1. **Science/literature around masks**
- **Case studies of facemasks preventing transmission**

    o [Chongquing, China case](#) – individual who was coughing did not wear face mask on bus (2 hour, 10 minute ride) – 5 other passengers of the 39 passengers were infected; Individual then bought mask and wore it on next bus ride – 50 minutes, 14 passengers, - no passengers were infected

    o [Hong Kong Special Administrative Region (HKSAR) case](#) – HKSAR was a community-wide mask wearing population and was compared to similar other non-mask wearing countries; COVID-19 incidence was lower in HKSAR than Spain, Italy, Germany, France, Singapore, and South Korea; HKSAR general public mask wearing compliance – 96.6%
    - *"Community-wide mask wearing may contribute to the control of COVID-19 by reducing the amount of emission of infected saliva and respiratory droplets from individuals with subclinical or mild COVID-19."*

    o [New York and Washington case](#) – "population-level benefit is greater the earlier masks are adopted"; "face masks decrease the equivalent effective transition rate"; should be combine with other measures like hygiene and social distancing;
    - *"Masks alone, unless they are highly effective and nearly universal, may have only a small effect (but still nontrivial, in terms of absolute lives saved) in more severe epidemics, such as the ongoing epidemic in New York state."*
    - *"Thus, it is important that masks not be viewed as an alternative, but as a complement, to other public health control measures (including non-pharmaceutical interventions, such as social distancing, self-isolation etc.). Delaying mask adoption is also detrimental. **These factors together indicate that even in areas or states where the COVID-19 burden is low (e.g. the Dakotas), early aggressive action that includes face masks may pay dividends**."*
    - *"Masks are valuable as both source control and primary prevention."* Even if someone has self-isolated and has no symptoms, they should still wear a mask when going out in public to prevent transmission.
    - *"our findings suggest that **face mask use should be as nearly universal (i.e., nation-wide)** as possible and implemented without delay, even if most masks are homemade and of relatively low quality."*
    - There is great potential for benefit and no obvious harm

    o [China, Italy, and NYC case comparison](#) – face coverings reduced the number of infections

- "This protective measure alone significantly reduced the number of infections, that is, **by over 78,000 in Italy from April 6 to May 9 and over 66,000 in New York City from April 17 to May 9."**
- Masks are inexpensive and the most effective way to prevent transmission; should be combined with "social distancing, quarantine, and contact tracing"

- **Universal face mask policy**
  - Policy rational
    - Mandating face masks may reduce transmission of droplets in the U.S.
    - If there is a supply issue, advocate for homemade mask use instead of medical mask use
  - "The masks can be used to block respiratory transmission from human to human, and are an effective way to control influenza. It is, therefore, necessary to wear a mask when respiratory infectious diseases are prevalent." –From European Review for Medical and Pharmacological Sciences
  - "we strongly support the use of cloth masks as a simple, economic and sustainable alternative to surgical masks as a means of source control for general community use, so that disposable surgical masks and N95 respirators can be reserved for use in healthcare facilities. Such an intervention is likely to be life saving in many resource-limited settings." – From European Respiratory Journal

- **Meta-analysis**
  - Systematic review and meta-analysis
    - "Face mask use could result in a large reduction in risk of infection…with stronger associations with N95 or similar respirators compared with disposable surgical masks or similar … Eye protection also was associated with less infection…"

- **Level of facemask use effectiveness prior to COVID-19**

  - Respiratory source control using a surgical mask: An in vitro study

  - The efficacy of medical masks and respirators against respiratory infection in healthcare workers

    - Healthcare workers in Beijing, China who continuously wore N95 respirators during their shift had significantly lower risk of laboratory-confirmed viral respiratory infection, bacterial colonization, and droplet-transmitted infections compared to healthcare workers following usual mask wearing practices.

- Similarly, those with targeted or intermittent use of N95 respirators during their shift had significantly lower risk of droplet-transmitted infections and bacterial colonization compared to those following usual mask wearing practices.

- No significant associations were observed between the continuous use of medical masks during a shift and any of the above outcomes.

   o [Testing the Efficacy of Homemade Masks: Would They Protect in an Influenza Pandemic?](#) – number of microorganisms (similar in size to influenza viruses) isolated from coughs of healthy participants wearing homemade cotton masks, surgical masks, and no mask were compared.

     - The use of surgical and cotton masks resulted in significantly fewer microorganisms expelled into the air compared to wearing no mask, and the surgical mask was found to be more effective at preventing the transmission of smaller particles compared to the homemade mask.

       - Both surgical and homemade masks reduced droplet transmission of influenza-sized particles compared to wearing no mask. Although surgical masks were more effective, homemade cotton masks were still more effective than wearing no mask.

   o [Risk Factors for SARS among Persons without Known Contact with SARS Patients, Beijing, China](#)

- **Other literature**
   o [Community Universal Face Mask Use during the COVID 19 pandemic – from households to travelers and public spaces](#)
     - Previous RCT found that rate of infection among healthcare workers wearing cloth masks was higher than those wearing surgical masks, and cloth masks had poor filtration compared to surgical masks.
       - MacIntyre CR, Seale H, Dung TC, et al. A cluster randomised trial of cloth masks compared with medical masks in healthcare workers. BMJ open. 2015;5(4):e006577-e.
     - Another study assessing aerosol particle transmission among healthy volunteers found that respirators were most effective, followed by surgical masks, and then cloth masks at reducing particle transmission. Although cloth masks are not the best, this study suggests that they offer some protection.
       - van der Sands MT, P; Sabel, R. Professional and Home-Made Face Masks Reduce Exposure to Respiratory Infections among the General Population. PLoS ONE. 2008;3(7):e2618.
     - "The results show that if N95 respirators are only 20% effective in reducing susceptibility and infectivity, only 10% of the population would

have to wear them to reduce the number of influenza A (H1N1) cases by 20%. We can conclude from our model that, if worn properly, facemasks are an effective intervention strategy in reducing the spread of pandemic (H1N1) 2009."

- Tracht SMDV, S.Y; Hyman, J.M Mathematical Modeling of the Effectiveness of Facemasks in Reducing the Spread of Novel Influenza A (H1N1). PLoS ONE 2010;5(2):e9018.

o [Psychopathological responses and face mask restrictions during the COVID-19 outbreak: Results from a nationwide survey](#)

o [Use of Face Masks in COVID-19](#)

o [To mask or not to mask: Modeling the potential for face mask use by the general public to curtail the COVID-19 pandemic](#)

- "Model simulations, using data relevant to COVID-19 dynamics in the US states of New York and Washington, suggest that broad adoption of even relatively ineffective face masks may meaningfully reduce community transmission of COVID-19 and decrease peak hospitalizations and deaths. … Notably, masks are found to be useful with respect to both preventing illness in healthy persons and preventing asymptomatic transmission."

o [Turbulent Gas Clouds and Respiratory Pathogen EmissionsPotential Implications for Reducing Transmission of COVID-19](#)
o [Who should wear a face mask? Experts weigh in on Canada's COVID-19 response](#)

2. **What the experts say**
- **"**if you are in a public place where you will encounter other people, you should wear a mask."

  -[Lisa Maragakis, M.D., M.P.H., Johns Hopkins Medicine](#)

- "'When you have crowds of people together and you have the lack of wearing a mask that increases the risk of there being transmissibility. I have no doubt about that,'"

  -[Dr. Anthony Fauci, White House health advisor](#)

- " face masks combined with other preventive measures, such as frequent hand-washing and social distancing, help slow the spread of the virus."

  -[Mayo Clinic](#)

- "Washable, cloth face coverings or disposable, non-medical face coverings prevent the wearer from spreading large respiratory droplets to others, and to their surroundings."

  -[Harvard University Health Services](#)

- "CDC recommends that people wear cloth face coverings in public settings and when around people who don't live in your household, especially when other social distancing measures are difficult to maintain."
  -Centers for Disease Control and Prevention (CDC)

- "If possible, wear a cloth face covering in situations when physical distancing is difficult."
  -Wisconsin Department of Health Services

- "**Non-medical, fabric masks** are being used by many people in public areas, but there has been limited evidence on their effectiveness and WHO does not recommend their widespread use among the public for control of COVID-19. However, for areas of widespread transmission, with limited capacity for implementing control measures and especially in settings where physical distancing of at least 1 metre is not possible – such as on public transport, in shops or in other confined or crowded environments – WHO advises governments to encourage the general public to use non-medical fabric masks."
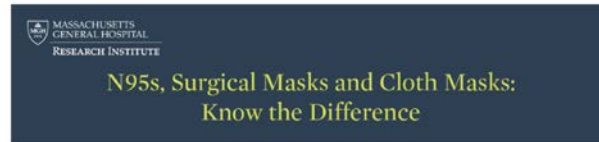
Risks to wearing masks:

"There are potential risks and disadvantages that should be taken into account in any decision-making process on the use of masks:

- Non-medical or fabric masks could increase potential for COVID-19 to infect a person if the mask is contaminated by dirty hands and touched often, or kept on other parts of the face or head and then placed back over the mouth and nose
- Depending on the type of mask used, could cause difficulty in breathing
- They can lead to facial skin breakdown
- They can lead to difficulty with communicating clearly
- They can be uncomfortable to wear
- It is possible that mask use, with unclear benefits, could create a false sense of security in the wearer, leading to diminished practice of recognized beneficial preventive measures such as physical distancing and hand hygiene."

  -The World Health Organization (WHO)

3. Difference between: cloth; surgical; and N95 masks and why use (Rachel L)
   - CDC Infographic on Difference between medical masks: surgical mask v. N95 Respirator (https://www.cdc.gov/niosh/npptl/pdfs/UnderstandDifferenceInfographic-508.pdf)
   - Massachusetts General Hospital Research Institute Infographic on Differences between Masks (https://mgriblog.org/2020/04/29/the-difference-between-n95s-surgical-masks-and-cloth-masks/)

- o
- o Droplets vs. Aerosols
  - Droplets are large particles of liquid from a cough or sneeze – usually fall onto a surface due to their size – transmission can occur from a surface
  - Aerosols are extremely small and light – stay airborne for extended period of time – released from talking, breathing, coughing sneezing.
  - Droplets are like rain, aerosols are like fog
- o N95 Masks (respirators)
  - All N95s are tested and approved by the National Institute for Occupational Safety and Health (NIOSH)
  - Tight fitting, fit-tested, uses static electricity to filter 95% of particles in the environment, can be sterilized and reused by same person
  - "**N95s are critical supplies that should be reserved for health care workers and other first responders, otherwise we are putting them at tremendous risk**" – Dr. Alba Mass General Research Institute
- o Surgical Masks
  - Fluid resistant, does not require fit-test, does not protect against aerosols, **typically used in medical settings**, one-time-use
- o Cloth masks
  - Does not protect against aerosols, but risk of being infected in public by aerosols is so low due to open spaces, cloth mask is sufficient
  - Typically homemade, cotton**, recommended to general public for use in public settings**

- CDC Recommendations for Cloth Face Covers/Cloth Masks
  (https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/prevention.html)
  - o Cover your mouth and nose with a cloth face cover when around others
  - o You could spread COVID-19 to others even if you do not feel sick.
  - o The cloth face cover is meant to protect other people in case you are infected.
  - o Everyone should wear a cloth face cover in public settings and when around people who don't live in your household, especially when other social distancing measures are difficult to maintain.

- o Cloth face coverings should not be placed on young children under age 2, anyone who has trouble breathing, or is unconscious, incapacitated or otherwise unable to remove the mask without assistance.
- o **Do NOT use a facemask meant for a healthcare worker. Currently, surgical masks and N95 respirators are critical supplies that should be reserved for healthcare workers and other first responders.**
- o Continue to keep about 6 feet between yourself and others. The cloth face cover is not a substitute for social distancing.

- Visualizing the effectiveness of face masks in obstructing respiratory jets
(https://aip.scitation.org/doi/10.1063/5.0016018)
  - o "We observe that a single-layer bandana-style covering can reduce the range of the expelled jet to some extent, compared to an uncovered cough. Importantly, both the material and construction techniques have a notable impact on the masks' stopping-capability. **The stitched mask made of quilting cotton was observed to be the most effective, followed by the commercial mask, the folded handkerchief, and, finally, the bandana.** Importantly, our observations suggest that a higher thread count by itself is not sufficient to guarantee better stopping-capability; the bandana covering, which has the highest thread count among all the cloth masks tested, turned out to be the least effective."
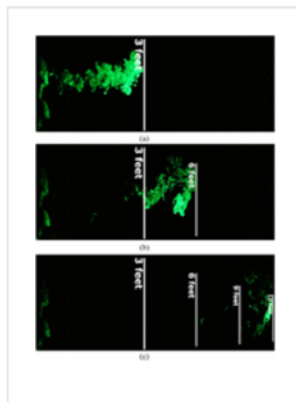
-

FIG. 2. An emulated heavy cough jet travels up to 12 ft in ~50 s, which is twice the CDC's recommended distancing guideline of 6 ft.[7] Images taken at (a) 2.3 s, (b) 11 s, and (c) 53 s after the initiation of the emulated cough.
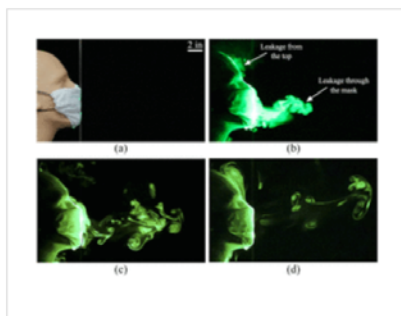
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FIG. 3. (a) A face mask constructed using a folded handkerchief. Images taken at (b) 0.5 s, (c) 2.27 s, and (d) 5.55 s after the initiation of the emulated cough.
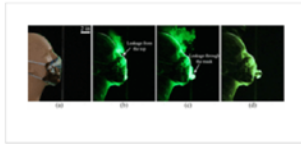
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FIG. 4. (a) A homemade face mask stitched using two-layers of cotton quilting fabric. Images taken at (b) 0.2 s, (c) 0.47 s, and (d) 1.68 s after the initiation of the emulated cough.
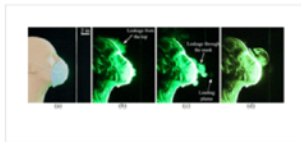
⬇ PPT | High-resolution

FIG. 5. (a) An off-the-shelf cone style mask. (b) 0.2 s after initiation of the emulated cough. (c) 0.97 s after initiation of the emulated cough. The leading plume, which has dissipated considerably, is faintly visible. (d) 3.7 s after initiation of the emulated cough.

-

Mask type	Material	Threads/in.	Average jet distance
Uncovered	...	...	~8 ft
Bandana	Elastic T-shirt material	85	~3 ft 7 in.
Folded handkerchief	Cotton	55	1 ft 3 in.
Stitched mask	Quilting cotton	70	2.5 in.
Commercial mask[a]	Unknown	Randomly assorted fibres	8 in.

[a]CVS Cone Face Mask.

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4. Regardless of differences; the case for protection. (Rachel L)

- Still Confused About Masks? Here's the Science Behind How Face Masks Prevent Coronavirus (https://www.ucsf.edu/news/2020/06/417906/still-confused-about-masks-heres-science-behind-how-face-masks-prevent)
  - Studies have found that viral load peaks in the days before symptoms begin and that speaking is enough to expel virus-carrying droplets. [need evidence]

- o "I think the biggest thing with COVID now that shapes all of this guidance on masks is that **we can't tell who's infected**," said Chin-Hong. "You can't look in a crowd and say, oh, that person should wear mask. **There's a lot of asymptomatic infection, so everybody has to wear a mask**."
- o Masks may be more effective as a "source control" because they can prevent larger expelled droplets from evaporating into smaller droplets that can travel farther.
- o Another factor to remember, noted Rutherford, is that you could still catch the virus through the membranes in your eyes, a risk that masking does not eliminate.
- o <u>In one simulation</u>, researchers predicted that 80 percent of the population wearing masks would do more to reduce COVID-19 spread than a strict lockdown.
  - ▪ https://arxiv.org/pdf/2004.13553.pdf
  - ▪ Results show a near perfect correlation between early universal masking and successful suppression of daily case growth rates and/or reduction from peak daily case growth rates, as predicted by our theoretical simulations.
  - ▪ Taken in tandem, our theoretical models and empirical results argue for urgent implementation of universal masking in regions that have not yet adopted it as policy or as a broad cultural norm. As governments plan how to exit societal lockdowns, **universal masking is emerging as one of the key NPIs (non-pharmaceutical interventions) for containing or slowing the spread of the pandemic. Combined with other NPIs including social distancing and mass contact tracing, a "mouth-and-nose lockdown" is far more sustainable than a "full body lockdown", from economic, social, and mental health standpoints.** To provide both policy makers and the public with a more concrete feel for how masks impact the dynamics of virus spread, we are making an interactive visualization of the ABM simulation available online at http://dek.ai/masks4all. We recommend immediate mask wearing recommendations, official guidelines for correct use, and awareness campaigns to shift masking mindsets away from pure self-protection, towards aspirational goals of responsibly protecting one's community.

- Community Use Of Face Masks And COVID-19: Evidence From A Natural Experiment Of State Mandates In The US
  (https://www.healthaffairs.org/doi/10.1377/hlthaff.2020.00818)
  - o Mandating face mask use in public is associated with a decline in the daily COVID-19 growth rate by 0.9, 1.1, 1.4, 1.7, and 2.0 percentage-points in 1–5, 6–10, 11–15, 16–20, and 21+ days after signing [universal mask policy], respectively. **Estimates suggest as many as 230,000–450,000 COVID-19 cases possibly averted By May 22, 2020 by these mandates.** The findings suggest that requiring face mask use in public might help in mitigating COVID-19 spread.