

**The science of COVID-19 and some of best
practices for minimizing risk:**

Presentation for Researchers

UC SANTA BARBARA
Office of Research

Objectives and Overview

In this presentation we provide an overview of the science of transmission of infections and information about the steps you can take to reduce the risk of infecting or being infected while doing research at UC Santa Barbara

Overview of what is contained in this presentation:

- The Science: what is new about SARS-COV-2 that makes it dangerous, how it is transmitted, how long it lingers
- Visualizations of how talking, shouting, coughing and sneezing can distribute the virus in droplets and aerosols
- The power of hygiene, physical distancing, face coverings and how to make and use various face coverings
- Examples of best practices

COVID-19 is a new disease, with new dangers

Asymptomatic and pre-symptomatic carriers are thought to be the source of ~50% of total cases

- Asymptomatic carriers are people who are infected and would test positive for infection and contagious but have no COVID-19 symptoms
- Pre-symptomatic carriers are people who are infected and contagious and will later show symptoms of COVID-19

The testing from Korea, cruise ships and Iceland is very thorough

- [CDC Director Says 1 In 4 May Have No Coronavirus Symptoms : Shots - Health News](#)
- [Public Health Responses to COVID-19 Outbreaks on Cruise Ships...](#)

Pre-symptomatic carriers can shed significant amounts of virus 2-3 days before symptoms first appear.

- [WHO says the coronavirus can spread one to three days before symptoms start](#)

Studies of COVID-19 vs. other infectious diseases

nature medicine

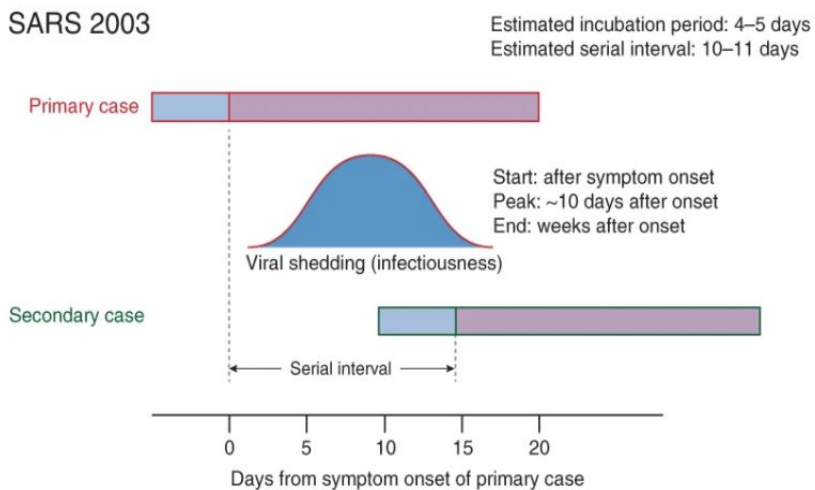
Brief Communication | Published: 15 April 2020

Temporal dynamics in viral shedding and transmissibility of COVID-19

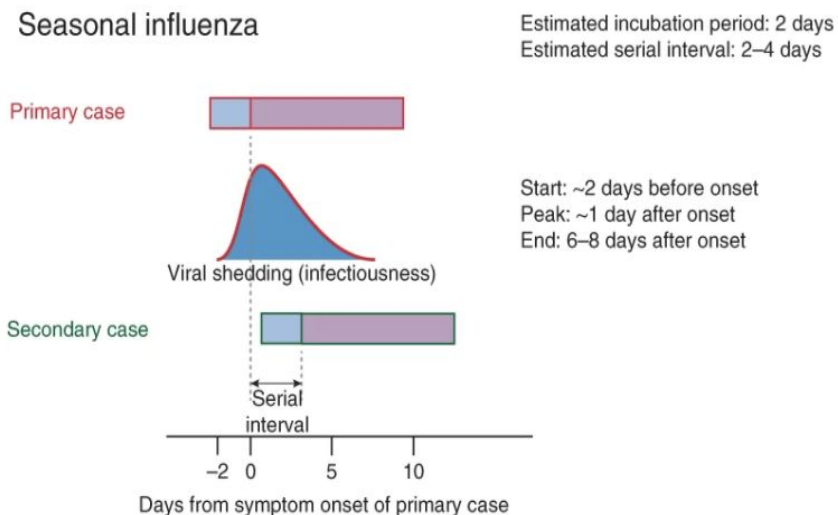
COVID-19

- 44% (25-69%) of secondary cases were infected during pre- or asymptomatic range
<https://www.nature.com/articles/s41591-020-0869-5>
- 46% (21-46%) infected during pre- or asymptomatic range
<https://wellcomeopenresearch.org/articles/5-58>
- 48% (32-67%) infected during pre- or asymptomatic range
<https://www.medrxiv.org/content/10.1101/2020.03.05.20031815v1.full.pdf>

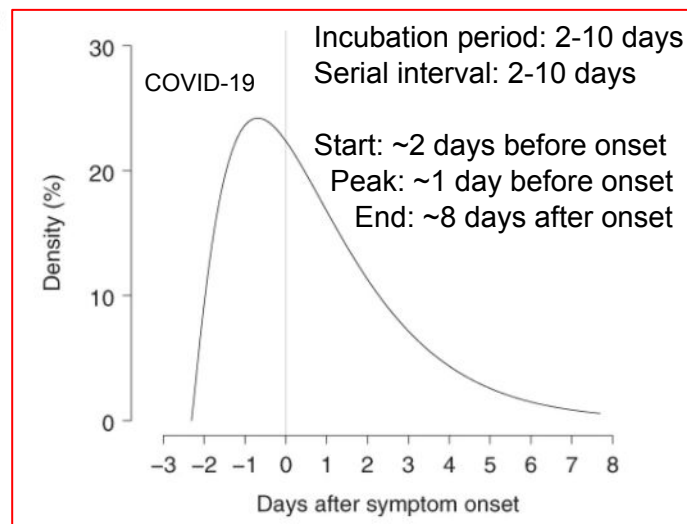
SARS 2003



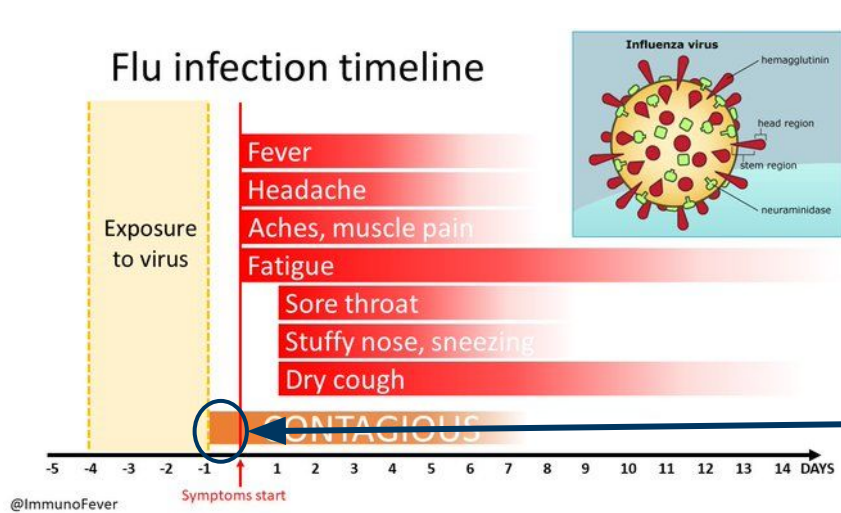
Seasonal Influenza



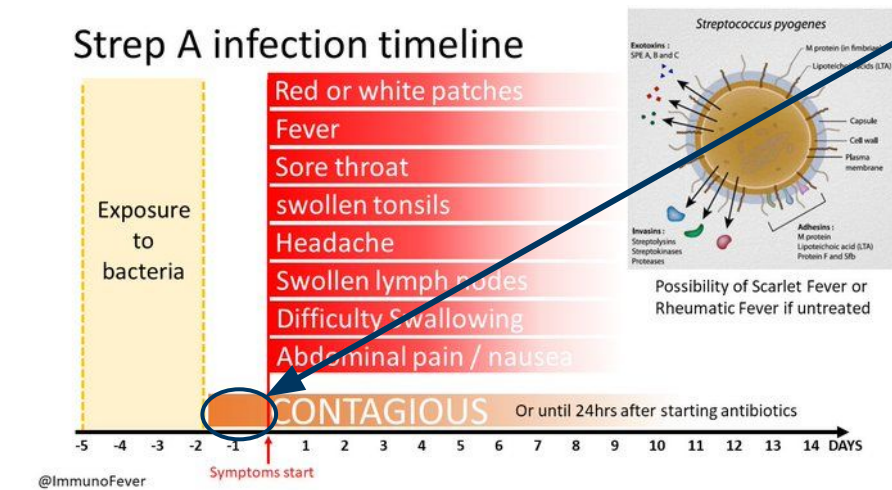
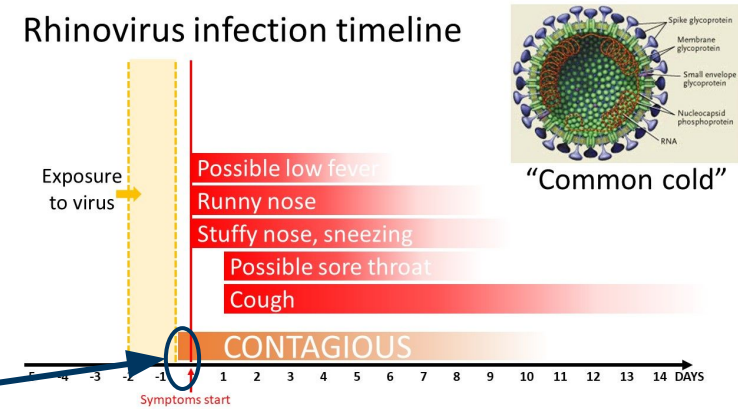
COVID-19 Viral Shedding (infectiousness)



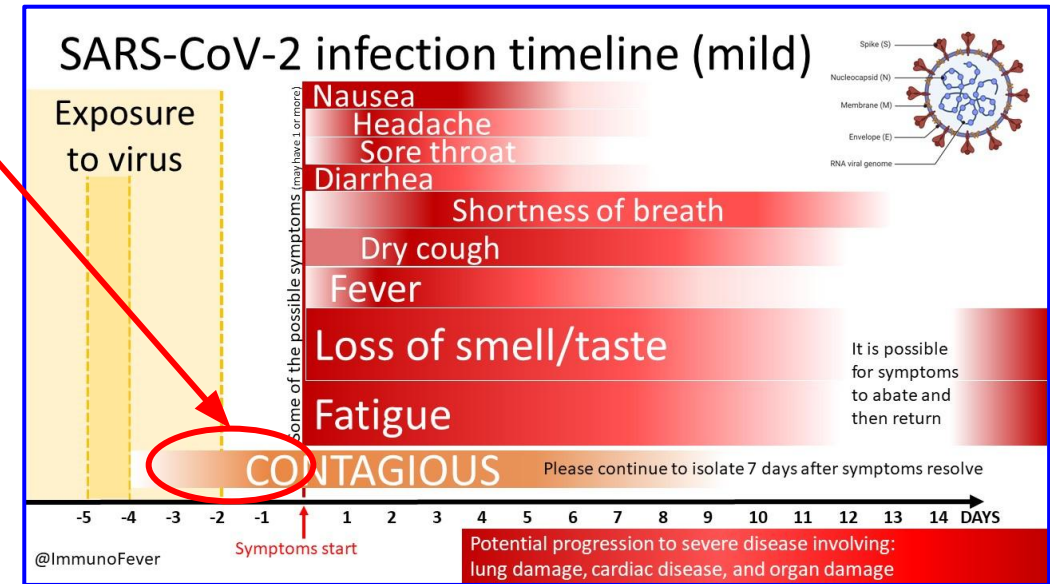
Symptoms and timing vs. other infectious diseases



Covid-19 has a longer time period in which infected persons are contagious before showing symptoms.



So it can spread unnoticed if testing does not include people without symptoms.



Source: Dr. Michael Tal <https://twitter.com/immunoFever/status/1250573587833970688>

How is it transmitted?

CDC Release (Friday, May 22, 2020¹)

- The primary and most important mode of transmission for COVID-19 is through close contact from person-to-person.
- Based on data from lab studies on COVID-19 and what we know about similar respiratory diseases, it may be possible that a person can get COVID-19 by touching a surface or object that has the virus on it and then touching their own mouth, nose, or possibly their eyes...

¹ [CDC updates COVID-19 transmission webpage to clarify information about types of spread | CDC Online Newsroom](#)

How long does the SARS-COV-2 virus hang around ?

On Wood, Cardboard: 24 hours

Plastic, Stainless steel: 72 hours

Fabrics: Up to 24 hours but viral fragments found up to 7 days on surfaces of masks

Washing masks/Clothes? CDC recommends warmest water and dry completely

But surfaces may not be the most significant source of transmission



shutterstock.com • 618538130

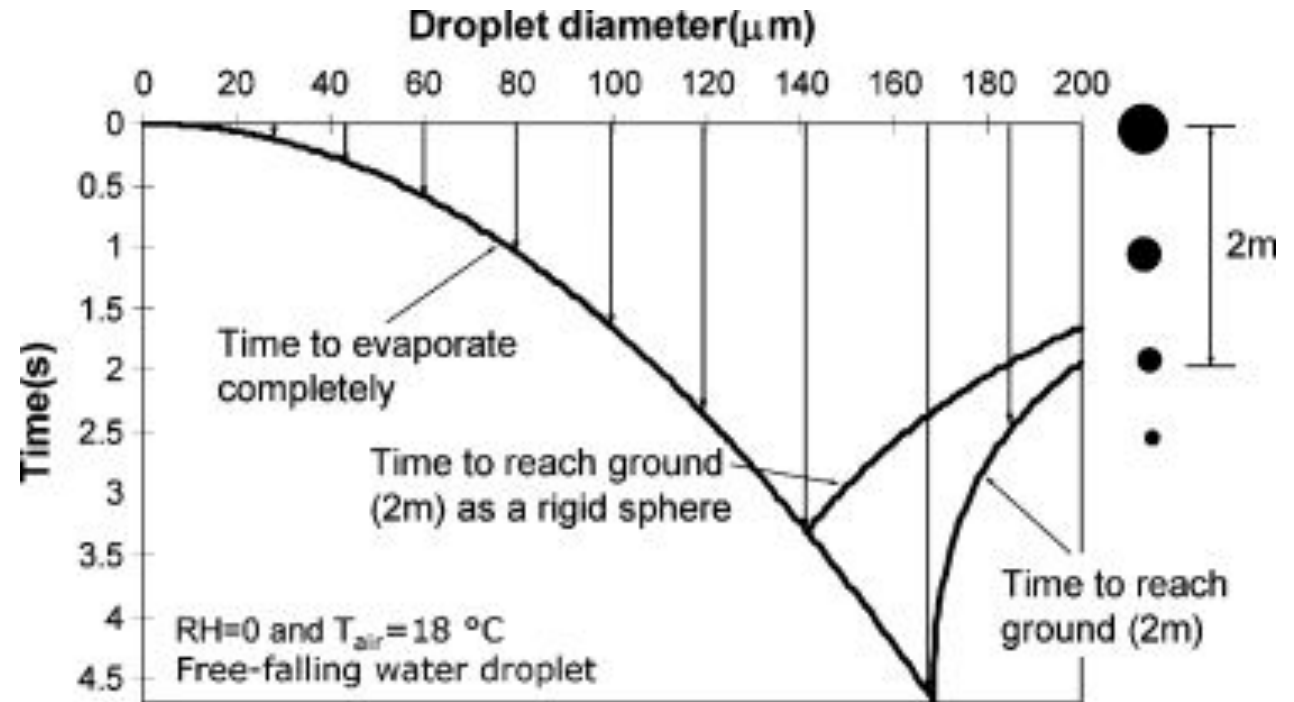
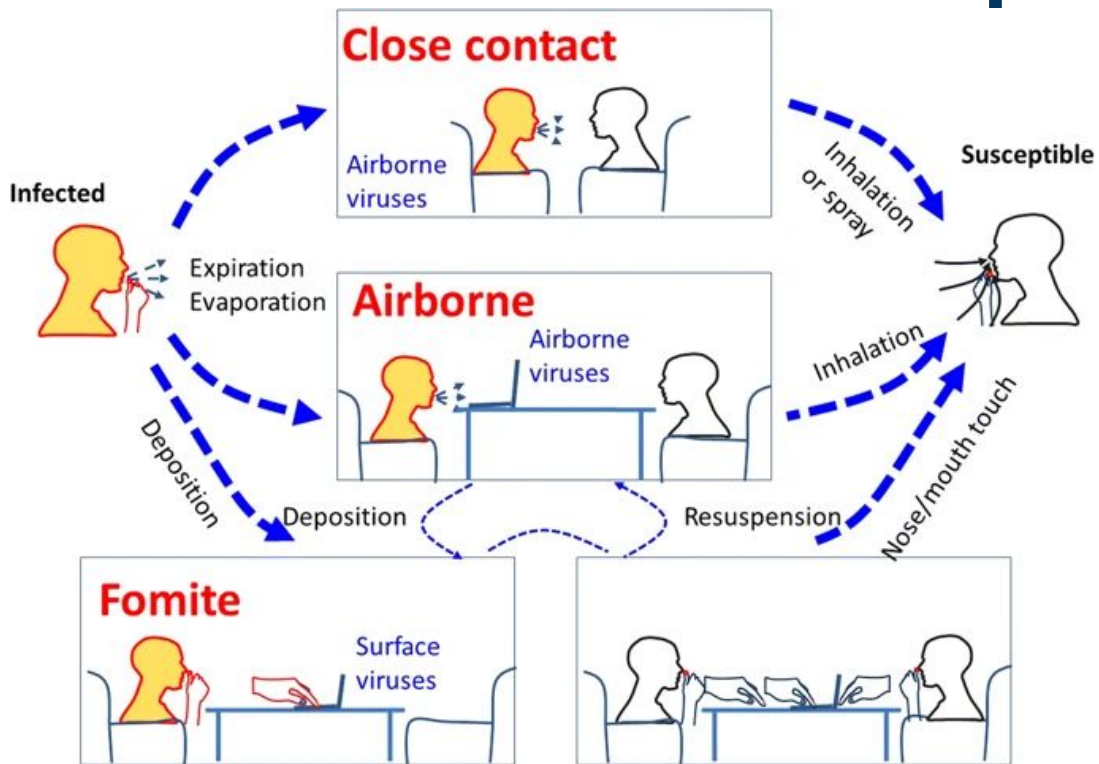


shutterstock.com • 715597165



[Cleaning and Disinfecting Public Spaces for COVID-19](#)
[Guideline for Disinfection and Sterilization in Healthcare Facilities, 2008](#)
[Stability of SARS-CoV-2 versus environmental conditions](#)

Transmission via droplet, aerosol and fomite



- Sneezing can generate approximately a million droplets of up to $100\ \mu\text{m}$ in diameter, + 1000s of larger droplet particles formed predominantly from saliva
- Most people incorrectly think that only coughs or sneezes can generate the infectious droplets
- **Studies show that talking for 5 minutes can generate the same number of droplet nuclei as a cough, i.e. some 3000 droplet nuclei**

[How far droplets can move in indoor environments...](#)

The bigger the droplet the bigger the dose

Studies of influenza¹ show larger droplets have larger doses of virus, making infection more likely²



[See how a sneeze can launch germs much farther than 6 feet](#)

image: <http://lbourouiba.mit.edu/image-gallery/sneeze-sequence>

¹ **Influenza Virus Aerosols in the Air and Their Infectiousness**

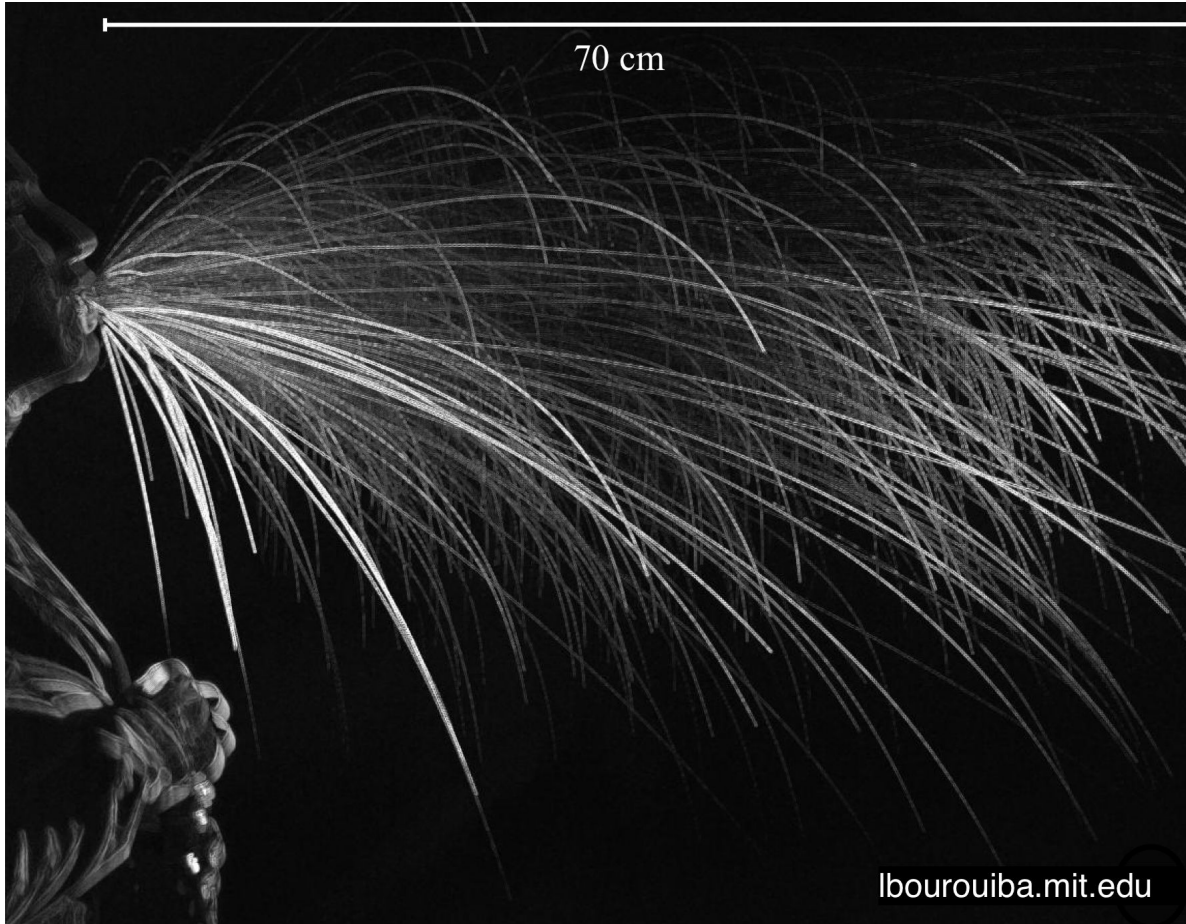
Adv. Virology 2014 Article 859090 [Influenza Virus Aerosols in the Air and Their Infectiousness](#)

Study: Airborne flu viruses may play a big role in transmission

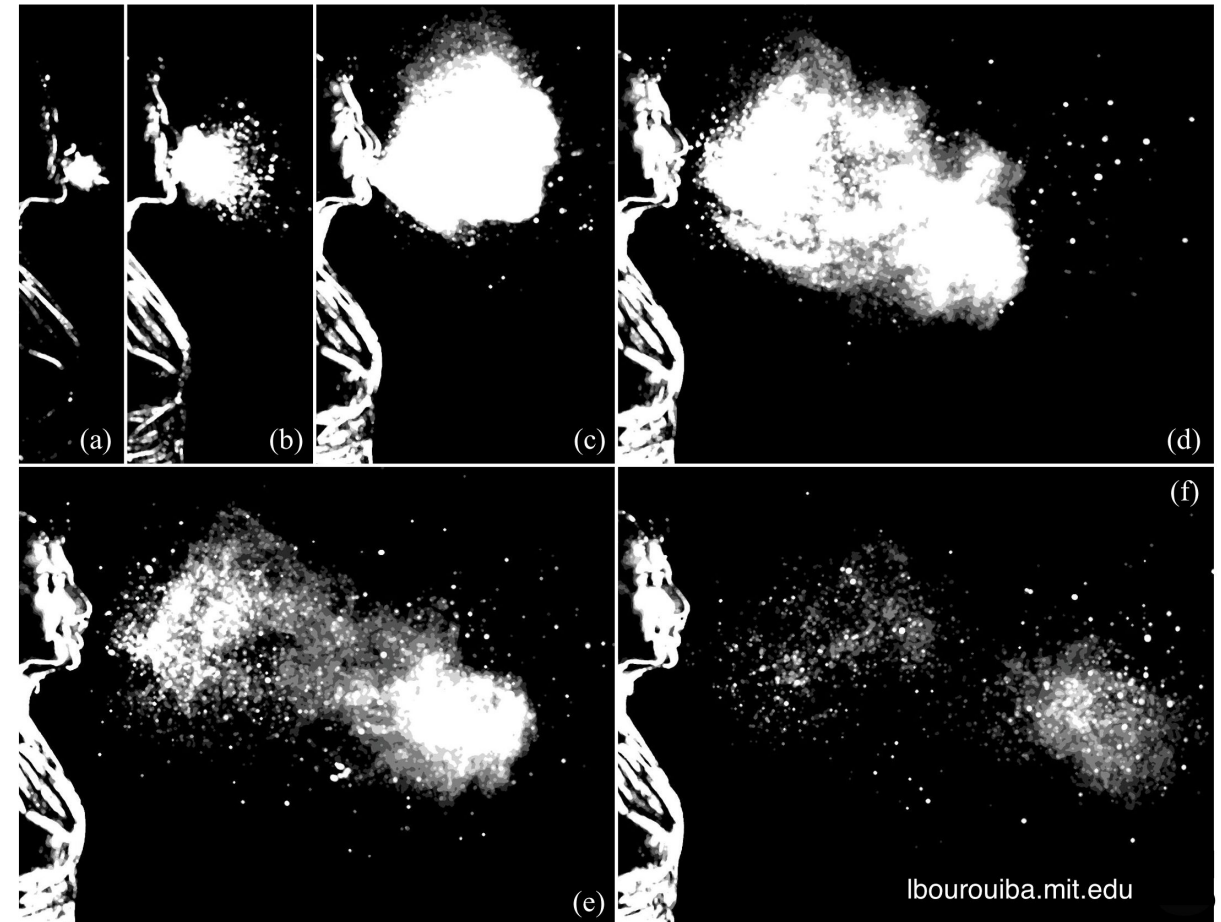
² CIDRAP Feb 01, 2013 [Study: Airborne flu viruses may play big role in transmission](#)

Coughs and Sneezes - the science of droplet and aerosol spread

Coughing - emission of droplets and aerosols



Sneezing - even more emission of droplets and aerosols



<http://lbourouiba.mit.edu/image-gallery/cough-sequence>

6 feet marginal, we strongly recommend 10 feet

Watch this video to see why 6 feet is just barely adequate, even in the absence of wind currents.

- Avoid anyone who is coughing
- Do not come to work if you're coughing!

3 foot (1m) vs. 6 ft (2m) social distancing



This Ansys simulation demonstrates that 6 feet is just ok, in the absence of air currents. In Italy, the COVID-19 crisis led them to revise their distancing to 4 meters or 13 feet!

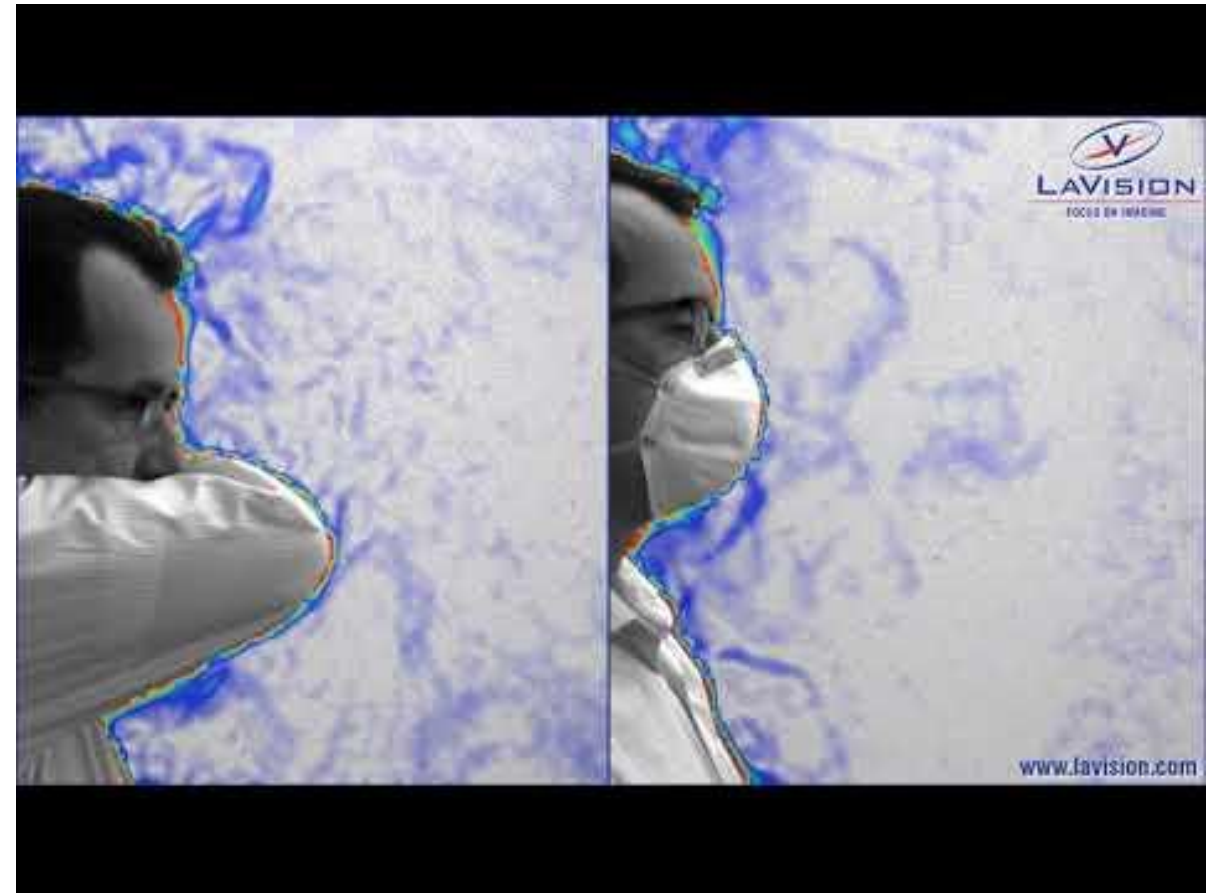
We strongly recommend 9 feet minimum for research on campus.

Why wear a face covering?

1. Protect each other by not spreading the virus if you have it.
2. Reduce face touching by wearing something that covers your face.
3. Homemade cloth face coverings can be 4-6x more effective than no mask in preventing droplet/aerosol emission
4. County of Santa Barbara mandate as of May 26,2020. \$1000 fine if not worn.¹

“Something doesn’t have to be 100% effective to be beneficial.” - Dr. Anthony Fauci, US director of the National Institute of Allergy and Infectious Diseases

¹[County of Santa Barbara face-coverings order](#)



What about masks? Types of masks

For more information see: [UC Santa Barbara Respiratory Protection Program Manual](#)



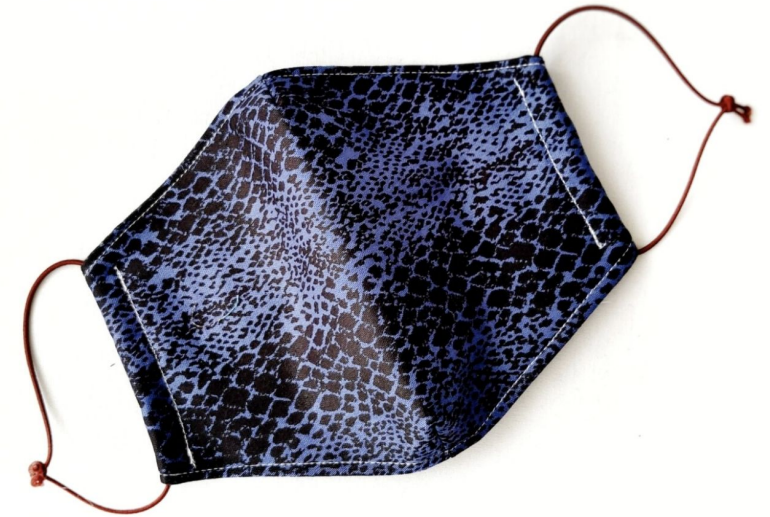
N-95, KN-95

Reserved for medical responders and specific jobs



Surgical

Meet FDA requirements. Should be reserved for healthcare workers, or sick personnel, to prevent the spread of infection



Homemade and general purpose

Do not meet NIOSH or FDA requirements

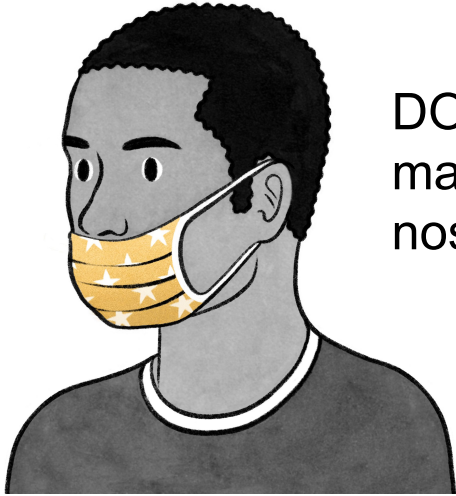
How to wear a face cover

Wear your face cover so it comes all the way up, close to the bridge of your nose, and all the way down under your chin. Do your best to tighten the loops or ties so it's snug around your face, without gaps.



New York Times: [How NOT to Wear a Mask](#)

How NOT to wear a mask/face covering



DON'T: Wear the mask below your nose.

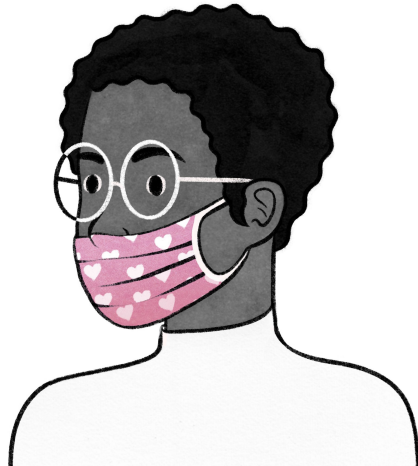


DON'T: Wear your mask loosely with gaps on the sides.



DON'T: Leave your chin exposed.

Never share your face covering



DON'T: Wear your mask so it covers just the tip of your nose.



DON'T: Push your mask under your chin to rest on your neck.

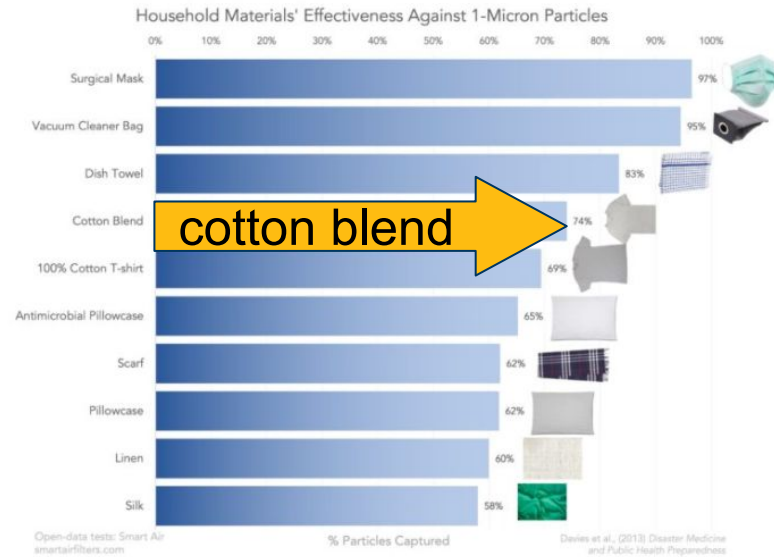
How to put on and take off a mask/face-covering

- Wash hands thoroughly before touching and putting on the mask
- Inspect the mask for any tears or holes
 - Medical masks: make sure the colored side of the mask face outwards (typically blue) with the metallic strip on top
- Ensure the strings/elastic bands are can keep the mask firmly in place
- Masks with ear loops: hold by the ear loops and place a loop around each ear
 - **DO NOT TOUCH INSIDE SURFACE OF THE MASK WITH YOUR HANDS!**
- Make sure it covers your nose, mouth and chin. Ineffective if worn improperly!
- Pinch the metallic strip so it molds to the bridge of your nose
 - Replace mask if contaminated, damaged, wet, if you cough, sweat, etc.
 - Try not once to touch it on face. Frequent handling may reduce protection
 - Wash your hands thoroughly before and after touching the mask
- When you take off your mask be sure to not let inside touch surfaces. Dispose carefully or place in a sealed bag for washing.
- Wash your hands thoroughly

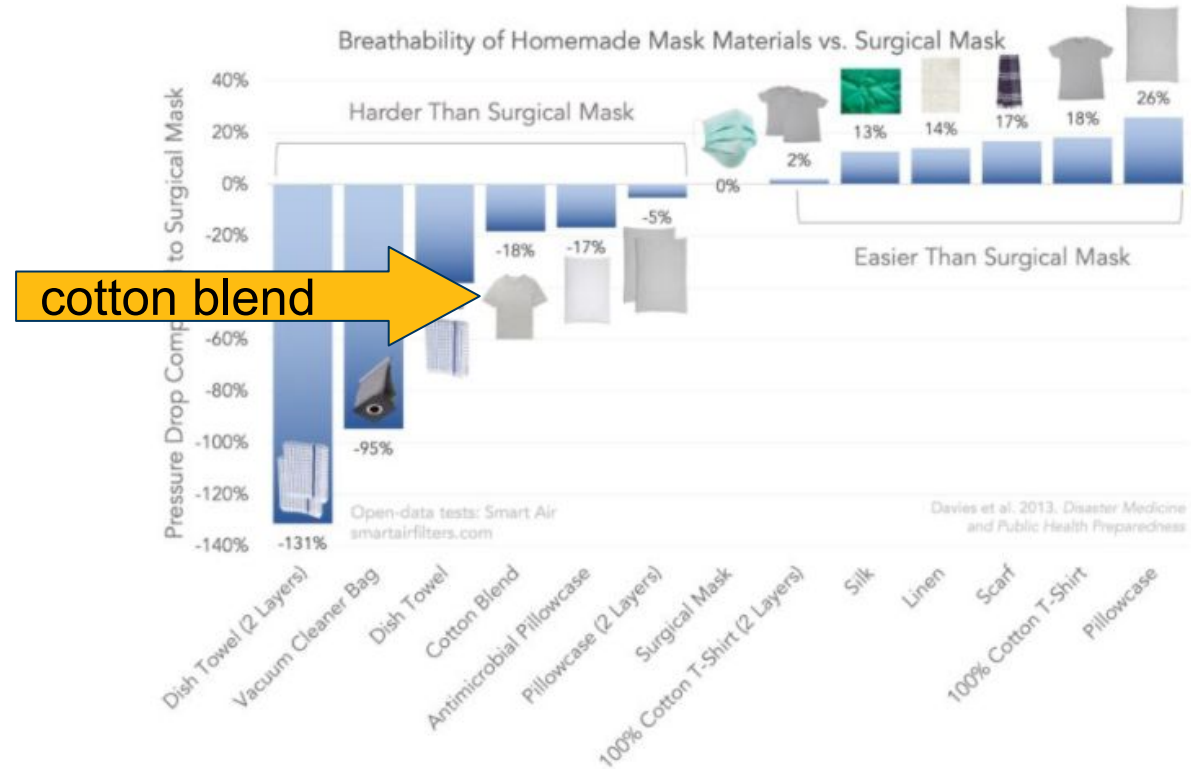
CDC Proper Reuse of Mask: [Strategies for Optimizing the Supply of N95 Respirators: COVID-19](#)

Homemade mask materials have different effectivenesses: Cotton blend combines reasonably good effectiveness and breathability

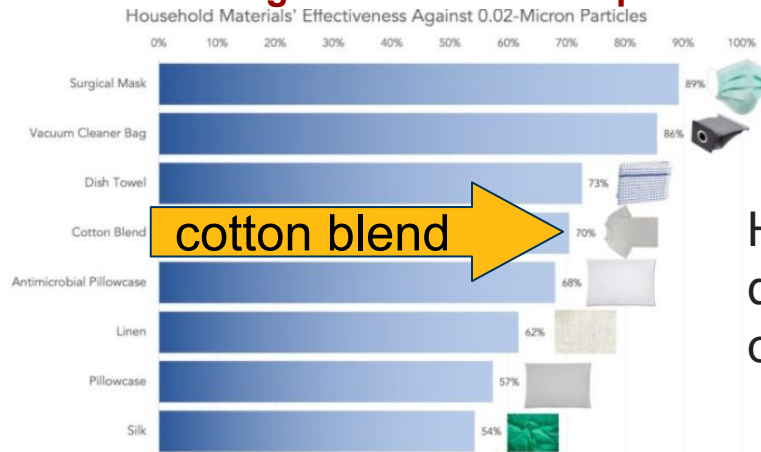
Effectiveness against 1 -micron particles



Breathability



Effectiveness against 0.02 -micron particles



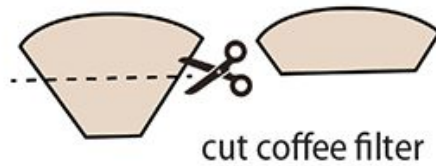
Household filters (vacuum, HVAC) may be tempting but they can contain dangerous materials like fiberglass! Do not use them. Paper coffee filters are ok if they only contain paper.

Source: [What Are The Best Materials for Making DIY Masks?](https://www.santabarbara.edu/research/office-of-research/what-are-the-best-materials-for-making-diy-masks/)

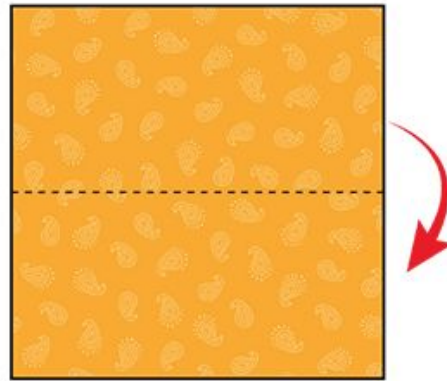
How to make your own face covering - No sew method (via CDC)

Tutorial

1.



2.



3.



Fold filter in center
of folded bandanna.

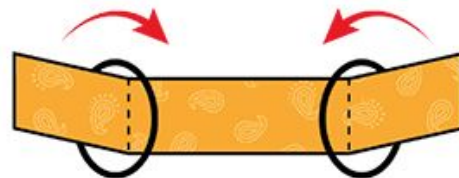
Fold top down. Fold bottom up.

4.



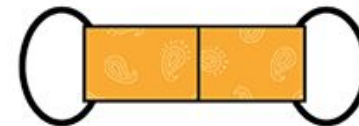
Place rubber bands or hair ties
about 6 inches apart.

5.



Fold side to the middle and tuck.

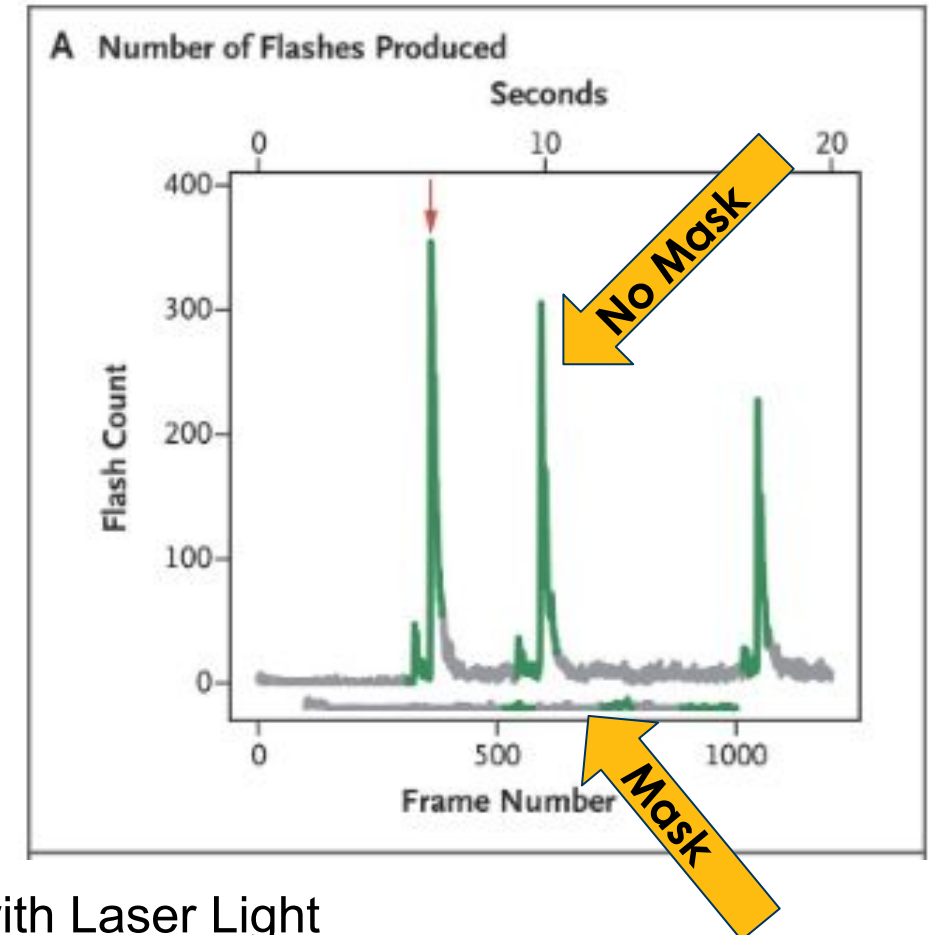
6.



Striking video: Talking with and without a mask



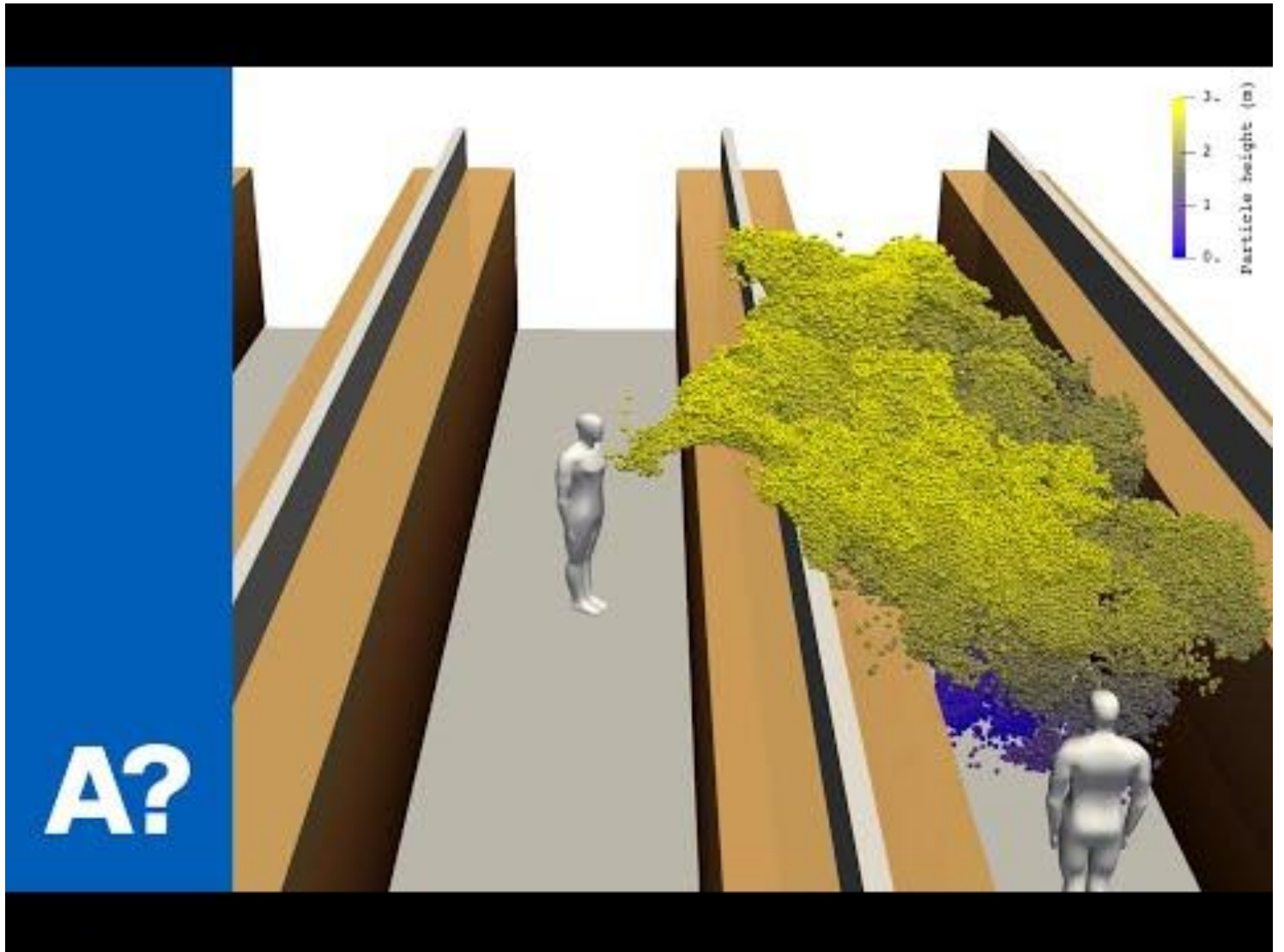
Figure 1.



Source: Visualizing Speech-Generated Oral Fluid Droplets with Laser Light Scattering NEJM April 15, 2020 <https://www.nejm.org/doi/full/10.1056/NEJMc2007800>

Avoid those without face covers. They may cough!

Finnish Meteorological Institute / Aalto University / VTT / University of Helsinki / IT Center for Science CSC.
Animation: Mikko Auvinen and Antti Hellsten.

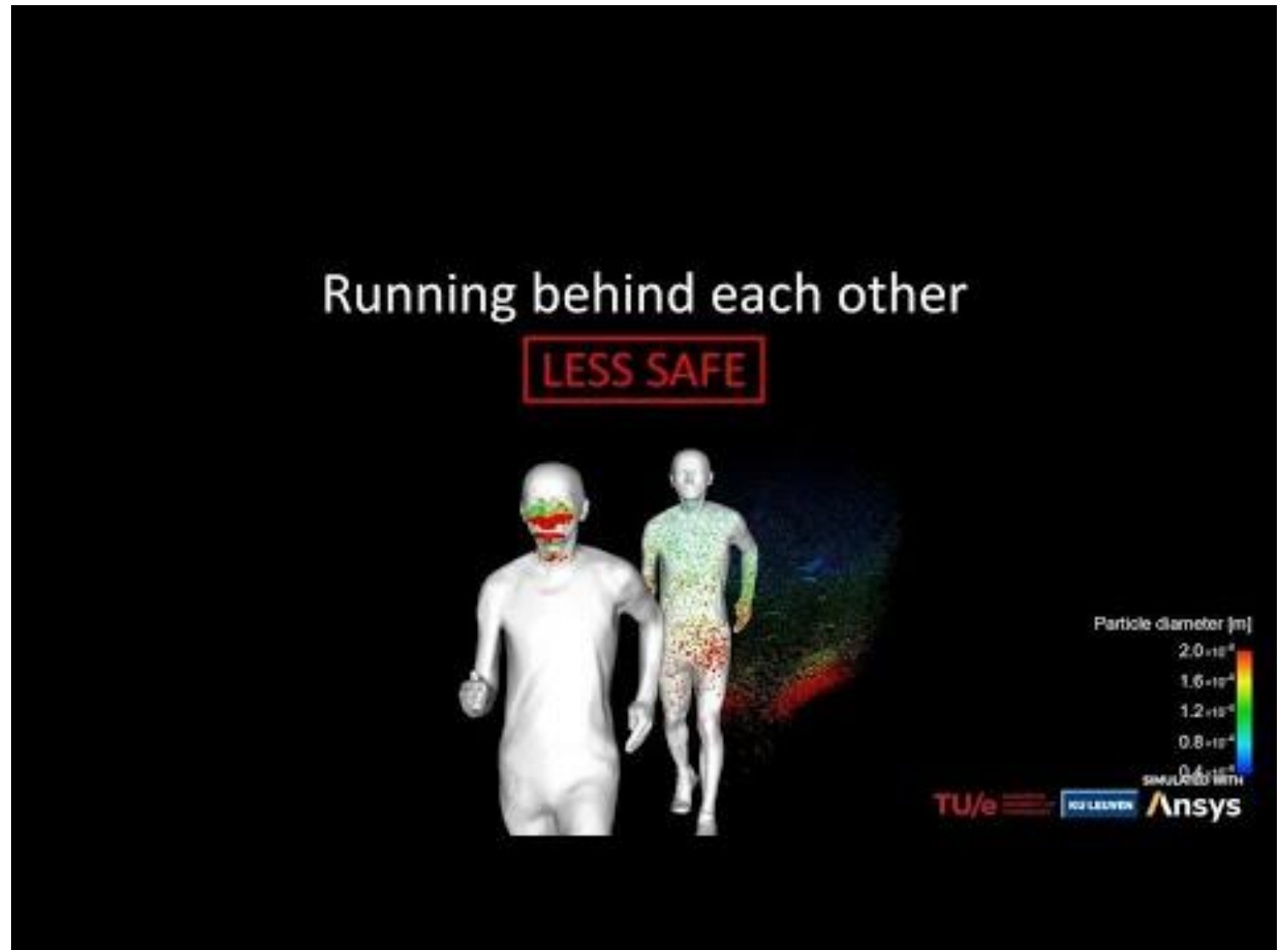


Consider possible airflows, even outdoors

Standard social distancing guidelines may be insufficient when exercising, even outside!

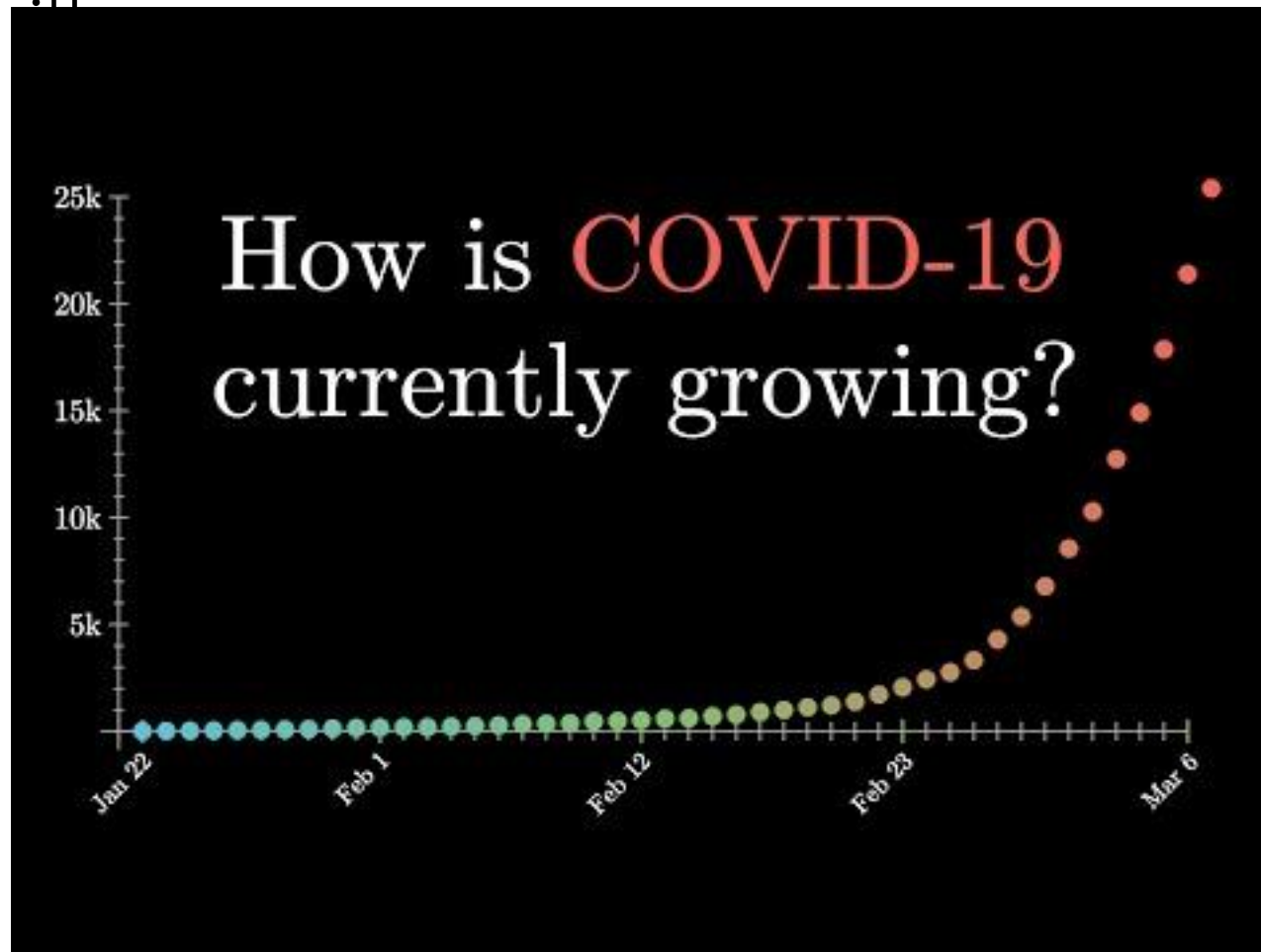
Analysis by Ansys partners Bert Blocken and Fabio Malizia at TUE & KU Leuven:

Substantially more space is required to avoid droplets from a runner or cyclist in front of you.

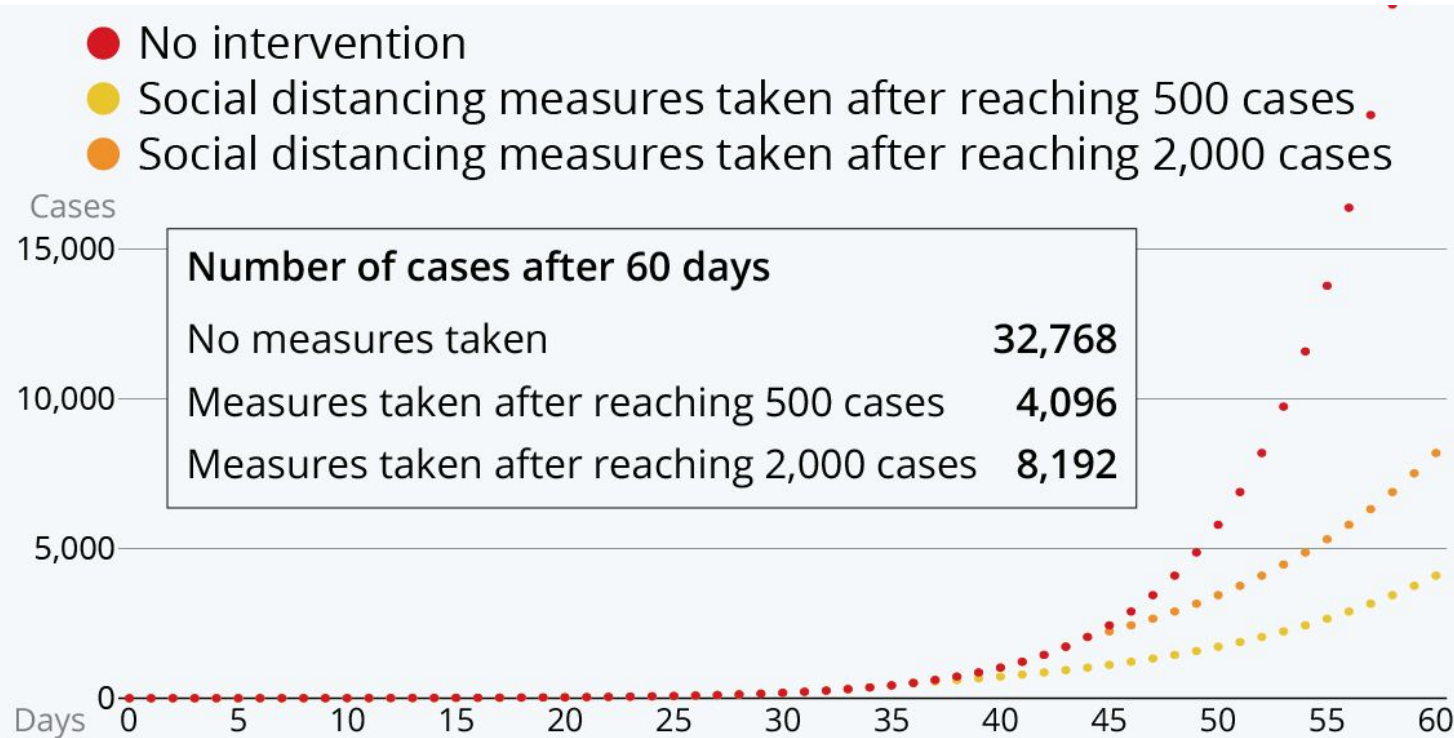


Social Distancing: most effective way to halt the spread of COVID-19: Kahn academy math lesson

9' video* explains spread: Watch

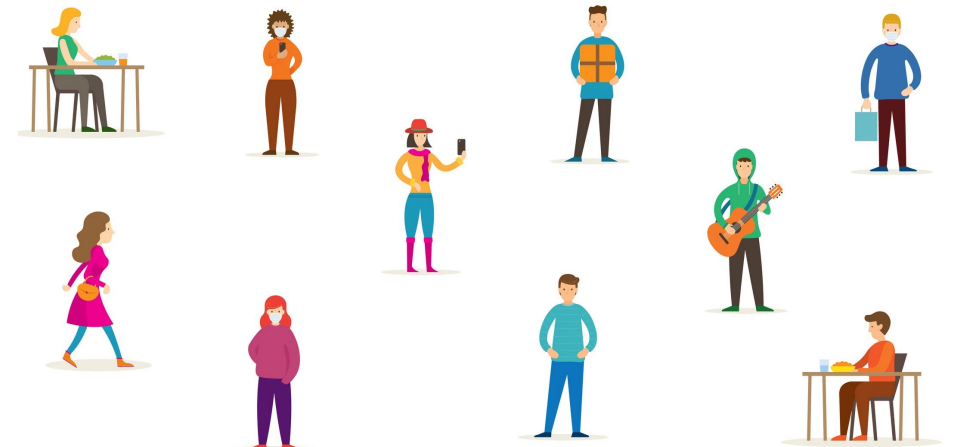


Why Social Distancing is So Important



* Please note that the chart is based on simple assumptions. It is merely meant to illustrate the importance of policy measures to slow down the exponential spread of a virus.

Source: Statista



S O C I A L D I S T A N C I N G

Language

The words we use create reality

Social Distancing



Physical Distancing



Stay at least 6 feet and preferably 10 feet away

⊗ **Less clear**

“Practice social distancing.”

- ⊗ New term
- ⊗ Unclear
- ⊗ Not specific
- ⊗ Conceptual

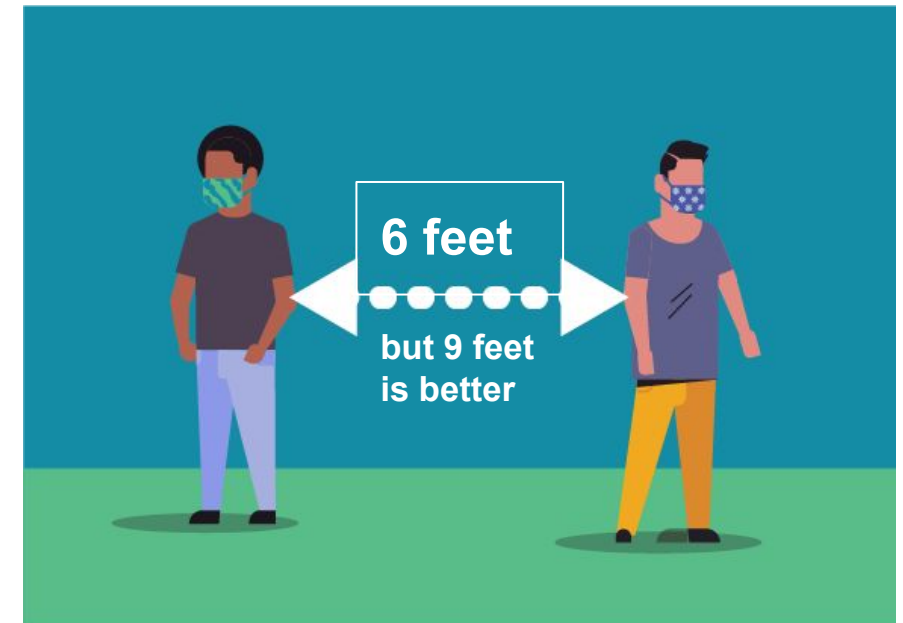
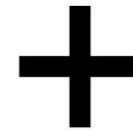
✓ **More clear**

“Stay at home.
Get groceries
once per week.”

- ✓ Use known words
- ✓ Be clear
- ✓ Be specific
- ✓ Be concrete

Shared Social Responsibility

- Surgical and homemade masks don't give perfect protection, but do reasonably protect others from you
- So the key idea is, when we voluntarily wear masks, everyone is reasonably protected from everyone else
- If everyone voluntarily wore a mask, it would also help protect surfaces from becoming potentially virus contaminated as quickly, or contaminated to the same concentrations



Journal study* An 80% compliance rate [wearing masks] essentially eliminated the influenza outbreak.

**Modeling the Effectiveness of Respiratory Protective Devices in Reducing Influenza Outbreak Risk Analysis 39 647 (2019)*

9 things to do that limit your exposure to coronavirus

Durland Fish, PhD, Emeritus Professor of Epidemiology, Yale University



Wash your hands

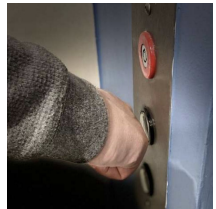
- At every opportunity
- Soap and water
- 40 seconds minimum

[Hand Hygiene: Why, How & When?](#)



Signature

- Carry and use your own pen
- Use back of fingernail for touch pads



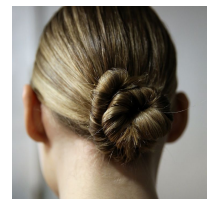
Use your knuckle

- To push elevator buttons
- Little finger knuckle is least likely to touch your face
- Use cotton swab for elevator



Hand sanitizer

- Carry and use
- Avoid sharing papers and objects with others



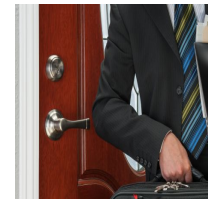
Long hair - pull back or cover

- Ponytail or bun



Credit card

- Avoid handling money
- Use Apple Pay



Opening doors

- Use your left hand (if right handed)
- Use your elbows
- Avoid using door knobs



Handrails

- Use gloves or fabric of your coat to cover hands



Sneezing and coughing

- Hold your breath (if someone around you does it)
- If someone behind you in line sneezes/coughs, let them in front of you

Best steps to take after going back home*:

Shanghai example of ALL the things you can do...

1. Leave shoes outside (alcohol spray to clean)
2. Change to slippers
3. Take off gloves (dispose inside-out or clean & dry outside)
4. Wash hands - first time
5. Take off outer clothes and hang outside or in unused space
6. Take off masks (dispose inside-out)
7. Take off glasses, clean them, wash hands - second time
8. Wash face with eyes closed
9. (Wash nose with nasal spray)
10. (Rinse mouth)
11. Take shower or wash head if you had a long stay outside

Handwashing (it is about technique not time)



Best Practices ala Korea*

1. Hand sanitizer at entrances, cafeteria, by elevators, stairs, in meeting rooms
2. Distribution of personal face-coverings and hand sanitizer to staff
3. Wear face-coverings in the office
 - Before COVID-19, mask acceptable in Korea for various reasons (e.g. air pollution, airborne transmitted disease). Everyone wears masks by default now
4. No Face to face meetings
 - Email reports and if necessary Zoom/Skype meetings
5. Flexible work hours, work from home (WFH) whenever possible
 - Shift work hours to avoid peak public transit times and lessen childcare impact
 - Organize schedule: experiments at lab, data processing work from home
6. Staggered lunch hours
 - Lunch hours are staggered per floor to reduce the crowd size at the cafeteria
 - New time slot every Monday via email
7. COVID-19 visitor, business travel restrictions in place
8. Slack, google chatting with friends and family
 - Chat/talk to your family, friends and colleagues while working to check that they are okay. It helps you feel connected and supported
9. Nintendo Switch/online games
 - Family games can be a life saver

*Many Asian countries got ahead of the curve.
We can learn a lot from them!*

Places to watch out for Germs

1. Handrails
2. Telephones
3. Public Tables
4. Condiment Containers
5. Doorknobs
6. Remote Controls
7. Light Switches
8. Shopping Carts
9. Airplane Tray Tables



Each case is very serious

Effect on the individual

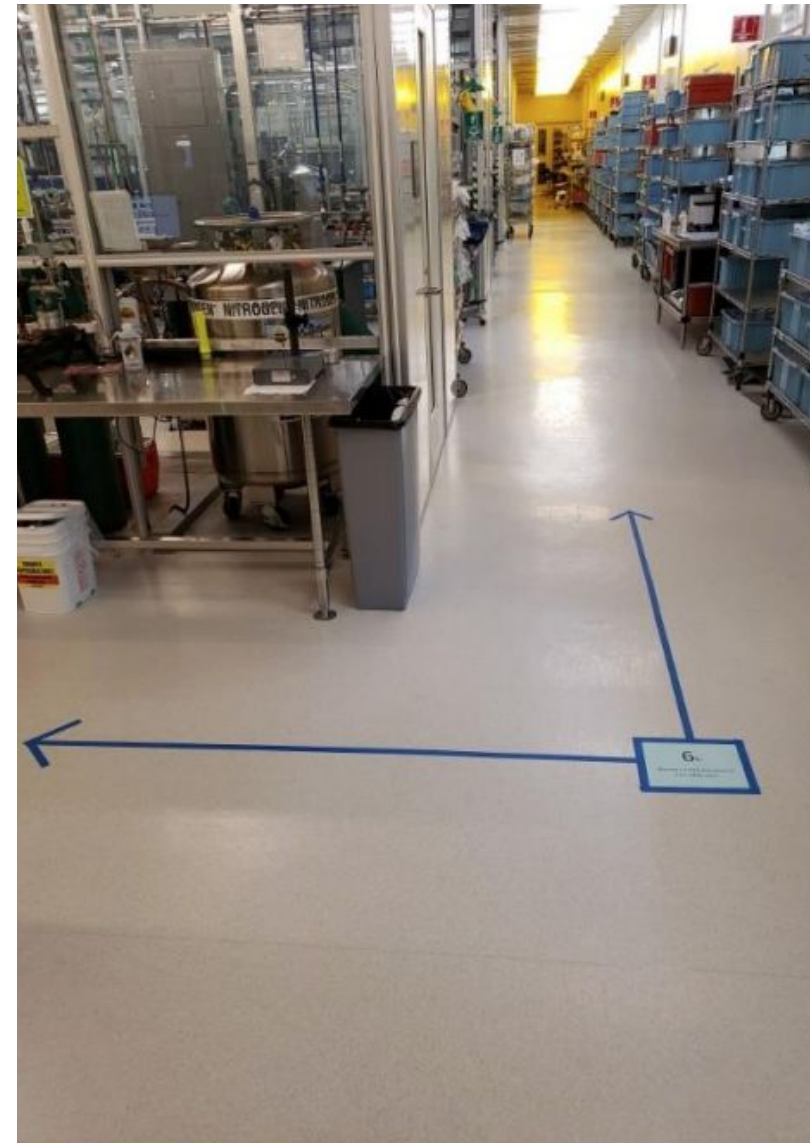
- High fatality rate for older & those with pre-existing problems
- Young are not invulnerable and can suffer severe illness
- Even non-fatal cases may cause lasting harm

Each positive has effect on the community

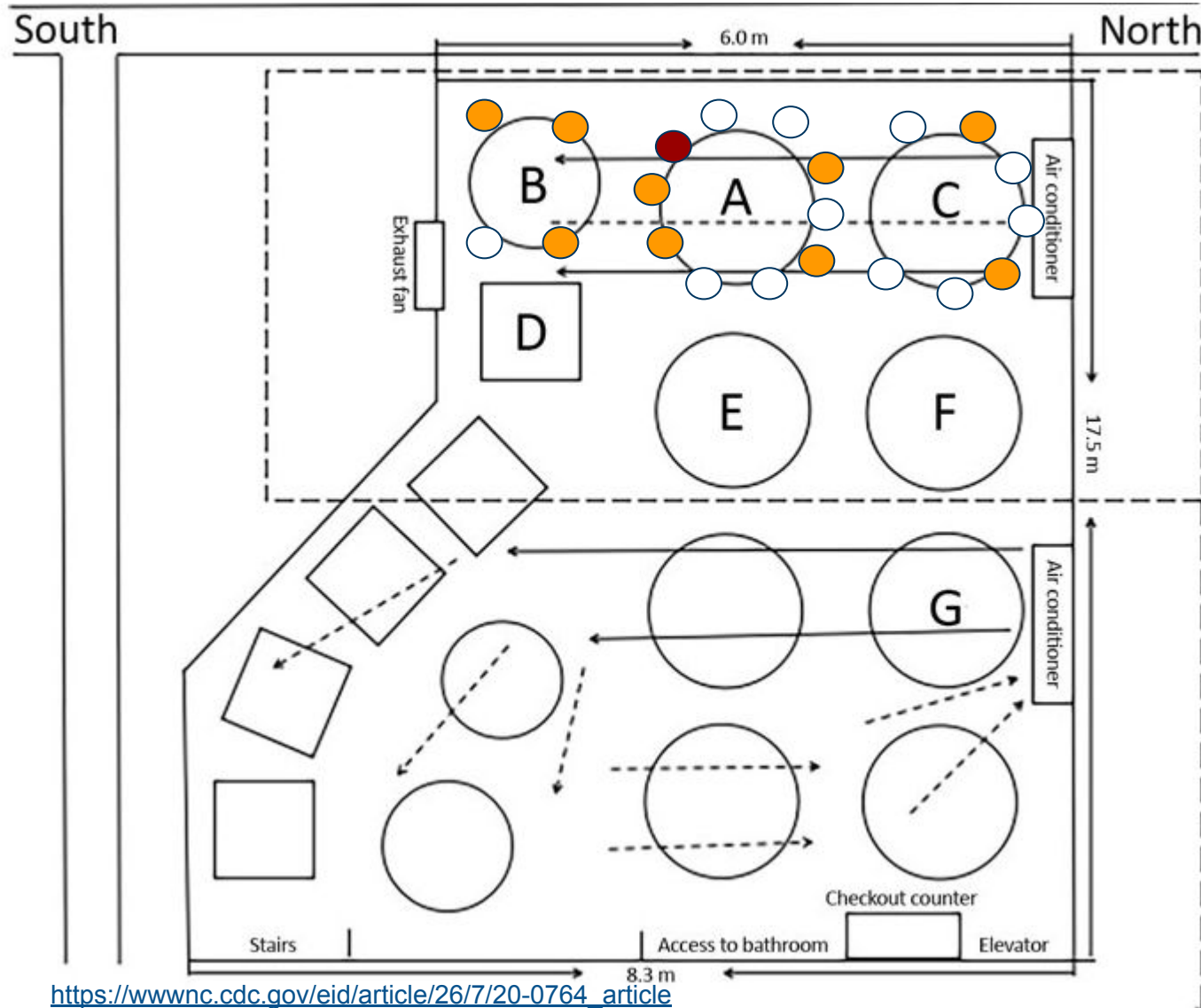
- Each new positive case is an impact that will ring through the community as new chains of infections

[Break the Chain of Infection](#)

Pay attention to posted signage



Posted signs are there to protect you



https://wwwnc.cdc.gov/eid/article/26/7/20-0764_article

Example of an outbreak in a restaurant

- One person (red) infected 9 other people (orange)
- In the flow of air conditioner

Take distancing requirements and guidance very seriously

- They may be protecting you from something you don't see or think about

Safety Culture



Biological laboratories and even accelerator laboratories like CERN and Fermilab have **a culture of safety** with careful procedures for working in biological, radiation, oxygen deprivation, and other potentially dangerous environments.

It works!

Knowing the precautions to take becomes second nature and has produced **strong safety records.**

<https://kt.cern/competences/radiation-protection-and-monitoring>

Safety Culture



© Ian Britton <https://flic.kr/p/4pbhwo>

Processes can appear to be onerous. They're designed to be safe not necessarily fast.

- Consistency is key. Processes are there to protect you in your worst moments not your best.

This requires **communal action**: hold each other to high standards, **call out issues when you see them**, build a culture of safety.

A process of continuous improvement



More Science (for those interested)

Today's speakers:

Introductory remarks from **UCSB Chancellor Henry Yang**

Carolina Arias Gonzalez, PhD

Assistant Professor in Molecular, Cellular, and Developmental Biology, UCSB

Dr. Arias (Ph.D. Microbiology, New York University Sackler Institute for Graduate Biomedical Sciences) has extensively studied virus-host interactions, as well as drug screens to identify FDA-approved compounds that could be used to curtail Zika virus infection. Dr. Arias joined the UCSB faculty late in 2016.



Lynn N. Fitzgibbons, MD

Infectious Disease Specialist, Cottage Health, Santa Barbara

Dr. Fitzgibbons is board certified in Infectious Diseases and Internal Medicine, and is chair of the Division of Infectious Disease at Cottage Health. She is the Medical Education Director of Research and Quality, and is a Clinical Associate Professor of Medicine at USC, as well as Adjunct Assistant Professor at UCSB in the Geography Department. She oversees the HIV and Infectious Disease clinic at the Santa Barbara County Public Health Department.

UCSB's Interdisciplinary Research Centers, NOVIM, and Cottage Health invite you to a seminar series on:

Issues, Approaches, and Consequences of the COVID-19 Crisis



By comparing the sequence of the viral genomes from different isolates we can infer their relationships

<https://www.youtube.com/watch?v=uBnRbkTGEjs&feature=youtu.be>

Recommended reading and UCSB Documentation

Recommended Reading:

- [Amid the Coronavirus Crisis, a Regimen for Reentry](#)
Strongly recommended.
- [The CIDRAP Viewpoint:](#)
 - The Future of the COVID-19 Pandemic: Lessons learned from Pandemic Influenza
- [Chop Wood Carry Water: How to Fall In Love With the Process of Becoming Great](#)

And from Student Health Services to the
UC Santa Barbara Community ...

UCSB Illness & Injury Prevention Plan

<https://www.ehs.ucsb.edu/iipp>

<https://www.ehs.ucsb.edu/dsr>

https://www.ehs.ucsb.edu/files/docs/ii/IIPP_Contents.pdf

https://docs.google.com/spreadsheets/d/1FwR1i7CLc4DLX6LOmEr48pAKmJmJ00DI_XyErte3AYk/edit#gid=0



UCSB PRINCIPLES OF COMMUNITY

Personal and professional accountability to these campus expectations will contribute to the health, safety and wellbeing of our entire campus community.

REVIEW:

<https://diversity.ucsb.edu/about/principles-of-community>



ASSESSMENT & MITIGATION RESOURCES

LIFE SCIENCES

<https://covid19.ca.gov/pdf/guidance-life-sciences.pdf>

<https://covid19.ca.gov/pdf/checklist-life-sciences.pdf>

<https://recoverysbc.org/wp-content/uploads/2020/05/Life-Sciences-v4.pdf>

OFFICE SPACES

<https://covid19.ca.gov/pdf/guidance-office-workspaces.pdf>

<https://covid19.ca.gov/pdf/checklist-office-workspaces.pdf>

<https://recoverysbc.org/wp-content/uploads/2020/05/Office-Workspaces-v4.pdf>

Symptoms of Coronavirus (COVID-19)

Know the symptoms of COVID-19, which can include the following:



Symptoms can range from mild to severe illness, and appear 2-14 days after you are exposed to the virus that causes COVID-19.

***Seek medical care immediately if someone has emergency warning signs of COVID-19.**

- Trouble breathing
- Persistent pain or pressure in the chest
- New confusion
- Inability to wake or stay awake
- Bluish lips or face

This list is not all possible symptoms. Please call your medical provider for any other symptoms that are severe or concerning to you.



It is important for you to be able to distinguish between what is consistent with an explainable root cause of any symptoms, i.e. muscles (injury or excessive exercise), headache (history of migraines), cough/congestion (history of allergies, medication side effect). Please discuss these confidentially with your primary care provider for appropriate planning for return to the workplace.

CAMPUS RESOURCES FOR STUDENTS

(CLICK LINKS)



UC SANTA BARBARA
**STUDENT
HEALTH**

STUDENT HEALTH SERVICE (In-person, online, & telehealth service is available during regular business hours)

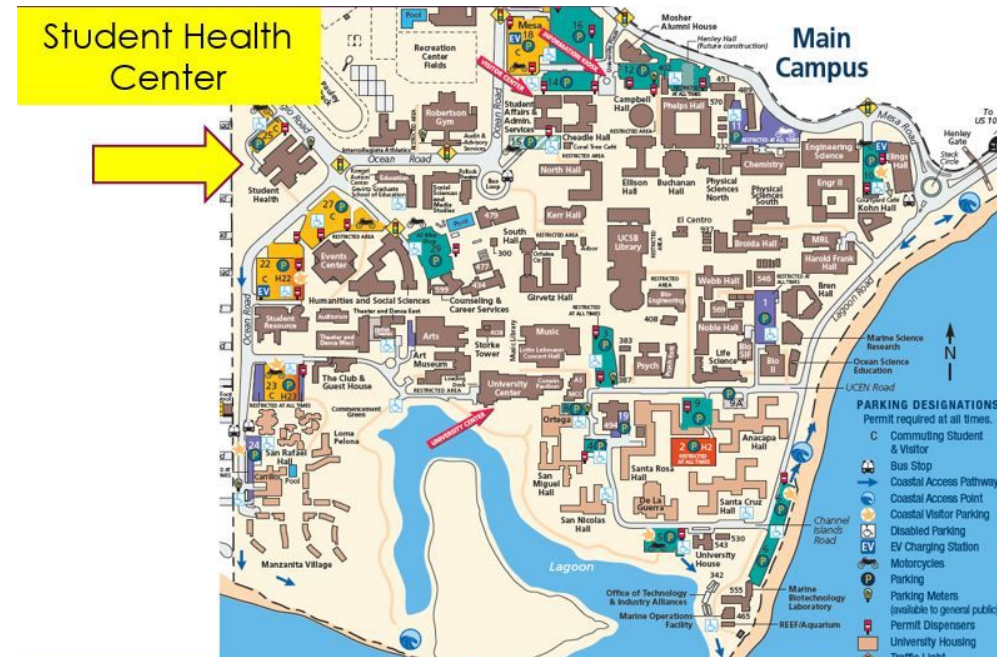
APPOINTMENT DESK QUEUE

PATIENT PORTAL GATEWAY

NURSE TRIAGE 805.893.7219

INSURANCE ADVISOR QUEUE

AFTERHOURS



RESOURCES FOR STAFF & FACULTY

Santa Barbara Community Based Covid-19 Testing

<https://publichealthsb.org/testing/>

UCSB Research: Insert options here that are pending.

[Livehealthonline.com](http://livehealthonline.com)

[Cottage CareNow](#)

[Sansum Clinic](#)

[Santa Barbara Neighborhood Clinics](#)

[Santa Barbara County Public Health Clinics](#)

[MedCenter on Fairview](#)

[Jackson Medical Group](#)



OR your local licensed primary healthcare provider or clinic.

UC SANTA BARBARA