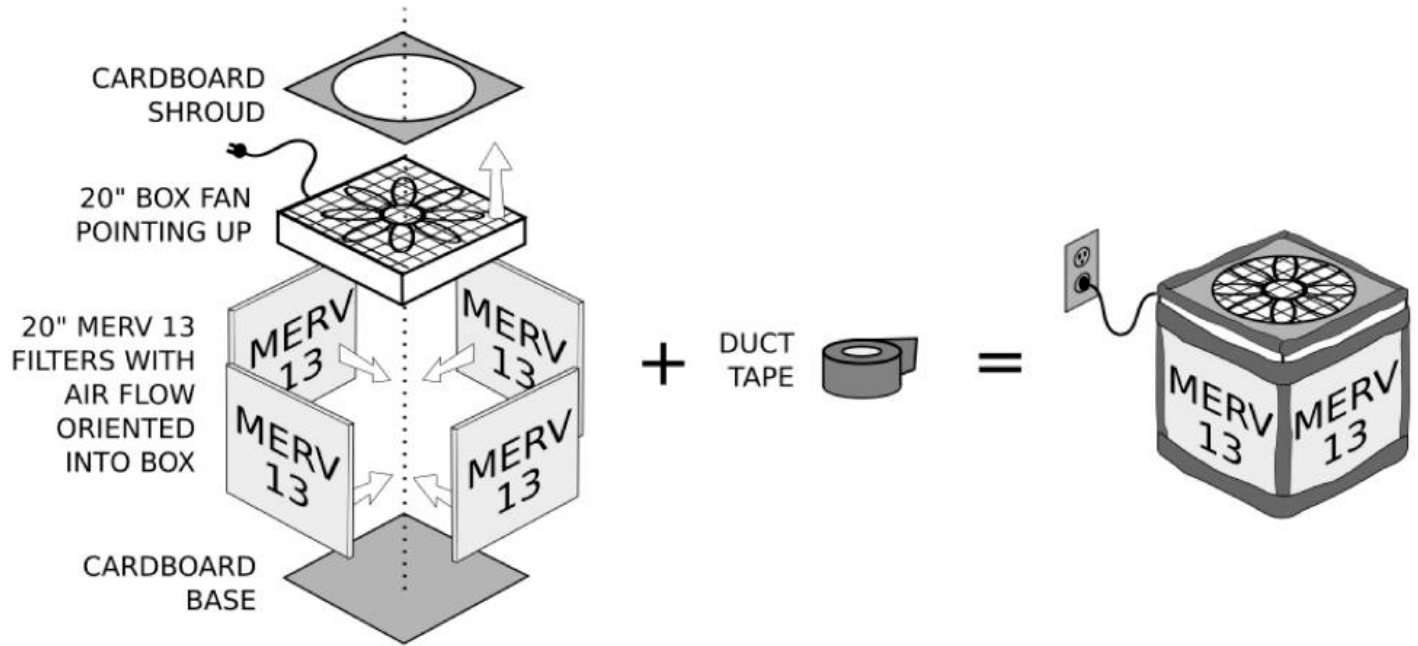


Sample Graph of CO₂ levels at Different Locations on the Tulane Campus



Corsi-Rosenthal Boxes

Construction Instructions for Cube Model



Examples Built and Used on Tulane's Campus

Cube (4 x 1" MERV-13 filters)



Stand-up single-filter version (4" MERV-13 filter)



Examples of Mass Construction of DIY Corsi-Rosenthal Boxes at Schools

