School Ventilation: A Vital Tool to Reduce COVID-19 Spread

Paula J. Olsiewski, PhD, Contributing Scholar

ReOpening Tribal Schools & Buildings Webinar

July 8, 2021

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BLOOMBERG SCHOOL
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Center for
Health Security

Our Mission

The Center for Health Security works to protect people's health from epidemics and disasters and ensure that communities are resilient to major challenges.

Today's Presentation

- Background
- Research Process
- May 2021 Report
- Six recommendations
- Conclusions

POLICYFORUM

PUBLIC HEALTH

Next Flu Pandemic: What to Do Until the Vaccine Arrives?

Most scientists consider another influenza pandemic inevitable, but there is little information on how best to protect the public before a vaccine can be made available.

Stephen S. Morse,[1]* Richard L. Garwin,[2] Paula J. Olsiewski[3]

Also often neglected are protective measures that fall between individual protection and the whole population—the "excluded middle," such as buildings, facilities, and smaller areas, including work places and homes. Examples might include improved air-handling systems, room-size fans, portable air-filtration units, or physical barriers such as room dividers and doors. Industrial hygienists

Letter to Family and Friends Tweet Thread

Paula Olsiewski
@polsiewski

I've seen a lot of questions about the importance of ventilation and the spread of SARS-CoV2. I have expertise in the science of indoor air quality & want to share some simple steps you can take to make your home & family safer during the pandemic. 1/

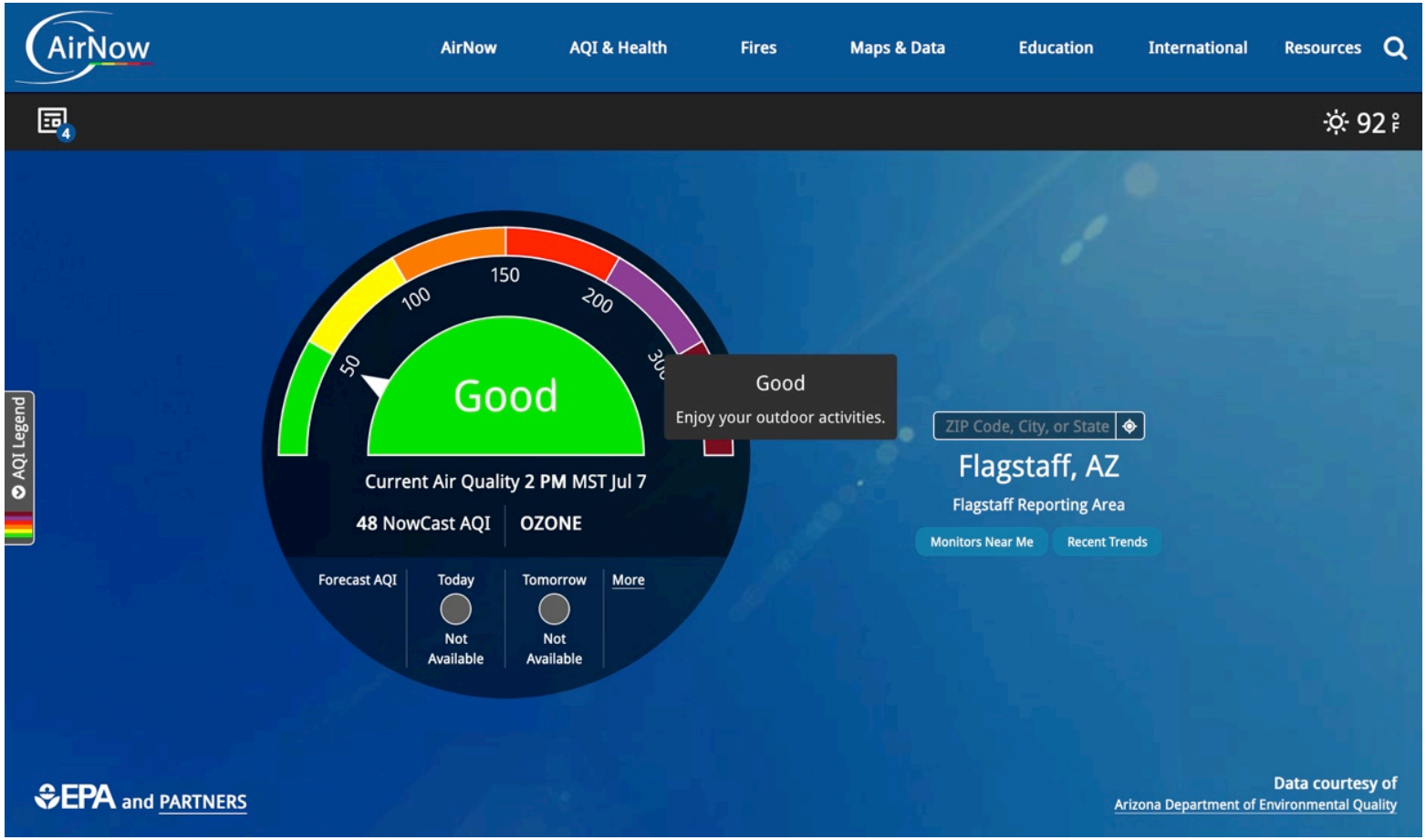
8:27 AM · Nov 17, 2020 · Twitter Web App

View Tweet activity

2K Retweets **519** Quote Tweets **5.5K** Likes

What do you know about the air you breathe?

Outdoor air is regulated and monitored hourly



Air Quality Index Scale and Color Legend

The table below defines the Air Quality Index scale as defined by the US-EPA 2016 standard:

AQI	Air Pollution Level	Health Implications	Cautionary Statement (for PM2.5)
0 - 50	Good	Air quality is considered satisfactory, and air pollution poses little or no risk	None
51 -100	Moderate	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.	Active children and adults, and people with respiratory disease, such as asthma, should limit prolonged outdoor exertion.
101-150	Unhealthy for Sensitive Groups	Members of sensitive groups may experience health effects. The general public is not likely to be affected.	Active children and adults, and people with respiratory disease, such as asthma, should limit prolonged outdoor exertion.
151-200	Unhealthy	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects	Active children and adults, and people with respiratory disease, such as asthma, should avoid prolonged outdoor exertion; everyone else, especially children, should limit prolonged outdoor exertion
201-300	Very Unhealthy	Health warnings of emergency conditions. The entire population is more likely to be affected.	Active children and adults, and people with respiratory disease, such as asthma, should avoid all outdoor exertion; everyone else, especially children, should limit outdoor exertion.
300+	Hazardous	Health alert: everyone may experience more serious health effects	Everyone should avoid all outdoor exertion

Indoor air is not regulated

- Building codes and standards are designed around odor control, thermal comfort, and energy savings.
- Many areas in hospitals are designed for health.
- Poor indoor air quality in schools is a longstanding problem

Why should we care about indoor air?

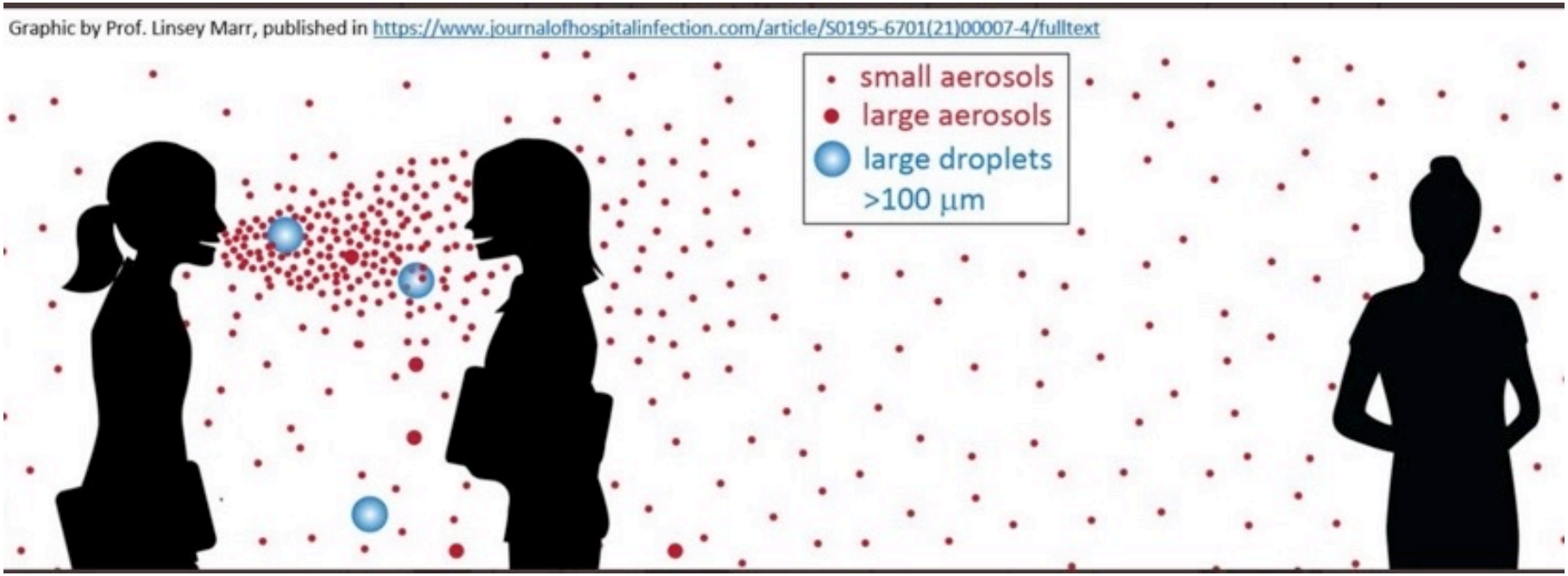
People spend 90% of their time indoors

We share air with other people

Infected people emit virus

Covid-19 is airborne

Graphic from Prof. Linsey Marr
The virus travels on particles



Important Definitions

- Ventilation
- Air changes per hour (ACH)
- Minimum efficiency reporting values (MERV)
- HEPA filter

Ventilation

- The process of supplying air to or removing air from a space for the purpose of controlling air contaminant levels, humidity, or temperature within the space.*

- Ventilation improvements are a cost-effective public health measure.

- Flexible funds available to schools to reduce risks related to Covid 19 under the American Rescue Plan

Definition from ASHRAE, https://xp20.ashrae.org/terminology

Air changes per hour (ACH)

- The number of times in one hour that the air volume of a space is supplied with either outdoor air or air that has been pushed through a filter
- Homes: 1 ACH
- Hospitals: 6-12 ACH (every 10-5 minutes!)
- Schools: designed for 2-3 ACH, much less in practice

MERV

- Scaled rating on the effectiveness of air filters
- Worst case performance when dealing with particles in the range of 0.3-1,1-3, and 3-10 microns
- MERV 13 captures 50%, 85% and 90% in the three ranges
- HEPA filters remove 99.97% or higher for 0.3 micron particles

Three proven methods to improve indoor air quality

- Ventilation
- Filtration
- Ultraviolet Germicidal Irradiation (UVGI)
- All three are effective regardless of the Covid Variant

Improving indoor air quality can reduce spread of Covid-19

- Center's first product released in 11/20
- Graphic on how to make homes safer during Covid-19 by increasing ventilation and filtration

Make the air in your home safer during COVID-19 by increasing ventilation and filtration.

You can take steps to make your home's air safer when guests visit.

Tips to Improve Ventilation and Filtration in Your Home

If your home uses **mechanical ventilation** (a central heating and air conditioning system that moves air through ducts):

- Install a higher efficiency filter into your HVAC system—if possible a MERV 13. Set the system's fan to ON,
- Attach a MERV 13 filter to a box fan (not placed in a window) to create a DIY portable air cleaner, or
- Use a portable HEPA air cleaner.

If your home uses **natural ventilation** (windows that open, radiators for heating, no central air conditioning):

- Open windows to increase ventilation; make sure you can feel a cross breeze,
- Attach a MERV 13 filter to a box fan (not placed in a window) to create a DIY portable air cleaner, or
- Use a portable HEPA air cleaner.

If you are using a **portable HEPA air cleaner**, use one that can clean the size of the room where you are using it. Run it continuously, if guests are in your home.

Consider using a **carbon dioxide (CO_2) sensor** to help monitor good indoor air ventilation. Outdoor air levels of CO_2 hover around 400 parts per million. Indoor readings higher than 800 ppm indicate that your ventilation is not optimal.

Don't forget:

- SARS-CoV-2, the virus that causes COVID-19, lingers in air and can travel more than 6 feet. It can also accumulate if there are people crowded in an indoor space.
- It's spread by sick and asymptomatic people who shed the virus with every breath.
- The higher the local infection rate, the more people shedding virus in your community.
- Wear masks always, except when you are at home with people you live with. If someone is in your home who does not live there, everyone should wear masks.

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Links to More Resources:
Do it yourself: Box-Fan Air Filter
The New York Times: Mask work. Really. We'll Show You How.
How can airborne transmission of COVID-19 indoors be minimized?

Increased ventilation and filtration will reduce but not eliminate the risk for exposure.

This infographic was updated on January 22, 2021.

Many schools have poor indoor air quality

Focus on indoor air quality in schools during & after Covid-19 pandemic

Research Process

- Literature review
- Interviews with 32 experts
- February 23, 2021 webinar: A National Conversation on Indoor Air & K-12 Schools During the COVID-19 Pandemic

Interviewees

Destiny Aman, MS
JPoint Collaborative

William Bahnfleth, PhD, PE
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Claire Barnett, MBA
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COVID Straight Talk

Webinar: 3 Panels plus Q & A

- The State of Ventilation in Schools and the Importance of Healthy Air During the Pandemic and Beyond
- Technical Solutions to Improve Indoor Air Quality in Schools
- Using Policy and Other Supportive Mechanisms to Implement Healthy Air in Schools

School Ventilation:
A Vital Tool to Reduce COVID-19 Spread

May 2021

Johns Hopkins Bloomberg School of Public Health | Center for Health Security

Six Recommendations

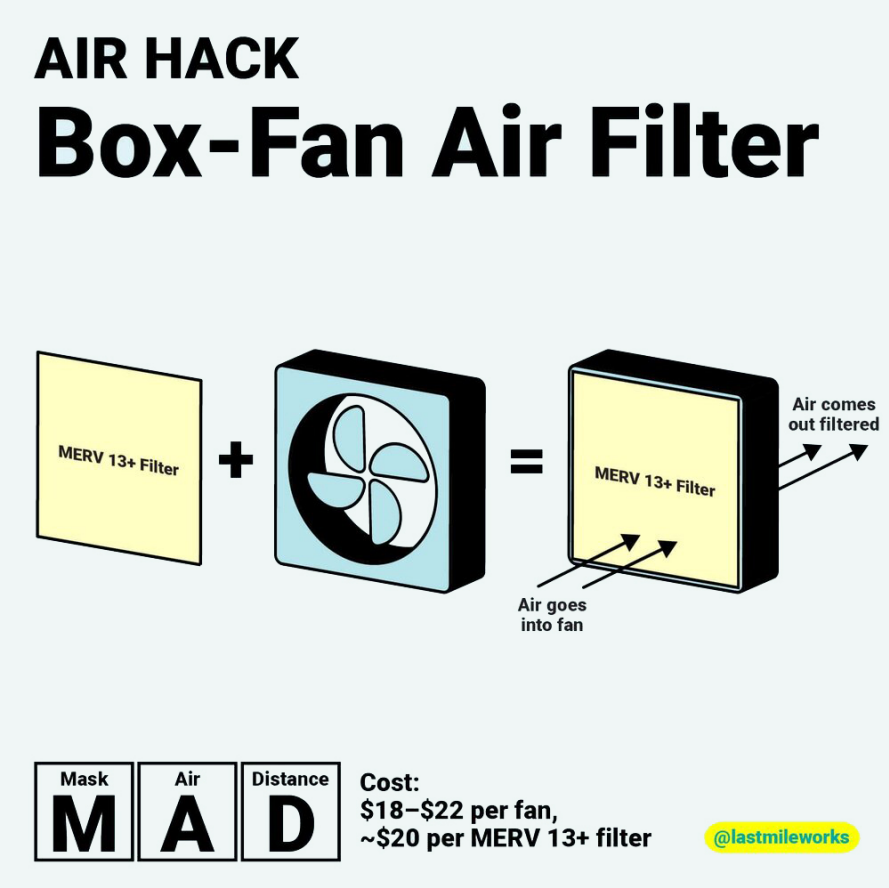
Five for school administrators and decision makers

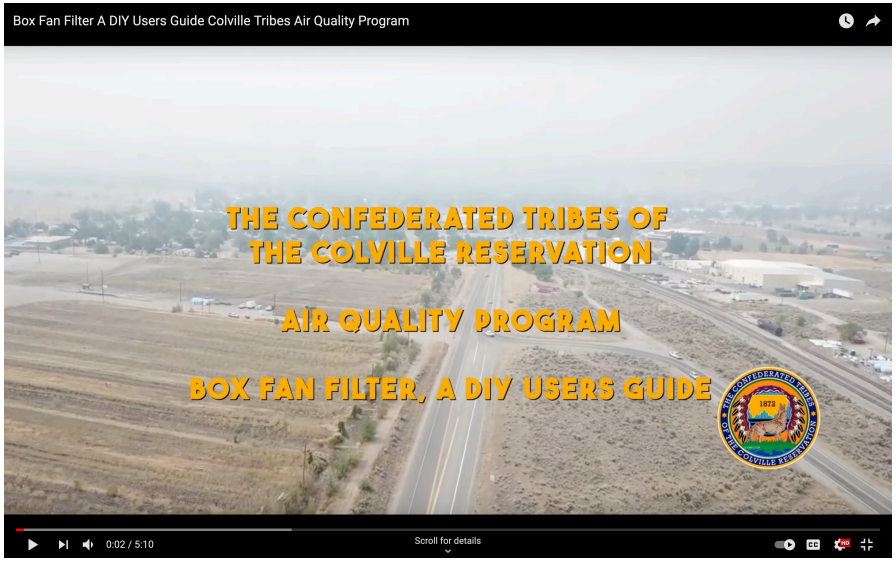
One for the US Government

School administrators and decision makers should

1. Improve school ventilation now by bringing in as much outdoor air as the HVAC system will safely allow and upgrading filtration.
2. Purchase HEPA air filtration units to be placed in classrooms and common occupied space

DIY Air Filter





School administrators and decision makers should

3. Use only proven technologies for improving IAQ: appropriate ventilation, filtration, or ultraviolet germicidal irradiation. They should not use chemical foggers or any “air cleaner” other than filtration and ultraviolet germicidal irradiation.

The primary aim for improving air quality should be to remove contaminants from the air and not introduce new substances in the air.

School administrators and decision makers should

4. Stop enhanced cleaning, disinfecting, “deep clean” days, and any other expensive and disruptive cleaning.

Fomite (surface) transmission is not a major driver of the spread of Covid-19.

Investments in ventilation will provide more value in risk reduction!

School administrators and decision makers should

5. Install mechanical ventilation systems where none exist and upgrade those that do not meet current standards.

All students, teachers, and staff deserve healthy air, and many are not currently getting it. Proper ventilation will improve health and education.

Upgrades to facilities will take time but will improve ventilation in schools for the long term.

The US Government should

6. Convene a federal task force dedicated to school air quality to develop guidance for long-term, sustainable, cost-effective improvements to indoor air quality in schools. This guidance should include accountability measures to assess improvements

Task force should create standards, develop a certification system for HVAC personnel, and provide recommendations for oversight and accountability.

Conclusions

- Airborne transmission of SARS-CoV-2 virus, the virus responsible for the COVID-19 pandemic, can be reduced by improving ventilation.
- Federal funds are now available to enable schools to make the needed changes. These changes will make our schools healthier during the current pandemic.
- If improved ventilation is properly installed, operated, and maintained, students and educators will benefit for years to come.

Conclusions (continued)

- The evidence-based recommendations described in this report can help schools and school districts to address COVID-19-related and longstanding ventilation problems.
- The report can provide a foundation for infrastructure investments that reliably use proven technology to raise the air quality in schools, which will improve student learning and the health of everyone in school buildings for decades to come

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Questions?

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Additional slides

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Haga que el aire de su hogar sea más seguro durante COVID-19 aumentando la ventilación y la filtración.

Puede tomar medidas para que el aire de su casa sea más seguro cuando tenga invitados.

Consejos para mejorar la ventilación y la filtración en su hogar

Si su hogar usa **ventilación mecánica** (un sistema de calefaccion central y/o aire acondicionado que mueve el aire por conductos):

- Instale un filtro de mayor eficiencia en su Sistema HVAC — si es posible un MERV 13. Deje el ventilador encendido permanentemente,
- Conecte un filtro MERV 13 a un ventilador de caja (no si esta colocado en una ventana) para crear un filtro de aire artesanal, o
- Utilice un limpiador de aire HEPA portátil.

Si su hogar usa **ventilación natural** (ventanas que se abren, radiadores para calefacción, sin aire acondicionado central):

- Abra las ventanas para aumentar la ventilación; asegurese de sentir una leve brisa cruzada,
- Conecte un filtro MERV 13 a un ventilador de caja (no si esta colocado en una ventana) para crear un filtro de aire artesanal, o
- Utilice un limpiador de aire HEPA portátil.

Si está utilizando un **filtro de aire HEPA portátil**, utilice uno que puede limpiar el tamaño de la habitación donde lo está usando. Úselo continuamente a la mayor potencia (no en "auto"), si hay invitados en su casa.

Considere usar un **sensor NDIR de dióxido de carbono (CO_2)** para mantener una buena ventilación del aire interior. El CO_2 al aire libre ronda las 400 partes por millón (ppm). Medidas mayores de 700 ppm cuando comparte el aire con otras personas indican que la ventilación no es suficiente.

No olvides:

- SARS-CoV-2, el virus que causa COVID-19, permanece en el aire y puede viajar más de 6 pies o 2 m. Es más peligroso si hay mucha gente compartiendo el mismo espacio interior.
- Se transmite por personas sin síntomas y también enfermas, que exhalan el virus al respirar y al hablar.
- Cuanto mayor sea la tasa de infección local, más personas propagarán el virus en su comunidad.
- Use mascarillas siempre, excepto cuando esté en casa con personas con las que vive. Si alguien está en su casa que no vive allí, o si alguien trabaja en un lugar donde los contagios son probables, todos deben usar mascarillas cuando estén en la misma habitación. Las mascarillas se deben ajustar *muy* bien a la cara, sin dejar huecos junto a la nariz o a los lados.

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Enlaces a más recursos:

Do it yourself: Box-Fan Air Filter

The New York Times: Mask work. Really. We'll Show You How.

How can airborne transmission of COVID-19 indoors be minimized?

Una mayor ventilación y filtración reducirá pero no eliminará el riesgo de contagio.