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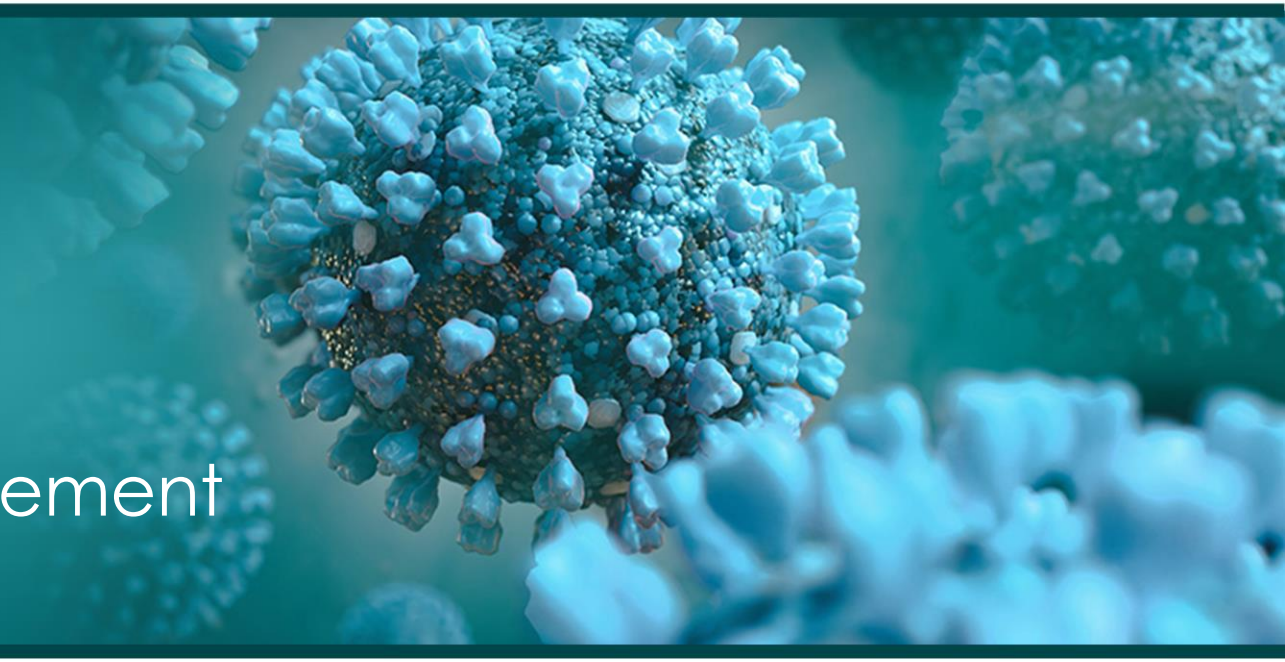
SOLUTIONS FOR HEALTH CARE PROFESSIONALS

OSAP.org
The Safest Dental Visit™

COVID-19 & DENTISTRY

Making Sense of Aerosol Management



Hosted by Gary Severance, DDS, Executive Leader of Professional Relations, Henry Schein

Speaker

David Reznik, DDS

Director of the Oral Health Center of Grady Health System's Infectious Disease Program

Speakers

Gary Severance, DDS

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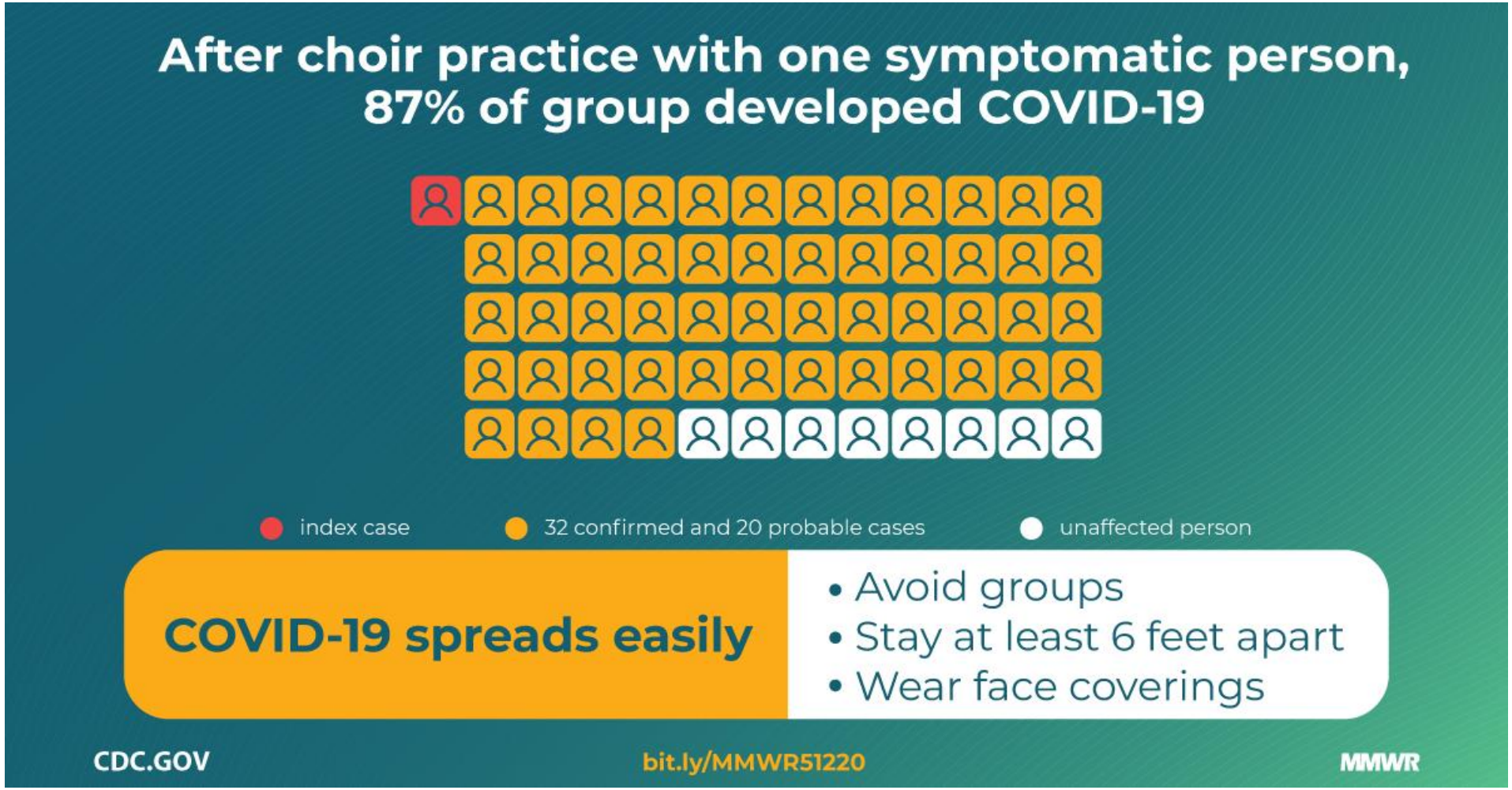
High SARS-CoV-2 Attack Rate Following Exposure at a Choir Practice — Skagit County, Washington

Following a 2.5-hour choir practice attended by 61 persons, including a symptomatic index patient, 32 confirmed and 20 probable secondary COVID-19 cases occurred (attack rate = 53.3% to 86.7%); three patients were hospitalized, and two died. Transmission was likely facilitated by close proximity (within 6 feet) during practice and augmented by the act of singing.

The potential for superspreader events underscores the importance of physical distancing, including avoiding gathering in large groups, to control spread of COVID-19.

- Hamner L, Dubbel P, Capron I, et al. High SARS-CoV-2 Attack Rate Following Exposure at a Choir Practice — Skagit County, Washington, March 2020. MMWR Morb Mortal Wkly Rep. ePub: 12 May 2020. DOI: http://dx.doi.org/10.15585/mmwr.mm6919e6external icon

High SARS-CoV-2 Attack Rate Following Exposure at a Choir Practice — Skagit County, Washington



Pseudo-chilblains or "COVID toes"

One hypothesis a lot of inflammation caused by the virus, The condition resembles pernio, caused by exposure to cold temperatures, resulting in inflammation which can appear as skin sores or bumps.

The other theory is that the symptom is due to blood vessel clots, which can occur in COVID-19 patients.

COVID-19 Impact on Children

Children are presenting with a multisystem inflammatory condition with features of toxic shock syndrome and atypical Kawasaki disease.

Kawasaki-like signs of this "SARS-CoV-2-related inflammatory syndrome" include the following:

- an erythematous rash
- conjunctivitis and glossitis with high fever
- abdominal pain
- gastrointestinal symptoms
- cardiac inflammation

Other Dermatological Conditions Seen in Association with COVID-19

Pseudo-chilblains

- Pseudo-chilblains acral lesions correlated with a milder disease course and younger patient age

Vesicular (chicken pox-like) eruptions (9%)

Maculopapular eruptions (47%)

Urticaria (19%)

Livedo or necrosis (6%)

Chilblains

Chilblains are the painful inflammation of small blood vessels in your skin that occur in response to repeated exposure to cold but not freezing air.

Also known as pernio, chilblains can cause itching, red patches, swelling and blistering on your hands and feet.

Chilblains usually clear up within one to three weeks, especially if the weather gets warmer.

Urticaria (Hives)

A rash of round, red welts on the skin that itch intensely, sometimes with dangerous swelling, caused by an allergic reaction, typically to specific foods. Also referred to as Hives

Livedo reticularis

Livedo reticularis is a common skin finding consisting of a mottled reticulated vascular pattern that appears like a lace-like purplish discoloration of the skin.[1] The discoloration is caused by swelling of the venules owing to obstruction of capillaries by thrombi.

Challenges?

One of the biggest challenges we face is obtaining enough personal protective equipment for staff.

The ADA has asked Congress to expand the non-payroll costs allowable for the Paycheck Protection Program to include personal protective equipment costs as dental offices reopen.

Availability of N95 equivalents or greater.

N95 vs. FFP2 vs. KN95

N95 and KN95 masks both filter up to 95% of particles and create an airtight seal around the face.

The FDA has authorized the emergency use of KN95 masks and FFP2 masks where there is a shortage of NIOSH approved N95 masks

- FDA: https://www.fda.gov/medical-devices/personal-protective-equipment-infection-control/faqs-shortages-surgical-masks-and-gowns
- FDA: https://www.fda.gov/media/136449/download

Counterfeit Respirators / Misrepresentation of NIOSH-Approval

https://www.cdc.gov/niosh/npptl/usernotices/counterfeitResp.html

How to Identify a NIOSH-Approved Respirator

NIOSH-approved respirators have an approval label on or within the packaging of the respirator (on the box itself and/or within the users' instructions).

Additionally, an abbreviated approval is on the filtering facepiece respirator (FFR) itself.

You can verify the approval number on the NIOSH Certified Equipment List (CEL) or the NIOSH Trusted-Source page to determine if the respirator has been approved by NIOSH.

- https://www.cdc.gov/niosh/npptl/topics/respirators/disp_part/respsource.html

Signs That a Respirator May Be Counterfeit

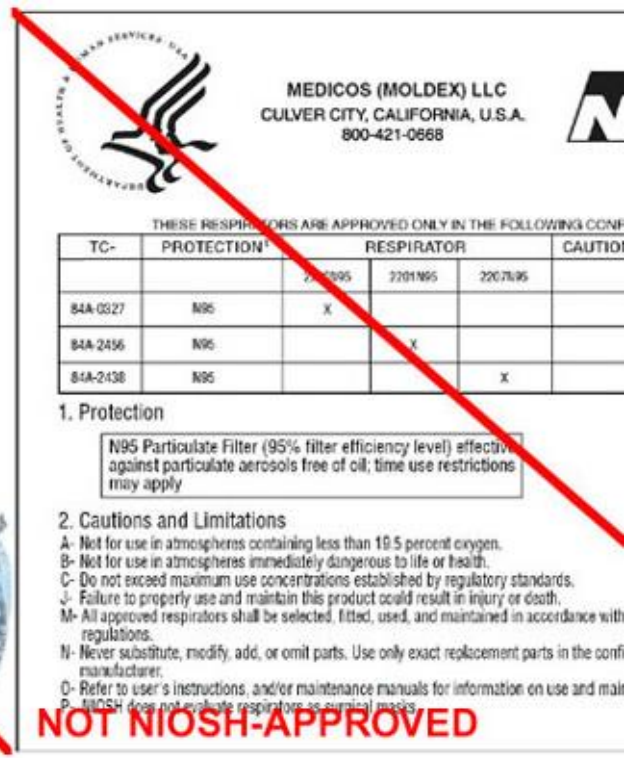
- No markings at all on the filtering facepiece respirator
- No approval (TC) number on filtering facepiece respirator or headband
- No NIOSH markings
- NIOSH spelled incorrectly


NISH
NOTE: Misspelling of
NIOSH

Signs That a Respirator May Be Counterfeit

- Presence of decorative fabric or other decorative add-ons (e.g., sequins)
- Claims for the of approval for children (NIOSH does not approve any type of respiratory protection for children)
- Filtering facepiece respirator has ear loops instead of headbands

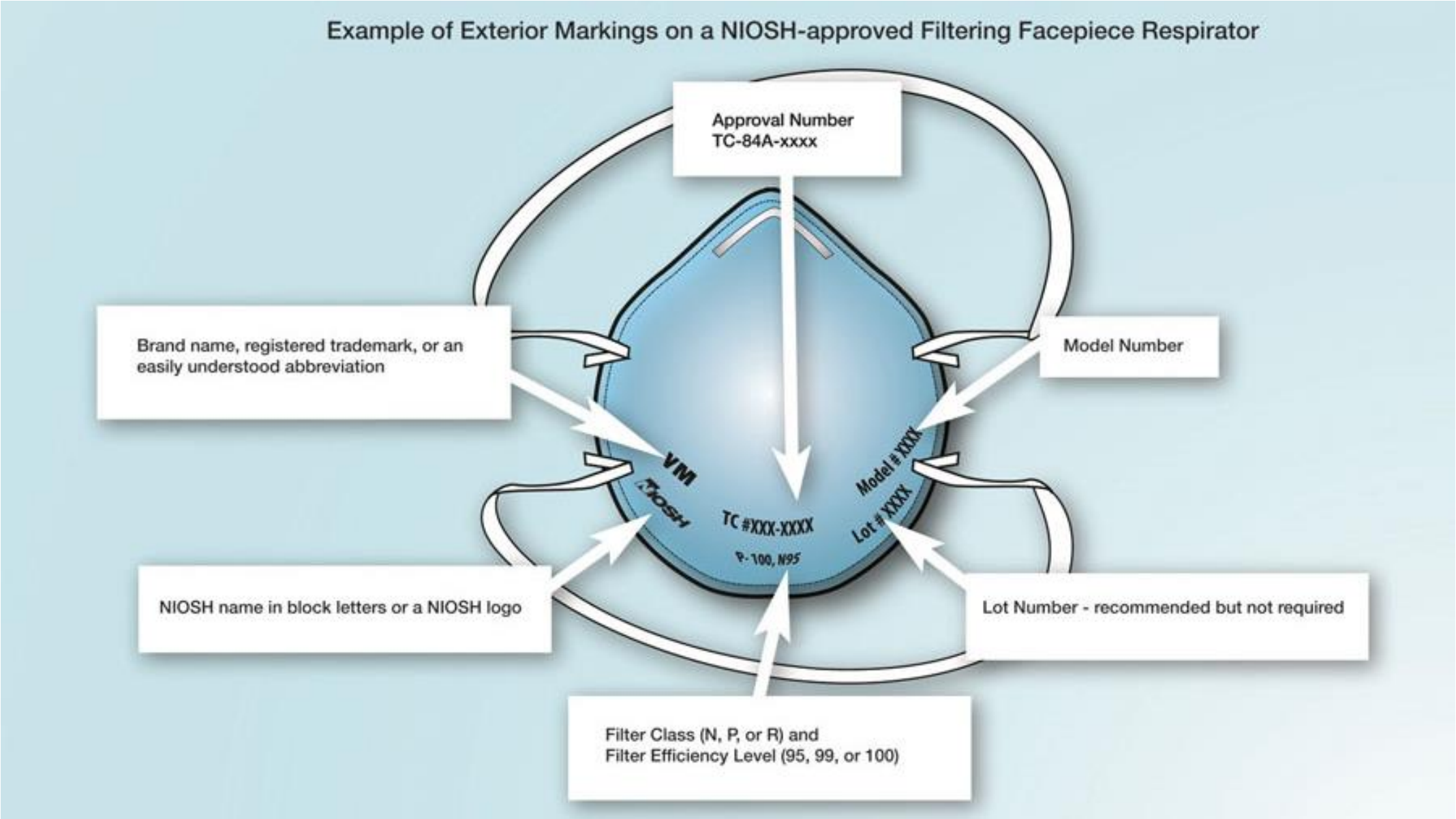
Counterfeit Example



This is an example of a counterfeit respirator.

Medicos is selling an N95 respirator using the Moldex approval number and label without Moldex's permission.

Medicos is not a NIOSH approval holder or private label holder. (3/12/2020)


Example of Exterior Markings on a NIOSH-approved Filtering Facepiece Respirator
Approval Number
TC-84A-xxxx
Brand name, registered trademark, or an easily understood abbreviation
Model Number
NIOSH name in block letters or a NIOSH logo
Lot Number - recommended but not required
Filter Class (N, P, or R) and
Filter Efficiency Level (95, 99, or 100)
VM
NIOSH
TC #XXX-XXXX
P-100, N95
Model # XXXX
Lot # XXXX

Donning and Doffing PPE – CDC Videos

Donning (How to Safely Put on PPE: https://youtu.be/of73FN086E8

Doffing (How to Safely Take off PPE): https://youtu.be/PQxOc13DxvQ

Dentistry as a Profession

Top 100 Job Rankings - 2020
U.S. News & World Report

- Dentists (#2)
- Orthodontist (#4)
- Oral and Maxillofacial Surgeon (#9)
- Dental Hygienist (#24)
- Dental Assistant (#66)

US News & World Report, 2020

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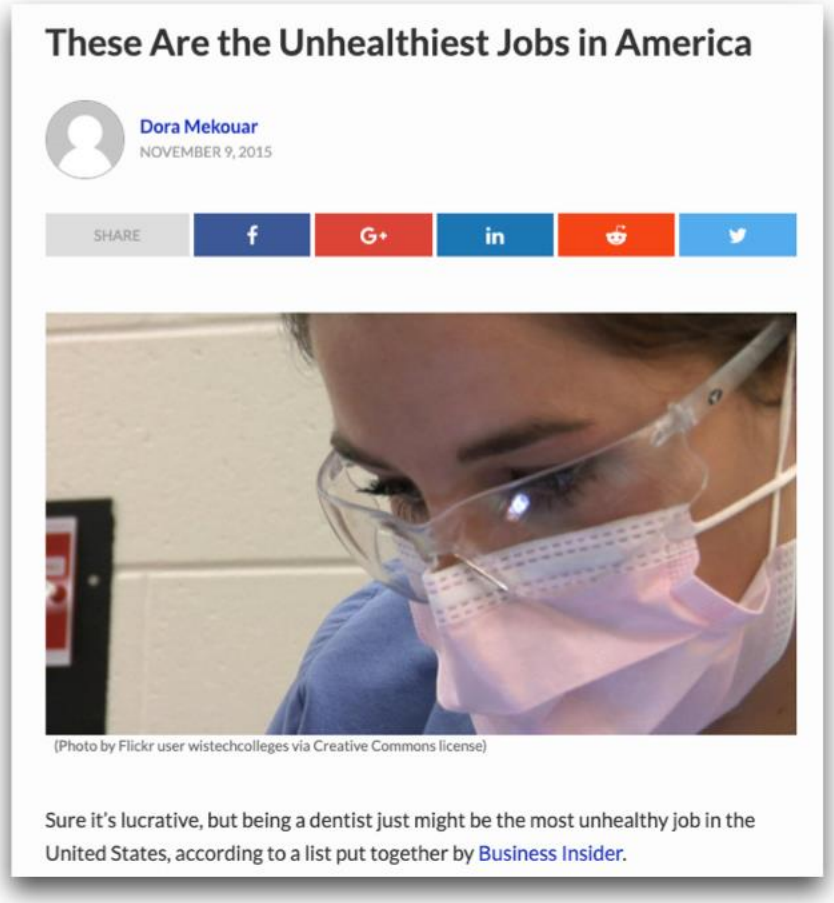


These Are the Unhealthiest Jobs in America

Dora Mekouar
NOVEMBER 9, 2015

SHARE

(Photo by Flickr user wistechcolleges via Creative Commons license)

Sure it's lucrative, but being a dentist just might be the most unhealthy job in the United States, according to a list put together by Business Insider.

https://www.businessinsider.com/most-unhealthy-jobs-in-america-2017-4 referencing the US Department of Labor - O*NET Online occupational database

Unhealthiest Jobs in America

968 Occupations ranked by six health care risks

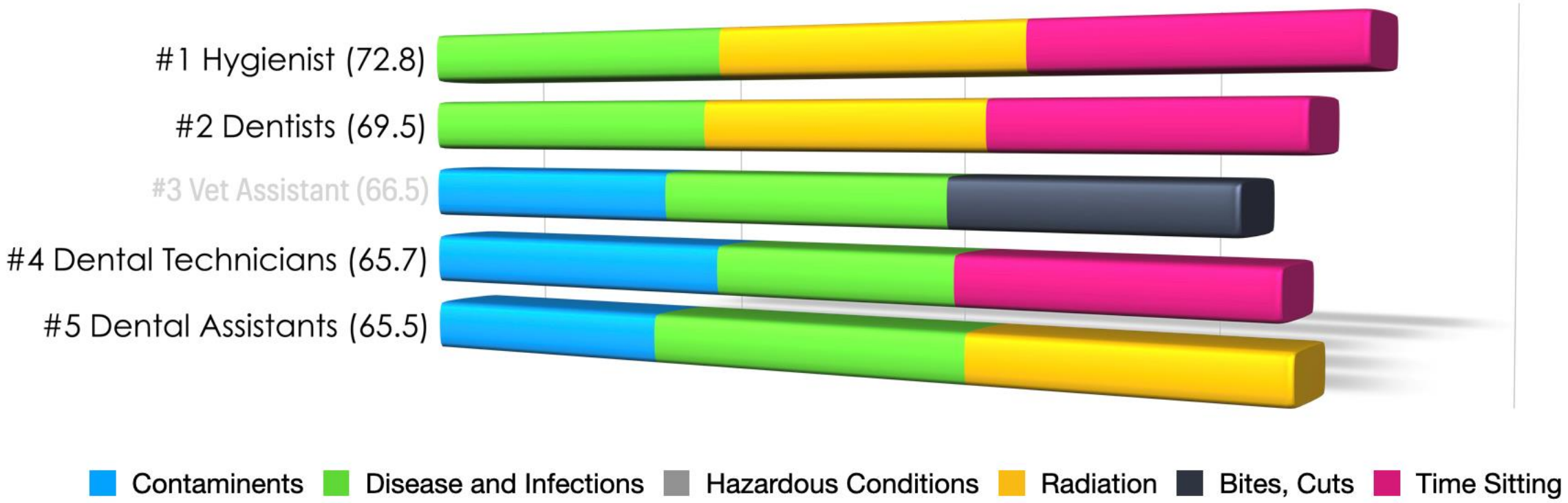
1. Exposure to contaminants
2. Exposure to disease and infection
3. Exposure to hazardous conditions
4. Exposure to radiation
5. Risk of minor burns, cuts, bites and stings
6. Time spent sitting

https://www.businessinsider.com/most-unhealthy-jobs-in-america-2017-4 referencing the US Department of Labor - O*NET Online occupational database

Unhealthiest Jobs in America

968 Occupations ranked by six health care risks

(*only the top 3 health risks are graphed for each profession)



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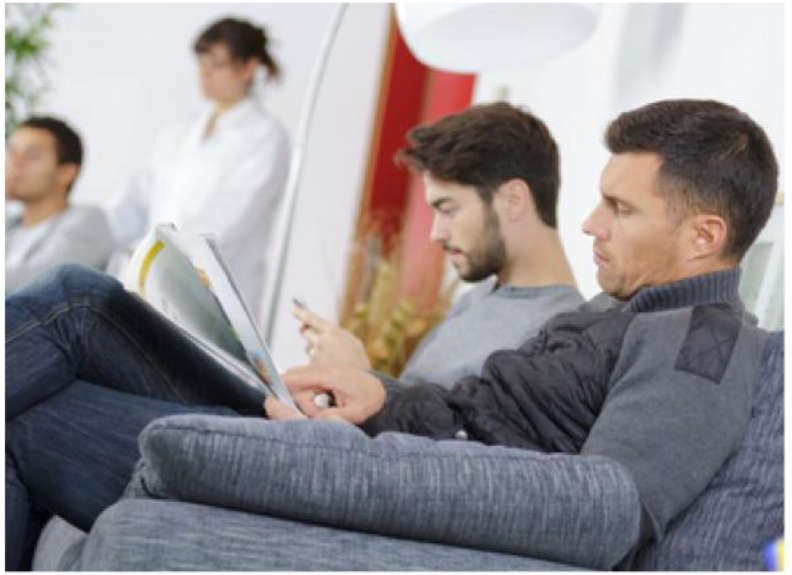
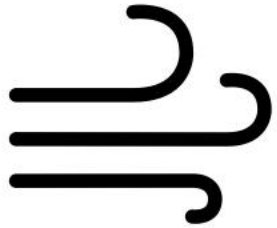


Poor Indoor Air Quality

- Headaches
- Dryness and irritation of the eyes, nose and throat
- Coughing
- Sneezing
- Shortness of breath
- Dizziness
- Nausea

"the air conditioning seems to do a decent job of recirculating the air, but the key term here is recirculating. Bacteria, viruses, and all sorts of airborne things are being blown around the (dental) office."

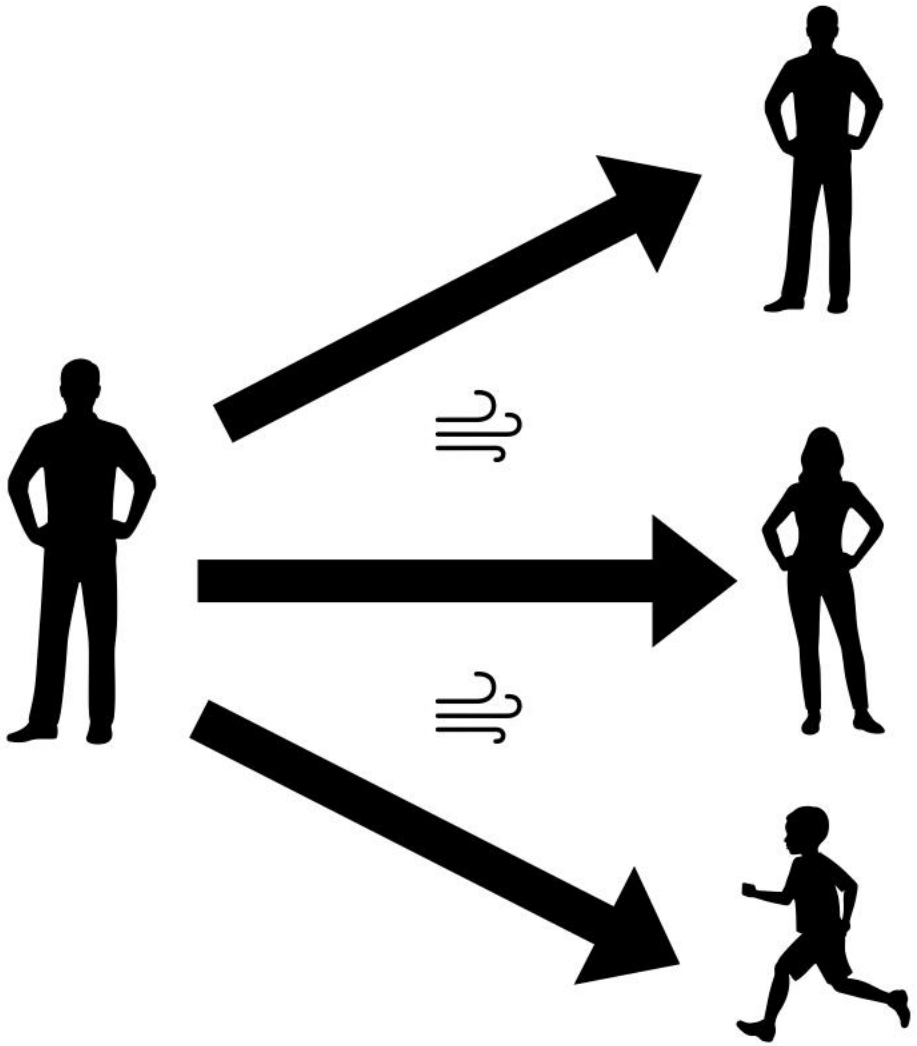


Paul Feuerstein, DMD. In the Air Tonight. January 2011. www.dentaleconomics.com

The Next Level of Dental Protection

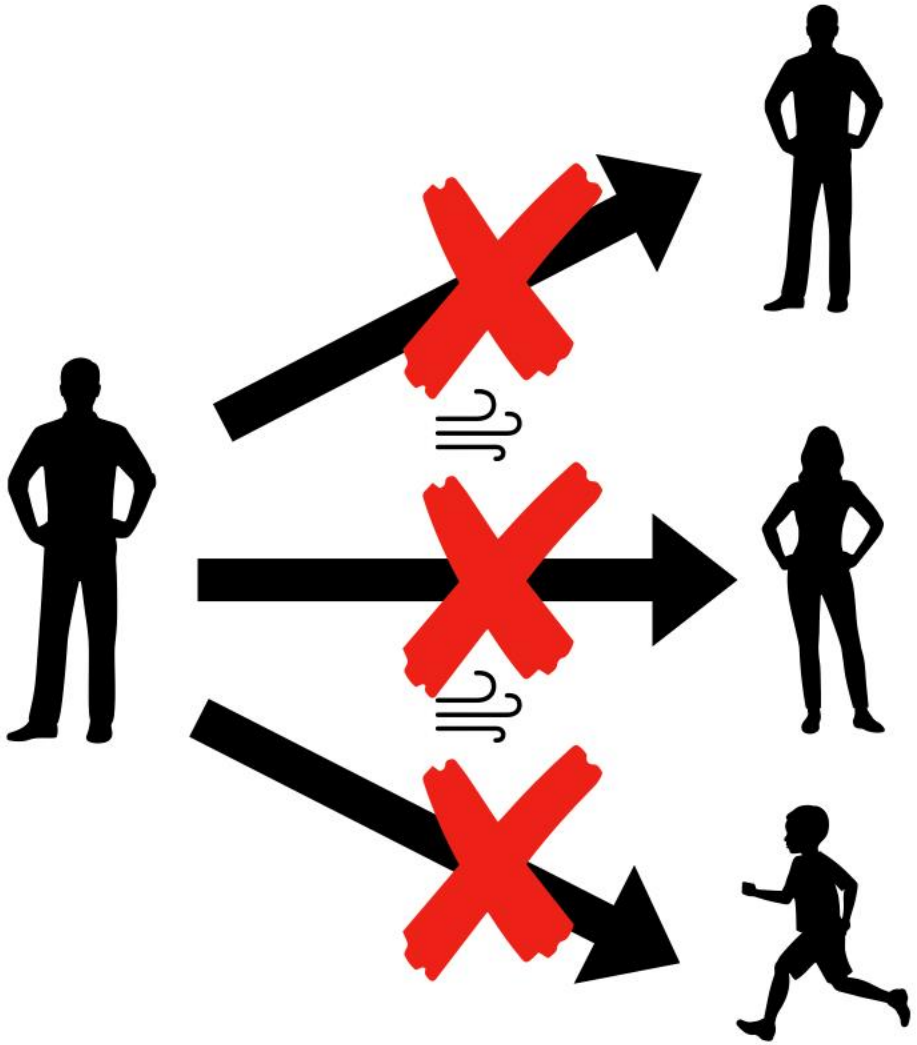
- Sterilize instruments
- Disinfect surface contaminants
- Precaution protocols (PPE)
- Intraoral aerosol management
- ~~Extraoral aerosol management~~
- ~~Indoor air quality~~

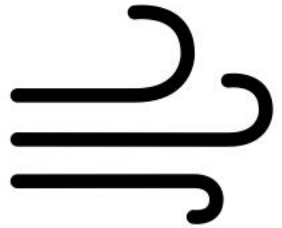
The Chain of Infection



ASHRAE, Position Document on Infectious Aerosols. www.ashrae.org

Break the Chain of Infection





Ventilation

Filtration

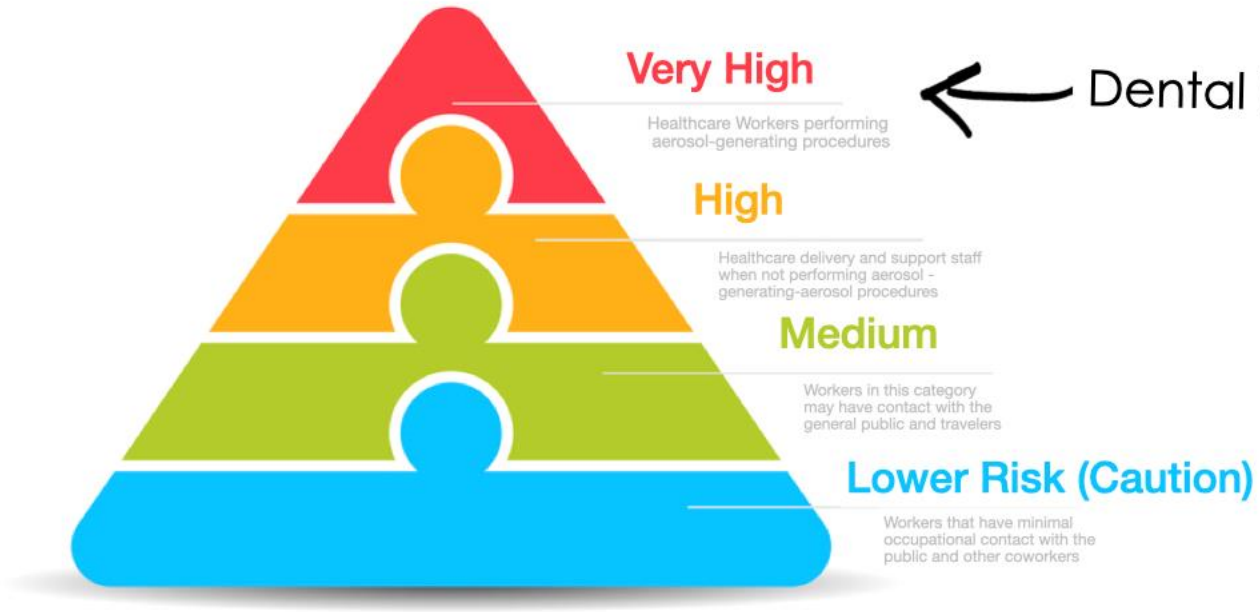
Air distribution

Disinfection technologies

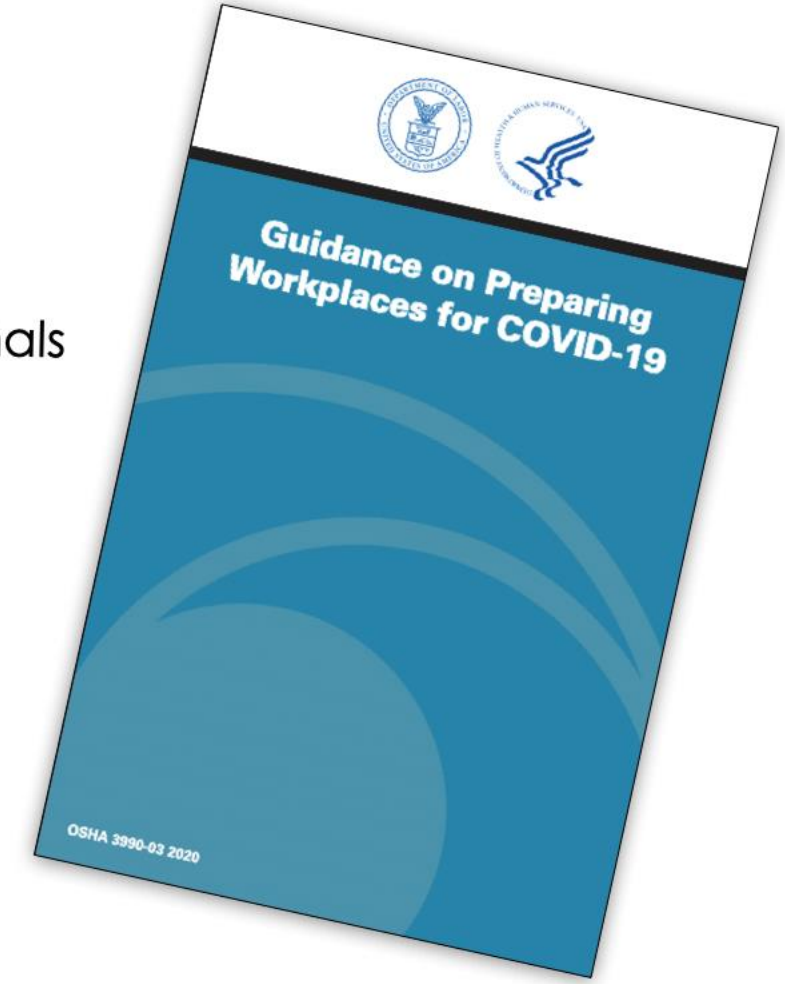
ASHRAE, Position Document on Infectious Aerosols. www.ashrae.org

Very High COVID-19 Exposure Risk

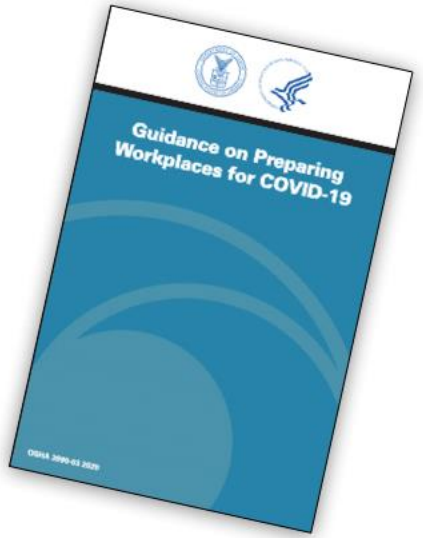
Occupational Risk Pyramid for COVID-19



← Dental Professionals



Engineering Infection Controls



Engineering Infection Controls

- Installing high-efficiency air filters
- Increasing ventilation
- Installing physical barriers
- Specialized negative pressure ventilation in some settings
- Installing a drive-through window for customer service

Aerosols and Aerosol Management

Steps in Controlling Air Pollutants

1. Source Control
2. Ventilation
3. Air Cleaning

EPA United States Environmental Protection Agency

"(the)FDA believes that certain sterilizers, disinfectant devices, and air purifiers falling within the scope of this guidance may help reduce this risk of viral exposure based on our current understanding of these devices and SARS-CoV-2."

Contains Nonbinding Recommendations

Enforcement Policy for Sterilizers, Disinfectant Devices, and Air Purifiers During the Coronavirus Disease 2019 (COVID-19) Public Health Emergency

Guidance for Industry and Food and Drug Administration Staff

March 2020

U.S. FOOD & DRUG ADMINISTRATION

U.S. Department of Health and Human Services
Food and Drug Administration
Center for Devices and Radiological Health

There is Not One Solution That Fits All

- Infection control bundling
- Layering of protective procedures

Source Control

+

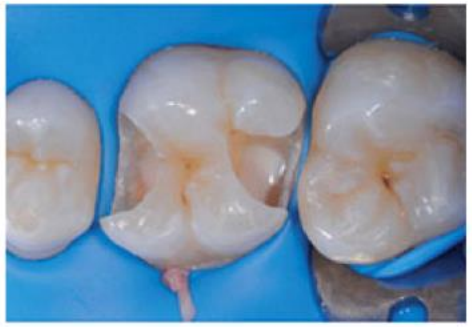
Ventilation

+

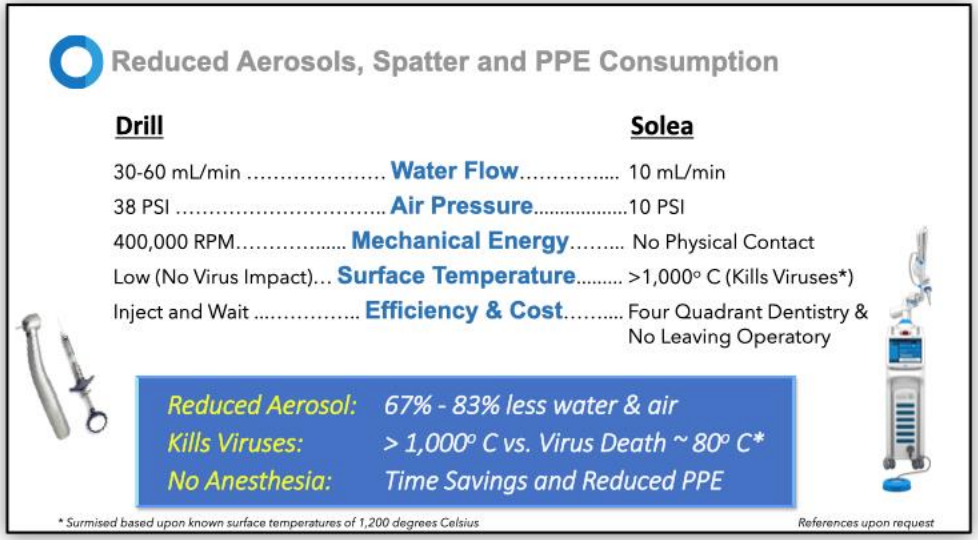
Air cleaning

Aerosols and Aerosol Management

1. Source Control




"…based on these factors, the risk of aerosolization and transmission is significantly lower with Solea than the drill[1]."



[1] ConvergentDental.
Ando Y, Aoki A, Watanabe H, Ishikawa I. Bactericidal effect of erbium YAG laser on periodonto-pathic bacteria. Laser Surg Med 1996;19(2):190-200.
Russell AD, Lethal effects of heat on bacterial physiology and structure. Sci Prog 2003;86(1-2):115-137.

Digital Impression Systems - Minimizing Aerosols/Transport

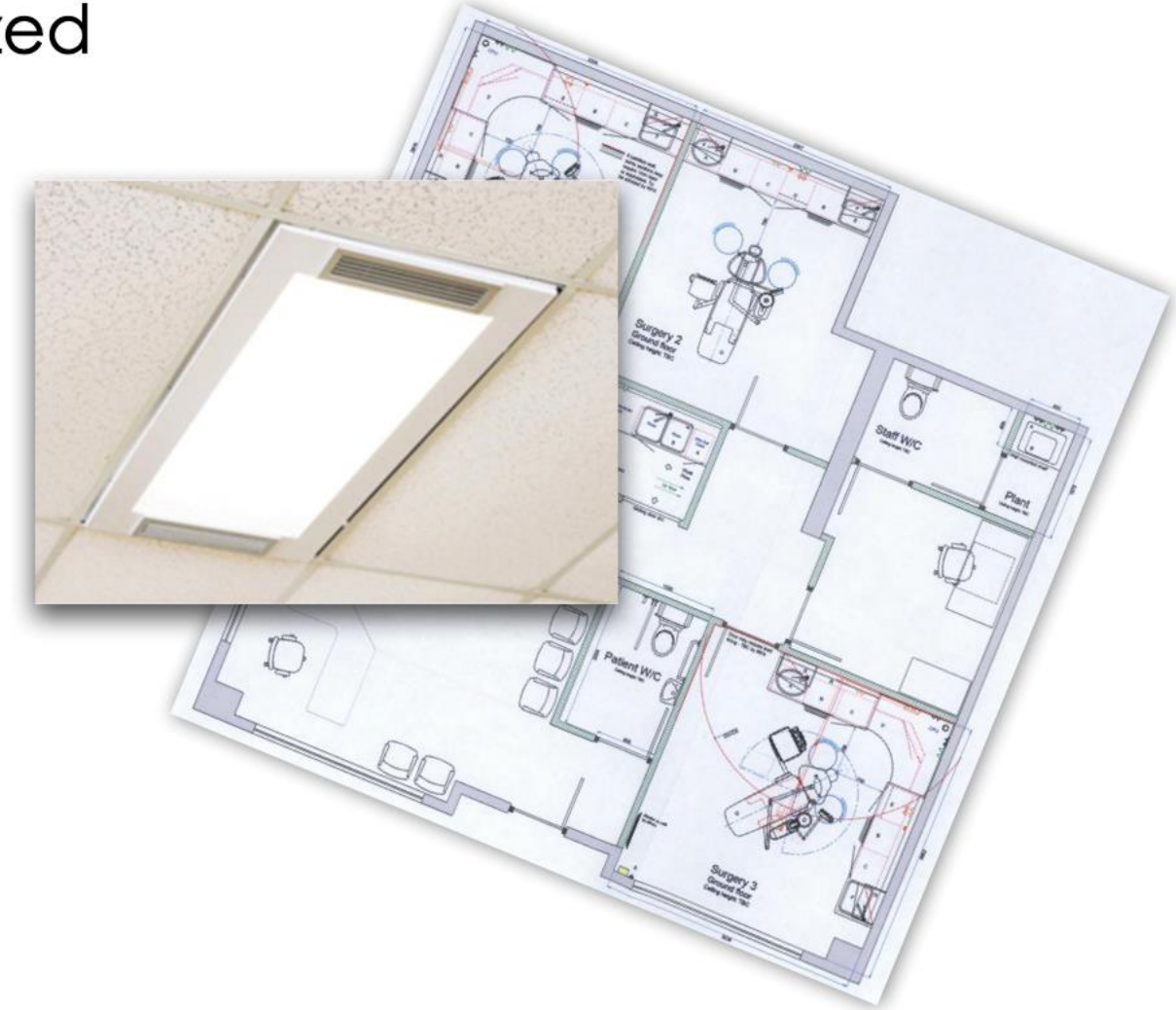
Chairside Solutions to Reduce # of Visits

Aerosols and Aerosol Management

2. Ventilation - local and centralized

Aerosols and Aerosol Management

3. Air Cleaning - local and centralized



Benefits of Air Purification/Ventilation

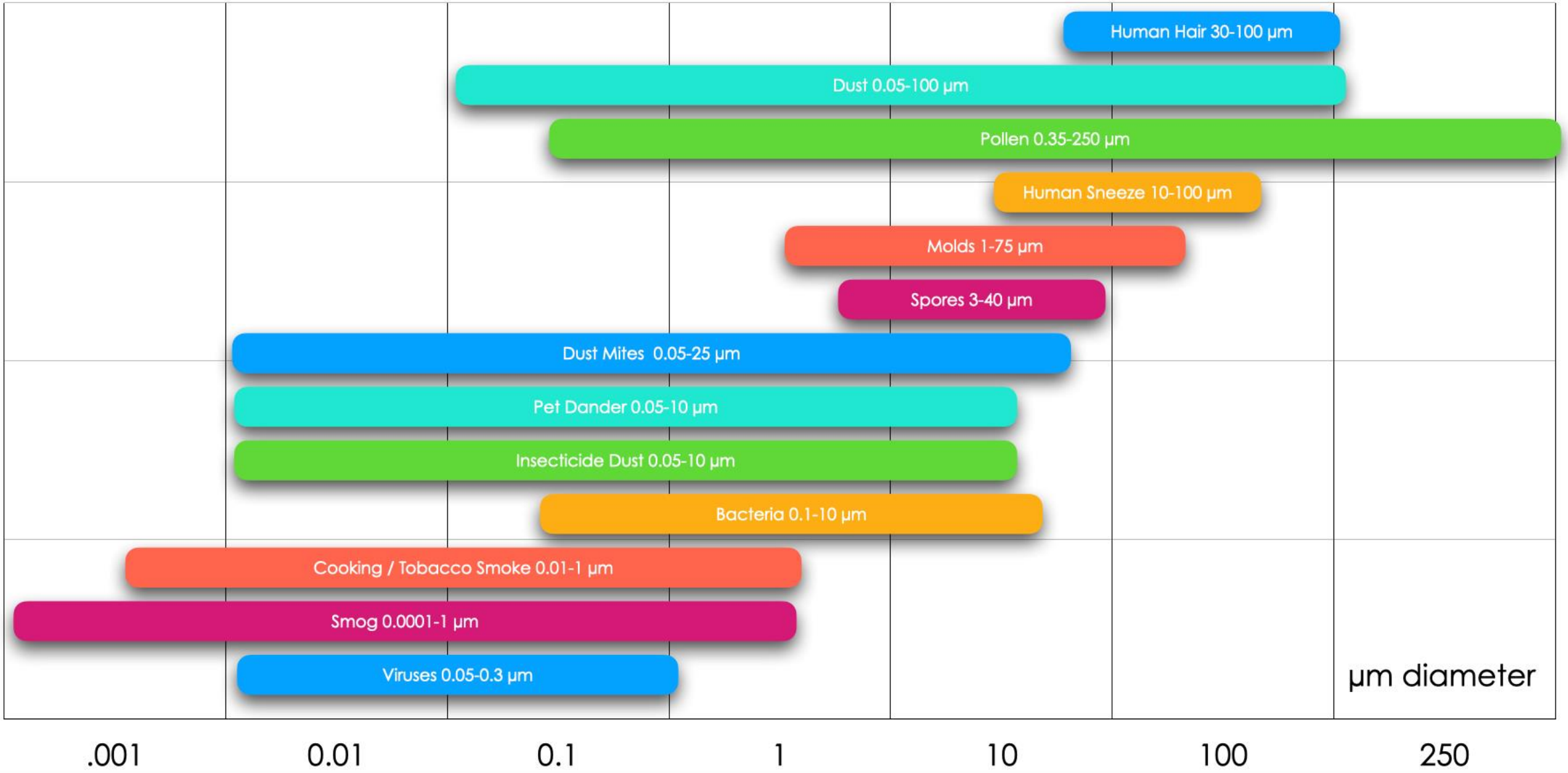
- Overall well-being and health of the dental team
- Patient health and wellness
- Positive patient impressions of the dental practice
- Increased productivity
- Decreased absenteeism

Wyon DP, Indoor Air. 2004;14 Suppl 7:92-101. The effects of indoor air quality on performance and productivity.

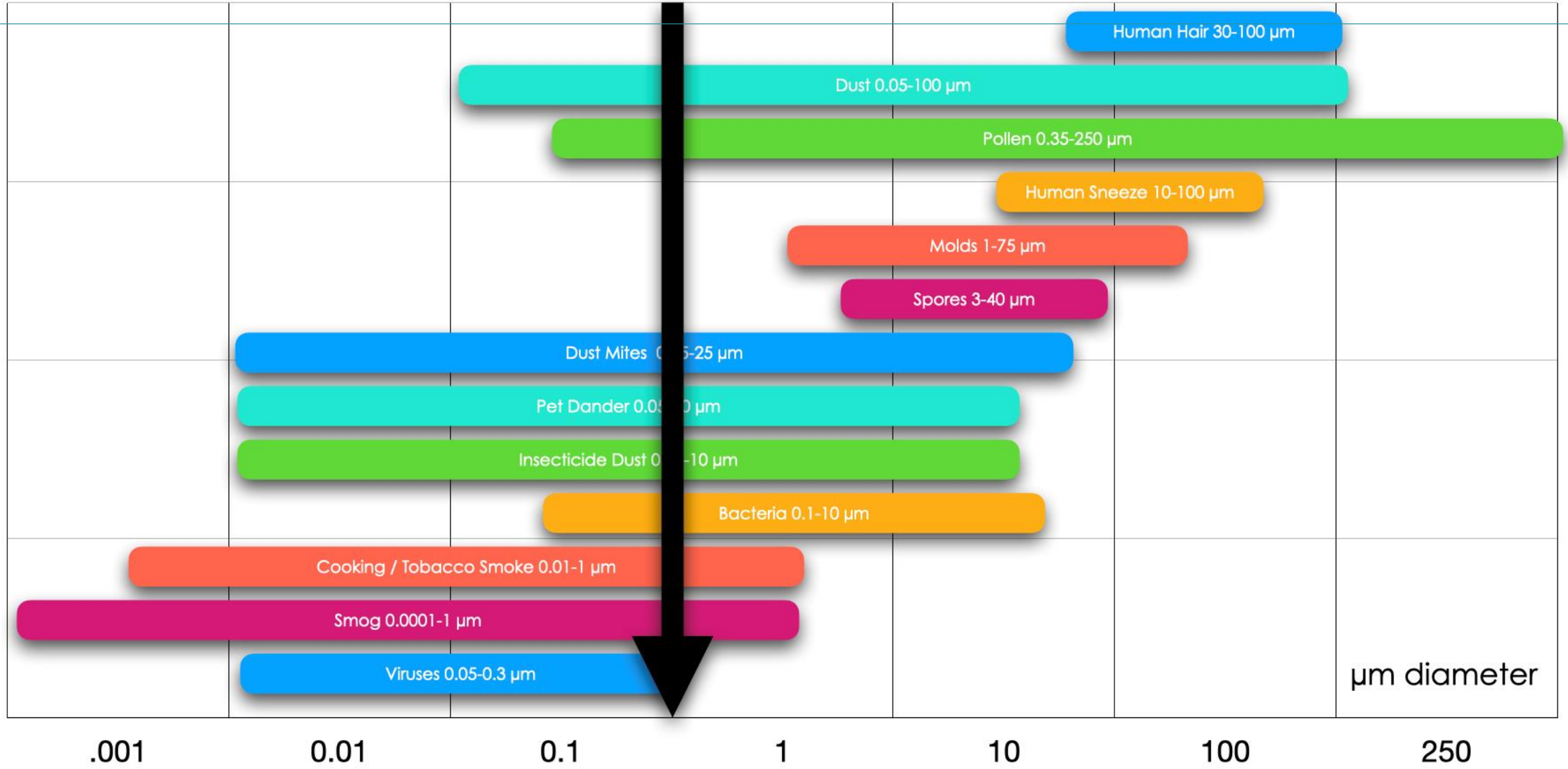
MacNaughton, P.; Pegues, J.; Satish, U.; Santanam, S.; Spengler, J.; Allen, J. Economic, Environmental and Health Implications of Enhanced Ventilation in Office Buildings. *Int. J. Environ. Res. Public Health* **2015**, *12*, 14709-14722.

Methodologies of Air Purification

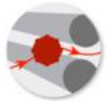
- Air filtering (HEPA, MERV, Carbon filters)
- Use of shielded UV light (UV Germicidal Irradiation (UVGI), PhotoCatalytic Oxidation (PCO)
- Ionization of the air (Negative Ion Purification)


Human Hair 30-100 µm
Dust 0.05-100 µm
Pollen 0.35-250 µm
Human Sneeze 10-100 µm
Molds 1-75 µm
Spores 3-40 µm
Dust Mites 0.05-25 µm
Pet Dander 0.05-10 µm
Insecticide Dust 0.05-10 µm
Bacteria 0.1-10 µm
Cooking / Tobacco Smoke 0.01-1 µm
Smog 0.0001-1 µm
Viruses 0.05-0.3 µm
µm diameter
.001
0.01
0.1
1
10
100
250

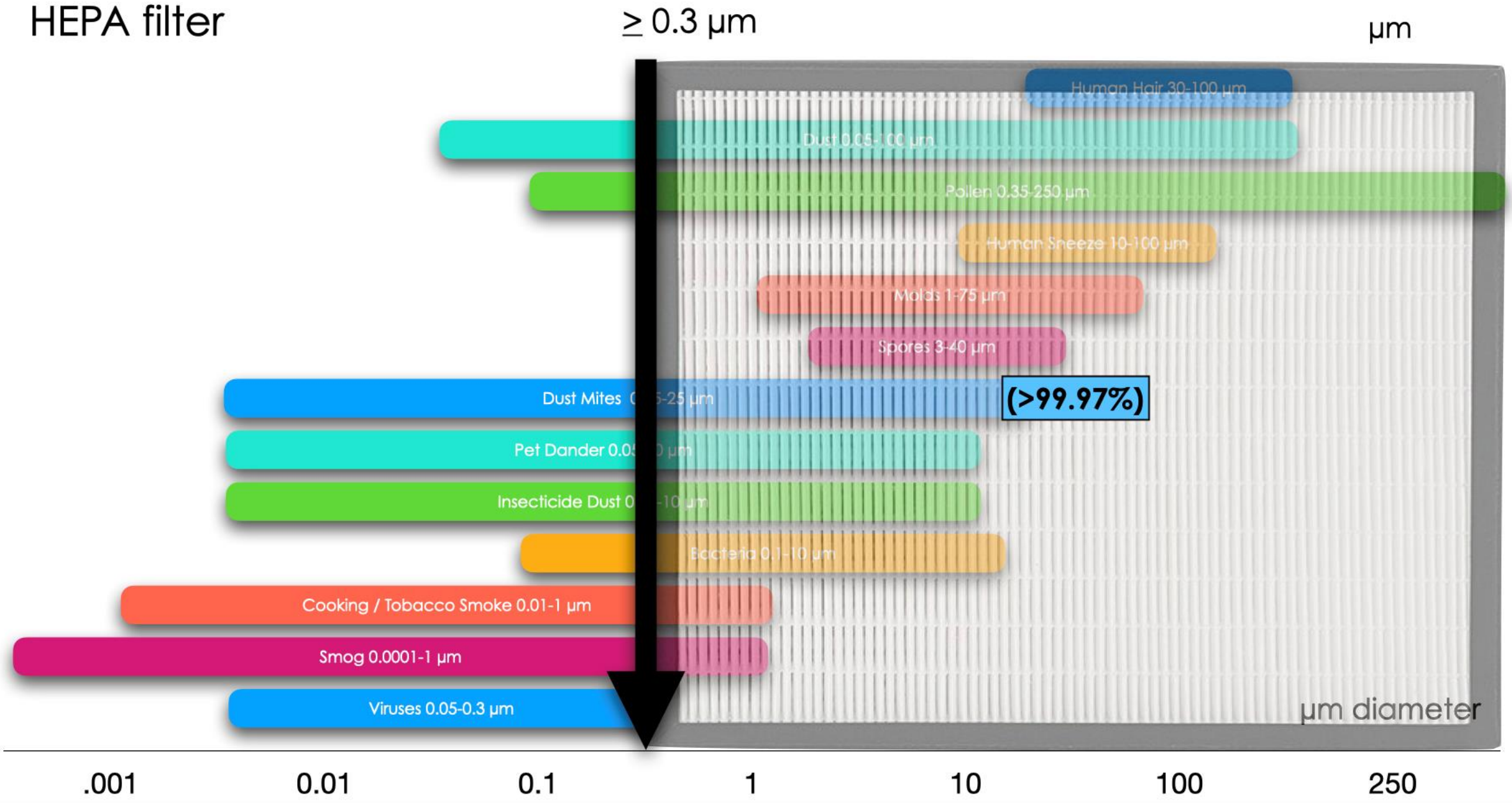
Most Penetrating Particle Size (0.3µm)



HEPA (High Efficiency Particulate Air)

- Filters 99.97% of particles that are 0.3 microns (µ)
- 0.3µ are labeled the most penetrating particle size (MPPS)
- HEPA filters can filter larger and smaller particles than 0.3µ
- Made of interlaced glass fibers that create a fibrous maze
  - Straining - particle larger than the gap 
  - Impingement - collide and stick 
  - Interception - inertia of particles carries them into the fibers 
  - Diffusion - small particles travel erratically so more likely to hit a fiber 

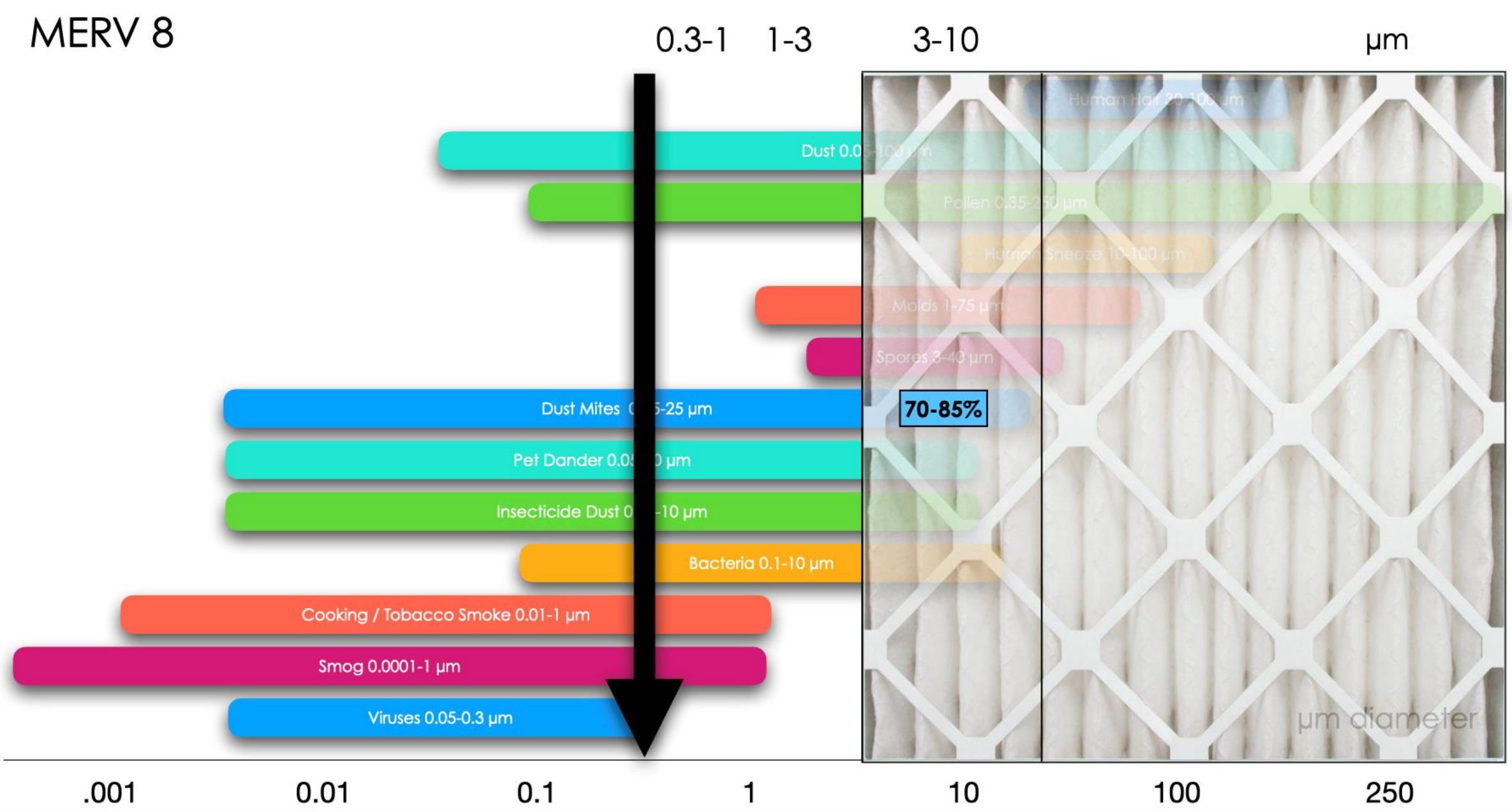
Guidelines for Environmental Infection Control in Health-Care Facilities (2003), CDC

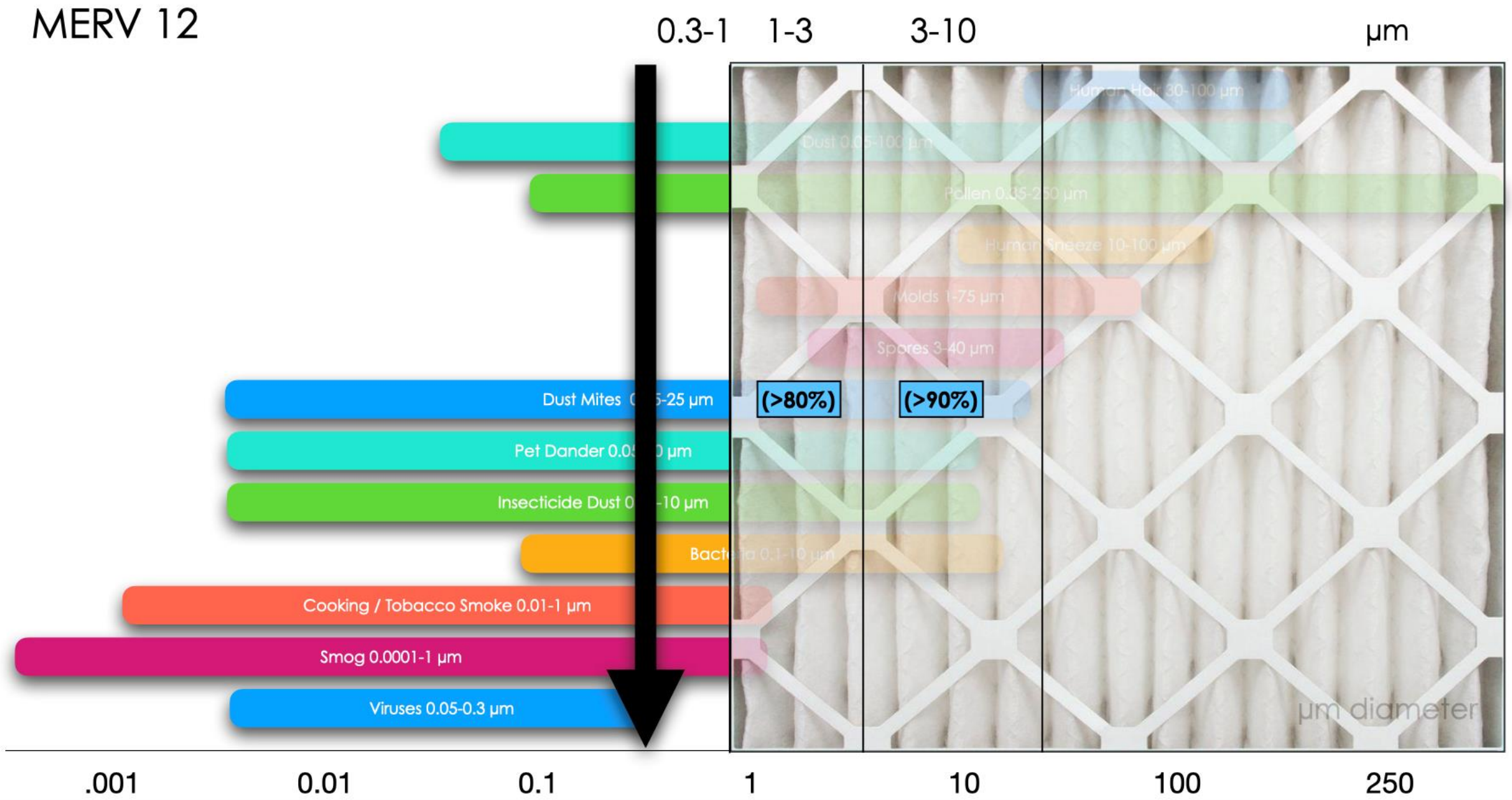

HEPA filter
≥ 0.3 µm
µm
Human Hair 30-100 µm
Dust 0.05-100 µm
Pollen 0.35-250 µm
Human Sneeze 10-100 µm
Molds 1-75 µm
Spores 3-40 µm
Dust Mites
(>99.97%)
Pet Dander
Insecticide Dust
Bacteria 0.1-10 µm
Cooking / Tobacco Smoke 0.01-1 µm
Smog 0.0001-1 µm
Viruses 0.05-0.3 µm
µm diameter
.001
0.01
0.1
1
10
100
250

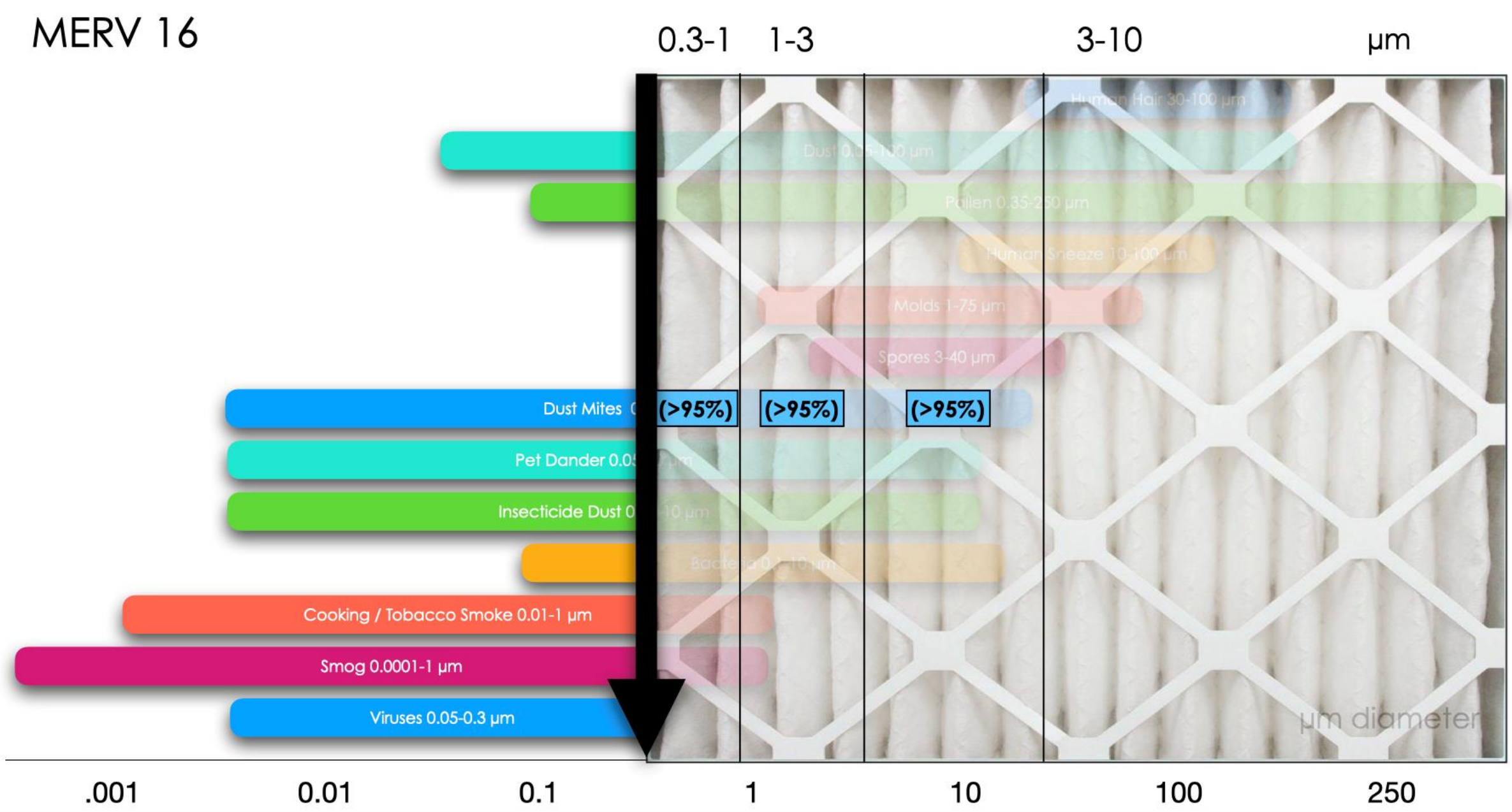
MERV (Minimum Efficiency Reporting Value)

- Rating system created by the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)

- MERV rating is the filter's ability to capture particles
  - 0.3-1.0 microns
  - 1.0-3.0 microns
  - 3.0-10 microns
- The higher the MERV rating (1-20) the better the filter is at trapping specific types of particles
- Filter with a MERV of 17 or higher trap 99.97% of particles 0.3µ and higher


MERV 8
0.3-1
1-3
3-10
µm
Dust 0.0
Pollen
Human Sneeze 10-100 µm
Molds 1-75 µm
Spores 3-40 µm
Dust Mites
-25 µm
70-85%
Pet Dander 0.0
µm
Insecticide Dust 0
-10 µm
Bacteria 0.1-10 µm
Cooking / Tobacco Smoke 0.01-1 µm
Smog 0.0001-1 µm
Viruses 0.05-0.3 µm
µm diameter
.001
0.01
0.1
1
10
100
250


MERV 12
0.3-1
1-3
3-10
µm
Dust Mites
Pet Dander
Insecticide Dust
Cooking / Tobacco Smoke 0.01-1 µm
Smog 0.0001-1 µm
Viruses 0.05-0.3 µm
(>80%)
(>90%)
µm diameter
.001
0.01
0.1
1
10
100
250

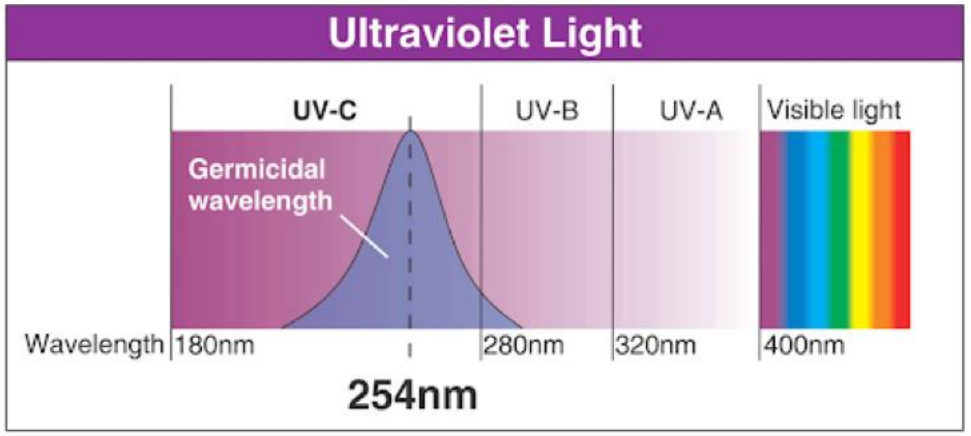

MERV 16
0.3-1
1-3
3-10
µm
Human Hair 30-100 µm
Dust 0.01-100 µm
Pollen 0.35-250 µm
Human Sneeze 10-100 µm
Molds 1-75 µm
Spores 3-40 µm
Dust Mites
Pet Dander 0.05
Insecticide Dust 0
Bacte
(>95%)
(>95%)
(>95%)
Cooking / Tobacco Smoke 0.01-1 µm
Smog 0.0001-1 µm
Viruses 0.05-0.3 µm
µm diameter
.001
0.01
0.1
1
10
100
250

Activated Carbon (charcoal) Filters

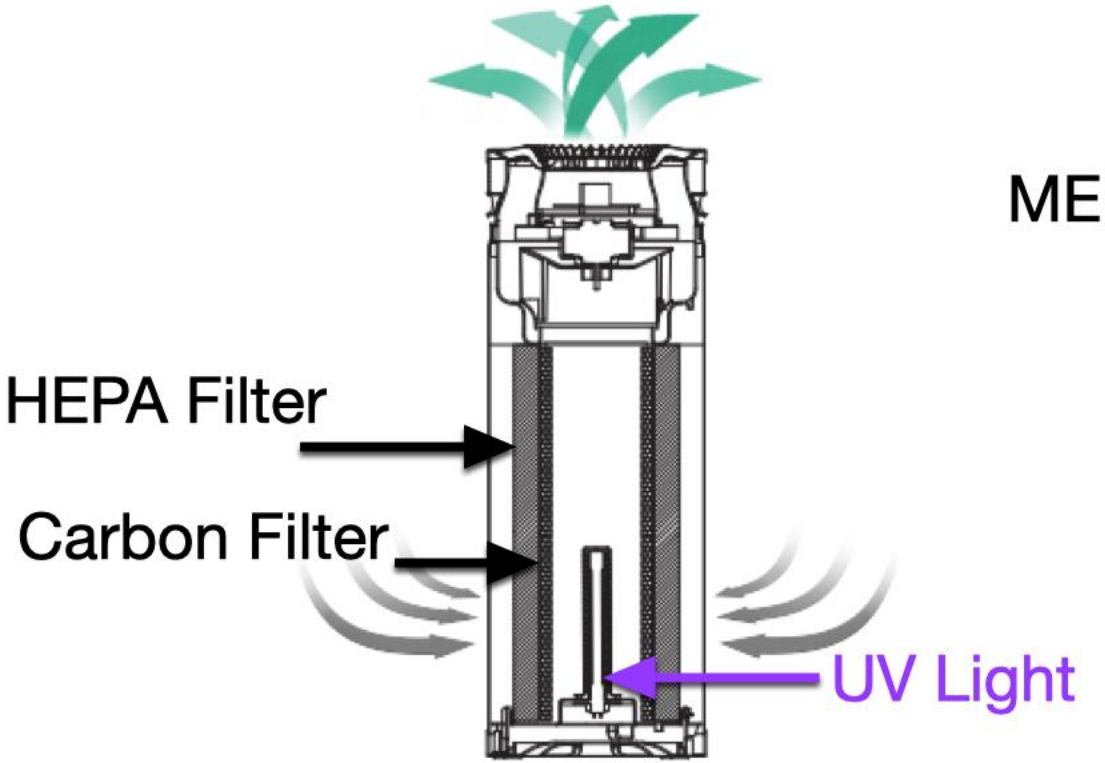
- Carbon that has been treated (activated) with oxygen to open up millions of tiny pores of various molecular sizes
- Highly adsorbent capturing odorous, gaseous, liquid contaminates
  - Organic chemicals and compounds
  - Reduce ozone accumulation

Ultraviolet Light

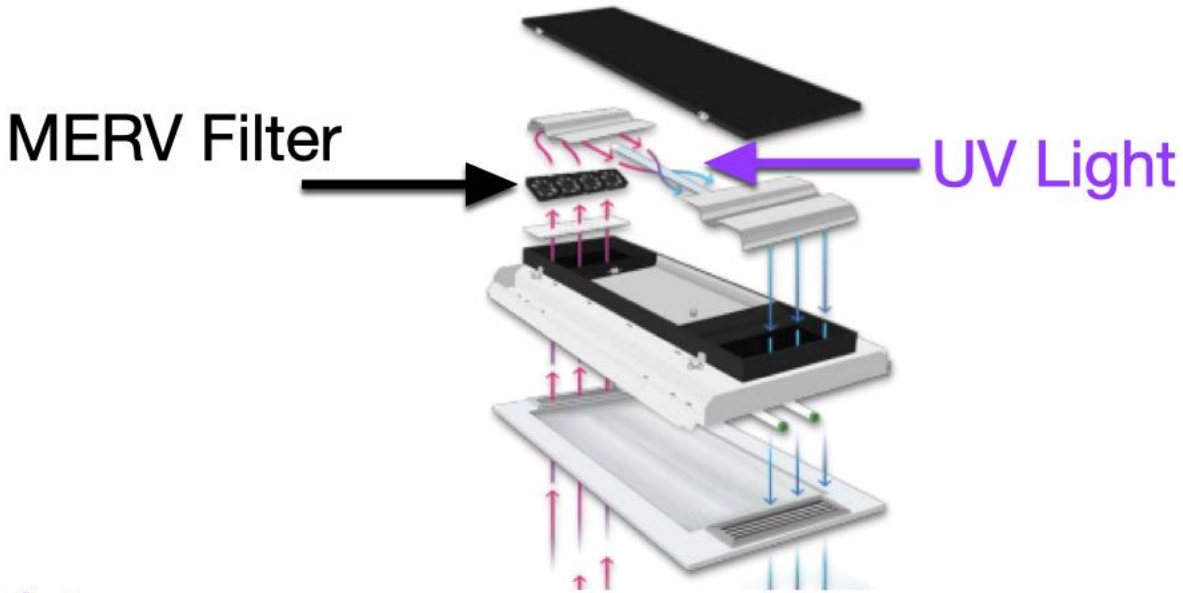
- Ultraviolet Germicidal Irradiation (UVGI)
- UV-C light (180-290nm) - most often 253.7nm for UVGI
- Inactivates microorganism by damaging DNA/RNA
- Can cause skin/eye damage, so source must be shielded or used only when no one present



Combinations of Filters and UV



Air Purifier



Overhead Light

Ionization (Negative Ion Purification)

- Creating negative (electrons) and positive (proton) ions
- Most forms of pollution, toxic chemicals, pollen, mold, pet dander, and other harmful chemicals in the air all carry a positive electrical charge, making them positive ions
- Negative ions outweigh positive ions and can create clusters and bring positive ion particles down out of the air
- Waterfalls, the sea, rivers and electrical storms produce negative ions

Ionization (Negative Ion Purification)

- Locally - in specific space

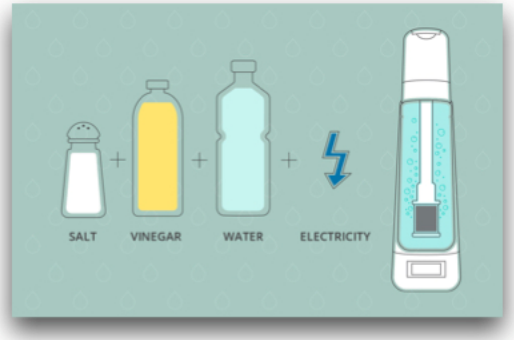
- Centrally - within the HVAC System

Photocatalytic Oxidation (PCO)

- Combination of UV-C and a titanium dioxide filter
- Creates highly reactive electrons (-) in the air
- Upon contact with the pollutant (particle) it oxidizes (burns) it

Electrolized Water (EO Water, Hypochlorous Acid)

- Electrolized Water is produced by the electrolysis of water and salt. The generated result is a mildly acidic form of chlorine known as Hypochlorous Acid (HOCl) which happens to be the foundation of the human immune system.
- Upon contact with the pollutant (particle) it oxidizes (burns) it. Can be used on direct contact to surfaces or fogged in an area.
- Vinegar lowers the pH (the acidity) of the solution so that the right amounts of hypochlorous acid & sodium hydroxide are created.
- Electrolyzed alkaline ionized water loses its potency fairly quickly, so it cannot be stored for long.



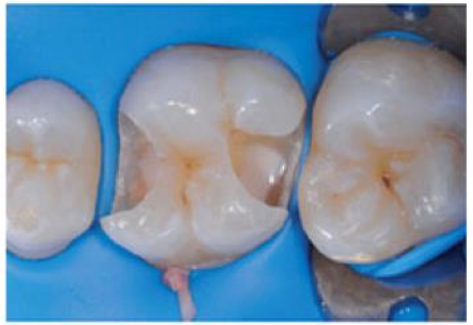
Negative Pressure Rooms

- Isolation technique to prevent cross-contamination from room to room
- Ventilation that creates a “negative pressure” (pressure lower than of the surroundings) drawing passive air in - typically under door seal
- For a negative pressure room, the sum of the exhausted air must exceed the sum of the supplied air, preventing infectious particles from escaping other than as intended
- Air forced out - normally to the outside, can also be filtered prior to exiting

Consider Multiple Solutions

- Infection control bundling
- Layering of protective procedures

Source Control



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+

Ventilation

©Tekitronics

+

Air cleaning

©Surgically Clean Air

Air Purification System (APS) Selection Considerations

- Types or combination of methods (filters, UVGI, ionization)

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- Types or combination of methods (filters, UV-C, Ionization)
- Air flow capacity - cubic feet per minute (CFM)
  - Measuring the flow of air
- Size of Room(s)/Space(s) (sq ft or cu ft)
  - sq ft (ft^2)- square feet (LxW) assume 8' ceilings (determined off blueprints)
  - cu ft (ft^3)- cubic feet (LxWxH)

Air Purification System (APS) Selection Considerations

- ACH/ACPH - Air Change Rate or Air Change Per Hour (Clean Air Delivery Rates/CADR)
  - If Space is consistent and uniform:

$$\frac{60 \times \text{Airflow of the system (CFM)}}{\text{Volume of the Room (L x W x H)}} = \text{Air Change(s) Per Hour (ACPH)}$$

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- 144 CFM
- 230 CFM
- 294 CFM
- 383 CFM

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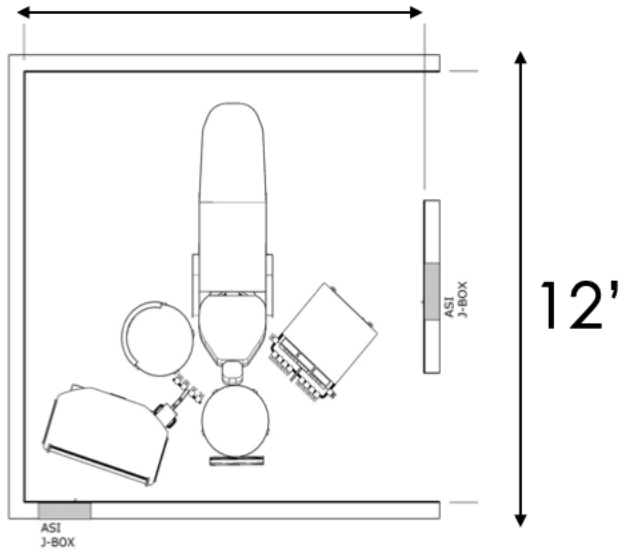
assuming a 10'x12'x 8 Operatory (960 cu ft)

- 144 CFM
- 230 CFM
- 294 CFM
- 383 CFM



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$$\frac{60 \times 383}{960} = \underline{\mathbf{24}} \text{ Air Changes/Hour}$$

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- Sound level (dB)
  - Some APS have multiple airflow settings
    - Typically, the higher the airflow the greater the sound
    - Dishwasher 50dB
    - Conversation 60dB
    - Dental Drill 60-99dB

Air Purification System Selection

Operational Costs

- Energy efficiency
- Filter replacement
- UV lights
- Consumables
- Waste management
- Time to clean between patients

Every Office and Need is Unique

- Square footage
- Office design
- Office environment
- Patient flow
- Team members
- Aerosol producing procedures

Every Office and Need is Unique

- Infection control bundling
- Layering of protective procedures

  - Source Control
  - Ventilation
  - Air Cleaning

Contact your Henry Schein Representative for solutions on Air Management for your practice.

Thank You!

Have topics you'd like us to cover relating to COVID-19 & Dentistry?

- **Email: webinars@henryschein.com**
- **Comment on YouTube Recording – and Subscribe!**

For more information and a full list of references, please visit the Henry Schein COVID-19 resource center:

www.henryschein.com/COVID19update