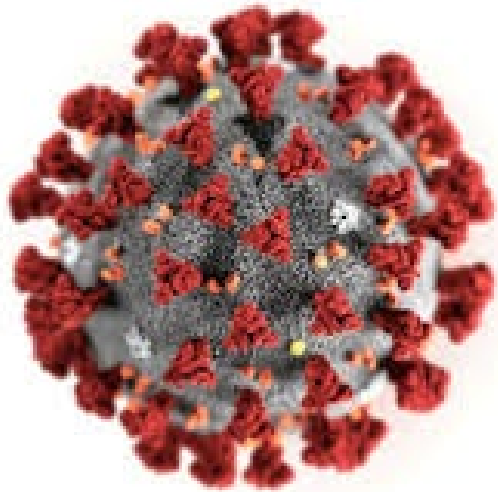




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Safer Cleaning, Sanitizing and Disinfecting in Child Care Facilities During the COVID-19 Pandemic



Vickie Leonard, RN, NP (retired) PhD
Environmental Health in Early Care and
Education Project,
Western States Pediatric Environmental
Health Specialty Unit (WSPEHSU)

UCSF

University of California
San Francisco



WESTERN STATES
PEHSU Pediatric Environmental
Health Specialty Units



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CHILDREN'S
ENVIRONMENTAL
HEALTH
NETWORK



Western States Pediatric Environmental Health Specialty Unit

- Mark Miller, MD MPH
- Stephanie Holm, MD, MPH
- Timur Durrani, MD MPH
- Victoria Leonard, RN (retired) PhD
- Sam Goldman, MD MPH
- Maria Valenti
- Valerie Gallardo



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Environmental Health in
Early Care and Education Project

Many young children spend the majority of their waking hours in child care facilities. The health impacts of environmental health exposures are especially important for this age group. For these reasons, the UCSF PEHSU has started a new program, the **Promoting Environmental Health in Early Care and Education Project**. This project will extend the work of the PEHSU's Program Coordinator, Vickie Leonard, in greening child care environments. This work is based on two Toolkits developed with funding from the California Department of Pesticide Regulation: *Integrated Pest Management: A Toolkit for Early Care and Education*, and *Green Cleaning, Sanitizing, and Disinfecting: A Toolkit for Early Care and Education*. New work on PCBs in schools and child care centers is in the planning stages.

Green Cleaning Toolkit

Sign Up Today for Green Cleaning Updates from CERCHI

The Green Cleaning, Sanitizing and Disinfecting Toolkit presents practical information on how to keep early care and education (ECE) environments clean and safe using practices and products that are less hazardous and that protect young children and staff from infectious diseases. [Click here to to purchase hard copies of the Green Cleaning Toolkit from Informed Green Solutions.](#)

Click on the images or titles below to download handouts from the Green Cleaning Toolkit.

GREEN CLEANING, SANITIZING AND DISINFECTING: A TOOLKIT FOR
EARLY CARE AND EDUCATION

Green Cleaning, Sanitizing and Disinfecting
A Checklist for Early Care and Education

Green Cleaning, Sanitizing and Disinfecting
A Curriculum for Early Care and Education

[Green Cleaning, Sanitizing and Disinfecting Checklist](#)

[Green Cleaning, Sanitizing and Disinfecting Curriculum](#)

PROJECTS

- Childhood Leukemia and the Environment
- Wildfires and Children's Health
- PCBs in Schools
- Safer Disinfecting During the COVID-19 Pandemic
- Environmental Health in Early Care and Education Project**
- A Story of Health – A Multi-Media eBook
- Reducing Childhood Lead Poisoning in Immigrant Communities From Imported Makeup
- Promotores and Environmental Health

New edition of Green Cleaning, Sanitizing and Disinfection: A Toolkit for Early Care and Education will be available in March or April including updates for COVID-19

How do we best protect children and staff in child care facilities from SARS CoV-2?

- ▶ SARS CoV-2, the virus that causes COVID-19, is transmitted primarily in droplets and aerosols.
- ▶ Droplets are heavier and fall to the ground.
- ▶ Aerosols are lighter and can travel in air farther and last in the air longer than droplets.

Efforts to make ECE facilities safer from transmission of SARS CoV-2 should be focused primarily on reducing virus *in the air*.



How do we best protect children and staff in child care facilities from SARS CoV-2?

The Layered Risk Reduction Approach!

- ▶ Can lead to a 95% reduction in risk (possibly even lower in child care aged children because they are less likely to transmit SARS CoV-2 than older children or adults) of transmission of the COVID-19 virus.
- ▶ Results in decreased use of, and exposure to, harmful chemicals for indiscriminate disinfection of surfaces.

We can't disinfect our way out of this pandemic!



The Layered Risk Reduction Approach

- Reduce source
- Require masks inside
- Distance from source
- Ventilate
- Filter
- Disinfect
- Educate

Thanks to Richard L. Corsi, Ph.D., PE. Dean, Maseeh College of Engineering & Computer Science, Portland State University



Reduce Source

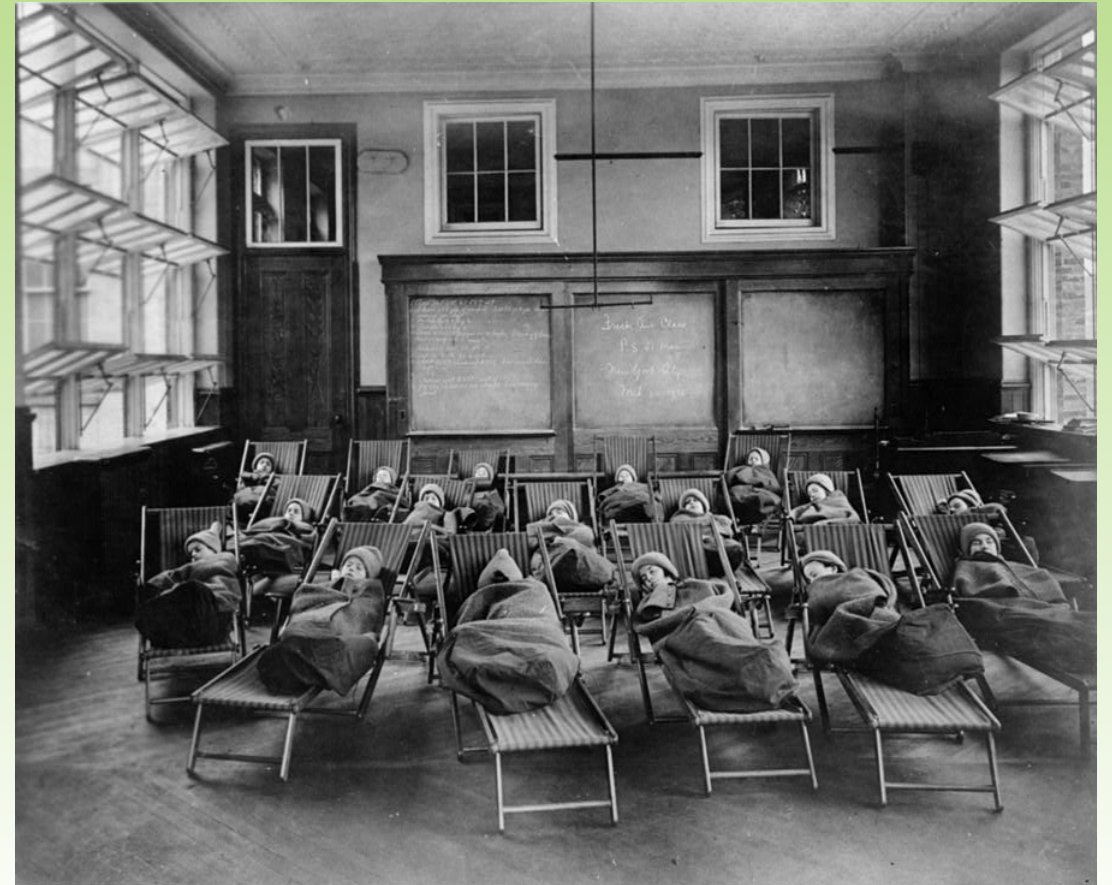
- ▶ Stay home when you are sick.
- ▶ Quarantine if you are within 6 feet of someone for 15 minutes or more who is diagnosed with COVID-19.
- ▶ Get vaccinated!
- ▶ Avoid singing.
- ▶ Reduce numbers indoors; eat outside if possible.



Reduce Source



(1911) *An Open Air Class on Day Camp Rutherford, New York Manhattan Island across river.* New York, 1911. [Photograph] Retrieved from the Library of Congress, <https://www.loc.gov/item/98504844/>.



(1911) *Fresh air class--Public School #51--Manhattan, N.Y. City--Rest hour.* New York, 1911. [Photograph] Retrieved from the Library of Congress, <https://www.loc.gov/item/98504828/>.



Require masks

- ▶ Keep mask on especially when speaking, shouting, singing.
 - 10 times more aerosols are produced when speaking than when just breathing.
 - 50 times more when shouting, singing (which is why these activities should be discouraged, even with a mask).
- ▶ Most children as young as two can be taught to wear a mask.
 - No masks for children younger than two.
- ▶ Surgical masks more available now, provide more protection to the wearer.
- ▶ Cloth masks-three layers is best.



Photo: © Victoria Leonard



Require Masks

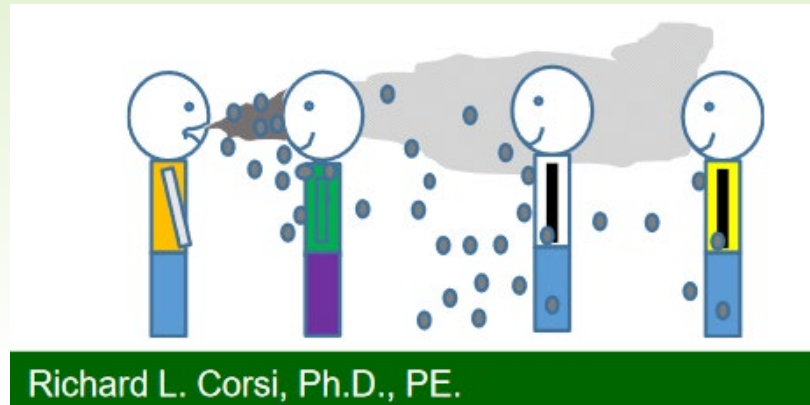
“...a ‘mouth-and-nose lockdown is far more sustainable than a full lockdown, from economic, social, and mental health standpoints.’”

Lelieveld J, et al. Model Calculations of Aerosol Transmission and Infection Risk of COVID-19 in Indoor Environments. International journal of environmental research and public health. 2020;17(21). Epub 2020/11/07. doi: 10.3390/ijerph17218114.

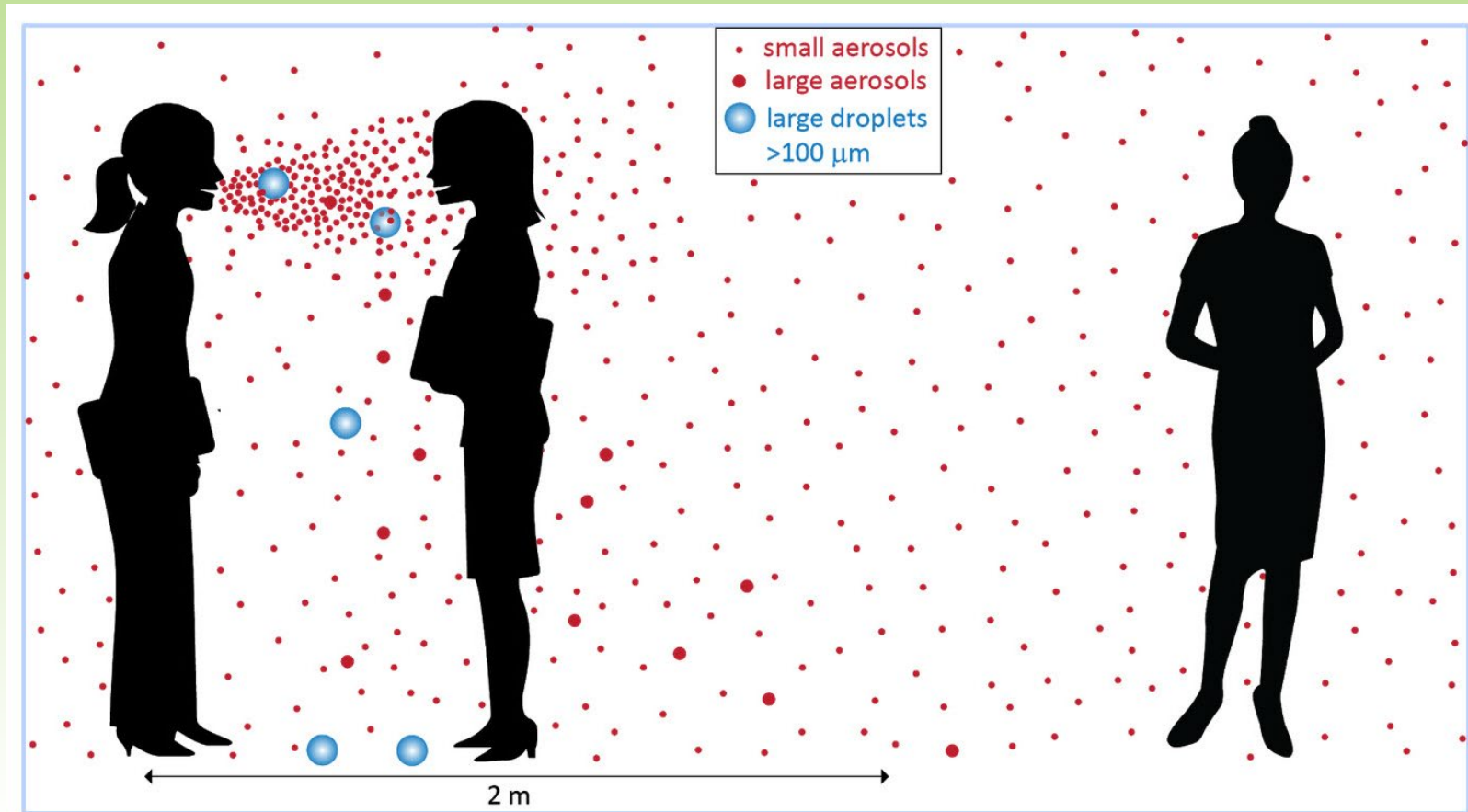


Social Distance

- ▶ Social distance-everyone stays 6 feet away from others when it's possible.
 - Younger children have trouble with social distancing, but also are less likely to transmit the virus that causes COVID-19.
 - Older children are more likely to transmit COVID-19 but are also better able to social distance.



Social Distance



Courtesy of Linsev Marr



Ventilate

- ▶ Building ventilation can be as effective as public health interventions.
- ▶ Ventilation is an important way to remove particles from the air. There are several kinds of ventilation equipment including:
 - Windows/Doors
 - HVAC, including filters that are part of most HVAC systems
 - Outdoor air penetration of the building envelope (infiltration)-less common in newer, tight buildings
- ▶ These tools provide fresh air by diluting infectious airborne microbes in the air and removing some, or all, of them by filtering them out.



Improving Indoor Air Quality

What can you do to improve the air in ECE facilities?

- ▶ Increase ventilation rate
 - Maximize outdoor ventilation rate (bring in more fresh outdoor air)
 - HVAC, doors, windows
- ▶ Increase filter efficiency
 - Upgrade HVAC filter efficiency to MERV > or = 13
- ▶ Supplement with portable air cleaners

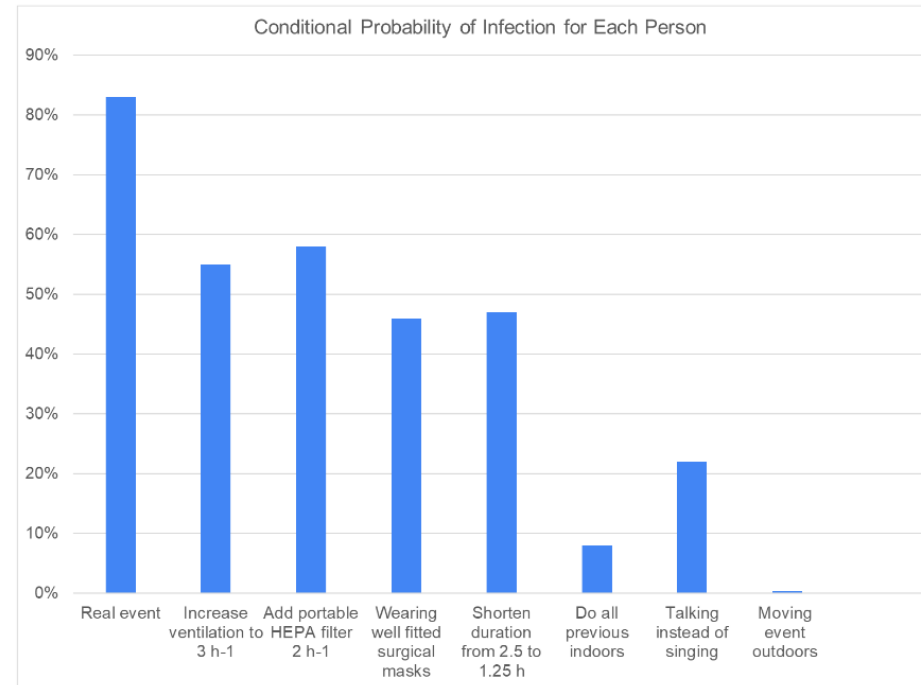


Skagit, Washington choir case

A COVID-19 superspreader unknowingly infected 52 of the 60 singers (or 86.7%) at a choir practice in Washington State leading to the deaths of two people

Example of Skagit Choir & Controls

- What happens if we could change conditions
- All are changing only 1 thing, except “do all previous indoors”



Probability of infection applies to airborne virus only. Hand washing and cleaning/disinfecting surfaces confers (small) additional reduction in risk from surface transmission.

Prof. Jose L. Jimenez, University of Colorado-Boulder



What is the role of disinfection in reducing the transmission of SARS-CoV-2?

- ▶ We can't disinfect our way out of the COVID-19 Pandemic! New research shows little transmission from surfaces.
 - “In my opinion, the chance of transmission through inanimate surfaces is very small, and only in instances where an infected person coughs or sneezes on the surface, and someone else touches that surface soon after the cough or sneeze (within 1–2 h)....I believe that **fomites that have not been in contact with an infected carrier for many hours do not pose a measurable risk of transmission in non-hospital settings. A more balanced perspective is needed to curb excesses that become counterproductive.**”
- Goldman E. Exaggerated risk of transmission of COVID-19 by fomites. The Lancet Infectious diseases. 2020;20(8):892-3. Epub 2020/07/07. doi: 10.1016/s1473-3099(20)30561-2.



What is the role of disinfection in reducing the transmission of SARS-CoV-2?

- ▶ Aerosol disinfectant sales by Reckitt Benckiser are up over 100% in 2020, climbing +120% in the third quarter of 2020.
- ▶ Indiscriminate use of disinfectants can cause health effects.
 - Frequent users have increased risk of:
 - chronic obstructive pulmonary disease (COPD),
 - asthma,
 - eye irritation.

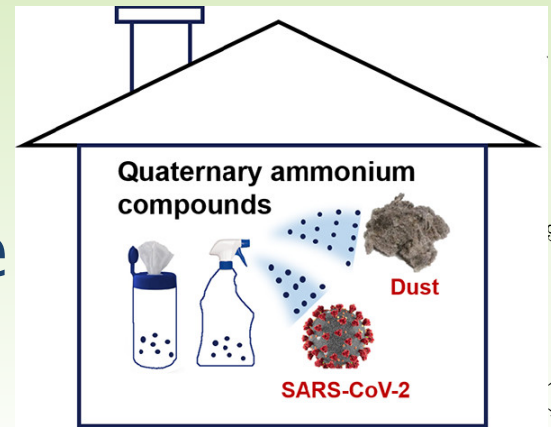


What is the role of disinfection in reducing the transmission of SARS-CoV-2?

- ▶ Disinfectant residues left on a surface can become airborne and inhaled:
 - contributing to poor indoor air quality affecting those with
 - asthma, allergies
- These residues contain chemicals that can:
- cause cancer, eye and skin irritation, central nervous system impairment.

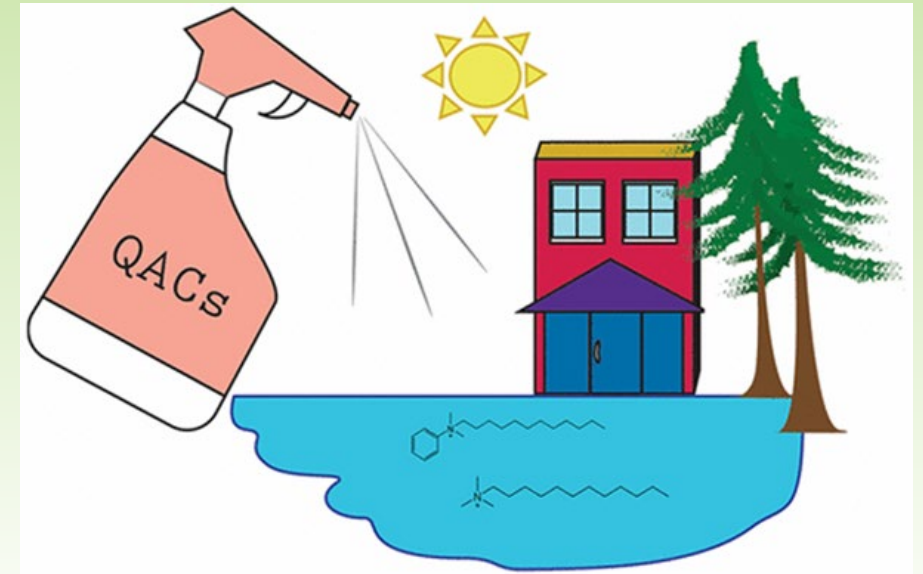
Children are particularly affected by ingesting these residues in dust.

Animal studies show some disinfectants can impact reproductive health.



What is the role of disinfection in reducing the transmission of SARS-CoV-2?

- ▶ Increased use of disinfectants has impacts on human health but also on the environment. For example:
 - Half of all disinfectants on EPA's List N (disinfectants believed to be effective against SARS CoV-2) were quaternary ammonium compounds in June, 2020.
 - These compounds
 - are released during manufacture and after use into surface waters,
 - break down slowly,
 - are toxic to aquatic organisms.



Hora PI, Pati SG, McNamara PJ, Arnold WA. Increased Use of Quaternary Ammonium Compounds during the SARS-CoV-2 Pandemic and Beyond: Consideration of Environmental Implications. Environmental science & technology letters. 2020;7(9):622-31



What is the role of disinfection in reducing the transmission of SARS-CoV-2?

- ▶ Disinfectants are an important tool for reducing the risks of infection in ECE but they should only be used when and where they are needed, and the safest possible products should be used.



Photo: © Victoria Leonard



Devices

New technologies are now available that involve a number of different devices that manufacturers make disinfection claims for.

- ▶ The EPA does not license devices the way it does chemical disinfectants (which are registered pesticides).
- ▶ The EPA does not verify the disinfection claims of device manufacturers.
 - if you decide to use a device that makes disinfection claims, you will need to review the manufacturer's efficacy data and decide whether the device will work for your purposes.



Which disinfection application methods should you choose?

- ▶ Apply ready to use or diluted disinfectant with a microfiber cloth, sponge, mop, or autoscrubber.
- ▶ Disinfecting wipes: make sure surface remains glistening wet for the required contact time.



- ▶ These are the safest ways to apply disinfectants. They produce the least aerosolized particles in the air.
- ▶ When aerosolized particles are in the air:
 - we breathe them.
 - they react with other chemicals in the air and we end up with the unintended chemical consequences.
 - These have not been adequately studied!
 - They land on surfaces where they dry and then flake off into dust.



Which disinfection application methods should you choose?

- ▶ Apply directly on the surface with a mechanical spray device (using the coarse or stream setting).

- ▶ Spraying increases aerosolized disinfectant in the air where we can breathe it. You also get “bounce back” when you spray hard surfaces, increasing exposure of the person applying the spray.



Which disinfection application methods should you choose?

- ▶ **Electrostatic sprayers apply a positive charge to disinfectants as they pass through a sprayer nozzle.**
 - Charged droplets repel one another, look for neutral surfaces which they stick to and wrap around to coat all sides.
 - Provide a more uniform coating of disinfectant on sprayed objects.

- ▶ Use only List N products approved for use with electrostatic sprayers.
- ▶ Verify on the product label and follow specific application instructions, including required contact times and PPE
- ▶ Wear the personal protective equipment (PPE) listed on the product label or SDS.
- ▶ At a minimum, the following PPE should be worn while using an electrostatic sprayer:
 - Protective clothing: disposable gown, Tyvek coveralls or lab coat
 - Chemical goggles (non-vented)
 - Face shield (if splash or spray to face possible)
 - Disposable gloves (nitrile \geq 5 mil)
 - Respiratory protection

University of Washington: Environmental Health and Safety, (2021) "Electrostatic Sprayers"

<https://ehs.washington.edu/system/files/resources/electrostatic-sprayers-focus-sheet.pdf>



Which disinfection application methods should you choose?

Issues with electrostatic sprayers:

- Many of the disinfectants used with ESs are QUATS (irritate lungs and linked to reproductive harms in animals)
- You still have to clean surfaces first. This is often overlooked when describing the advantages of sprayers.
- The room has to be empty. It's not clear how long the disinfectant remains in the air (depends on how many air changes/hour your ventilation can achieve).
- Spraying is often indiscriminate-backpacks, furniture etc.
- Is sufficient disinfectant applied to surfaces to stay glistening wet for the required contact time?
- If not rinsed, QUATS dry on surfaces and flake off into dust which young children ingest.
- We don't know what the unintended consequences are of sending an electric current through liquid antimicrobial disinfectants and then spraying indoor environments.
- Precautionary Principle!



Which disinfection application methods should you choose?

▶ Electrolyzed water (Hypochlorous Acid)

- The result of applying an electrical current to salt water.
- The active ingredient of electrolyzed water is hypochlorous acid (HOCL).

- ▶ Use the premeasured packets of reagents and follow directions to make your own solution that goes with a handheld sprayer (or wheeled sprayer) made specifically to use those particular packets.
- ▶ Larger machines are more complicated to use and depend on the pH of the solution to work properly.



Which disinfection application methods should you choose?

► Issues with Electrolyzed water

- When HOCL evaporates out of a solution it becomes a *gas*. It reacts with
 - other indoor gases,
 - light,
 - surfaces,
 - airborne particles,
 - *the lining of your lungs or skin,*to form by products that are harmful to our health.
- There is concern among scientists about the health effects of exposure to HOCl gas itself, but also to the daughter products of its chemical reactions which have not been well studied,



Which disinfection application methods should you choose?

- ▶ Foggers/misters depend on gravity to deliver disinfectant to surfaces.

- ▶ Foggers should never be used.
 - Surfaces still have to be pre-cleaned.
 - Delivery to surfaces may be uneven and contact time, and therefore disinfection, may not be achieved.
 - They invite indiscriminate use of disinfectants indoors.
 - They pose health risks to the applicator and they do not accomplish anything that you can't accomplish by using conventional application methods.
 - Foggers may cause permanent damage to electronic equipment.



Which disinfection application methods should you choose?

- When ozone is infused in water, it becomes aqueous ozone. It is an effective cleaner and it also destroys organisms by damaging their internal structures and cell walls.
- Some aqueous ozone devices make disinfecting claims, others claim to be sanitizers. They claim effectiveness against a large number of bacteria and viruses including E coli and salmonella.
- In some device tests, aqueous ozone does not kill SARS CoV-2.
- Aqueous ozone breaks down into oxygen and water. It leaves no residue and does not have to be rinsed.

Issues with Aqueous Ozone

- Ozone in its *gaseous* form is very toxic to humans. Do not spray aqueous ozone in the air.
- Health effects of gaseous ozone include respiratory symptoms, reduced lung function, and airway inflammation.
- People with asthma are especially susceptible to gaseous ozone exposure.



Devices

Dry steam vapor technology:

- Very effective for cleaning and rapid sanitizing/disinfecting.
- Approved for most surfaces, including food contact surfaces.
- Unfortunately, still very expensive.
- Doesn't technically meet many state licensing requirements that ECE facilities use a “hospital grade disinfectant.”
- EPA registers, but does not evaluate effectiveness of, devices marketed as effective for disinfecting.

Research shows microfiber and steam were as effective as disinfectant at controlling an outbreak of norovirus.



Courtesy of Advanced Vapor Technology



Devices

► UV light

- For surfaces:
- EPA research shows microbes can hide from UV light in cracks/crevices of uneven surfaces, even stainless steel.
- Light must have direct line of sight to all surfaces requiring disinfection.

Issues with UV

- Direct exposure to UV wavelengths can damage skin and eyes and genetic material. Must be used when rooms are unoccupied.
- Ozone can also be generated by prolonged use of some UV-C devices.
- The costs/benefits of installation and operation of UV radiation bulbs to disinfect air have not been fully demonstrated to outweigh the use of an effective ventilation system in schools.



► Questions?

- pehsu@ucsf.edu

WSPEHSU website:

<https://wspehsu.ucsf.edu/>

Green Cleaning, Sanitizing, and Disinfecting Toolkit:

<https://wspehsu.ucsf.edu/projects/environmental-health-in-early-care-and-education-project/>



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ATSDR does not endorse the purchase of any commercial products or services mentioned in PEHSU publications

