

# Masks Do Work: New Evidence and Examples for Broad and Required Public Use of Masks for COVID-19

A working paper for state and local health policy and research  
A companion summary and bibliography by Colorado Ideas 2.0

updated May 1, 2021\*

\*(Initial release July 2020, with ten supplements through February 2021; integrated in this edition)

Since March 2020, fast-paced, unprecedented actions by state and federal public health officials have featured statewide stay-at-home orders, limits on gatherings, closure of businesses and recreation spaces, and near-universal recommendations for social distancing, sanitizing hands and surfaces, and use of face masks. The use of universal masks and/or face coverings plays a visible and prominent role in COVID-19 responses, but had limited academic or science study or research until 2020.

**This report provides a summary and highlights of some of the best NEW EVIDENCE-BASED SOURCES specific to the broad use of masks and cloth face coverings. It is designed to assist and inform state and local policymakers who may not have regular access to medical and technical journals. All contents in this document focus on excerpted transcribed material from peer reviewed or “pre-reviewed” publications, along with selected major media summaries. Facts, data, descriptions, opinions and conclusions in this compendium are the property and responsibility of the cited original authors or publishers.** This summary is intended for use with any local or broader audience. The findings may be of considerable interest to health practitioners, from MDs to front-line coordinators and workers; it may not so easily translate to the general public. The science papers’ conclusions include some plain language (underlines added for emphasis only).

**Companion Report:** One year ago we compiled and posted a first 50-state report and analysis,

- **“Policies on Required Use of Masks to prevent the spread of COVID-19: An Updated Nationwide Review.”** Our April 2021 online update at ([PDF, 17 pp](#)) at [https://lnkd.in/g\\_3BKUa](https://lnkd.in/g_3BKUa) tracks expanded and retracted requirements, with live links to state executive orders, consumer summaries and shifting timetables.

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**About the authors:** This report series was compiled and distributed by Richard Cauchi, director and lead health advisor at Colorado Ideas 2.0, LLC. They are not responsible for the facts and opinions expressed in the articles cited or quoted. [Colorado Ideas 2.0, LLC](#)

## Masks Stop the Transmission of COVID-19

### ■ Identifying airborne transmission as the dominant route for the spread of COVID-19

*One of the latest peer-reviewed scientific studies.* On June 12 CNN and most major news outlets brought new medical research out of the academic journals and into the headlines. They reported that “A team of researchers in Texas and California compared Covid-19 infection rate trends in Italy and New York both before and after face masks were made mandatory. Both locations started to see infection rates flatten only after mandatory face mask measures were put in place, according to the study published (June 11) Thursday in the Proceedings of the National Academy of Sciences.”

- The researchers calculated that wearing face masks prevented more than 78,000 infections in Italy between April 6 and May 9, and more than 66,000 infections in New York City between April 17 and May 9.
- “Our results show that the airborne transmission route is highly virulent and dominant for the spread of COVID-19.
- Our analysis reveals that the difference with and without mandated face covering represents the determinant in shaping the trends of the pandemic. This protective measure significantly reduces the number of infections.
- Other mitigation measures, such as social distancing implemented in the United States, are insufficient by themselves in protecting the public. Our work also highlights the necessity that sound science is essential in decision-making for the current and future public health pandemics.”

CNN’s coverage noted that “*The researchers wrote that both the World Health Organization and the US Centers for Disease Control and Prevention emphasized the prevention of contact transmission, but both organizations have largely ignored the importance of the airborne transmission route.*”<sup>1</sup>

- Title: Identifying airborne transmission as the dominant route for the spread of COVID-19  
Authors: The team of five researchers are from the Texas A&M University, the University of Texas, the University of California, San Diego, and the California Institute of Technology.
- Source: Proceedings of the National Academy of Sciences. June 11, 2020  
<https://www.pnas.org/content/early/2020/06/10/2009637117>; (PDF format = 7 pp)

### ■ Masks and face coverings stop the transmission. The peer-reviewed Royal Society (England) published one of the early COVID-specific articles, with a conclusion, “Masks contribute to the management of community transmission of Covid19 within the general population...”

- Their use can reduce onward transmission by asymptomatic and pre-symptomatic wearers - especially when widely used in situations where physical distancing is not possible or predictable. Face masks, including homemade cloth masks, contribute to reducing viral transmission.
- We know that respiratory droplets (mouth and nose) from infected individuals are a major mode of transmission. Droplets are generated via talking and breathing<sup>15</sup> also from coughing or sneezing: especially in non- AND pre-symptomatic individuals.<sup>2</sup>
- Source: “Face Masks for the General Public” [published](#) by The Royal Society (England), May 4, 2020. ([PDF](#))

### ■ A modelling framework assesses the likely effectiveness of facemasks in combination with ‘lock-down’

The Royal Society (England) has published a second medical analysis (by different research teams) that scientifically models the widespread use of face masks. A University released summary makes these points:

- “The research suggests that lockdowns alone will not stop the resurgence of SARS-CoV-2, and that even homemade masks with limited effectiveness can dramatically reduce transmission rates if worn by enough people, regardless of whether they show symptoms.
- The researchers call for information campaigns across wealthy and developing nations alike that appeal to our altruistic side: “Cultural and even political issues may stop people wearing facemasks, so the message needs to be clear: “my facemask protects you, your facemask protects me”.
- Lead author Dr. Richard Stutt explains “Our analyses support the immediate and universal adoption of facemasks by the public. If widespread facemask use by the public is combined with physical distancing and some lockdown, it

may offer an acceptable way of managing the pandemic and re-opening economic activity long before there is a working vaccine."

- The report concludes, "Despite the potential for facemasks to reduce SARS-CoV-2 transmission, there does not appear to be any focus on investing efforts in properly designed studies on facemasks, or evaluating large populations including 'at risk' patients and in a variety of communities. We argue that these are required urgently. In summary, our modelling analyses provide support for the immediate, universal adoption of facemasks by the public, similar to what has been done in Taiwan."

- Source: Published in the *Proceedings of the Royal Society A* as a peer-reviewed article, June 10, 2020 <https://royalsocietypublishing.org/doi/10.1098/rspa.2020.0376> ; University news release: <https://medicalxpress.com/news/2020-06-widespread-facemask-covid-.html>

## ■ "Physical distancing, face masks, and eye protection to prevent person-to-person transmission of ... COVID-19:"

The UK-based Lancet released another article , described as a systematic review and meta-[analysis](#) "based on 172 previous studies from around the world, found that "face mask use could result in a large reduction in risk of infection. ...For the general public, evidence shows that physical distancing of more than 1 m is highly effective and that face masks are associated with protection, even in non-health-care settings, with either disposable surgical masks or reusable 12–16-layer cotton ones." The findings come from a systematic review of 44 studies, including seven involving the virus causing COVID-19. The remaining focused on SARS or MERS. <sup>3</sup>

This analysis to ... assess the use of face masks and eye protection to prevent transmission of viruses is the latest evidence that initial guidance from U.S. health authorities discouraging mask use was a misstep. "This puts all that information clearly in one place for policymakers to use," said study co-author Dr. Derek Chu of McMaster University in Hamilton, Ontario.

- Sources: [The Lancet](#), funded by the World Health Organization. [Analysis](#) by the Washington Post June 1, 2020. <https://www.thelancet.com/action/showPdf?pii=S0140-6736%2820%2931142-9>

## ■ "Universal Masking is Urgent"

Joint authors (from Berkeley U, Hong Kong, UK, France and Finland) "present two models for the COVID-19 pandemic predicting the impact of universal face mask wearing...

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. 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 non-pharmaceutical interventions (NPIs) for containing or slowing the spread of the pandemic."

- Combined with ... 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.

- Title: "Universal Masking is Urgent in the COVID-19 Pandemic: SEIR and Agent Based Models, Empirical Validation, Policy Recommendations" – prepublication 4/21/2020 by De Kai, PHD MBA, et al; May 12
- Text: ([PDF, 19 pages](#)). Interactive simulation available online at <http://dek.ai/masks4all>

## ■ [Masks4All Online](#) Information site

"How to Significantly Slow Coronavirus?" featuring Minister of Health of the Czech Republic.

- Video for public use or download: [bit.ly/Masks4All-download](http://bit.ly/Masks4All-download)
- Graphic comparing results in required vs recommended mask states [Graphic link](#) June 24, 2020 NYT

## ■ Masks and social distancing work, new analysis finds -

Lead author Jeremy Howard, University of San Francisco data scientist, stated,

- Roughly three-quarters of humanity has been under some kind of government masking orders in recent months.
- The research "suggests that masks — even ones that are handmade — significantly lower the likelihood of

transmission of the coronavirus among people moving about their communities.”

- “Mask wearing seems to be the number one most effective tool in slowing the epidemic”
  - Source: University of San Francisco data scientist Jeremy Howard. <sup>4</sup> Washington Post, June 5, 2020. <https://www.washingtonpost.com/technology/2020/06/05/masks-benefits-study-italy/> <sup>5</sup>

## ■ **Turbulent Gas Clouds and Respiratory Pathogen Emissions... Reducing Transmission of COVID-19.**<sup>6</sup>

This study from MIT, peer-reviewed in JAMA, and dramatic visual demonstration of how a cough can spread across a room, reaching up to 27 feet, was a “wake-up call” when the video was released and reproduced by the New York Times and other online media.

- Watch the lab video of a human sneeze:
- “Turbulent gas cloud dynamics should influence the design and recommended use of surgical and other masks. These masks can be used both for source control (i.e., reducing spread from an infected person) and for protection of the wearer (i.e., preventing spread to an unaffected person).”
  - Source: JAMA, online March 26; 2020. Author: Lydia Bourouiba, PhD, Massachusetts Institute of Technology, (visual graphic on last page)

## ■ **“Fauci says the WHO's comment on asymptomatic spread is wrong.”**

In publicly refuting a confusing remark, [Dr. Anthony Fauci, the top infectious diseases expert in the US](#). Explained, “Here's the difference between asymptomatic and pre-symptomatic spread.”

- “A World Health Organization official recently said asymptomatic spread “appears to be rare,” prompting widespread confusion because doctors and scientists have been saying the opposite for months.
- But the WHO's comment “was not correct,” Evidence shows that 25% to 45% of infected people likely don't have symptoms, Fauci told ABC's “Good Morning America” on Wednesday. “And we know from epidemiological studies they can transmit to someone who is uninfected even when they're without symptoms,” said Fauci, the director of the National Institute of Allergy and Infectious Diseases. So to make a statement to say that's a rare event was not correct.”
- And while the public might use the word “asymptomatic” to describe any infected person who doesn't have symptoms, the bigger concern may be infection from “pre-symptomatic” carriers. How can I tell if someone is pre-symptomatic or asymptomatic? You can't. Both types of carriers look and feel normal, though the pre-symptomatic carriers will get symptoms later.
  - Source: CNN, June 10,2020 | Listen [http://lite.cnn.com/en/article/h\\_cff600c488ea3e1a7a24ffd9489e16ef](http://lite.cnn.com/en/article/h_cff600c488ea3e1a7a24ffd9489e16ef)

## ■ **“It is Time to Address Airborne Transmission of COVID-19”.**

The [NY Times](#) captured the message of this communication: **“239 Experts With One Big Claim: The Coronavirus Is Airborne.”** The brief letter-format is 1) aimed primarily at WHO; 2) it does not explicitly list masks/cloth coverings as a solution. It does emphasize “microdroplets small enough to remain aloft in air and pose a risk...”

- Excerpt: “We appeal to the medical community and to the relevant national and international bodies to recognize the potential for airborne spread of COVID-19. There is significant potential for inhalation exposure to viruses in microscopic respiratory droplets (microdroplets) at short to medium distances (up to several meters, or room scale), and we are advocating for the use of preventive measures to mitigate this route of airborne transmission. Studies by the signatories and other scientists have demonstrated beyond any reasonable doubt that viruses are released during exhalation, talking, and coughing in microdroplets small enough to remain aloft in air and pose a risk of exposure at distances beyond 1 to 2 meters from an infected individual ... “

- Source: Oxford Academic: Clinical Infectious Diseases ([Full document](#)); authors: Lidia Morawska (Australia), Donald K Milton (Univ. of Maryland). Published July 6, 2020.

## Cloth Face Coverings Are Effective

- Non-Medical Cloth-based face masks reduce emission of particles by significant amounts, for example study #1<sup>15</sup> showed that they are almost completely eliminated. Study #2<sup>17</sup> showed that cloth masks filtered viral particles during coughing at 50 to 100%. Both commercially available and homemade cloth masks and surgical masks can play a role.
  - Source: “Face Masks for the General Public” [published](#) by The Royal Society (England), May 4, 2020. ([PDF](#)) *(also cited above in part 1)*

## ■ Seeing is Believing: Effectiveness of Facemasks

### “Visualizing the effectiveness of face masks in obstructing respiratory jets”

The latest research, from [Florida Atlantic University](#)’s College of Engineering and Computer Science, published June 30, 2020 in the journal *Physics of Fluids*, demonstrates through visualization of emulated coughs and sneezes, a method to assess the effectiveness of facemasks in obstructing droplets.

- Their study shows “well-fitted homemade masks with multiple layers of quilting fabric, and off-the-shelf cone style masks, proved to be the most effective in reducing droplet dispersal. These masks were able to curtail the speed and range of the respiratory jets significantly, albeit with some leakage through the mask material and from small gaps along the edges.” “Our researchers have demonstrated how masks are able to significantly curtail the speed and range of the respiratory droplets and jets” said Dean Stella Batalama, PhD. (*illustration, p. 8*)
- “Importantly, uncovered emulated coughs were able to travel noticeably farther than the currently recommended 6-foot distancing guideline. Without a mask, droplets traveled more than 8 feet.”
  - Source: [Stella Batalama](#), Ph.D., dean of FAU’s College of Engineering and Computer Science. “University News release: <https://www.fau.edu/newsdesk/articles/efficacy-facemasks-coronavirus.php> *Physics of Fluids* Journal: <https://aip.scitation.org/doi/10.1063/5.0016018>

## ■ Tests of 10 Cloth fabrics found that the best material is cotton t-shirt.

This Illinois University-based science study found that cloth-based masks were even better to breathe in than a medical mask. Most common household fabrics, such as T-shirt material, have 40% or higher droplet blocking when used as a single layer.

- In two layers, to our surprise, T-shirt fabric had a 98% droplet blocking efficiency – exceeding that of the medical mask, while maintaining better breathability.
- There has been ... “little information on the effectiveness of home-made face coverings in reducing droplet dissemination. Here, we ascertained the performance of ten different fabrics, ranging from cotton to silk, in blocking high velocity droplets, using a 3-layered commercial medical mask as a benchmark material. We also assessed their breathability and ability to soak water. We reason that the materials should be as breathable as possible, without compromising blocking efficiency, to reduce air flow through the sides of the mask since such flow would defeat the purpose of the mask. We found that most home fabrics substantially block droplets, even as a single layer. With two layers, blocking performance can reach that of surgical mask without significantly compromising breathability.”
- Click to see a video the [medical mask test](#). or (<https://youtu.be/XG1Du-GOJs0>)
  - Source: medRxiv at <https://www.medrxiv.org/content/10.1101/2020.04.19.20071779v1>, April 24, 2020  
Article by: University of Illinois <https://news.illinois.edu/view/6367/808377> May 1, 2020

## Masks don't just filter the air; they keep people away; yet create group solidarity.

- **How do masks change human behavior?** This engineering-oriented science study, based in Italy, “investigated if and how wearing various Personal Protection Equipment, like masks, influences social distancing
  - ...findings suggest that wearing masks has a profound effect on how we perceive others, and in particular how close we are willing to get to strangers. (Without a mask researchers) “found that fellow pedestrians actually drew closer ... as he passed them on a sidewalk, typically within a foot. Wearing a mask, people drifted back — nearly twice as far as when he wasn’t wearing a mask — suggesting the mere sight of protective gear activated the

underlying knowledge among fellow pedestrians that keeping their distance helped keep them safe.” In other words, masks appeared to make an extremely social species less social — and less vulnerable

- “It’s our humanity that is actually bringing us toward the virus,” said Marchiori, a professor at the University of Padua. “You have to take away a bit of humanity, to become a bit antisocial, to protect humanity.”

- Source: COVID-19 and the Social Distancing Paradox: dangers and solutions Massimo Marchiori, University of Padua, Italy; full text: <https://arxiv.org/pdf/2005.12446.pdf> Published in Washington Post, June 5, 2020

- <https://www.washingtonpost.com/technology/2020/06/05/masks-benefits-study-italy/>

- **Getting universal use of face masks accepted by the public** – The Royal Society (cited above also examined the positive result of people responding to being in groups that also are wearing masks, termed “group solidarity.”
  - behavioral science tells us people view an action as correct in a given situation to the degree they see others performing it<sup>57 58</sup>,
  - there is an advantage to encouraging universal application in appropriate settings (such as public transportation) with the goal of setting new norms around mask use.
  - The visibility of masks can be expected to act as a reminder of the need for physical distance, increased hand washing, reduced face touching, and Community and group solidarity.
  - “apart from population control, mask-wearing, hand-washing, and social distancing are all necessary and must be implemented early to suppress transmission.”<sup>7</sup>

### “Shutdown orders prevented about 60 million COVID-19 infections – “Far from Over”

According to a [research study](#)<sup>8</sup> published June 8 “Shutdowns” Prevented about 60 million in the United States and 285 million in China, that examined how stay-at-home orders and other restrictions limited the spread of the contagion.

- A separate [study](#) from epidemiologists at Imperial College London estimated the shutdowns saved about 3.1 million lives in 11 European countries, including 500,000 in the United Kingdom, and dropped infection rates by an average of 82 percent, sufficient to drive the contagion well below epidemic levels.
- “The two reports ...come with a clear warning that the pandemic, even if in retreat in some of the places hardest hit, is far from over. The overwhelming majority of people remain susceptible to the virus.” The two reports used completely different methods to reach similar conclusions. They suggest that the aggressive and unprecedented shutdowns, which caused massive economic disruptions and job losses, were effective at halting the exponential spread of the novel coronavirus.
  - Source: published simultaneously in the journal [Nature](#), June 8, 2020.  
[www.washingtonpost.com/health/2020/06/08/shutdowns-prevented-60-million-coronavirus-infections-us-study-finds/](http://www.washingtonpost.com/health/2020/06/08/shutdowns-prevented-60-million-coronavirus-infections-us-study-finds/)

### Public Messages:

- **“All your questions about how to wear a face mask – answered”**  
CNN's **Dr. Sanjay Gupta** explains why wearing them in addition to physical distancing is so important. "Ultimately, it's about having some form of barrier with multiple layers," said CNN Chief Medical Correspondent Dr. Sanjay Gupta in a [CNN video](#) on why masks in addition to physical distancing are important.
  - **Source:** [CNN video](#) – published as [#CNNTownHall](#) <https://cnn.it/3c5PctB> April 23, 2020
- **“If we all wear masks, we could help each other.”** Dr. Joseph Vinetz, professor in the infectious disease section at Yale School of Medicine stated “The benefit of wearing masks in public is to protect others from exposure if you are sick or if you're an [asymptomatic carrier](#). But if we all wear masks, we could help each other, "The idea about the face mask is to prevent the virus from coming out of somebody's mouth and nose, mostly out of their mouth. They prevent somebody, when they talk or sometimes when they sneeze or cough, from expelling virus and leading to infection in other people."

- **Source:** Dr. Joseph Vinetz, professor in the infectious disease section at Yale School of Medicine. <https://www.cnn.com/2020/04/01/europe/iceland-testing-coronavirus-intl/index.html>

## Population Impact Success Examples

**Comparison of weekly new cases in states** with four policy approaches, from mandatory to only recommended. Results document that broad public use of masks was associated with a drop in cases (25% and 12%), while states with requirements only for employees (e.g. Colorado, ) showed a spike in cases (70%) and states with no statewide required use showed an 84% case increase. Published in NY Times, June 24, 2020.

### International Results

The United States is different from Asia and Europe, but results of stringent mask policies are notable, as cited in three diverse published articles:

- **Japan** on May 6, 21 people died of COVID-19 in Japan. In the United States, 2,129 died. Comparing overall death rates is even starker point of comparison with total U.S. deaths at staggering 76,032 and Japan’s fatalities at 577. Japan’s population is about 38% of the U.S., but even adjusting for population, the Japanese death rate is a mere 2% of America’s. *One reason is that nearly everyone there is wearing a mask,*<sup>9</sup> (a)
- **Hong Kong**, “85% of respondents reported avoiding crowded places and 99% reported wearing face masks when leaving home”<sup>68</sup>.
- **Austria** had 90% drop in coronavirus cases after requiring people to wear face masks”- [published](#) (b)
- **Czech Republic** “63 Czechs per 100,000 has been infected and less than two per 100,000 have died from the virus.” (b)
- **Slovakia**. 21 per 100,000 people have caught it and just (0.2) (two-tenths per 100,000 have died) (b)
- **Spain** residents will have to continue to wear face masks even after the country officially lifts its state of emergency on June 21, the health minister, Salvador Illa, announced June 9, as the government presented its “new normalcy” plan. Citizens must “learn to cohabit with the virus” and maintain hygiene rules “until we conclusively defeat the virus.” (c)
  - Sources: (a) Universal Masking is Urgent in the COVID-19 Pandemic: SEIR and Agent Based Models, Empirical Validation, Policy Recommendations – prepublication 4/21; posted May 12 by De Kai, et al ([PDF](#))
  - (b) “Austria Has 90% Drop in Coronavirus Cases After Requiring People to Wear Face Masks”- [published](#) in Science Times, April 21, 2020.
  - (c) New York Times, June 9, 2020 - <https://www.nytimes.com/2020/06/09/world/coronavirus-updates.html>

States where mask use is ...	New cases, June 1-7	New cases, June 15-21	Change
Mandatory in public	61,064	45,950	-25%
Required by employees and patrons of certain businesses	24,860	21,796	-12%
Required by employees of certain businesses	28,321	48,062	+70%
Recommended, but not required	38,638	71,165	+84%
<b>U.S. total</b>	<b>152,883</b>	<b>186,973</b>	<b>+22%</b>

JOHN DUCHNESKIE / Staff Artist  
SOURCES: National Governors Association; New York Times

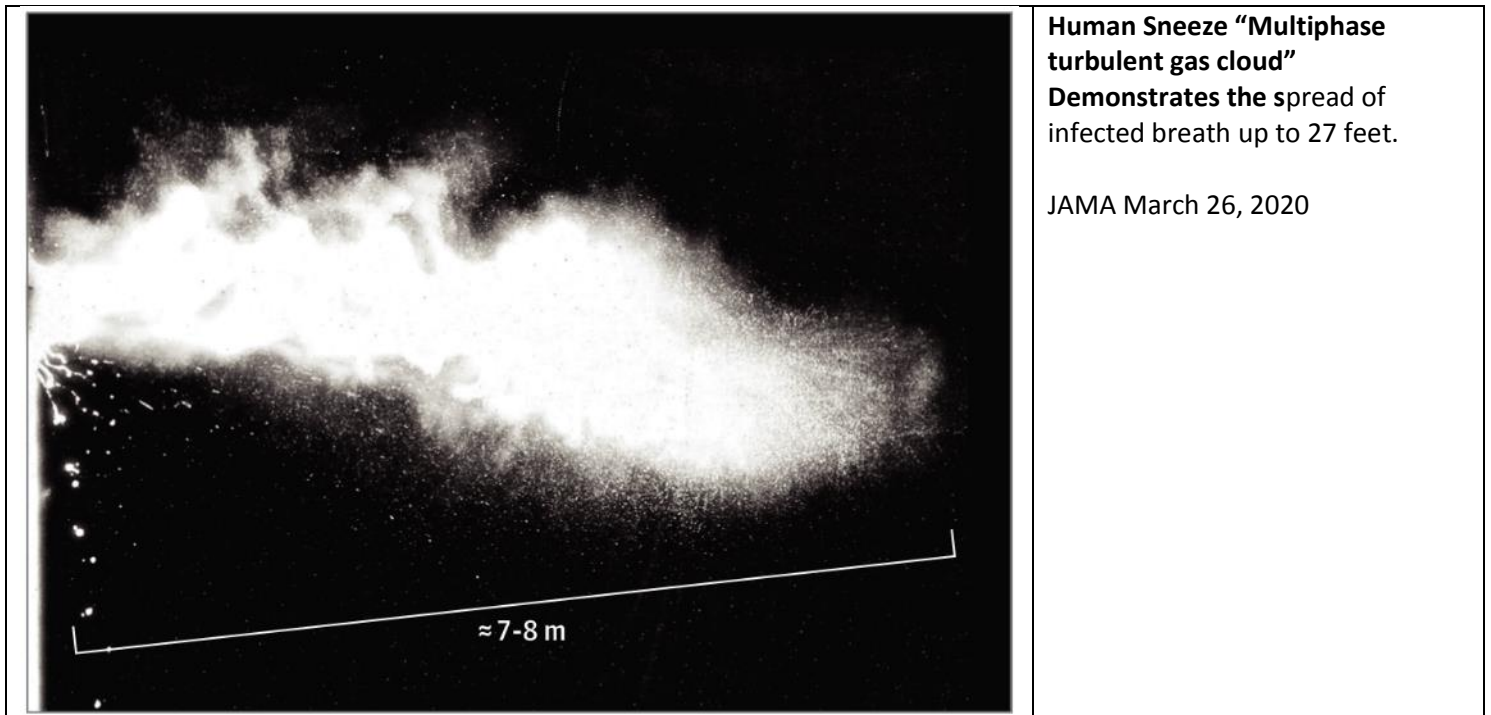
## Is there a health risk from wearing a cloth face covering or mask?

Some opponents to masks have claimed that wearing a mask causes an unhealthy concentration of CO2 which is damaging to health - falsely noted that wearing masks over a period can cause hypercapnia.

- AP’S Assessment: **False**. There is no evidence that wearing a mask causes hypercapnia, or that masks can trap the virus and lead to an infection in the brain. Hypercapnia occurs when there is too much carbon dioxide in the bloodstream. Mild cases can lead to issues such as headache and anxiety; severe cases can interfere with breathing.
- SEE [separate BCPH memo](#) on health risks and masks.

## Additional References and Reading (especially for readers seeking peer-review articles or breaking news)

- **The W.H.O. walked back an earlier assertion that asymptomatic transmission is ‘very rare.’**
  - Scientists had sharply criticized the W.H.O. for creating confusion on the issue, given the far-ranging public policy implications. Governments around the world have recommended face masks and social distancing measures because of the risk of asymptomatic transmission. Source: New York Times, June 9, 2020.  
<https://www.nytimes.com/2020/06/09/world/coronavirus-updates.html>
- **“Policies on Required Use of Masks to prevent the spread of COVID-19: An Updated Nationwide Review”** by Colorado Ideas 2.0., Richard Cauchi. Updated July 2020 ([PDF Link](#))<sup>10</sup>
- **“Face Masks Against COVID-19: An Evidence Review”** April 12, 2020 - [PDF link](#) by preprints.org
- **“To mask or not to mask: Modeling the potential for face mask use by the general public”**- April 2020 [link](#) (16 pp)
- **“Do Face Masks Create a False Sense of Security A COVID-19 Dilemma”**-MedRxiv, May 23, 2020.  
<https://www.medrxiv.org/content/10.1101/2020.05.23.20111302v2.full.pdf>
- MedicalExpress “News tagged with *masks-online* - [masks](#)



## NOTES & SOURCES

<sup>1</sup> CNN: “These are the states requiring people to wear masks when out in public. June 19, 2020  
<https://www.cnn.com/2020/06/12/health/coronavirus-mask-wellness-trnd/index.html>

<sup>2</sup> “Face Masks for the General Public” [published](#) by The Royal Society (England), May 4, 2020. ([PDF-12 pp](#))

<sup>3</sup> “Physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: a systematic review and meta-analysis” by Derek Chu for the COVID-19 Systematic Urgent Review Group Effort (SURGE), London, UK.  
<https://www.thelancet.com/action/showPdf?pii=S0140-6736%2820%2931142-9>



<sup>4</sup> Howard was among a group of scientists who publicly advocated for a reversal of that position, adopting the [Twitter hashtag #Masks4All](#) and a profile picture of himself in dark mask and sunglasses. A missing element, though, has been data on how individuals react when ordered to wear masks, especially in societies not accustomed to doing so during public health emergencies.

<sup>5</sup> Masks and social distancing work, new analysis finds. AP By Carla K. Johnson, June 1, 2020

<sup>6</sup> "Turbulent Gas Clouds and Respiratory Pathogen Emissions: Potential Implications for Reducing Transmission of COVID-19." [Published by JAMA](#), March 26, 2020 9 (The demonstration of how a cough spread across a room)

<sup>7</sup> "Face Masks for the General Public" [published](#) by The Royal Society (England), May 4, 2020. ([PDF-12 pp](#))

<sup>8</sup> "The effect of large-scale anti-contagion policies on the COVID-19 pandemic." Nature June 8, 2020. <https://www.nature.com/articles/s41586-020-2404-8> [reference.pdf](#)

<sup>9</sup> "Universal Masking is Urgent in the COVID-19 Pandemic: SEIR and Agent Based Models, Empirical Validation, Policy Recommendations" – by De Kai, PHD MBA, et al; prepublication 4/21; posted May 12 by De Kai, et al ([PDF, 19 pages](#))

<sup>10</sup> For more information: Publication research conducted and compiled by Richard Cauchi, Colorado Ideas 2.0, LLC. [info@colorado2.com](mailto:info@colorado2.com). All quoted and linked content is the property and the responsibility of the original authors.

### Visualizing the effectiveness of face masks in obstructing respiratory jets

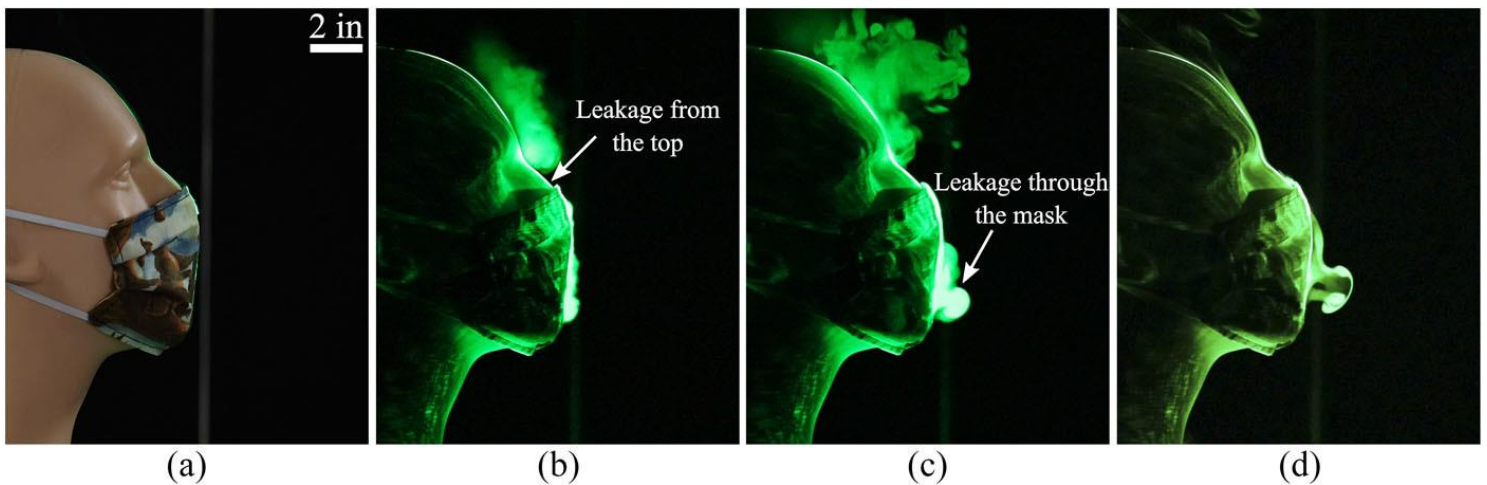


FIG. 4. (a) A homemade face mask stitched using two-layers of cotton quilting fabric. Images taken at (b) 0.2 s, (c) 0.47 s, and (d) 1.68 s after the initiation of the emulated cough (from report cited above)

### Broad and Required Public Use of Masks for COVID-19: New Evidence and Examples – Supplement A1\*

 Centers for Disease Control and Prevention  
CDC 24/7: Saving Lives, Protecting People™

### Scientific Brief: Community Use of Cloth Masks to Control the Spread of SARS-CoV-2

Updated Nov. 10, 2020 - (CDC full text transcript)

CDC Original post: <https://www.cdc.gov/coronavirus/2019-ncov/more/masking-science-sars-cov2.html>

## Background

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SARS-CoV-2 infection is transmitted predominately by respiratory droplets generated when people cough, sneeze, sing, talk, or breathe. CDC recommends community use of [masks](#), specifically non-valved multi-layer cloth masks, to prevent transmission of SARS-CoV-2. Masks are primarily intended to reduce the emission of virus-laden droplets (“source control”), which is especially relevant for asymptomatic or presymptomatic infected wearers who feel well and may be unaware of their infectiousness to others, and who are estimated to account for more than 50% of transmissions.<sup>1,2</sup> Masks also help reduce inhalation of these droplets by the wearer (“filtration for personal protection”). The community benefit of masking for SARS-CoV-2 control is due to the combination of these effects; individual prevention benefit increases with increasing numbers of people using masks consistently and correctly.

## Source Control to Block Exhaled Virus

Multi-layer cloth masks block release of exhaled respiratory particles into the environment,<sup>3-6</sup> along with the microorganisms these particles carry.<sup>7,8</sup> Cloth masks not only effectively block most large droplets (i.e., 20-30 microns and larger)<sup>9</sup> but they can also block the exhalation of fine droplets and particles (also often referred to as aerosols) smaller than 10 microns;<sup>3,5</sup> which increase in number with the volume of speech<sup>10-12</sup> and specific types of phonation.<sup>13</sup> Multi-layer cloth masks can both block up to 50-70% of these fine droplets and particles<sup>3,14</sup> and limit the forward spread of those that are not captured.<sup>5,6,15,16</sup> Upwards of 80% blockage has been achieved in human experiments that have measured blocking of all respiratory droplets,<sup>4</sup> with cloth masks in some studies performing on par with surgical masks as barriers for source control.<sup>3,9,14</sup>

## Filtration for Personal Protection

Studies demonstrate that cloth mask materials can also reduce wearers’ exposure to infectious droplets through filtration, including filtration of fine droplets and particles less than 10 microns. The relative filtration effectiveness of various masks has varied widely across studies, in large part due to variation in experimental design and particle sizes analyzed. Multiple layers of cloth with higher thread counts have demonstrated superior performance compared to single layers of cloth with lower thread counts, in some cases filtering nearly 50% of fine particles less than 1 micron.<sup>14,17-29</sup> Some materials (e.g., polypropylene) may enhance filtering effectiveness by generating triboelectric charge (a form of static electricity) that enhances capture of charged particles<sup>18,30</sup> while others (e.g., silk) may help repel moist droplets<sup>31</sup> and reduce fabric wetting and thus maintain breathability and comfort.

## Human Studies of Masking and SARS-CoV-2 Transmission

Data regarding the “real-world” effectiveness of community masking are limited to observational and epidemiological studies.

- An investigation of a high-exposure event, in which 2 symptomatically ill hair stylists interacted for an average of 15 minutes with each of 139 clients during an 8-day period, found that none of the 67 clients who subsequently consented to an interview and testing developed infection. The stylists and all clients universally wore masks in the salon as required by local ordinance and company policy at the time.<sup>32</sup>
- In a study of 124 Beijing households with  $\geq 1$  laboratory-confirmed case of SARS-CoV-2 infection, mask use by the index patient and family contacts before the index patient developed symptoms reduced secondary transmission within the households by 79%.<sup>33</sup>
- A retrospective case-control study from Thailand documented that, among more than 1,000 persons interviewed as part of contact tracing investigations, those who reported having always worn a mask

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during high-risk exposures experienced a greater than 70% reduced risk of acquiring infection compared with persons who did not wear masks under these circumstances.<sup>34</sup>

- A study of an outbreak aboard the USS Theodore Roosevelt, an environment notable for congregate living quarters and close working environments, found that use of face coverings on-board was associated with a 70% reduced risk.<sup>35</sup>
- Investigations involving infected passengers aboard flights longer than 10 hours strongly suggest that masking prevented in-flight transmissions, as demonstrated by the absence of infection developing in other passengers and crew in the 14 days following exposure.<sup>36,37</sup>

Seven studies have confirmed the benefit of universal masking in community level analyses: in a unified hospital system,<sup>38</sup> a German city,<sup>39</sup> a U.S. state,<sup>40</sup> a panel of 15 U.S. states and Washington, D.C.,<sup>41,42</sup> as well as both Canada<sup>43</sup> and the U.S.<sup>44</sup> nationally. Each analysis demonstrated that, following directives from organizational and political leadership for universal masking, new infections fell significantly. Two of these studies<sup>42,44</sup> and an additional analysis of data from 200 countries that included the U.S.<sup>45</sup> also demonstrated reductions in mortality. An economic analysis using U.S. data found that, given these effects, increasing universal masking by 15% could prevent the need for lockdowns and reduce associated losses of up to \$1 trillion or about 5% of gross domestic product.<sup>42</sup>

## Conclusions

Experimental and epidemiological data support community masking to reduce the spread of SARS-CoV-2. The prevention benefit of masking is derived from the combination of source control and personal protection for the mask wearer. The relationship between source control and personal protection is likely complementary and possibly synergistic<sup>14</sup>, so that individual benefit increases with increasing community mask use. Further research is needed to expand the evidence base for the protective effect of cloth masks and in particular to identify the combinations of materials that maximize both their blocking and filtering effectiveness, as well as fit, comfort, durability, and consumer appeal. Adopting universal masking policies can help avert future lockdowns, especially if combined with other non-pharmaceutical interventions such as social distancing, hand hygiene, and adequate ventilation.

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## Supplement A<sup>10</sup> – July 2020

Compiled and posted by Colorado Ideas 2.0

### ■ “Masks Do More than Protect Others during COVID-19: Reducing the Inoculum of SARS-CoV-2”<sup>10</sup>

“Conclusion: For this particular pillar of pandemic control to work in the U.S., leading politicians will need to endorse and model mask-wearing. .... Although universal public masking can certainly protect others, the “inoculum” theory argues for a major protective effect for the individual and will allow for the preservation of life and less severe illness, along with other COVID-19 control measures, as society re-opens. This perspective puts forth another advantage of population-level facial masking (protecting the individual) for SARS-CoV-2 control based on an old but enduring theory regarding viral inoculum driving clinical manifestations, as well as epidemiologic observations for COVID-19 over time.<sup>10</sup>

The NY Times (7/28/2020) posted “[Masks May Reduce Viral Dose, Some Experts Say](#),” providing an informed-layperson summary:

**People wearing face coverings will take in fewer coronavirus particles, evidence suggests, making disease less severe.**

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Different kinds of masks “block virus to a different degree, but they all block the virus from getting in,” said Dr. Monica Gandhi, (lead author and) an infectious disease physician at the University of California, San Francisco. If any virus particles do breach these barriers, she said, the disease might still be milder. Dr. Gandhi and her colleagues make this argument in a [new paper](#) slated to be published in the Journal of General Internal Medicine. Drawing from animal experiments and observations of various events during the pandemic, they contend that people wearing face coverings will take in fewer coronavirus particles, making it easier for their immune systems to bring any interlopers to heel.

... Some independent experts say the paper is a welcome update, given the pervasive idea that wearing a mask is a mostly altruistic act. “It’s been a real deficiency in the messaging about masking to say that it only protects the other,” said Charles Haas, an environmental engineer and expert in risk assessment at Drexel University. “From the get-go, that never made sense scientifically.” In other settings, too, from [hospitals](#) to [hair salons](#), face coverings may have driven down rates of overall infection, perhaps preventing disastrous outbreaks. ... Even in the United States, the slow upward tick in mask-wearing has coincided with what appears to be a [more modest death rate](#), compared to the [surge that occurred](#) after the virus first made landfall in North America.

Additional author quotes of interest... Link: <https://ucsf.app.box.com/s/blvolkp5z0mydzd82riks4wyleagt036>.

There are two likely reasons for the effectiveness of facial masks: The first - to prevent the spread of viral particles from asymptomatic individuals to others - has received a great deal of attention.<sup>10,11</sup> However, the second theory - that reducing the inoculum of virus to which a mask-wearer is exposed will result in milder disease<sup>12-27</sup> - has received less attention and is the focus of our perspective. This group showed that, if 80% of the population wears a moderately effective mask, nearly half of the projected deaths over the next two months could be prevented... universal masking in a Boston healthcare system reduced health care worker infection rates substantially.<sup>46,47</sup>

**N Y TIMES ©**

<https://www.nytimes.com/2020/07/27/health/coronavirus-mask-protection.html>

Article: <https://pubmed.ncbi.nlm.nih.gov/23498357/>

## Masks May Reduce Viral Dose, Some Experts Say

**People wearing face coverings will take in fewer coronavirus particles, evidence suggests, making disease less severe.**

By [Katherine J. Wu](#) - July 27, 2020



- Researchers have long known that masks can [prevent people from spreading airway germs](#) to others — findings that have driven much of the conversation around these crucial accessories during the coronavirus pandemic.

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But now, as cases continue to rise across the country, experts are pointing to an array of evidence suggesting that masks [also protect the people wearing them](#), lessening the severity of symptoms, or in some instances, staving off infection entirely.

Different kinds of masks “block virus to a different degree, but they all block the virus from getting in,” said Dr. Monica Gandhi, an infectious disease physician at the University of California, San Francisco. If any virus particles do breach these barriers, she said, the disease might still be milder.

Face masks on display in a store in the Little Five Points neighborhood of Atlanta. Credit...Dustin Chambers for The New York Times

Dr. Gandhi and her colleagues make this argument in a [new paper](#) slated to be published in the Journal of General Internal Medicine. Drawing from animal experiments and observations of various events during the pandemic, they contend that people wearing face coverings will take in fewer coronavirus particles, making it easier for their immune systems to bring any interlopers to heel.

Dr. Tsion Firew, an emergency physician at Columbia University who wasn't involved in the work, cautioned that the links between masking and milder disease haven't yet been proved as cause and effect. Even so, the new paper “reiterates what we say about masks,” she said. “It's not just a selfless act.”

Ideas about the importance of viral dose in the development of disease have cropped up in the medical literature since [at least the 1930s](#), when two researchers formally noted that mice exposed to larger quantities of germs were more likely to die. More recently, scientists have gone as far as to [puff different amounts of a flu virus](#) up the noses of human volunteers. The more virus in this nasal plume, they found, the likelier the participants were to get infected and experience symptoms.

That sort of experiment can't be done ethically for the new coronavirus, given how dangerous it is. But earlier this year, a team of researchers in China tried something similar in hamsters: They housed coronavirus-infected and healthy animals in adjoining cages, some of which were separated by buffers made of surgical masks. Many of the healthy hamsters behind the partitions never got infected. And the unlucky animals who did [got less sick](#) than their “maskless” neighbors.

Some indirect data has been accumulating from people as well. Researchers have tentatively estimated that about 40 percent of coronavirus infections [do not produce any symptoms](#). But when some people [wear masks](#), the proportion of asymptomatic cases [seems to skyrocket](#), reportedly surpassing 90 percent during one outbreak at a seafood plant in Oregon. Wearing a face covering doesn't make people impervious to infection, but these trends of asymptomatic cases could suggest that masks lead to milder disease, potentially reducing hospitalizations and deaths.

Particularly compelling, Dr. Gandhi said, is the data from cruise ships, which pack big groups of people into close quarters. [More than 80 percent](#) of those infected aboard Japan's Diamond Princess in February — before masking had become common practice — came down with symptoms, she noted. But on another vessel that left Argentina in March, and on which all passengers were issued surgical masks after someone onboard came down with a fever, the level of symptomatic cases was [below 20 percent](#).

Some independent experts say the paper is a welcome update, given the pervasive idea that wearing a mask is a mostly altruistic act.

“It's been a real deficiency in the messaging about masking to say that it only protects the other,” said Charles Haas, an environmental engineer and expert in risk assessment at Drexel University. “From the get-go, that never made sense scientifically.”

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In other settings, too, from [hospitals](#) to [hair salons](#), face coverings may have driven down rates of overall infection, perhaps preventing disastrous outbreaks. And countries like Japan, Taiwan and South Korea, where outbreaks quickly sparked a wave of widespread masking, managed to rein in the number of coronavirus-related hospitalizations and deaths early on.

Even in the United States, the slow upward tick in mask-wearing has coincided with what appears to be a [more modest death rate](#), compared to the [surge that occurred](#) after the virus first made landfall in North America. These trends have also likely been influenced by increased testing, a downward shift in the average age of people contracting the virus and improvements in coronavirus treatments. Still, masks probably aren't hurting things, Dr. Gandhi said.

The idea that face coverings can curb disease severity, although not yet proven, “makes complete sense,” said Linsey Marr, an expert in virus transmission at Virginia Tech. “It’s another good argument for wearing masks.”

Dr. Marr and other researchers are still sussing out exactly how much inbound or outbound virus different types of masks block. But based on a [wealth](#) of [past evidence](#) and [recent observations](#), the amount that’s filtered out is probably high — perhaps 50 percent or more of the larger aerosols being sent in both directions, Dr. Marr said. Certain coverings, like N95 respirators, will do better than others, but even looser-fitting cloths can waylay some viral particles.

Still, some experts are not ready to embrace all ideas about two-way protection.

What’s outlined in Dr. Gandhi’s paper “is still just a theory, and needs more research,” said Nancy Leung, an epidemiologist at the University of Hong Kong. While there’s good evidence that masks reduce the spread of viruses within a population, it’s much harder to nail down how face coverings influence symptoms, Dr. Leung said, in part “because of the difficulty in conducting those studies.”

Dr. Gandhi acknowledged these limitations. But with no end to the pandemic in sight, the need for masks is only growing, she said, especially as researchers continue to document the virus’s ability to spread silently. Even people who don’t have symptoms can spray the virus into their environment when they sneeze, cough, sing, speak or even breathe. And those who fall ill may be at their [most contagious](#) in the days before the first signs of sickness appear.

To tame this pandemic, people should act as if they’ve been infected, “even if you feel right as rain,” Dr. Gandhi said.

Masks alone aren’t a substitute for other public health measures like physical distancing and good hygiene. But unlike sustained lockdowns that keep people apart, shielding our faces is easier and more sustainable, Dr. Gandhi said.

Safeguarding yourself and others from this deadly disease, she added, “is as simple as covering up the two holes in your face that shed the virus.”

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*A version of this article appears in print on July 28, 2020, , Section A, Page 4 of the New York edition with the headline: Wearing Masks ‘Not Just a Selfless Act,’ Experts Say.*



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## Broad Public Use of Masks – Supplement B

<https://www.nytimes.com/2020/07/30/opinion/coronavirus-aerosols.html>

Opinion

# Yes, the Coronavirus Is in the Air

**Transmission through aerosols matters — and probably a lot more than we’ve been able to prove yet.**

By Linsey C. Marr     Dr. Marr is a professor of engineering.

July 30, 2020



• •  
A sneeze. And what it spreads. Just how much does the new coronavirus circulate in the tiny airborne aerosols we spew out simply by breathing?  
Credit...Bettmann, via Getty Images Plus

Finally. The World Health Organization has now formally recognized that SARS-CoV-2, the virus that causes Covid-19, [is airborne](#) and that it can be carried [by tiny aerosols](#).

As we cough and sneeze, talk or just breathe, we [naturally release](#) droplets (small particles of fluid) and aerosols (smaller particles of fluid) into the air. Yet until earlier this month, the W.H.O. — like the U.S. Centers for Disease Control and Prevention or Public Health England — [had warned mostly](#) about the transmission of the new coronavirus through direct contact and droplets released at close range. The organization had cautioned against aerosols only in rare circumstances, such as after intubation and other [medical procedures](#) involving infected patients in hospitals.

After [several months of pressure from scientists](#), on July 9, the W.H.O. changed its position — going from denial to [grudging partial acceptance](#): “Further studies are needed to determine whether it is possible to detect viable SARS-CoV-2 in air samples from settings where no procedures that generate aerosols are performed and what role aerosols might play in transmission.”

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I am a civil and environmental engineer who studies how viruses and bacteria spread through the air — as well as [one of the 239 scientists](#) who signed [an open letter](#) in late June pressing the W.H.O. to consider the risk of airborne transmission more seriously.

A month later, I believe that the transmission of SARS-CoV-2 via aerosols matters much more than has been officially acknowledged to date.

In a peer-reviewed study published in Nature on Wednesday, researchers at the University of Nebraska Medical Center found that aerosols collected in the hospital rooms of Covid-19 patients contained the coronavirus.

This confirms the results of a study from late May (not peer-reviewed) in which Covid-19 patients were found to release SARS-CoV-2 simply by exhaling — without coughing or even talking. The authors of that study said the finding implied that airborne transmission “plays a major role” in spreading the virus.

Accepting these conclusions wouldn’t much change what is currently being recommended as best behavior. The strongest protection against SARS-CoV-2, whether the virus is mostly contained in droplets or in aerosols, essentially remains the same: Keep your distance and wear masks.

Rather, the recent findings are an important reminder to also be vigilant about opening windows and improving airflow indoors. And they are further evidence that the quality of masks and their fit matter, too.

The W.H.O. defines as a “droplet” [a particle larger than 5 microns](#) and has said that droplets don’t travel farther than one meter.

In fact, there is no neat and no meaningful cutoff point — at 5 microns or any other size — between droplets and aerosols: All are tiny specks of liquid, their size ranging along a spectrum that goes from very small to really microscopic. (I am working with medical historians to track down the scientific basis for the W.H.O.’s definition, and we have not found a sensible explanation yet.)

Yes, droplets tend to fly through the air like mini cannonballs and they fall to the ground rather quickly, while aerosols can float around for many hours. But basic physics also says that a 5-micron droplet takes about a half-hour to drop to the floor from the mouth of an adult of average height — and during that time, the droplet can travel many meters on an air current. Droplets expelled in coughs or sneezes also travel much farther than one meter.

Here is another common misconception: To the (limited) extent that the role of aerosols had been recognized so far, they were usually mentioned as lingering in the air, suspended, and wafting away — a long-distance threat.

But before aerosols can get far, they must travel through the air that’s near: meaning that they are a hazard at close range, too. And all the more so because, just like the smoke from a cigarette, aerosols are most concentrated near the infected person (or smoker) and become diluted in the air as they drift away.

A peer-reviewed study by scientists at the University of Hong Kong and Zhejiang University, in Hangzhou, China, published in the journal Building and Environment in June concluded, “The smaller the exhaled droplets, the more important the short-range airborne route.”

So what does this all mean exactly, practically? Can you walk into an empty room and contract the virus if an infected person, now gone, was there before you? Perhaps, but probably only if the room is small and stuffy. Can the virus waft up and down buildings via air ducts or pipes? Maybe, though that hasn’t been established. More likely, the research suggests, aerosols matter in extremely mundane scenarios.

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Consider [the case of a restaurant in Guangzhou](#), southern China, at the beginning of the year, in which one diner infected with SARS-CoV-2 at one table spread the virus to a total of nine people seated at their table and two other tables. Yuguo Li, a professor of engineering at the University of Hong Kong, and colleagues [analyzed video footage](#) from the restaurant and in a preprint (not peer reviewed) published in April found no evidence of close contact between the diners. Droplets can't account for transmission in this case, at least not among the people at the tables other than the infected person's: The droplets would have fallen to the floor before reaching those tables.

But the three tables were in a poorly ventilated section of the restaurant, and an air conditioning unit pushed air across them. Notably, too, no staff member and none of the other diners in the restaurant — including at two tables just beyond the air conditioner's airstream — became infected.

Similarly, just one person is thought to have infected 52 of the other 60 people at [a choir rehearsal](#) in Skagit County, Wash., in March. Several colleagues at various universities and I analyzed that event and in [a preprint \(not peer-reviewed\) published last month](#) concluded that aerosols likely were the dominant means of transmission.

Attendees had used hand sanitizer and avoided hugs and handshakes, limiting the potential for infection through direct contact or droplets. On the other hand, the room was poorly ventilated, the rehearsal lasted a long time (2.5 hours) and singing is known to produce aerosols and [facilitate the spread of diseases like tuberculosis](#). What about the outbreak on the Diamond Princess cruise ship off Japan early this year? Some 712 of the 3,711 people on board became infected.

Professor Li and others also [investigated that case](#) and in a preprint (not peer reviewed) in April concluded that transmission had not occurred between rooms after people were quarantined: The ship's air-conditioning system did not spread the virus over long distances.

The more likely cause of transmission, according to that study, appeared to be close contact with infected people or contaminated objects before the passengers and crew members were isolated. (The researchers did not parse precisely what they meant by contact, or if that included droplets or short-range aerosols.)

But [another, recent, preprint](#) (not peer reviewed) about the Diamond Princess concluded that “aerosol inhalation was likely the dominant contributor to Covid-19 transmission” among the ship's passengers. It might seem logical, or make intuitive sense, that larger droplets would contain more virus than do smaller aerosols — but they don't.

[A paper published this week](#) by The Lancet Respiratory Medicine that analyzed the aerosols produced by the coughs and exhaled breaths of patients with various respiratory infections found “a predominance of pathogens in small particles” (under 5 microns). “There is no evidence,” the study also concluded, “that some pathogens are carried only in large droplets.”

A [recent preprint](#) (not peer reviewed) by researchers at the University of Nebraska Medical Center found that viral samples retrieved from aerosols emitted by Covid-19 patients were infectious.

Some scientists [have argued](#) that just because aerosols can contain SARS-CoV-2 does not in itself prove that they can cause an infection and that if SARS-CoV-2 were primarily spread by aerosols, there would be more evidence of long-range transmission.

I agree that long-range transmission by aerosols probably is not significant, but I believe that, taken together, much of the evidence gathered to date suggests that *close-range* transmission by aerosols is significant — possibly very significant, and certainly more significant than direct droplet spray.

The practical implications are plain:

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- **Social distancing really is important.** It keeps us out of the most concentrated parts of other people’s respiratory plumes. So stay away from one another by one or two meters at least — though farther is safer.
  - **Wear a mask.** Masks help block aerosols released by the wearer. [Scientific evidence](#) is also building that [masks protect the wearer from breathing in aerosols](#) around them.

When it comes to masks, size *does* matter. The gold standard is a N95 or a KN95 respirator, which, if properly fitted, filters out and prevents the wearer from breathing in at least 95 percent of small aerosols.

The efficacy of surgical masks against aerosols varies widely. [One study from 2013](#) found that surgical masks reduced exposure to flu viruses by between 10 percent and 98 percent (depending on the mask’s design).

A recent paper found that surgical masks can completely block seasonal coronaviruses [from getting into the air](#).

To my knowledge, no similar study has been conducted for SARS-CoV-2 yet, but these findings might apply to this virus as well since it is similar to seasonal coronaviruses in size and structure. [My lab has been testing cloth masks on a mannequin, sucking in air through its mouth at a realistic rate. We found that even a bandanna loosely tied over its mouth and nose blocked half or more of aerosols larger than 2 microns from entering the mannequin.](#)

[We also found that especially with very small aerosols — smaller than 1 micron — it is more effective to use a softer fabric \(which is easier to fit tightly over the face\) than a stiffer fabric \(which, even if it is a better filter, tends to sit more awkwardly, creating gaps\).](#)

- **Avoid crowds.** The more people around you, the more likely someone among them will be infected. Especially avoid crowds indoors, where aerosols can accumulate.
- **Ventilation counts.** Open windows and doors. Adjust dampers in air-conditioning and heating systems. Upgrade the filters in those systems. Add portable air cleaners, or install germicidal ultraviolet technologies to remove or kill virus particles in the air.

It’s not clear just how much this coronavirus is transmitted by aerosols as opposed to droplets or via contact with contaminated surfaces. Then again, we still don’t know the answer to that question [even for the flu](#), which has been studied for decades.

But by now we do know this much: Aerosols matter in the transmission of Covid-19 — and probably even more so than we have yet been able to prove.

*Linsey C. Marr ([@linseymarr](#)) is a professor of civil and environmental engineering at Virginia Tech.*

Related:

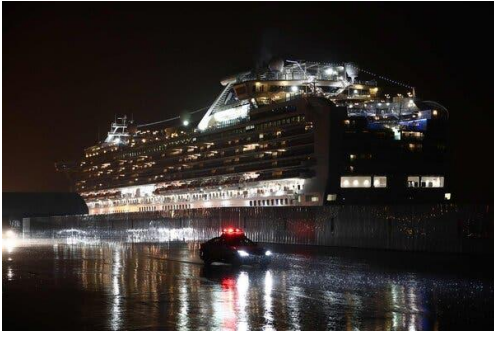
**Effectiveness of surgical masks against influenza bioaerosols** [C Makison Booth<sup>1</sup>](#), [M Clayton](#), [B Crook](#), [J M Gawn](#)  
J Hosp Infect . 2013 May;84(1):22-6. doi: 10.1016/j.jhin.2013.02.007. Epub 2013 Mar 14.  
DOI: [10.1016/j.jhin.2013.02.007](#)

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**BROAD PUBLIC USE OF MASKS – Supplement C**

July 30, 2020

**Study Finds Evidence Virus Can Float in Air for Minutes or Longer**



<https://www.nytimes.com/2020/07/30/health/diamond-princess-coronavirus-aerosol.html>

Full academic journal article <https://www.medrxiv.org/content/10.1101/2020.07.13.20153049v1.full.pdf+html>

## Aboard the Diamond Princess, a Case Study in Aerosol Transmission

A computer model of the cruise-ship outbreak found that the virus spread most readily in microscopic droplets light enough to linger in the air.

July 30, 2020 - By [Benedict Carey](#) and [James Glanz](#)

The Diamond Princess cruise ship, docked in Yokohama, Japan, in February. More than 700 of the 3,711 people onboard tested positive for the coronavirus. *Credit...agence France-Presse — Getty Images*

- In a year of endless viral outbreaks, the details of the Diamond Princess tragedy seem like ancient history. On Jan. 20, one infected passenger boarded the cruise ship; a month later, more than 700 of the 3,711 passengers and crew members had tested positive, with many falling seriously ill. The invader moved as swiftly and invisibly as the perpetrators on Agatha Christie’s Orient Express, leaving doctors and health officials with only fragmentary evidence to sift through.

Ever since, scientists have tried to pin down exactly how the coronavirus spread throughout the ship. And for good reason: The Diamond Princess’ outbreak remains perhaps the most valuable case study available of coronavirus transmission — an experiment-in-a-bottle, rich in data, as well as a dark warning for what was to come in much of the world.

Now, researchers are beginning to use macroscopic tools — computer models, which have revealed patterns in the virus’s global spread — to clarify the much smaller-scale questions that currently dominate public discussions of safety: How, exactly, does the virus move through a community, a building or a small group of people? Which modes of transmission should concern us most, and how might we stop them?

In a new report, a research team based at Harvard and the Illinois Institute of Technology has tried to tease out the ways in which the virus passed from person to person in the staterooms, corridors and common areas of the Diamond Princess. It found that the virus spread most readily in microscopic droplets that were light enough to float in the air, for several minutes or much longer.

The new findings add to an escalating debate among doctors, scientists and health officials about the primary routes of coronavirus transmission. Earlier this month, after [pressure from more than 200 scientists](#), the World Health Organization acknowledged that the virus could linger in the air indoors, potentially causing new infections. Previously, it had emphasized only large droplets, as from coughing, and infected surfaces as the primary drivers of transmission. Many clinicians and epidemiologists continue to argue that these routes are central to disease progression.

The new paper has been posted on a preprint server and submitted to a journal; it has not yet been peer-reviewed, but it was shown by Times reporters to nearly a dozen experts in aerosols and infectious disease. The new findings

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if confirmed, would have major implications for making indoor spaces safer and choosing among a panoply of personal protective gear.

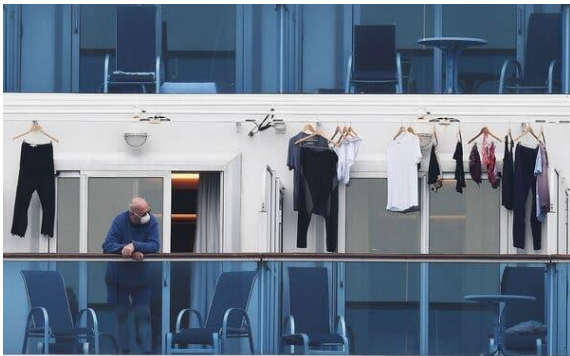
For example, ventilation systems that “turn over” or replace the air in a room or building as often as possible, preferably drawing on external air to do so, should make indoor spaces healthier. But good ventilation is not enough; the Diamond Princess was well ventilated and the air did not recirculate, the researchers noted. So wearing good-quality masks — standard surgical masks, or cloth masks with multiple layers rather than just one — will most likely be needed as well, even in well-ventilated spaces where people are keeping their distance.

The computer modeling adds a new dimension of support to an accumulating body of evidence implicating small, airborne droplets in multiple outbreaks, including at [a Chinese restaurant](#), a [choir in Washington State](#), as well as [a recent study](#) at a Nebraska hospital to which 13 passengers from the Diamond Princess had been evacuated.

One researcher not involved in the new work, Julian Tang, an honorary associate professor of respiratory sciences at the University of Leicester in the United Kingdom, said the paper was “the first attempt, as far as I know, to formally compare the different routes of coronavirus transmission, especially of short versus long-range aerosols.”

He characterized the distances and the kinds of particles involved with a simple analogy from everyday life: “If you can smell what I had for lunch, you’re getting my air, and you can be getting virus particles as well.”

Another researcher, Linsey Marr, a professor of civil and environmental engineering at Virginia Tech who studies airborne transmission of viruses, had a more vivid description of the finding: the “garlic breath” effect.



“As you’re close to someone, you smell that garlic breath,” Dr. Marr said. “As you’re farther away, you don’t smell it.”

The “garlic breath” effect would suggest that powerful ventilation in buildings — primarily using outside air, or very well filtered — could reduce the transmission of the virus. The study found that small particles also had some ability to spread it at longer distances, presumably beyond the range of breath odor.

A passenger on the Diamond Princess during a quarantine period in February.

From the start of the pandemic, scientists have grappled with the mechanisms of coronavirus spread. Early on, surface transmission was widely emphasized; larger droplets, which travel on more ballistic trajectories, like a stone through the air, and strike mucus membranes directly, are now favored by a number of researchers.

Other possibilities are candidates as well, said Dr. John Conly, an infectious disease physician and infection control expert with the University of Calgary in Canada who has done consulting with the World Health Organization.

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“We’re getting surprises all the way along,” Dr. Conly said. “This paper I find interesting, but it has a long way to go to be able to get into a line of credibility, in my mind.”

Dr. George Rutherford, a professor of epidemiology at the University of California, San Francisco, was equally skeptical. He said that, outside of hospital settings, “large droplets in my mind account for the vast majority of cases. Aerosols transmission — if you really run with that, it creates lots of dissonance. Are there situations where it could occur? Yeah maybe, but it’s a tiny amount.”

Dr. Tang and other scientists strongly disagree. “If I’m talking to an infectious person for 15 or 20 minutes and inhaling some of their air,” Dr. Tang said, “isn’t that a much simpler way to explain transmission than touching an infected surface and touching your eyes? When you’re talking about an outbreak, like at a restaurant, that latter seems like a torturous way to explain transmission.”

In the new analysis, a team led by Parham Azimi, an indoor-air researcher at Harvard’s T.H. Chan School of Public Health, studied the outbreak on the Diamond Princess, where physical spaces and infections were well documented. It ran more than 20,000 simulations of how the virus might have spread throughout the ship. Each simulation made a variety of assumptions, about factors like patterns of social interaction — how much time people spent in their cabins, on deck or in the cafeteria, on average — and the amount of time the virus can live on surfaces. Each also factored in varying contributions of smaller, floating droplets, broadly defined as 10 microns or smaller; and larger droplets, which fall more quickly and infect surfaces or other people, by landing on their eyes, mouth or nose, say.

About 130 of those simulations reproduced, to some extent, what actually happened on the Diamond Princess as the outbreak progressed. By analyzing these most “realistic” scenarios, the research team calculated the most likely contributions of each route of transmission. The researchers concluded that the smaller droplets predominated, and accounted for about 60 percent of new infections over all, both at close range, within a few yards of an infectious person, and at greater distances.

“Many people have argued that airborne transmission is happening, but no one had numbers for it,” Dr. Azimi said. “What is the contribution from these small droplets — is it 5 percent, or 90 percent? In this paper, we provide the first real estimates for what that number could be, at least in the case of this cruise ship.”

The logic behind such transmission is straightforward, experts said. When a person is speaking, he or she emits a cloud of droplets, the vast majority of which are small enough to remain suspended in the air for a few minutes or longer. Through inhalation, that cloud of small droplets is more likely to reach a mucus membrane than larger ones soaring ballistically.

The smaller droplets are also more likely to penetrate deeply into the respiratory system, down to the lungs. It may take a much smaller viral load — fewer viruses — to cause infection in the lungs than higher up, such as in the throat. This, at least, is the case for other respiratory viruses, like the flu.

Brent Stephens, an engineering professor at the Illinois Institute of Technology in Chicago and a co-author on the paper, said the findings were important in shaping, for example, measures that should be taken as college students return to campus.

The first, he said, should be “really enforcing mask policies.” Another, he said, is to recognize that there is a “huge variability in mask quality,” and material that actually stops small aerosols when someone is breathing, speaking, coughing or sneezing is crucial. Surgical masks are good, he said, but single-ply fabrics often are not.

As various transmission routes come into clearer focus, they will provide specific guidelines on how to reopen schools, offices, restaurants and other businesses.

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“The value of this model is that it allows for recommendations and guidance to be specific to each unique environment,” said another co-author, Joseph G. Allen, an expert in indoor air quality and an assistant professor at Harvard’s T.H. Chan School of Public Health.

Dr. Allen said those environments ranged from restaurants to dentist offices. In each case, he said, there are low-cost solutions that sharply improve ventilation and filtration — most buildings fall well short of optimal levels — and in turn reduce the risks of airborne infection.

“To me, this is an all-in moment,” Dr. Allen said. “We need better ventilation and better filtration, across the board, in all our buildings.”

*Benedict Carey has been a science reporter for The Times since 2004. He has also written three books, “How We Learn” about the cognitive science of learning; “Poison Most Vial” and “Island of the Unknowns,” science mysteries for middle schoolers.*

*James Glanz is a reporter on the International Desk. He was previously on the Investigations Desk, and before that was the Baghdad bureau chief. He has a Ph.D. in astrophysical sciences from Princeton University and joined The Times as a science writer. [@jamesglanz](#)*

*A version of this article appears in print on July 31, 2020, Section A, Page 6 of the New York edition with the headline: **Study Finds Evidence Virus Can Float in Air for Minutes or Longer.***

More recent publications are shown below.

[Universal Masking in the United States - Article in JAMA \(September 2020\)](#)

[Masks Do More Than Protect Others During COVID-19: Reducing the Inoculum of SARS-CoV-2 to Protect the Wearer - Article in Journal of General Internal Medicine \(July 2020\)](#)

[Consumers and COVID-19: Survey Results on Mask-Wearing Behaviors and Beliefs - Article in Economic Commentary \(Federal Reserve Bank of Cleveland\) \(July 2020\)](#)

## **New science studies confirm value of required masks for COVID-19 prevention**

SUPPLEMENT D - August 20, 2020

To: Leaders and colleagues in state/local health policy  
From: Richard Cauchi, Colorado Ideas 2.0, Colorado

On August 7-10, three newly conducted studies were published, providing more “Evidence Supporting Population-Based Face Coverings.” Taken together, they make some of the stronger cases yet for mandatory use, ordered by state and local governments in the U.S. The materials are in the public domain and can be applicable nationwide. Their sources are specialized subscription academic journals, not commonly read by non-medical professionals. This email is intended as a convenient short-cut to the experts’ calculations and conclusions. The links go to full text online and PDF format versions of the articles as published. This allows you to share, link or print the material for those most interested, but especially so for state or local policymakers.

1. **Universal Masking in the United States: The Role of Mandates, Health Education and the CDC.**  
*Article in JAMA* (September 2020 edition; online release August 10)



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<https://jamanetwork.com/journals/jama/fullarticle/2769440>, (2 pp plus Supplement)

The authors, from Georgetown, Harvard and Emory universities, examine the questions, "Although many states and localities have ordered mask use, considerable variability and inconsistencies exist. Would a national mandate be an effective COVID-19 prevention strategy, and would it be lawful?... They conclude, "A better way to gain more national uniformity is by inducing states to enact mask laws. This respects states as key decision makers in public health and is more consistent with state autonomy. It is also easier to gain compliance with state and local directives rather than using federal officers to monitor and enforce a national mandate. A well-crafted use of federal spending powers would likely be constitutional...."

2. **Community Use of Face Masks and COVID-19: Evidence from A Natural Experiment Of State Mandates In The US.** Posted in [Health Affairs](#), August 10, 2020. (7 pp. Full text, [PDF](#))

The authors from the Univ. of Iowa, describe "This study provides evidence from a natural experiment on the effects of state government mandates for face mask use in public issued by fifteen states plus Washington, D.C., between April 8 and May 15, 2020. ... Estimates suggest that as a result of the implementation of these mandates, more than 200,000 COVID-19 cases were averted by May 22, 2020. The findings suggest that requiring face mask use in public could help in mitigating the spread of COVID-19."

> For academic pros and cons, both publications post reader comments and have extensive source notes.

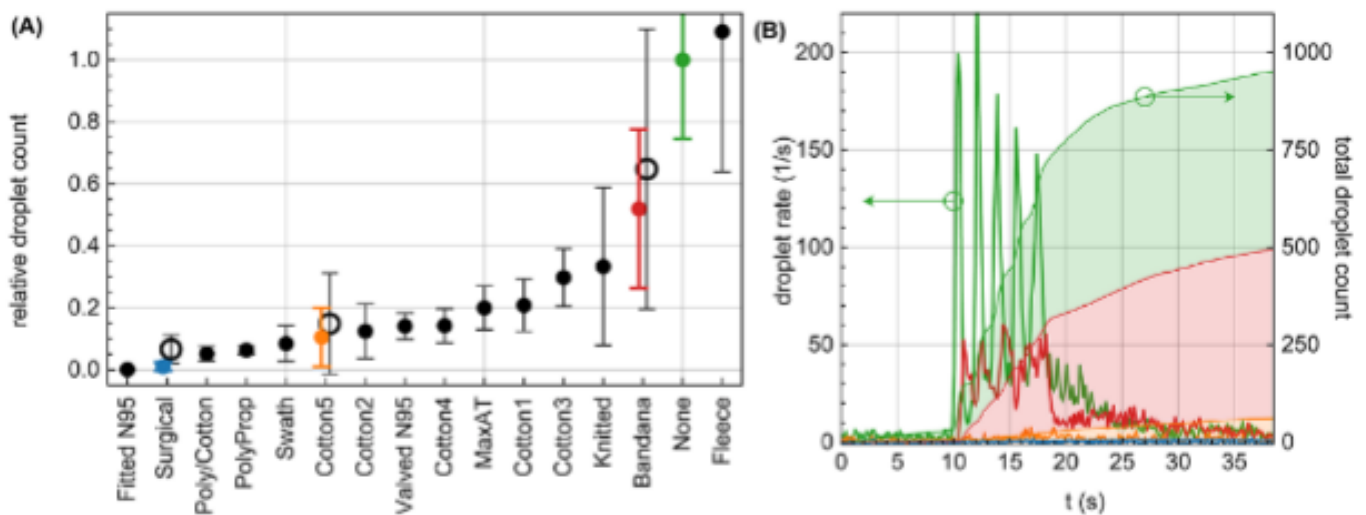
3. **Low-cost measurement of facemask efficacy for filtering expelled droplets during speech**

[Study](#) by Duke University researchers from multiple departments (Chemistry, Physics, Radiology, Medicine, Biomedical Engineering and Psychology & Neuroscience) published in Science Advances, August 7, 2020 (Full text, 11 pp, [PDF](#)). The researchers unveiled a simple method to evaluate the effectiveness of various types of masks, analyzing more than a dozen different facial coverings ranging from hospital-grade N95 respirators to bandanas. The researchers note "We have demonstrated a simple optical measurement method to evaluate the efficacy of masks to reduce the transmission of respiratory droplets during regular speech. In proof-of-principle studies, we compared a variety of commonly available mask types and observed that some mask types approach the performance of standard surgical masks, while some mask alternatives, such as neck fleece or bandanas, offer very little protection." A [Washington Post summary analysis](#), headlined "Wearing a neck gaiter may be worse than no mask at all, researchers find." It noted "Of the 14 masks and other coverings tested, the study found that some easily accessible cotton cloth masks are about as effective as standard surgical masks, while popular alternatives such as neck gaiters made of thin, stretchy material may be worse than not wearing a mask at all. The researchers specifically made note of the effectiveness of common cotton cloth masks, finding that several of the ones tested performed about as well as surgical masks, which come in second to the N95. Experts with the WHO have recommended that fabric masks should ideally have three layers."



Mask, Name	Description
1, 'Surgical' *	Surgical mask, 3-layer
2, 'Valved N95'	N95 mask with exhalation valve
3, 'Knitted'	Knitted mask
4, 'PolyProp'	2-layer polypropylene apron mask
5, 'Poly/Cotton'	Cotton-polypropylene-cotton mask
6, 'MaxAT'	1-layer Maxima AT mask
7, 'Cotton2'	2-layer cotton, pleated style mask
8, 'Cotton4'	2-layer cotton, Olson style mask
9, 'Cotton3'	2-layer cotton, pleated style mask
10, 'Cotton1'	1-layer cotton, pleated style mask
11, 'Fleece'	Gaiter type neck fleece
12, 'Bandana' *	Double-layer bandana
13, 'Cotton5' *	2-layer cotton, pleated style mask
14, 'Fitted N95'	N95 mask/no exhale valve, fitted

*Read graph below or [PDF](#) for results*



**Fig. 3. Droplet transmission through face masks. (A)** Relative droplet transmission through the corresponding mask. Each solid data point represents the mean and standard deviation over 10 trials for the same mask, normalized to the control trial (no mask), and tested by one speaker. The hollow data points are the mean and standard deviations of the relative counts over four speakers. A plot with a logarithmic scale is shown in Supplementary Fig. S1. **(B)** The time evolution of the droplet count (left axis) is shown for representative examples, marked with the corresponding color in (A): No mask (green), Bandana (red), cotton mask (orange), and surgical (blue – not visible on this scale). The cumulative droplet count for these cases is also shown (right axis).

## "A Smoking Gun": Infectious Coronavirus Retrieved from Hospital Air" Viable SARS-CoV-2 in the air of a hospital room with COVID-19 patients

(News summary) – “A research team at the University of Florida has confirmed Covid-19 does live in aerosol droplets, and that the standard 6-foot social distancing protocols used around the world as safety precautions may not be sufficient. "It's unambiguous evidence that there is infectious virus in aerosols," Linsey Marr, an expert in airborne spread of viruses who was not involved in the work [told](#) the *New York Times*. For [this study](#), researchers collected air samples from a room in a hospital ward dedicated to Covid-19 patients who were not subject to procedures that are known to produce aerosols, the *Times* reported. The research team collected two sets of samples, one at approximately 7 feet from the patients and another at about 16 feet, and found that Covid-19 virus contained in samples at both distances could infect cells in a lab dish. Although not peer reviewed, scientists are pointing to this study as a potential 'smoking gun,' regarding the issue of aerosol transmission.

<https://www.medrxiv.org/content/10.1101/2020.08.03.20167395v1> | <https://www.medrxiv.org/content/10.1101/2020.08.03.20167395v1.full.pdf>

### Excerpts:

“Viable virus was isolated from air samples collected 2 to 4.8meters (6.5 to 15 feet) away from the patients. The genome sequence of the SARS-CoV-2 strain isolated from the material collected by the air samplers was identical to that isolated from the NP swab from the patient with an active infection. Estimates of viable viral concentrations ranged from 6 to 74 TCID units/L of air. **Interpretation:** Patients with respiratory manifestations of COVID-19 produce aerosols in the absence of aerosol-generating procedures that contain viable SARS-CoV-2, and these aerosols may serve as a source of transmission of the virus.”

## Viable SARS-CoV-2 in the air of a hospital room with COVID-19 patients

Comments (2)

Previous

Posted August 04, 2020.

John A Lednický, Michael Lauzardo, Z. Hugh Fan, Antarpreet S Jutla, Trevor B Tilly, Mayank Gangwar, Moiz Usmani, Sripriya N Shankar, Karim Mohamed, Arantza Eiguren-Fernandez, Caroline J Stephenson, Md. Mahbulul Alam, Maha A Elbadry, Julia C Loeb, Kuttichantran Subramaniam, Thomas B Waltzek, Kartikeya Cherabuddi, John Glenn Morris Jr., Chang-Yu Wu

doi: <https://doi.org/10.1101/2020.08.03.20167395>

This article is a preprint and has not been peer-reviewed [what does this mean?]. It reports new medical research that has yet to be evaluated and so should not be used to guide clinical practice.

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Supplementary Material

Data/Code

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## BROAD PUBLIC USE OF MASKS – Supplement E -

August 25, 2020

To: Information for Leaders and colleagues in state/local health policy

From: Online summaries by Colorado Ideas 2.0, LLC <sup>10</sup>

# Two meters or one: what is the evidence for physical distancing in covid-19?

publication source: BMJ (former British Medical Journal) : <https://www.bmj.com/content/370/bmj.m3223>

This article reviews previous studies and helpfully integrates 72 common human situations into a single, easy to view graphic: **GRAPHIC: What is the evidence for physical distancing**

Type and level of group activity	Low occupancy			High occupancy		
	Outdoors and well ventilated	Indoors and well ventilated	Poorly ventilated	Outdoors and well ventilated	Indoors and well ventilated	Poorly ventilated
<b>Wearing face coverings, contact for short time</b>						
Silent	Low	Low	Low	Low	Low	Medium
Speaking	Low	Low	Low	Low	Low	Medium
Shouting, singing	Low	Low	Medium	Medium	Medium	High
<b>Wearing face coverings, contact for prolonged time</b>						
Silent	Low	Low	Medium	Low	Medium	High
Speaking	Low	Low*	Medium	Medium*	Medium	High
Shouting, singing	Low	Medium	High	Medium	High	High
<b>No face coverings, contact for short time</b>						
Silent	Low	Low	Medium	Medium	Medium	High
Speaking	Low	Medium	Medium	Medium	High	High
Shouting, singing	Medium	Medium	High	High	High	High
<b>No face coverings, contact for prolonged time</b>						
Silent	Low	Medium	High	Medium	High	High
Speaking	Medium	Medium	High	High	High	High
Shouting, singing	Medium	High	High	High	High	High

**Risk of transmission**  
Low ■ Medium ■ High ■

\* Borderline case that is highly dependent on quantitative definitions of distancing, number of individuals, and time of exposure

**News analyses:**

- **Six feet of distance? It's more complicated than that**

News Source: New York Times, August 27, 2020

Since the beginning of the pandemic, keeping six feet away from people outside one's household has been the quintessential rule of social distancing. But a paper published on Tuesday in The BMJ (formerly The British Medical Journal) [argues](#) that the six-foot rule is an oversimplification descended from 19th-century science. Instead of single, fixed distancing rules, the authors propose graded guidelines to better reflect the many factors that determine how dangerous a given setting might be.

**What does that mean in practical terms?**

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The general scientific consensus, [according](#) to Andrew Joseph, Helen Branswell and Elizabeth Cooney of Stat, is that indoors is riskier than outdoors, large groups are riskier than small groups and prolonged contact is riskier than brief contact. Loud talking, heavy breathing, singing and screaming also [raise the risk of viral spread](#).

## • Social Distancing Is a Lot More Complicated Than Staying 6 Feet Apart

Online news source: <https://gizmodo.com/social-distancing-is-a-lot-more-complicated-than-being-1844845193>

The 6-foot rule for distancing from others during the covid-19 pandemic might be too rigid for its own good, a group of experts in the U.S. and UK are arguing. In a new paper out Tuesday, they make the case for adopting a more nuanced approach to staying safe, where people take into account things like whether they're indoors or outdoors, staying in a location for a prolonged time, or wearing a face mask in order to figure out their risk level and how far apart they should be from others.

The crux of their argument, [published](#) in the BMJ on Tuesday, is that the 6-foot rule—or 2-meter rule, outside of the U.S.—endorsed by public health groups like the World Health Organization is based on antiquated science first collected more than half a century ago, usually involving viruses very different from the culprit behind covid-19, the coronavirus called SARS-CoV-2. The group of experts include Nicholas Jones, a primary care doctor and doctoral research fellow at the University of Oxford in the UK, Zeshan Qureshi, a UK pediatrician, and Lydia Bourouiba, a mathematician and associate professor at MIT who has studied the fluid dynamics of how infectious diseases spread, including those caused by respiratory viruses like SARS-CoV-2.

As the authors note, we've had to learn and relearn a lot about how SARS-CoV-2 works. Initially, for instance, it was thought that the coronavirus was difficult to transmit between people at all. Even once human-to-human transmission was confirmed, it was still assumed that the virus was mostly spread through close contact with large droplets emitted by infected people and that these droplets had a very short range before they fall to the ground, roughly extending to 6 feet. In recent months, however, studies have shown that the virus can stay intact in tinier aerosols, which are capable of traveling farther than 6 feet and can stay aloft for longer periods of time. Other evidence has suggested that both droplets and aerosols can be propelled farther than 6 feet under the right conditions, such as indoor places with strong airflow from an air conditioning system.

Though there are still questions about how much of a role aerosols play in driving transmission of the virus, evidence continues to accumulate that covid-19 can at least sometimes act like an airborne disease. And as such, the authors argue, it's time to retire and replace the 6-foot rule.

Rather than think exclusively about personal space, they say, people should consider their circumstances. If you're outdoors and wearing a mask, then the risk of transmission during a group activity with only a few people should be relatively low and the need for distancing is less stringent, even if you're there for a while. If you're indoors in a well-ventilated place, not wearing a covering, and around people who are talking, that risk climbs, and distancing matters more. And if you're indoors for a long time, not wearing a face covering, and around people who are yelling or singing in a poorly ventilated room, that's a much higher risk than the first scenario, and ideally you shouldn't be there at all; but if you are, then keeping a distance is especially important, though it may not be sufficient to prevent you from becoming infected. It's admittedly not as easy to crunch down into a one-sentence heuristic as the 6-foot rule, though the authors have created a handy graphic. But the nuance of this advice might make life more comfortable for people earnestly worried about walking in the park or doing other outdoor activities, they argue.

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- **Seven months later, what we know about Covid-19 — and the pressing questions that remain.**

Online source: STAT, August 17, 2020 <https://www.statnews.com/2020/08/17/what-we-now-know-about-covid19-and-what-questions-remain-to-be-answered/>

## **Physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: a systematic review and meta-analysis**

Publication Source: [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(20\)31142-9/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)31142-9/fulltext)

Published June 27, 2020; prerelease June 1.

Excerpt: Summary

### **Background**

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) causes COVID-19 and is spread person-to-person through close contact. We aimed to investigate the effects of physical distance, face masks, and eye protection on virus transmission in health-care and non-health-care (eg, community) settings.

### **Methods**

We did a systematic review and meta-analysis to investigate the optimum distance for avoiding person-to-person virus transmission and to assess the use of face masks and eye protection to prevent transmission of viruses. We obtained data for SARS-CoV-2 and the betacoronaviruses that cause severe acute respiratory syndrome, and Middle East respiratory syndrome from 21 standard WHO-specific and COVID-19-specific sources. We searched these data sources from database inception to May 3, 2020, with no restriction by language, for comparative studies and for contextual factors of acceptability, feasibility, resource use, and equity. We screened records, extracted data, and assessed risk of bias in duplicate. We did frequentist and Bayesian meta-analyses and random-effects meta-regressions. We rated the certainty of evidence according to Cochrane methods and the GRADE approach. This study is registered with PROSPERO, CRD42020177047.

### **Findings**

Our search identified 172 observational studies across 16 countries and six continents, with no randomised controlled trials and 44 relevant comparative studies in health-care and non-health-care settings (n=25 697 patients). Transmission of viruses was lower with physical distancing of 1 m or more, compared with a distance of less than 1 m (n=10 736, pooled adjusted odds ratio [aOR] 0·18, 95% CI 0·09 to 0·38; risk difference [RD] –10·2%, 95% CI –11·5 to –7·5; moderate certainty); protection was increased as distance was lengthened (change in relative risk [RR] 2·02 per m;  $p_{\text{interaction}}=0\cdot041$ ; moderate certainty). Face mask use could result in a large reduction in risk of infection (n=2647; aOR 0·15, 95% CI 0·07 to 0·34, RD –14·3%, –15·9 to –10·7; low certainty), with stronger associations with N95 or similar respirators compared with disposable surgical masks or similar (eg, reusable 12–16-layer cotton masks;  $p_{\text{interaction}}=0\cdot090$ ; posterior probability >95%, low certainty).

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Eye protection also was associated with less infection (n=3713; aOR 0.22, 95% CI 0.12 to 0.39, RD -10.6%, 95% CI -12.5 to -7.7; low certainty). Unadjusted studies and subgroup and sensitivity analyses showed similar findings.

### Interpretation

The findings of this systematic review and meta-analysis support physical distancing of 1 m or more and provide quantitative estimates for models and contact tracing to inform policy. Optimum use of face masks, respirators, and eye protection in public and health-care settings should be informed by these findings and contextual factors. Robust randomised trials are needed to better inform the evidence for these interventions, but this systematic appraisal of currently best available evidence might inform interim guidance.

**Funding** : World Health Organization.

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## Broad Required Public Use of Masks

Supplement F – July, September 2020

Colorado Ideas 2.0

This Public Use of Masks supplement for September brings together five diverse reports, each of which adds to the knowledge (and advocacy) base in support of the required use of face masks.

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4. CDC Adds Then Retracts Aerosols as Main COVID-19 Mode of Transmission
5. Research Determines Protests Did Not Cause Spike in Coronavirus Cases

[F1]

CNBC [Health and Wellness](#)

## If everyone wears a mask, 58% of Covid-19 deaths could be prevented by fall, study says

Published Updated Fri, Jul 10, 2020 3:00 PM EDT

[Cory Stieg@corystieg](mailto:CoryStieg@corystieg)

A new [Covid-19 prediction model](#) makes another compelling case for [wearing masks and cloth face coverings](#).

If practically everyone in America wears masks while out in public, it could prevent tens of thousands of Covid-19 infections and deaths by the fall, according to researchers at the University of Washington's Institute for Health Metrics and Evaluation (IHME).

“It is hard to imagine any health intervention that would be more cost-effective,” Theo Vos, professor of health metrics sciences at the IHME, tells CNBC Make It. “Even if causing a small amount of discomfort to everyone.”



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Currently, with mask use as it is (between 20% and 60%, according to IHME) the model predicts over 208,200 cumulative deaths by Nov. 1. The model also predicts over 100,000 infections a day by late September, topping out at nearly 168,000 projected new infections on a single day on Nov. 1.

To date, there have been at least 3 million infections and [132,000 Covid-19 deaths](#) in the United States, according to data from Johns Hopkins University and Medicine. The U.S. hit a record [single-day Covid-19 infections](#) on July 8, with 60,000 daily infections reported.

But that could all change if 95% of people now start wearing masks anytime they're in public, according to the model. Universal mask usage could prevent nearly 45,500 projected Covid-19-related deaths by Nov. 1, or about a 58% reduction, Vos says.

**“In the mask scenario, assuming we can get 95% of people to always wear a mask, the cumulative deaths will reach 162,808 [by Nov. 1],” Vos says.**

**As for infections, the model predicts that universal mask usage could reduce the number of infections on Nov. 1 to a little under 33,500, an 80% reduction. This is “quite a big difference,” Vos says.**

So what does this mean for you? Wear a mask whenever you mingle with people, Vos says. Masks and cloth face coverings create a barrier to keep your respiratory droplets from spreading to other people and potentially infecting them, according to the [Centers for Disease Control](#).

A [recent Gallup poll](#) suggests that while mask usage among Americans is becoming more common — the percentage of U.S. adults who said they had worn a mask in public in the previous seven days went from 51% in early April to 86% in late June — not everyone is on board: 11% of US adults surveyed in June said they have not considered wearing a mask.

Dr. Anthony Fauci, the director of the National Institute of Allergy and Infectious Diseases, [said](#) that he's “strongly in favor of” mandating the use of face masks because of their efficacy.

This most recent IHME projection has not yet been peer-reviewed, but Vos says the results have been shared with the CDC and a group of modelers, convened by the World Health Organization, for comparisons. The IHME will submit a number of papers on the model at the end of this week, he says.

But the findings track with other studies on masks and their effect on Covid-19.

A [model from the University of Cambridge](#) found that if 100% of people wore masks all the time in public, it could [prevent a second wave](#) of Covid-19 in the 18 months that it will likely [take to get a vaccine](#) to market. (The United States is still experiencing the [first wave of Covid-19](#); the second one would occur when the [virus returns](#) or when a new strain of the virus develops.)

“As we all have come to recognize, wearing masks can substantially reduce transmission of the virus,” IHME director Dr. Christopher Murray said in a [press release](#). “Mask mandates delay the need for re-imposing closures of businesses and have huge economic benefits. Moreover, those who refuse masks are putting their lives, their families, their friends, and their communities at risk.”

***Don't miss:***

- [Study shows how face masks could prevent a second wave of Covid-19 — but there's a catch](#)
- [More than half of people with Covid-19 don't know how they got it — here's what that means for you](#)
- [Can face masks lower oxygen levels or weaken the immune system? Here's what health experts say](#)



<http://www.healthdata.org/news-release/new-ihme-forecasts-show-more-200000-us-deaths-november-1>

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## New IHME Forecasts Show More Than 200,000 US Deaths by November 1

**Publication date: July 7, 2020**

*'Many states expected to experience significant increases in cases and deaths'*

*High levels of mask wearing could reduce forecasted deaths by over 45,000*

*'Those who refuse masks are putting their lives, their families, their friends, and their communities at risk'*

SEATTLE (July 7, 2020) – In its first projections of COVID-19 deaths out to November 1, the Institute for Health Metrics and Evaluation (IHME) at the University of Washington is forecasting more than 200,000 deaths in the United States.

The forecast shows 208,255 deaths (with a range of 186,087 to 244,541). Those numbers drop to 162,808 (157,217 to 171,193), if at least 95% of people wear masks in public.

“We can now see the projected trajectory of the epidemic into the fall, and many states are expected to experience significant increases in cases and deaths in September and October,” said IHME Director Dr. Christopher Murray. “However, as we all have come to recognize, wearing masks can substantially reduce transmission of the virus. Mask mandates delay the need for re-imposing closures of businesses and have huge economic benefits. Moreover, those who refuse masks are putting their lives, their families, their friends, and their communities at risk.”

IHME’s new projections include the re-imposition of strong social distancing mandates when deaths per day reach a level of 8 per one million people, comparing that with a forecast if no action is taken, and a forecast if social distancing mandates are combined with at least 95% mask wearing in public spaces. Florida and Massachusetts 17,472 (11,275 to 32,577) and 12,906 (11,017 to 16,873), respectively, are expected to reach 8 per million deaths by November 1. The forecast for Florida, which is expected to reach 8 per million deaths on October 1, differs by 6,173 deaths if the state does not re-impose social distancing mandates. If mask wearing reaches 95%, that number drops to 9,849 (7,921 to 14,052).

The projections may increase if the current surge in infections spreads more widely in at-risk populations. Current data from states reporting the age breakdown of cases suggest that more cases are being detected in young people<sup>34</sup>

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who have a lower risk of death. The forecasts also show deaths beginning to increase again in many states in mid- to late September, due to the expected seasonality of COVID-19. Current data show a strong statistical relationship between COVID-19 transmission and pneumonia seasonality, which is included as a covariate in the model.

“The US didn’t experience a true end to the first wave of the pandemic,” Murray said. “This will not spare us from a second surge in the fall, which will hit particularly hard in states currently seeing high levels of infections.”

The forecasts by state (assuming social distancing mandates will be re-imposed when deaths reach 8 per million) are:

- Alabama: 3,443 (range of 2,117 to 6,260)
- Alaska: 14 (range of 13 to 15)
- Arizona: 5,553 (range of 3,905 to 8,621)
- Arkansas: 724 (range of 431 to 1,371)
- California: 16,827 (range of 13,131 to 24,278)
- Colorado: 1,937 (range of 1,765 to 2,508)
- Connecticut: 4,692 (range of 4,550 to 5,005)
- Delaware: 606 (range of 568 to 683)
- District of Columbia: 666 (range of 622 to 760)
- Florida: 17,472 (range of 11,275 to 32,577)
- Georgia: 3,857 (range of 3,298 to 5,031)
- Hawaii: 18 (range of 17 to 19)
- Idaho: 120 (range of 105 to 152)
- Illinois: 8,907 (range of 8,177 to 9,994)
- Indiana: 3,400 (range of 3,112 to 3,870)
- Iowa: 841 (range of 796 to 925)
- Kansas: 632 (range of 398 to 1,243)
- Kentucky: 1,139 (range of 773 to 2,295)
- Louisiana: 4,643 (range of 3,958 to 5,973)
- Maine: 125 (range of 116 to 145)
- Maryland: 3,880 (range of 3,685 to 4,213)
- Massachusetts: 12,906 (range of 11,017 to 16,873)
- Michigan: 7,114 (range of 6,757 to 7,912)
- Minnesota: 1,951 (range of 1,774 to 2,345)
- Mississippi: 2,438 (range of 1,805 to 3,807)
- Missouri: 1,757 (range of 1,349 to 2,615)
- Montana: 22 (range of 21 to 24)
- Nebraska: 588 (range of 404 to 989)
- Nevada: 1,304 (range of 731 to 3,366)
- New Hampshire: 704 (range of 500 to 1,218)
- New Jersey: 16,970 (range of 16,382 to 17,891)
- New Mexico: 924 (range of 622 to 1,881)
- New York: 32,221 (range of 32,022 to 32,468)
- North Carolina: 2,351 (range of 1,856 to 3,487)
- North Dakota: 97 (range of 90 to 110)
- Ohio: 5,712 (range of 4,130 to 10,296)
- Oklahoma: 587 (range of 497 to 790)
- Oregon: 471 (range of 333 to 778)
- Pennsylvania: 9,999 (range of 8,265 to 14,573)
- Rhode Island: 1,282 (range of 1,161 to 1,492)
- South Carolina: 4,059 (range of 2,175 to 8,225)
- South Dakota: 242 (range of 143 to 476)

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- Tennessee: 1,908 (range of 1,098 to 3,714)
  - Texas: 13,450 (range of 8,967 to 22,738)
  - Utah: 396 (range of 276 to 636)
  - Vermont: 59 (range of 58 to 61)
  - Virginia: 5,190 (range of 3,364 to 9,878)
  - Washington: 2,510 (range of 2,048 to 3,331)
  - West Virginia: 118 (range of 105 to 143)
  - Wisconsin: 1,410 (range of 1,112 to 2,072)
  - Wyoming: 18 (range of 18 to 19)

IHME will continue to forecast for different scenarios, including planned intermittent mandates in the fall when deaths per day are expected to reach higher levels within each state, recognizing that solutions are not uniform across communities.

The new death projections and other information, such as hospital resources usage, are available at <https://covid19.healthdata.org>.

**Contact:** [media@healthdata.org](mailto:media@healthdata.org)

#### **About the Institute for Health Metrics and Evaluation**

The Institute for Health Metrics and Evaluation (IHME) is an independent global health research organization at the University of Washington School of Medicine that provides rigorous and comparable measurement of the world's most important health problems and evaluates the strategies used to address them. IHME is committed to transparency and makes this information widely available so that policymakers have the evidence they need to make informed decisions on allocating resources to improve population health.

#### [COVID-19 resources](#)

IHME's COVID-19 projections were developed in response to requests from the University of Washington School of Medicine and other US hospital systems and state...

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## **[F3] Washington Post**

# **Spate of new research supports wearing masks to control coronavirus spread**

By [Ben Guarino](#), | [Chelsea Janes](#) and [Ariana Eunjung Cha](#)

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June 13, 2020 at 10:00 a.m. MDT

Four months of discord about the [coronavirus](#) epidemic have transformed the cloth mask into a potent political symbol, touted by Democrats as a key part of communal responsibility, labeled by some GOP leaders as a sign of government overreach and as a scarlet letter pinned on the weak.

But as partisan interests sew symbolism and controversy into masks, scientists are trying to provide answers about how effectively those masks prevent transmission of the coronavirus, and what role they should play in efforts to limit the pathogen's spread.

Several new studies published this month support wearing masks to curb the transmission of the novel coronavirus. The broadest, a review funded by the World Health Organization and published in the [journal Lancet](#), concluded that data from 172 observational studies indicate wearing face masks reduces the risk of coronavirus infection.

“Our findings suggest, in multiple ways, that the use of masks is highly protective in health-care and community settings,” said the author of the review, [Holger Schünemann](#), an epidemiologist and physician at McMaster University in Ontario.

But that conclusion came with an important caveat: “We have low certainty in that,” Schünemann said, meaning the authors cannot be strongly confident in the result. He spoke Friday from a small island in Italy where he and his wife, a fellow epidemiologist, were studying the prevalence of coronavirus antibodies.

The gold standard in science — a randomized, double-blinded controlled trial — is impossible to conduct in a pandemic, so researchers have turned to other analyses, said Andrew Noymer, an associate professor of population health and disease prevention at the University of California at Irvine who was not part of the review.

Reviews such as the Lancet report compile data from many smaller reports to synthesize those findings. Schünemann cautioned that the studies collected in the Lancet article were observational, not randomized trials. Observational research, which doesn't have a change imposed by scientists, generally has more limitations than controlled studies. The influence of outside factors cannot be eliminated, for example.

[Stay safe and informed as the United States reopens with our free Coronavirus Updates newsletter](#)

Face masks appear to be most effective when supplemented with hand-washing and physical distancing, Schünemann and his colleagues said. Most studies in the review analyzed face masks in hospitals or other medical settings, and some took place in households where an infected person lived.

The studies don't settle the question of whether the protective benefit of a face mask derives from the barrier it creates — or from behavior changes it might prompt. The mask could remind people not to touch their faces or

Wearing N95 respirators, compared with disposable surgical masks or reusable cotton masks, was more strongly associated with a reduction in risk of infection, but that was another low-certainty conclusion, Schünemann said.

“Anecdotally, it appears that face-mask use is an important control against multiple modes of SARS-CoV-2 transmission,” including droplets and aerosols, said Jeffrey Shaman, an epidemiologist at Columbia University.

He highlighted Asian countries such as South Korea, Taiwan and Vietnam that had high rates of face-mask use early in the pandemic. They “have had better success squashing the virus and keeping their economies going,” Shaman said.

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Werner Ernst Bischoff, a professor of infectious diseases at Wake Forest University known for his studies on respiratory transmission of viruses, said masks are critical because the simple act of breathing releases potentially infected particles. Loud talking, yelling and singing release even more.

“When you are going about in the course of normal activities like breathing, talking and singing, you expel these particles into the environment. You want to create a seal,” said Bischoff, who said he sees masks as the critical element in preventing transmission.

Mask use varies dramatically from state to state and even city to city, according to interviews with health officials in several states during the last three weeks. Epidemiologists have bemoaned the patchwork approach to mask mandates, arguing that mixed messaging from federal, state and local levels leads to apathy and skepticism toward the measure.

The Centers for Disease Control and Prevention recommends cloth face coverings where social distancing isn’t possible. [The CDC issued that guidance only after a tussle with the White House](#), and President Trump has eschewed wearing a mask at public appearances, [even in a Michigan manufacturing plant that requested he do so](#).

Friday, the CDC released guidance on mass gatherings, which are reappearing in the public square with ongoing protests and political rallies. Trump announced he will begin holding full-fledged campaign rallies next week.

The guidance urges venues hosting gatherings to require staff to use cloth face coverings, particularly when social distancing is difficult. The guidance also recommends that event hosts urge people to bring and use their own cloth face coverings.

The guidance says those recommendations are intended only to supplement, not replace, local and state recommendations, which vary dramatically. New York Gov. Andrew M. Cuomo (D) mandated wearing of masks in public April 17. Mask-wearing became so ingrained that in May shoppers hectored a woman who hadn’t covered her face, [compelling her to leave a Staten Island grocery store](#).

Maine, Massachusetts and the District are among jurisdictions that have instituted similar requirements. Other states have directed workers in restaurants and other businesses to wear masks, while recommending that residents follow suit.

[An Axios-Ipsos](#) poll this month found that 48 percent of Americans said they were wearing a mask “at all times” when they left their homes. And more than three-quarters — including those people who wear masks ubiquitously — said they wear their masks at least sometimes when they leave their homes. A [Washington Post-University of Maryland](#) national poll in May found 80 percent of Americans said it was “necessary” for people in their community to wear a mask when coming close to people outside their home; 20 percent said masks were “not necessary.”

Politicization has complicated the issue. Some GOP leaders associated pro-mask messaging with Democratic leadership and labeled masks a costume of the coastal elite. Some Republican lawmakers have criticized mask mandates as evidence of government overreach, and some have branded those wearing masks as weak.

Others, [like GOP North Dakota Gov. Doug Burgum](#), have made impassioned pleas to constituents to ignore politicization of masks.

“I would really love to see in North Dakota that we could just skip this thing that other parts of the nation are going through where they’re creating a divide — either it’s ideological or political or something — around masks versus no mask,” Burgum said in late May.

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Orange County, Calif., on Thursday became the latest jurisdiction to rescind a mask mandate even as it experienced its largest increase in cases, with hospitalizations rising.

Face coverings in public will be recommended — not required — going forward in Orange County. The order was issued by health care agency director Clayton Chau, who replaced Nichole Quick. She resigned Monday following a firestorm of criticism from elected officials and some residents who questioned the need for masks.

“Most of anti-maskers seem to be politicians who do not have scientific experience,” said Noymer, the University of California professor.

With colleagues, [Richard Stutt](#), a University of Cambridge researcher who simulates disease spread, published a model Wednesday in Proceedings of the Royal Society A that shows [widespread mask use, plus lockdown orders](#), greatly slows the virus’s spread.

“You can do lockdown, you can do masks, but you get the best result when you combine them,” Stutt said.

They made some conservative assumptions, including that coverings were not perfectly protective, but their simulation suggests that’s not necessary to lower the rate of transmission.

Unlike N95 masks or face shields, bandannas and cotton coverings cannot stop the smallest droplets. But Stutt said crude coverings that block only large droplets of expelled saliva and fluid can still help — in part because bigger volumes presumably contain more virus.

Wearing masks could have another benefit, [a study found](#): People may stand farther away from other people who wear masks, making it less likely for the virus to travel from person to person, though that assertion has not been peer-reviewed.

Experts have not fully embraced all of the new research promoting mask use. [A report published Thursday](#) in the influential Proceedings of the National Academy of Sciences journal, written by a group of aerosol chemists including the Nobel Prize-winning discoverer of the Antarctic ozone hole, was slammed on social media for using poor methods to estimate the number of New Yorkers saved by masks.

Johns Hopkins University infectious-disease epidemiologist Kate Grabowski [suggested the journal](#) should consider a retraction. And Willem van Schaik, a professor at the Institute of Microbiology and Infection at the University of Birmingham in England, [tweeted](#) that it was “terrible.”

Renyi Zhang, a Texas A&M University atmospheric sciences professor and an author of the PNAS paper, dismissed the calls for retraction. “Our paper is based on solid scientific evidence,” Zhang wrote in an email. “The method and conclusions from the paper can certainly be debated in an open, scientific fashion, but not on the basis of people’s perceptions.”

The PNAS paper provides an extrapolation of real-world data while the Royal Society article involves a simulation. Despite the weakness of some of the research, Noymer said that when combined with previous studies — including a 2013 paper from the Cambridge University Press that found cloth masks could reduce droplet spread — the overall findings point to the benefits of masks.

“Both studies support this anecdotal observation and provide some quantification of the effects of face masks,” said Shaman, the Columbia University epidemiologist, who was not involved with those reports.

Noymer said masks will probably only reduce the amount of droplets, not stop them completely, but that may be enough to prevent someone from becoming infected or result in a milder case.

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“We don’t need to be in scuba gear. Even if not an absolute barrier, it still helps,” he said.

*Emily Guskin contributed to this report.*

**Coronavirus: What you need to read**

The Washington Post is providing some coronavirus coverage free, including:

Updated September 16, 2020

**The latest:** [Live updates on coronavirus](#)

**Coronavirus maps:** [Cases and deaths in the U.S.](#) | [Cases and deaths worldwide](#)

**What you need to know:** [Vaccine tracker](#) | [Coronavirus etiquette](#) | [Summertime activities & coronavirus](#) | [Hand sanitizer recall](#) | [Your life at home](#) | [Personal finance guide](#) | [Make your own fabric mask](#) | Follow all of our [coronavirus coverage](#) and [sign up for our free newsletter](#).

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[F4]

## CDC Adds Then Retracts Aerosols as Main COVID-19 Mode of Transmission

### Health Affairs Blog

Marcia Frellick | September 21, 2020

The Centers for Disease Control and Prevention (CDC) today abruptly deleted information from its website that it had updated Friday on how COVID-19 is spread.

The CDC had updated [information on coronavirus spread](#) and had acknowledged the prominence of aerosol transmission.

CDC's new information still says that Sars-CoV-2 is commonly spread between people who are within about 6 feet of each other, which has been the agency's stance for months now.

However, the deleted update had added it is spread "through respiratory droplets or small particles, such as those in aerosols, produced when an infected person coughs, sneezes, sings, talks, or breathes. These particles can be inhaled into the nose, mouth, airways, and lungs and cause infection. This is thought to be the main way the virus spreads."

Responding to *Medscape Medical News* questions about the update, Jasmine Reed, spokesperson for the CDC, told *Medscape Medical News*, "A draft version of proposed changes to these recommendations was posted in error to the agency's official website. CDC is currently updating its recommendations regarding airborne transmission of SARS-CoV-2 (the virus that causes COVID-19). Once this process has been completed, the update language will be posted."

### Previous Information

Previously, the CDC said the [virus is spread](#) mainly among people who are within about 6 feet of each another through respiratory droplets propelled when an infected person coughs, sneezes, or talks.

Previous guidance also said, "These droplets can land in the mouths or noses of people who are nearby or possibly be inhaled into the lungs."

The now deleted update said, "There is growing evidence that droplets and airborne particles can remain suspended in the air and be breathed in by others, and travel distances beyond 6 feet (for example, during choir practice, in restaurants, or in fitness classes)."



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On July 6, *Clinical Infectious Diseases* [published the paper](#) "It Is Time to Address Airborne Transmission of Coronavirus Disease 2019," which was supported by 239 scientists.

The authors write, "There is significant potential for inhalation exposure to viruses in microscopic respiratory droplets (microdroplets) at short to medium distances (up to several meters, or room scale).

The World Health Organization (WHO) acknowledged after this research was published that airborne transmission of the virus *may* play a role in infection, especially in poorly ventilated rooms and buildings, but have yet to declare aerosols as a definitive contributor.

WHO has long stated that coronavirus is spread mainly by droplets that, once expelled by coughs and sneezes of infected people, fall quickly to the floor.

The CDC update was made Friday without announcement.

"This has been one of the problems all along," said Leana Wen, MD, an emergency physician and public health professor at George Washington University, Washington, DC. "The guidance from CDC changes on their website, but there's no press conference, there's no explanation of why they're changing this now."

Again Monday, there was no announcement that information had changed.

### **Update Added Air Purifiers for Prevention**

The CDC continues to recommend staying 6 feet from others, washing hands, wearing a mask and routinely disinfecting frequently touched surfaces.

The update had added, "Use [air purifiers to help reduce airborne germs](#) in indoor spaces."

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## **[F5] Research Determines Protests Did Not Cause Spike In Coronavirus Cases**

reported by Forbes: July 1, 2020

"Protests against systemic racism held in 300-plus U.S. cities following the death of George Floyd did not cause a significant increase in coronavirus infections, according to a team of economists who have published their findings in a 60-page [paper released](#) by the National Bureau of Economic Research; these somewhat surprising results are supported by Covid-19 testing data in many populous cities where demonstrations were held."

- ...researchers found "[no evidence](#) that urban protests reignited Covid-19 case growth during the more than three weeks following protest onset."

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- In fact, they determined that, based on cellphone data, “cities which had protests saw an [increase in social distancing](#) behavior for the overall population relative to cities that did not,” leading to “modest evidence of a small longer-run case growth decline.”
  - The study’s lead author, Dhaval Dave of Bentley University, [said](#), “In many cities, the protests actually seemed to lead to a net increase in social distancing, as more people who did not protest decided to stay off the streets.”
  - News analysis, see <https://www.forbes.com/sites/tommybeer/2020/07/01/research-determines-protests-did-not-cause-spike-in-coronavirus-cases/#449a6cb7dac7>
  - Full report from NBER <https://www.nber.org/papers/w27408.pdf> (71 pp) -



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## Broad and Required Public Use of Masks for COVID 19 – Supplement G– October 2020 <sup>10</sup>

**A new Research Study:** “[Effect of Face Masks on Gas Exchange in Healthy Persons and Patients with COPD](#)” published Oct. 2, 2020, provides a plain language description of how masks are safe. The NBC-Today Show article further simplifies and broadens public awareness of a journal article that otherwise few would read. [see p. 2]



### **Masks do not restrict oxygen flow or cause CO2 buildup, study finds**

<https://www.msn.com/en-us/health/wellness/masks-do-not-restrict-oxygen-flow-or-cause-co2-buildup-study-finds/ar-BB19DTVa>

October 2, 2020 - Erika Edwards 1 hr ago

NBC

Contrary to viral claims, wearing surgical masks or cloth face coverings does not restrict the amount of oxygen a person breathes in, nor does it cause a dangerous buildup of carbon dioxide, according to a study published Friday in the journal [Annals of the American Thoracic Society](#).



The study, though small, should help to further ease fears that masks are somehow physically harmful when, indeed, experts say mask use is by far one of the most effective ways to curb the spread of the coronavirus.

The study of masks' impact on lung function was inspired, researchers said, by a group of West Palm Beach, Florida, residents who expressed anger at a commissioners meeting in late June when local leaders ultimately voted to mandate masks. Some residents argued against the order, suggesting that wearing masks could lead people to inhale too much carbon dioxide. At least one other resident said without evidence that masks were "literally killing people."

Dr. Michael Campos, a pulmonologist affiliated with the Miami VA Medical Center and the University of Miami Hospital and Clinics, was watching the meeting on television and decided to do a study to determine whether masks have an impact on breathing. Campos and colleagues tested the effects of wearing a typical surgical mask on the body's ability to take in oxygen and exhale carbon dioxide.

Fifteen study participants were military veterans with severe chronic obstructive pulmonary disease, or COPD. Their lung function was below 50 percent. The volunteers were then compared with 15 other people who served as healthy controls.

All participants wore masks for about 30 minutes and then walked for 6 minutes, still wearing the face coverings. Using standard blood tests, researchers found no differences in levels of oxygen or carbon dioxide circulating in any of the participants' systems.

In fact, experts say, people with [underlying breathing problems](#) like COPD may be best served by wearing masks. "If you have a respiratory disease, you're at a much higher risk of contracting an infection, whether it's COVID-19 or the [flu](#) or any other respiratory problems," said Dr. Farrah Kheradmand, a pulmonologist and professor of medicine at Baylor College of Medicine in Houston, who was not involved with the research.

The study included basic surgical masks that are now widely available. It did not study [N95 masks](#), which are recommended for health care workers. Citing growing evidence that people can spread the coronavirus even if they [do not have symptoms](#), the study authors wrote that "universal mask use needs to be vigorously enforced in community settings, particularly now that we are facing a pandemic with minimal proven therapeutic interventions." "We believe our data will help mitigate fears about the health risks of surgical mask use and improve public confidence for more widespread acceptance and use."

This story originally appeared on [NBCNews.com](#).



## Effect of Face Masks on Gas Exchange in Healthy Persons and Patients with COPD

[Rajesh Samannan](#), [Gregory Holt](#), [Rafael Calderon-Candelario](#), [Mehdi Mirsaeidi](#), and [Michael Campos](#)

[Annals of the American Thoracic Society](#), Published online: October 2, 2020

as DOI: <https://doi.org/10.1513/AnnalsATS.202007-812RL> | [First Page](#) | [PDF \(68 KB\)](#)

Intro and Excerpts:

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“Current evidence, from observational studies to systematic reviews and epidemiologic modeling, supports the use of masks by the public, especially surgical masks, on mitigating COVID-19 transmission and deaths.1-5 However, public mask use has been heavily politicized with inconsistent recommendations by authorities leading to divided public opinion.

Objective: To evaluate whether gas exchange abnormalities occur with the use of surgical masks in subjects with and without lung function impairment.

We acknowledge that our observations may be limited by sample size, however our population offers a clear signal on the nil effect of surgical masks on relevant physiological changes in gas exchange under routine circumstances (prolonged rest, brief walking).

It is important to inform the public that the discomfort associated with mask use should not lead to unsubstantiated safety concerns as this may attenuate the application of a practice proven to improve public health. As growing evidence indicates that asymptomatic individuals can fuel the spread of COVID-19,12 universal mask use needs to be vigorously enforced in community settings, particularly now that we are facing a pandemic with minimal proven therapeutic interventions. We believe our data will help mitigate fears about the health risks of surgical mask use and improve public confidence for more widespread acceptance and use.”

Related: [Experts answer key questions about how to clean and store coronavirus face masks.](#)  
[Do you really need to wear a mask at home? Infectious disease experts say yes, in these two scenarios.](#)

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## **BROAD PUBLIC USE OF MASKS – Supplement H -**

February 5, 2021

To: Information for Leaders and colleagues in state/local health policy  
From: Online summaries by Colorado Ideas 2.0, LLC <sup>10</sup>

As part of our active tracking of “**Policies on Required Use of Masks...**” listed below are the latest news and medical reports from CDC, the first such agency reports from the Biden administration. Three linked documents, each from Feb. 5, 2021, provide timely information, that can be used in education and regulatory messages:

**Summary Article by N.Y Times:**

**“A new C.D.C. study adds to the evidence that masks can keep you out of the hospital.**

Link: <https://www.nytimes.com/live/2021/02/05/world/covid-19-coronavirus#a-new-cdc-study-adds-to-the-evidence-that-masks-can-keep-you-out-of-the-hospital>

“... New research published by the Centers for Disease Control and Prevention on Friday shows that statewide mask-wearing mandates were associated with a decline in the growth rate of Covid-19 hospitalizations. The study provides additional evidence that wearing of masks can help minimize transmission of the coronavirus.....”

**From CDC-MMWR , Feb 5, 2021.**

**“Decline in COVID-19 Hospitalization Growth Rates Associated with Statewide Mask Mandates — 10 States, March–October 2020” –**

“At the individual level, the prevention benefit of using a mask increases as more persons use masks consistently and correctly. Studies have confirmed the benefit of masking for SARS-CoV-2 control; each study demonstrated that, after implementation of directives from organizational or political leadership for universal masking, new infections decreased significantly... This study supports community masking to reduce the transmission of SARS-CoV-2.”\*

> **Link to full text:** <https://www.cdc.gov/mmwr/volumes/70/wr/mm7006e2.htm>

**From CDC-MMWR: “Observed Face Mask Use at Six Universities — United States, September–November 2020”**

“During September–November 2020, mask use was directly observed at six universities with mask mandates. Among persons observed indoors, 91.7% wore masks correctly, varying by mask type, from 96.8% for N95-type masks and 92.2% for cloth masks to 78.9% for bandanas, scarves, and similar face coverings. \*\*

Direct observation provides rapid feedback on mask use prevalence. Institutions of higher education can use this feedback to tailor training and messaging for correct mask use.”

**Link to full text:** <https://www.cdc.gov/mmwr/volumes/70/wr/pdfs/mm7006e1-H.pdf>

\*\* This study featured data from CSU in Colorado – the only western state college examined.



New York Times – Feb. 5, 2021

## [A new C.D.C. study adds to the evidence that masks can keep you out of the hospital.](#)

New research published by the Centers for Disease Control and Prevention on Friday shows that statewide mask-wearing mandates were associated with a decline in the growth rate of Covid-19 hospitalizations. The study provides additional evidence that wearing of masks can help minimize transmission of the coronavirus.

*Joggers wearing masks in downtown Los Angeles on Thursday. Credit...Mario Anzuoni/Reuters*

The [research](#), published in the Morbidity and Mortality Weekly Report by the agency, found that in three weeks or more following a mask mandate, Covid-19 hospitalization growth rates fell by 5.5 percent in people aged 18 to 64.

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The research focused on 10 states — California, Colorado, Connecticut, Maryland, Michigan, Minnesota, New Mexico, New York, Ohio and Oregon — that implemented mask mandates in the period from April to June of 2020. Hospitalization growth rates fell for adults 40 to 64 two weeks or more after the mandates were put into place, the research showed. [There are currently 34 states with mask mandates.](#)

Mask orders are “helping to protect people and helping the cases coming down,” said Dr. Rochelle Walensky, director for the C.D.C., in a briefing on Friday by the White House Covid-19 Response team. She added that the data remains somewhat open to interpretation in light of a multitude of changing factors taking place during the period these mandates were implemented.

The C.D.C.’s Morbidity and Mortality Weekly Report also published [another study](#) on Friday showing that college students appear to be doing an impressive job responding to the public health rallying cry to wear masks. From September to November, observers at six universities, five universities in the South and one in the West, found that 85.5 percent of 17,200 people on campus wore masks, with nearly 90 percent wearing them correctly (“If the mask completely covered the nose and mouth and was secured under the chin.”). Proper mask-wearing rates were higher indoors, 91.7 percent, the research found. The participating schools included five public universities with student populations ranging from 29,000 to 52,000, and one private university with 2,300 students. The rates of mask-wearing compliance were not specific by university; the research also noted that proper use of the masks varied by the type of covering: 96.8 percent for N95-type masks, 92.2 percent for cloth and 78.9 percent for “bandanas, scarves, and similar face coverings.”

**CDC-MMWR link:** <https://www.cdc.gov/mmwr/volumes/70/wr/mm7006e2.htm>

**Article by N.Y Times:** <https://www.nytimes.com/live/2021/02/05/world/covid-19-coronavirus#a-new-cdc-study-adds-to-the-evidence-that-masks-can-keep-you-out-of-the-hospital>