



Airborne Transmission of SARS-CoV-2

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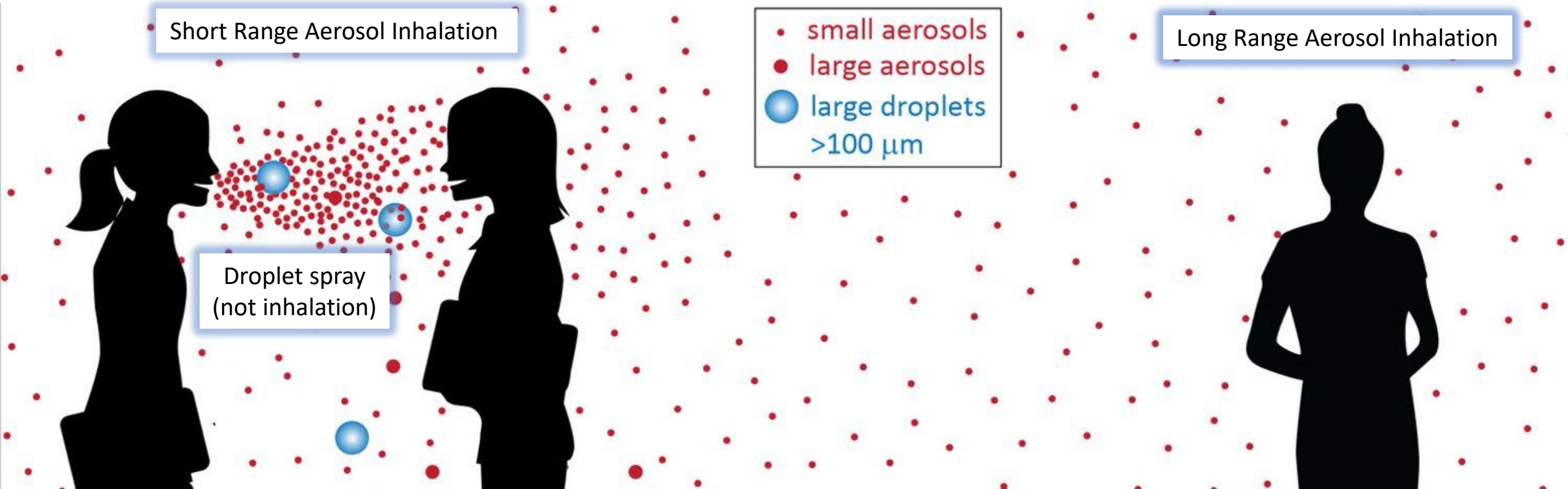
October 7, 2021

How can we safely re-open U.S. Schools with the Delta variant?

- COVID-19 is transmitted mostly in infectious aerosols produced in speech which can be inhaled
- Challenges in re-opening schools with the Delta variant
- Are there effective ways to control the airborne spread of SARS-CoV-2 in schools?
- Considerations in re-opening SD Unified (pre-Delta and current)
- How can we ensure a school is safe to re-open? What questions can parents ask? How can parents and teachers be better advocates? How can we unify across major groups to leverage and unify efforts?

Airborne Transmission of SARS-CoV-2

Tang, J. W.; et al, Dismantling myths on the airborne transmission of SARS-CoV-2. *Journal of Hospital Infection* 2021, 110, 89-96. (Graphic by Dr. Linsey Marr)



Speaking, singing, breathing [coughing/sneezing] produce

many more aerosols than droplets at close range

Aerosols (<100 μm) can **float (smoke)** and accumulate in room for hours

Droplets (>100 μm) **drop (cannonballs)** w/in 6 ft

Delta has 1000x viral load: Nearly as contagious as chicken pox

Once airborne pathway is acknowledged, it becomes a fixable problem

Shift focus to cleaning the air

Mail 9:13 AM Mon Mar 22 theatlantic.com

A Popular Latest *The Atlantic*

Hygiene Theater Is a Huge Waste of Time

People are power scrubbing their way to a false sense of security.

JULY 27, 2020

 **Derek Thompson**
Staff writer at *The Atlantic*

July 27, 2020



GETTY / THE ATLANTIC

Goldman, E., Exaggerated risk of transmission of COVID-19 by fomites. *The Lancet Infectious Diseases* 2020, 20 (8), 892-893. (July 3, 2020)

CDC: Infection from surface contamination is low

Science Brief: SARS-CoV-2 and Surface (Fomite) Transmission for Indoor Community Environments

Updated Apr. 5, 2021 Languages Print

The principal mode by which people are infected with SARS-CoV-2 (the virus that causes COVID-19) is through [exposure to respiratory droplets carrying infectious virus](#). It is possible for people to be infected through contact with contaminated surfaces or objects (fomites), but the risk is generally considered to be low.

CDC April 5, 2021

Response to a case in an indoor environment

When a person with suspected or confirmed COVID-19 has been indoors, virus can remain suspended in the air for minutes to hours. The length of time virus remains suspended and is infectious depends on numerous factors, including viral load in respiratory droplets or in small particles, disturbance of air and surfaces, ventilation, temperature, and humidity [27, 28, 29, 30, 31](#). Wearing masks consistently and correctly can substantially reduce the amount of virus indoors, including the amount of virus that lands on surfaces [32](#).

Based on limited [epidemiologic](#) and experimental data, the risk of infection from entering a space where a person with COVID-19 has been is low after 24 hours. During the first 24 hours, the risk can be reduced by [increasing ventilation](#) and waiting as long as possible before entering the space ([at least several hours](#), based on [documented airborne transmission cases](#)), and using personal protective equipment (including any protection needed for the cleaning and disinfection products) to reduce risk. [Certain techniques](#) can improve the fit and filtration effectiveness of masks [32](#).

CDC April 5, 2021

Riskiest locations are indoors, no masks, talking (or exertion)

Also, confined spaces like cars, elevators, bathrooms....

How about eating lunch?

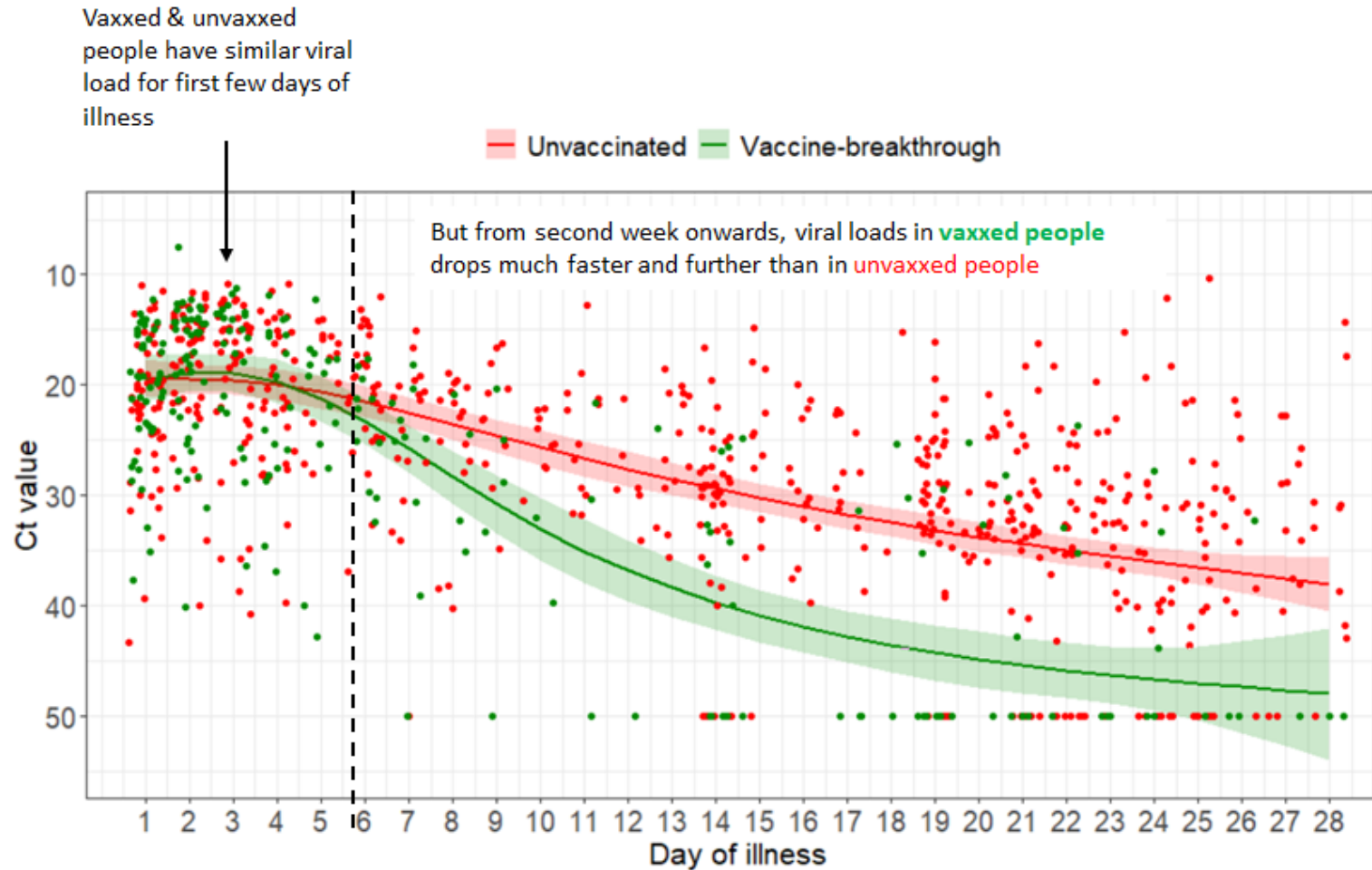
| Type and level of group activity | Low occupancy | | | High occupancy | | |
|---|------------------------------|-----------------------------|-------------------|------------------------------|-----------------------------|-------------------|
| | Outdoors and well ventilated | Indoors and well ventilated | Poorly ventilated | Outdoors and well ventilated | Indoors and well ventilated | Poorly ventilated |
| Wearing face coverings, contact for short time | | | | | | |
| Silent | Low | Low | Low | Low | Low | Medium |
| Speaking | Low | Low | Low | Low | Low | Medium |
| Shouting, singing | Low | Low | Medium | Medium | Medium | High |
| Wearing face coverings, contact for prolonged time | | | | | | |
| Silent | Low | Low | Medium | Low | Medium | High |
| Speaking | Low | Low* | Medium | Medium* | Medium | High |
| Shouting, singing | Low | Medium | High | Medium | High | High |
| No face coverings, contact for short time | | | | | | |
| Silent | Low | Low | Medium | Medium | Medium | High |
| Speaking | Low | Medium | Medium | Medium | High | High |
| Shouting, singing | Medium | Medium | High | High | High | High |
| No face coverings, contact for prolonged time | | | | | | |
| Silent | Low | Medium | High | Medium | High | High |
| Speaking | Medium | Medium | High | High | High | High |
| Shouting, singing | Medium | High | High | High | High | High |

Risk of transmission
 Low ■ Medium ■ High ■

* Borderline case that is highly dependent on quantitative definitions of distancing, number of individuals, and time of exposure

Delta viral load over time for unvaccinated vs breakthrough cases

“Masks for all” indoors is important



Masks are critical to block the release and inhalation of aerosols (close/long range)



PERSPECTIVES

VIEWPOINT: COVID-19

Reducing transmission of SARS-CoV-2

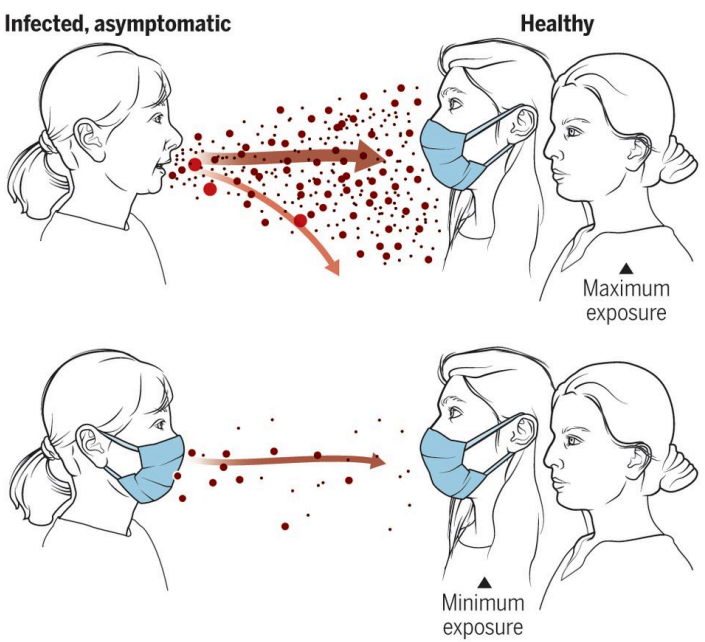
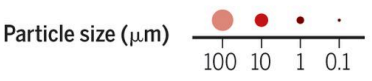


Masks and testing are necessary to combat asymptomatic spread in aerosols and droplets

Lots of resources available for picking masks

Masks reduce airborne transmission







Infectious aerosol particles can be released during breathing and speaking by asymptomatic infected individuals. No masking maximizes exposure, whereas universal masking results in the least exposure.







GRAPHIC: V. ALTOUNIAN/SCIENCE

CHOOSING THE RIGHT MASK

THE SIMPLIFIED MASK IDENTIFICATION TABLE SYSTEM – THE SMIT SYSTEM

| LEVEL OF PROTECTION | DIFFERENCE | PROTECTION AGAINST | | PROTECTION FOR | |
|--|--|----------------------|-----------------------|----------------|-------------------------|
| | | DROPLET TRANSMISSION | AIRBORNE TRANSMISSION | WEARER | THOSE AROUND THE WEARER |
| Level 1 CLOTH MASK (loose fit)  | - better than no mask -no electrostatic charge to attract and trap virus particles | MINIMAL + | MINIMAL + | MINIMAL + | MINIMAL + |
| Level 2 SURGICAL MASK, P1 (loose fit)  | -gaps allow the virus to bypass mask -not considered respiratory protection -provides moderate protection against droplets transmission -little protection from airborne transmission | MODERATE ++ | MINIMAL + | MINIMAL + | MODERATE ++ |
| Level 2 (+) SURGICAL MASK WITH BRACERS (tight fit)  | -bracers help seal the surgical mask so that all air has to pass through the filter material -provides respiratory protection similar to an N95 | GREAT +++++ | GREAT +++++ | GREAT +++++ | GREAT +++++ |
| Level 3 N95 WITH EXHALATION VALVES (tight fit)  | -uncovered valve offers better source protection than surgical masks -valve can be covered with a surgical mask to further improve source control protection -minimum level of protection needed to properly protect the wearer from the virus | GREAT +++++ | GREAT +++++ | GREAT +++++ | GOOD +++ |
| Level 3 (+) N95,KN94, KN95, FFP2, P2 (tight fit)   | -provides great protection for wearer and those around them from airborne AND droplet transmission -filters at least 95% of airborne particles at .3 microns -not made to be reused | GREAT +++++ | GREAT +++++ | GREAT +++++ | GREAT +++++ |

| | | | | | |
|--|---|----------------------|----------------------|----------------------|---|
| Level 4 N99, N100, FFP3, P3 KN99, KN100 (tight fit)  | -filters at least 99% of airborne particles at .3 microns -provides 100% protection to the wearer -disposable but less familiar than N95s | EXCEPTIONAL +++++ | EXCEPTIONAL +++++ | EXCEPTIONAL +++++ | GOOD (VALVE) +++ EXCEPTIONAL (WITHOUT VALVE) +++++ |
| Level 5 ELASTOMERIC RESPIRATOR WITH EXHALATION VALVES & N99, P99, N100, P100, FFP3 OR P3 FILTERS (tight fit)  | -uncovered valve offers better source protection than surgical masks -valve can be covered with a surgical mask to further improve source control protection -much higher protection than N95s -are available in half face & full face options -made to be reused for months to years | EXCEPTIONAL +++++ | EXCEPTIONAL +++++ | EXCEPTIONAL +++++ | GOOD +++++ |
| Level 5 (+) ELASTOMERIC RESPIRATOR WITHOUT EXHALATION VALVES & N99, P99, N100, P100, FFP3 OR P3 FILTERS (tight fit)  | -the most cost effective option for virus protection -provides a much better seal than N95s -filters at least 99% of airborne particles at .3 microns. -provides 100% protection to the wearer & as source control -made to be reused for months to years | EXCEPTIONAL +++++ | EXCEPTIONAL +++++ | EXCEPTIONAL +++++ | EXCEPTIONAL +++++ |
| Level 6 PAPR (loose and tight fit options)  | -much more expensive than all other options -uses battery power to blow air through a filter -can be reused for years -provides the best level of protection for the wearer but not readily available -PAPRs tend not to have good source control since they leak air that doesn't get filtered through an exhalation valve | BEST +++++ | BEST +++++ | BEST +++++ | MODERATE ++ |



How to Knot and Tuck Your Mask to Improve Fit



KNOT & TUCK



0:01 / 0:55



YouTube



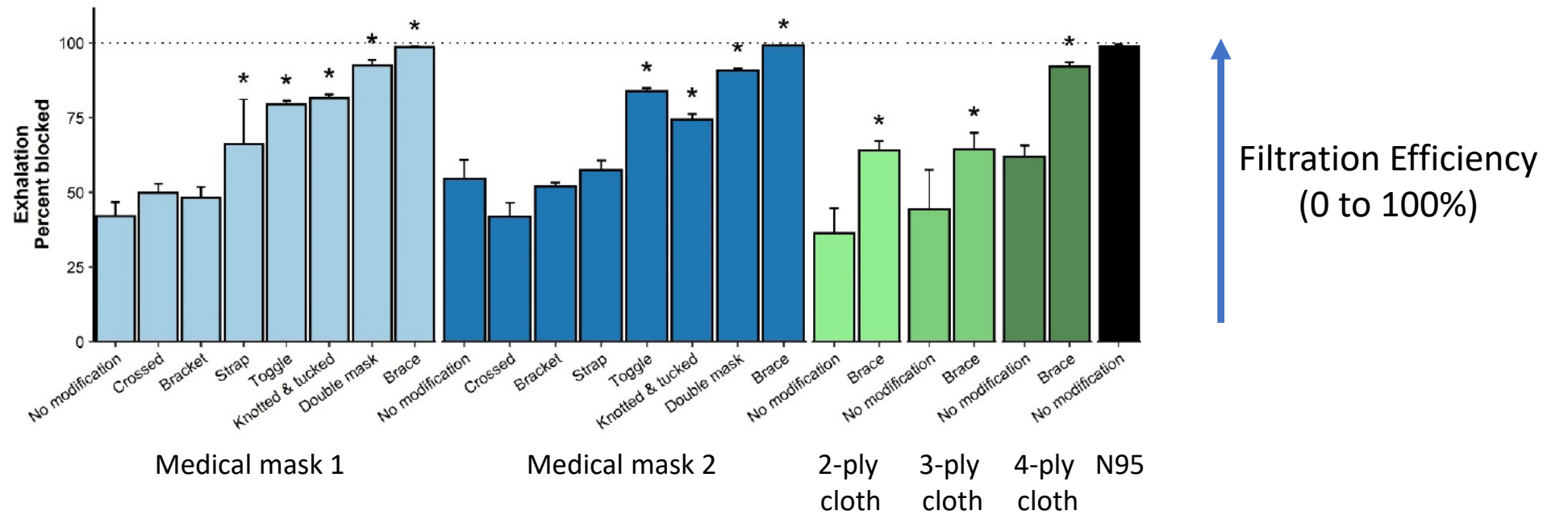
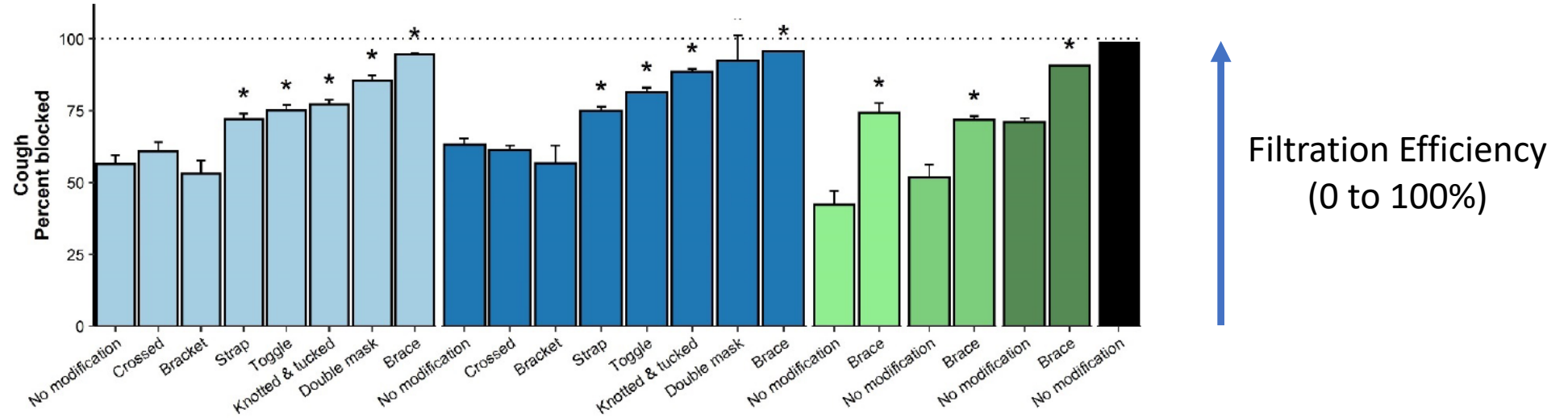
How to Knot and Tuck Your Mask to Improve Fit

The knot and tuck method can be used to make disposable masks fit better. This video can also be viewed ...

youtube.com

<https://youtu.be/GzTAZDsNBe0>

Mask Fit Modification



Why is it important to acknowledge COVID-19 is “airborne”?

Sends a clear and consistent message on why the public should “clean the air” and “avoid shared air”

- Will make better choices

Helps public understand why:

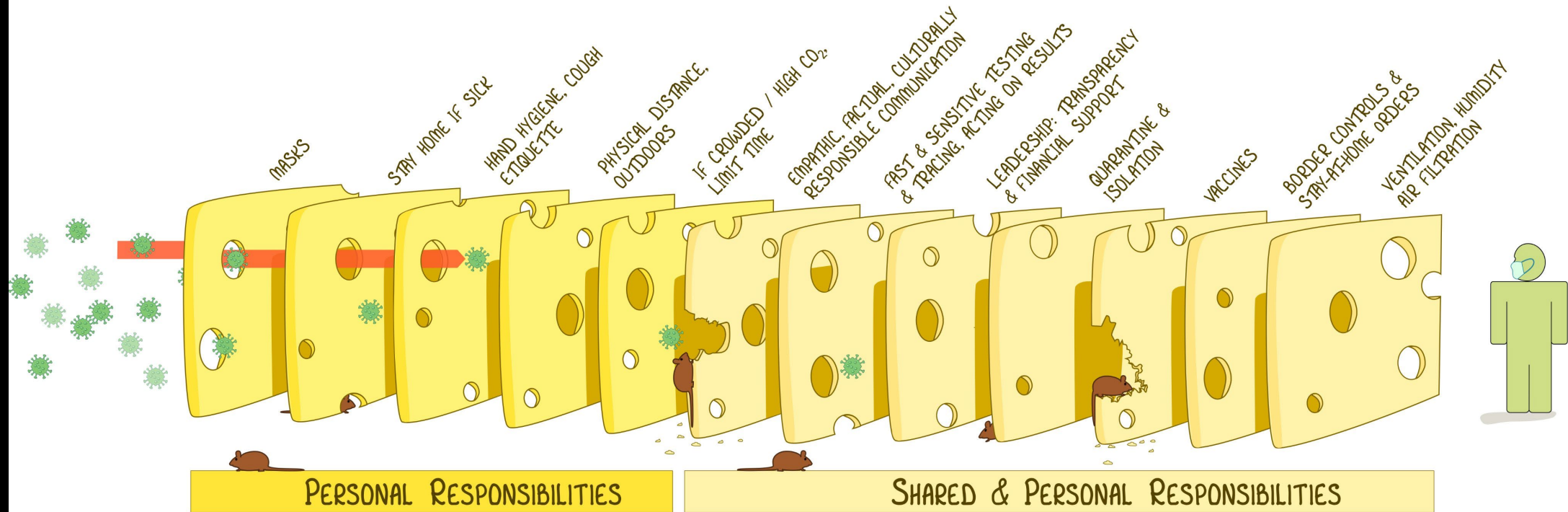
- Ventilation and filtration are important
- Wearing a good mask or KF94/KN95 respirator is critical
- There is no safe social distance indoors (think cigarette smoke)—wear a mask indoors at all times!
- Must avoid indoor crowded locations (bars/restaurants) where masks are removed as they are highest risk
- Healthcare, frontline, and other high-risk workers need to be provided with proper PPE, including respirators.



With Delta, a layered protection approach is critical

THE SWISS CHEESE RESPIRATORY VIRUS PANDEMIC DEFENCE

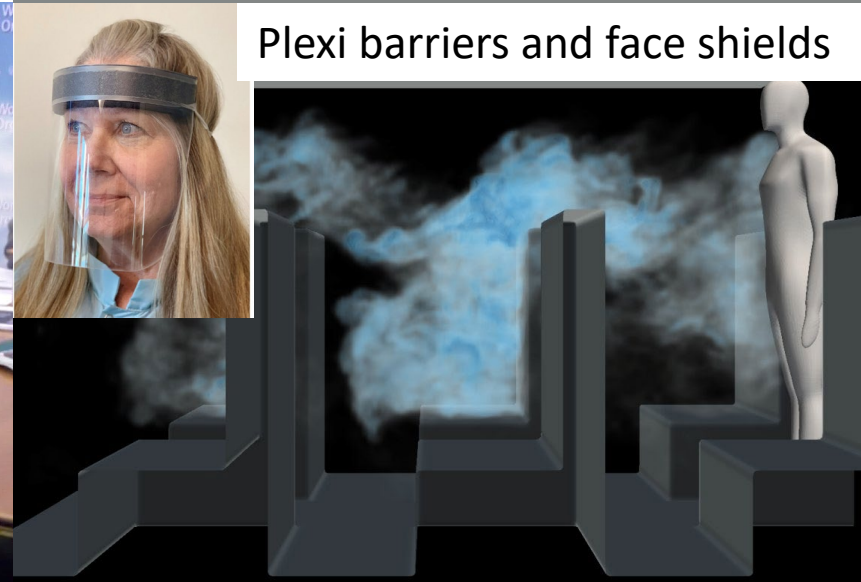
RECOGNISING THAT NO SINGLE INTERVENTION IS PERFECT AT PREVENTING SPREAD



EACH INTERVENTION (SLICE) HAS IMPERFECTIONS (HOLES) WHICH CHANGE IN SIZE, NUMBER AND POSITION DEPENDING ON HOW THE INTERVENTION IS ROLLED OUT.
(MULTIPLE LAYERS IMPROVE SUCCESS.)

 MISINFORMATON MOUSE

Also helps in understanding what not to do....



San Diego Unified District Re-opening (Spring 2021)-pre-Delta

- Masks required indoors at all times
- Ventilation (CO₂ measurements)—open doors, windows, bring in fresh air through HVAC system, add MERV13 wherever possible
- Standalone HEPA filtration (no ionizers, no spray oxidants in air!!): Check w/ particle sensors

San Diego Unified District Re-opening Plan

- Masks required indoors at all times
- Ventilation: open doors, windows, bring in fresh air through HVAC system, add MERV13 wherever possible: Check for “fresh air” w/ CO₂ monitors
- Standalone HEPA filtration (no ionizers, no spray oxidants in air!!): Check w/ particle sensors
- Lunch is riskiest time: Eat outdoors whenever possible w/ few people, no talking (ideally) or in highly filtered room in shifts
- Small cohorts and distancing (now many more students and less distancing)

Current academic year:

Vaccine policy for all that are eligible

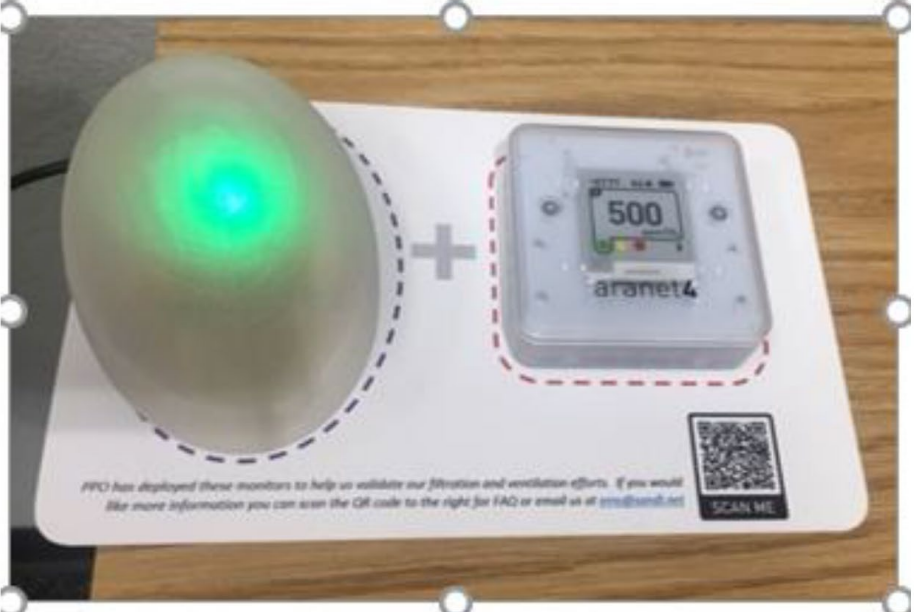
Indoor and outdoor mask mandates

Free and frequent testing (rapid testing)

Transparency on what schools are doing to lower risk of inhaling SARS-CoV-2 is critical



Here is an example of our “leave behind” placemat with QR code to our FAQ.



Example of our Particulate and CO2 sensors in use at one in Classroom.



SDUSD VENTILATION - PHASE 2

What do we do to keep our air quality safe?

In the classroom, this is what needs to be done daily to achieve adequate air exchanges and have the best possible air quality:

- Keep your ventilation running – AC or heat
- Bring in the fresh air - open your doors and windows
- Leave the air purifiers running on auto mode – set and forget, no need to change the setting or turn them off. The setting for “plasmawave” should remain “off.”
- We want the ventilation running more – centrally monitored, it will start earlier and run later.
- Don't run your ceiling fans or wall-mounted fans – they can induce potentially contaminated airflow directly from one person over another.
- Wear required facial coverings – the first line of defense in limiting the number of airborne particles which reduces airborne transmission of COVID-19.
- Plan ahead – we are moving a lot of air - It may not be as comfortable in your classroom/office.

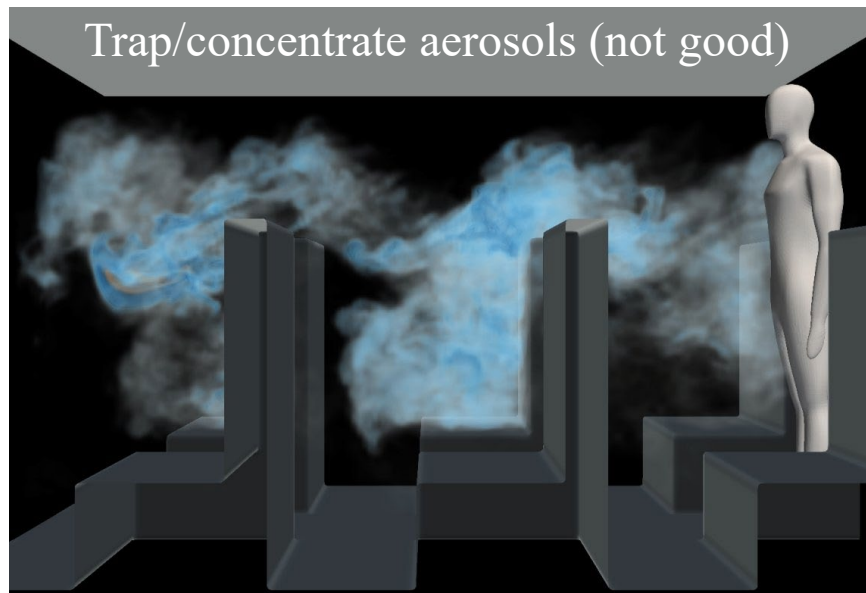
Do all of these at the same time!

What is the District doing to make it safer?

Ventilation is a key component to reduce the spread of COVID-19 in schools. As the district moves to having more people on campus and students in classrooms, ensuring adequate room ventilation is key to reducing the airborne transmission of COVID-19 indoors. Adequate ventilation is achieved by bringing in more outdoor air, either through open windows and doors or through the HVAC system; and by providing recirculated air that is highly filtered. These are best practices for diluting or displacing airborne COVID-19 particles if the particles happen to be present in a room.

Schools must be given clear guidance for reducing the risk indoors due to aerosol inhalation (for alpha)

- Do's—HEPA filtration, MERV 13, 6 ACH, open windows and doors (outdoor pollution can be problematic in certain areas and w/ wildfires)
- Don'ts (no ionizers, plasmas, gadgets), no plexiglass barriers, less intense focus on surface cleaning



Adding plexiglass barriers can increase risk

