COVID-19 Risks Reduction and PPE: What to Do at Work and Home

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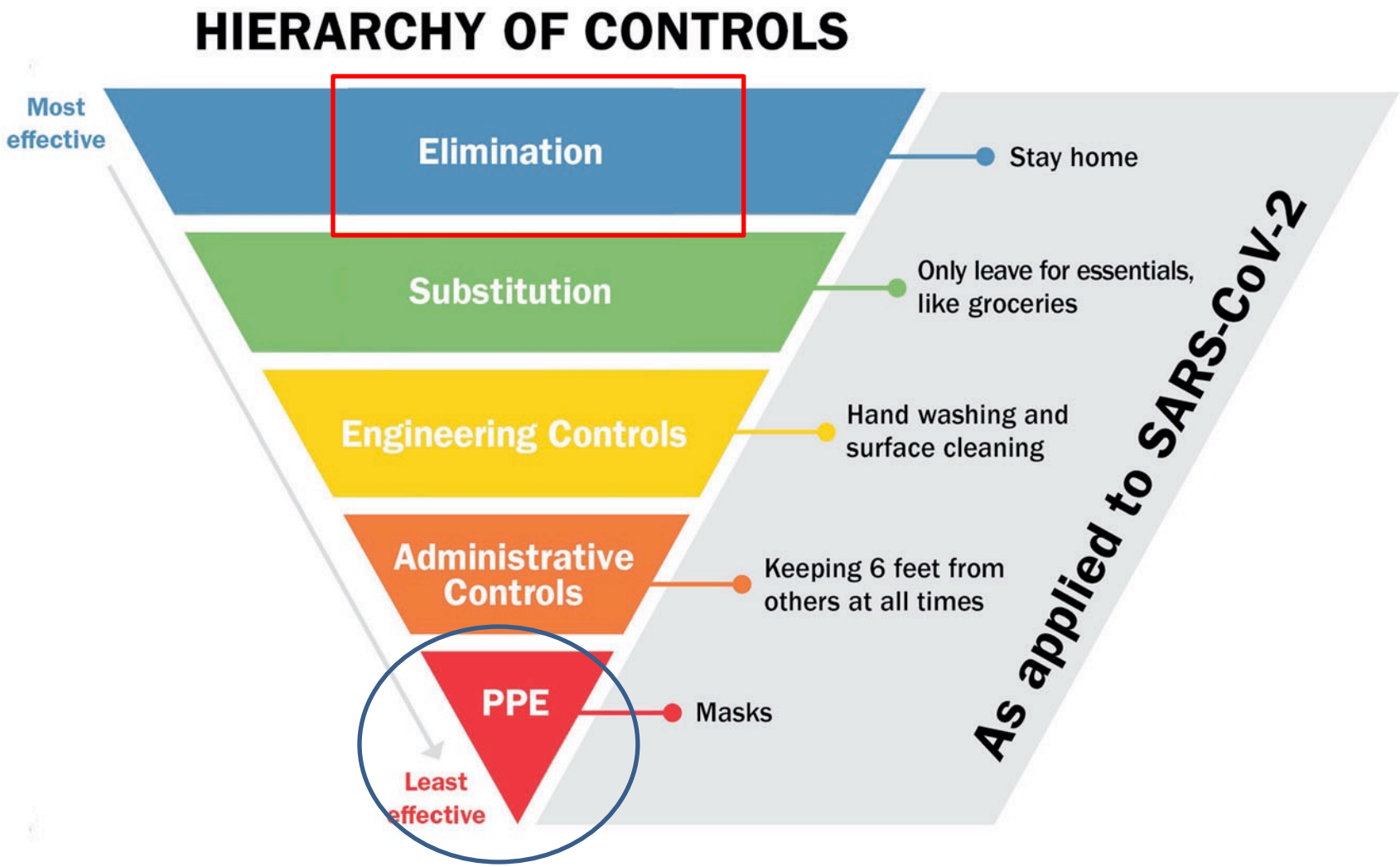
Courtesy: Dr. John Adgate, Colorado School of Public Health © 2020

Roadmap

- Personal Protective Equipment (PPE) and SARS-CoV-2 (virus) COVID-19 (disease) as of May 2020
  - N95s, Surgical Masks, Homemade Masks
- What are we trying to protect ourselves from?
  - And what is the 6 foot rule based upon?
  - What can N95/Surgical/Homemade masks do?
- What about exposure from the virus on surfaces (fomites)?

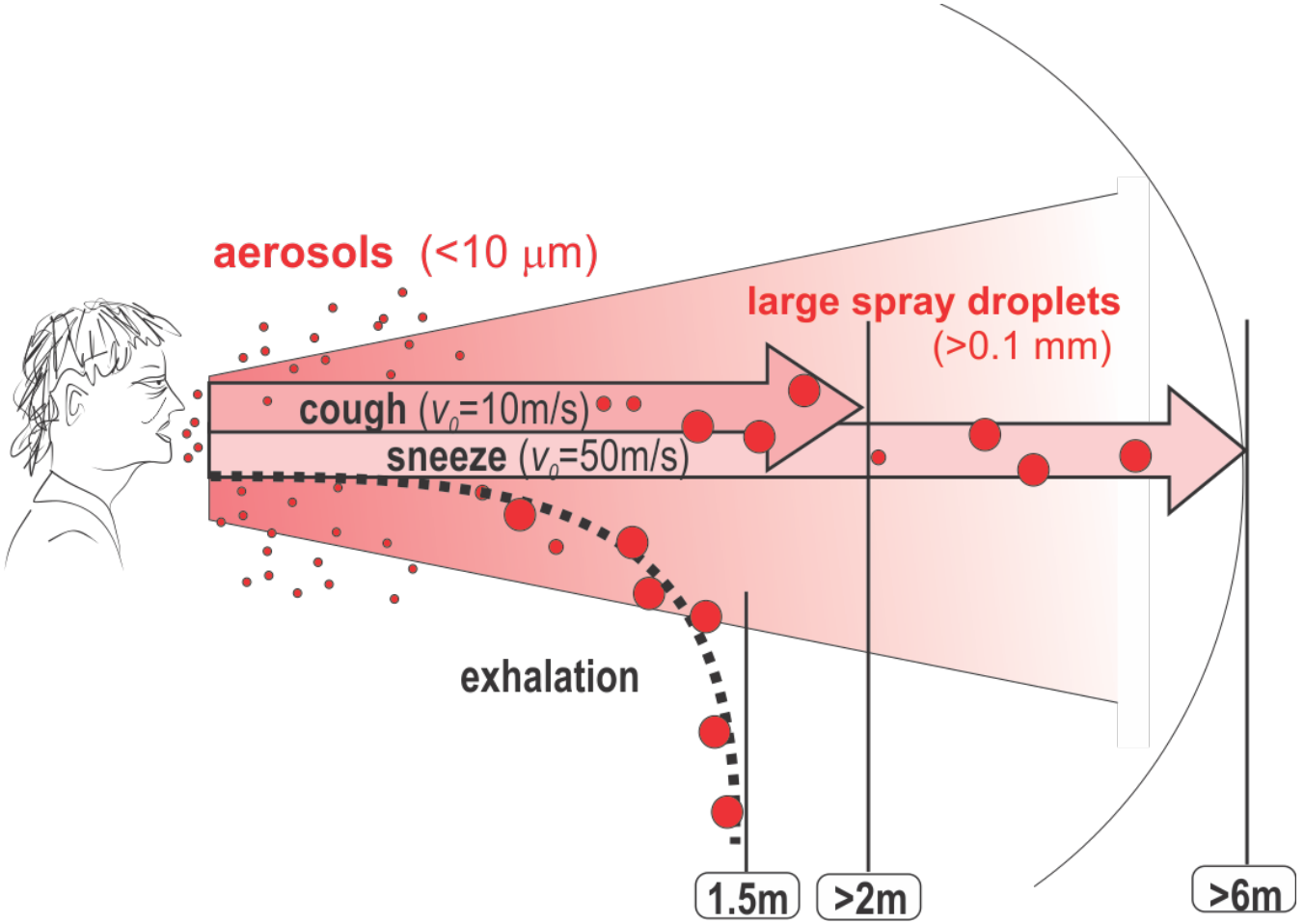


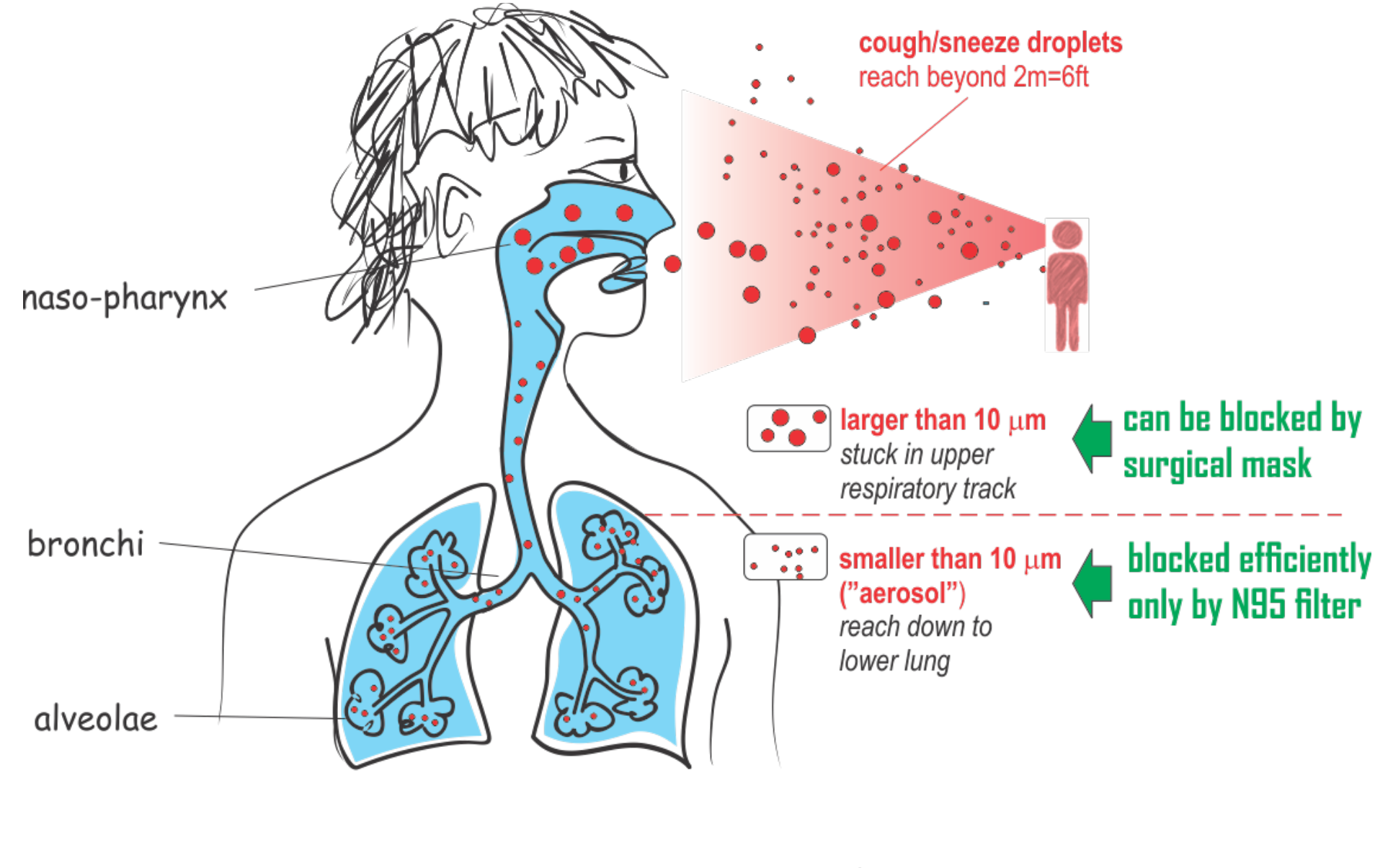
The Aerosol Science of Masks

- N95 is 95% efficient in filtration of 0.3 micron particles
  - A human hair is ~70 microns in diameter
  - 0.3 microns is the transition point between aerosol particles acting like particles to acting like gases, hence this is the most difficult size to filter
  - The COVID-19 virus itself is ~0.1 micron in size, though it can be in/on much larger droplets
- While FILTRATION is important, MASK FIT is also a big deal:
  - They need to seal well around the nose, workers need to be fit tested annually, multiple sizes needed

Aerosol Mechanics

https://medium.com/@Cancerwarrior/covid-19-why-we-should-all-wear-masks-there-is-new-scientific-rationale-280e08ceee71



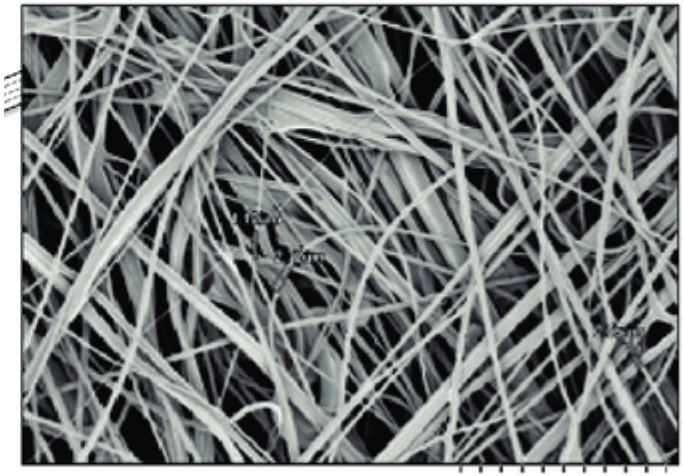


What is a N95

Healthcare

Industrial

Scanning electron micrograph image of
filter layer (non-woven polypropylene, met-blown)



CMT 1.0 KV 7.8 mm ×400 SE(U) 100 µm

Elastomeric Respirator

- "filtering facepiece" respirator
- High tech fabric
- Easily damaged by solvents, heat
- Not easy to clean and maintain filtration
- Equivalent protection to elastomeric respirator
- Medical N95s provide filtration and splash protection
  - Droplet and aerosol protection

Fit Testing

- OSHA required for employer-mandated use
- Specific to size and model of respirator
- Initial and annual fit testing required
- Involves spraying an aerosol of saccharin (sweet) or bitrex (bitter) into a hood while the user goes through specific exercises

What is a Surgical Mask?

- Multi-layer synthetic fabric
- Tested to resist blood splatters and provide some filtration
- No requirement for fitting to the face
- Only certified to provide droplet protection

Relative Particle Size (10,000x)	Typical Size	Most important way particles move in air	Take home message
 (Edge of particle)	100 micrometers (0.004”)	Coughing and Sneezing. These particles can typically travel about 2 m before they settle to the ground by gravity within several seconds.	Keep your distance from people who are coughing or sneezing. Cough and sneeze into your elbow. Homemade masks are most efficient at these sizes, but these particles fall to the ground quickly anyway.
	10 micrometers (0.0004”)	Gravity. These particles can only travel short distances, even from a sneeze, and settle to the ground in as little as 10 minutes.	Maintain social distancing from people to limit exposure to these particles. Homemade masks may help reduce transmission of these particles.
	0.3 micrometer (0.00001”)	These particles are very difficult to move without flowing air. These particles can remain in the air for hours, depending on ventilation.	Homemade masks are unlikely to reduce transmission of or exposure to these particles.
. (Barely visible)	0.05 micrometers (0.000002”) and smaller	The smallest particles diffuse to surfaces rapidly and are easily removed through many materials.	These particles are too small to carry COVID-19.

Note on micrometers/microns: **a human hair is ~70 micron in diameter**

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Source: Kohler and Rule, JHU, 2020

What about the Virus on Surfaces?

Definition: Fomite

Fomite

From Wikipedia, the free encyclopedia

A **fomite** (/ˈfoʊmaɪt/) or **fomes** (/ˈfoʊmiːz/) is any inanimate object that, when contaminated with or exposed to infectious agents (such as pathogenic bacteria, viruses or fungi), can transfer disease to a new host.[1]

Camp Lazear, the building where experiments were made which proved that yellow fever is not transmitted by means of infected clothing

Details [edit]

Human Viral Shedding

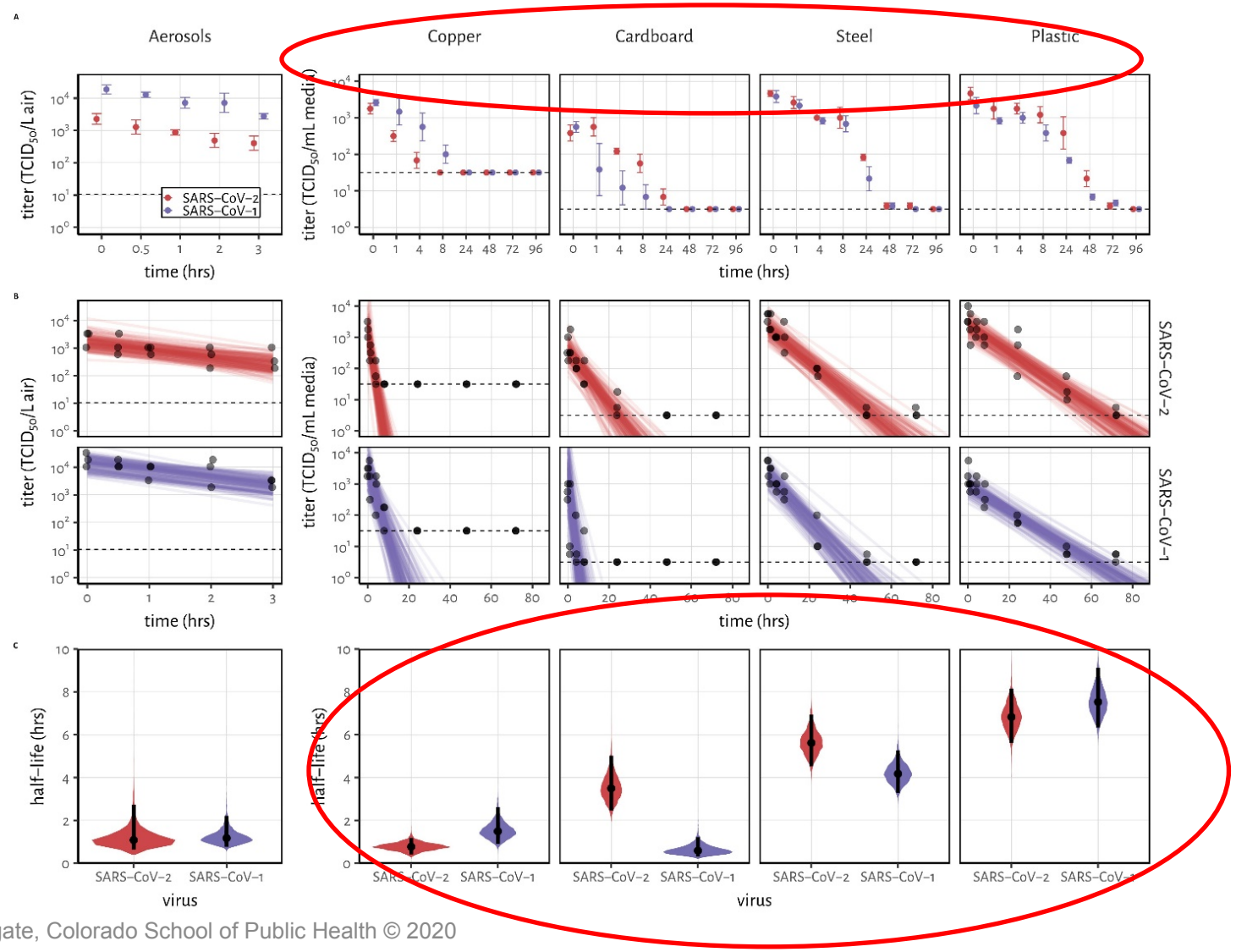
- Viral shedding peaks before symptoms in infected cases
- Asymptomatic people may shed virus up to 6 weeks (!)
- The virus can exist on surfaces, though the amount deposited (in 1,000s to Millions) determines viability/half life
- Transfer from surface to skin to eyes, nose, mouth is one reason why we tell people to not touch their face

Virus Viability on Surfaces

- Scientists use the term “half life”
  - These are times to virus un-detectability
  - They depend on the initial quantity of virus.
  - If you start with more virus, you'll have at least some infectious virus around for longer

Virus on Surfaces

(Doremalan et al NEJM)



Disinfection/Sanitizing

- Experiments used a Corona virus related to SARS-CoV-2, a reasonable proxy
- Half lives on test surfaces:
  - Copper < Cardboard < Steel < Plastic
  - **BUT**, absolute times to virus un-detectability depend on the initial quantity of virus
  - Longest half life (6-9 days on plastic) probably an overestimate as initial quantities were very high
  - Caveat is only infectious/shedding individuals might shed that much in a cough, but conditions would need to be the "perfect storm"
  - In the case of the "perfect storm" the surface type probably doesn't matter.

The Good News

- In most cases the virus is likely viable on surfaces for hours at most.
- Common hand soap/detergents wipe out the virus if properly used
- Sanitation is the goal; disinfection if more difficult, though possible with the right tools
  - For things like N95 masks this is UV and hydrogen peroxide vapor – don't try this at home!

So What Should You Do?

Best Practices I (JHU)

I don't think I have COVID-19, should I wear a homemade mask?

- Some people who have COVID-19 do not have any symptoms and can spread the virus unknowingly. **The best ways to prevent infection is to limit your exposure to other people through social/physical isolation, and practicing hand hygiene**.
- Wearing a homemade mask may reduce the spread of virus to others via large droplets. ***However, it is unlikely that wearing a homemade mask will prevent you from becoming infected if exposed to a strong source***.

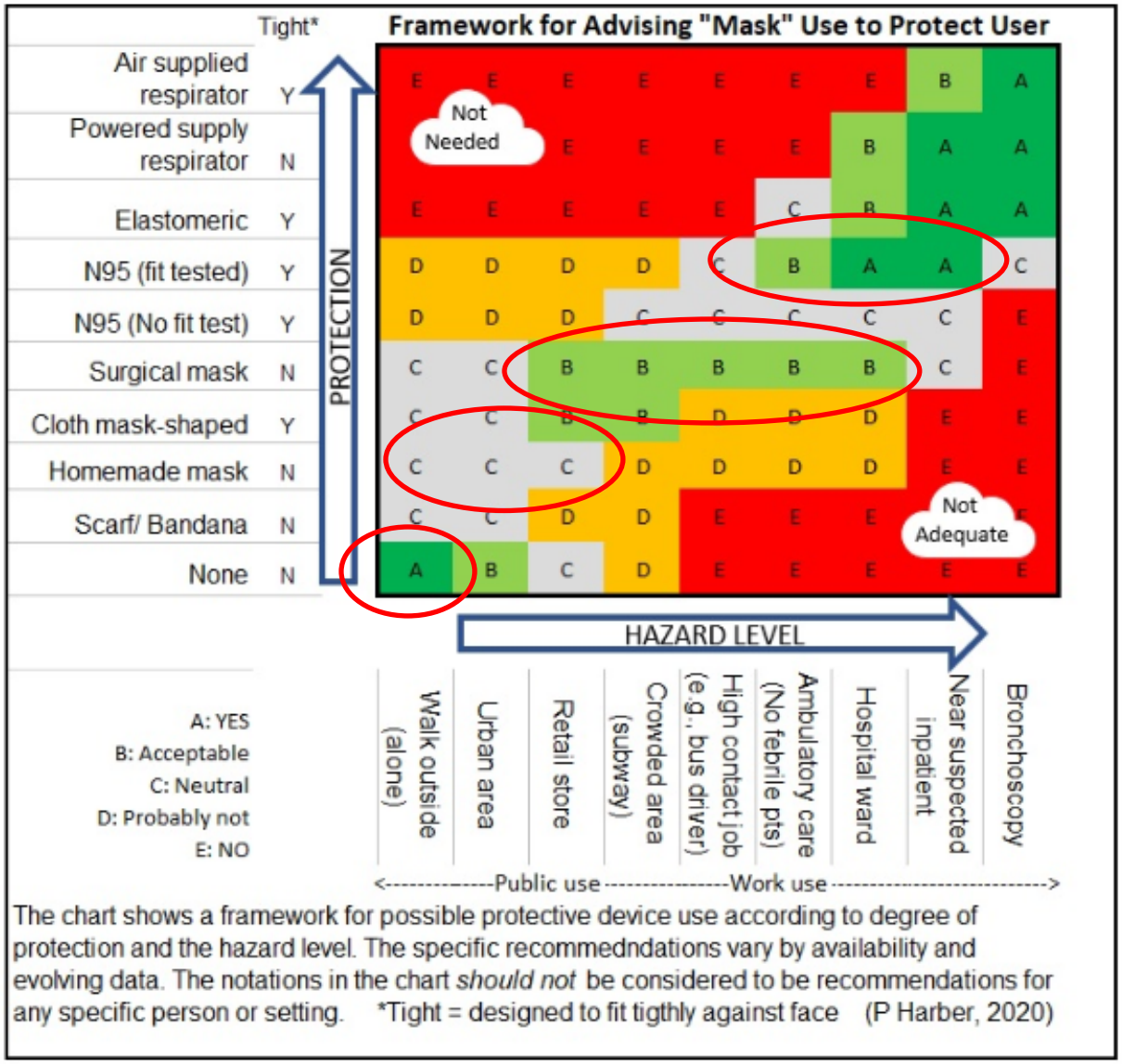
Best Practices II (JHU)

I have decided to wear a homemade mask, what are some best practices?

- **Wash your hands** before you put on the mask.
- If your mask has ties, secure the bottom first, then pull the mask by the upper ties over your mouth and chin.
- **Wash your hands every time you touch your mask during the day! (Yes, every time.)**
- **Wash your mask every time you remove it** and wash your hands with soap and water after removing the mask.
- **Assume that there could be virus on both sides of the mask any time you touch it.**
- **Wear a clean mask each time you need to put one on.**

This applies to cloth/washable masks: might make sense to have several cloth masks and homemade disposable masks

An evolving perspective on masks and respirators…



The chart shows a framework for possible protective device use according to degree of protection and the hazard level. The specific recommedndations vary by availability and evolving data. The notations in the chart *should not* be considered to be recommendations for any specific person or setting. *Tight = designed to fit tigthly against face (P Harber, 2020)

Final Thoughts

- Workers
  - Still a N95 shortage
  - Reuse of disposables/disinfection increasing
- Citizens
  - "6 foot" rule isn't based on much science per se, though it's based on sound logic, though is also scenario dependent
  - Wear a mask when prudent, wash hands frequently, and socially isolate is the best advice to avoid infection
  - Fomite transfer is possible, but cleaning/sanitizing regularly (daily/hourly) will help reduce risk

Resources

- Mask masking:
  - Shop towel mask: https://www.youtube.com/watch?v=mai-UqdNRi8&feature=youtu.be
  - Colorado: https://www.coloradomaskproject.com/
- Huang Graphics: https://medium.com/@Cancerwarrior/covid-19-why-we-should-all-wear-masks-there-is-new-scientific-rationale-280e08ceee71
- Davies, A et al. 2013. Testing the Efficacy of Homemade Masks: Would They Protect in an Influenza Pandemic? Disaster Med Public Health Preparedness. 2013;7:413-418)
- Johns Hopkins OHS Lab
- Brosseau, L at CIDRAP: https://www.cidrap.umn.edu/news-perspective/2020/03/commentary-covid-19-transmission-messages-should-hinge-science
- Ed Young: https://www.theatlantic.com/health/archive/2020/04/pandemic-confusing-uncertainty/610819/