**ARE MASKS REALLY EFFECTIVE AGAINST COVID-19?**

<table>
<thead>
<tr>
<th>Type of Mask</th>
<th>Effective For Healthcare Workers?</th>
<th>Effective For the General Public?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multilayer Cloth Masks and Face Coverings</td>
<td>No. Excellent Evidence</td>
<td>Probably. Good Evidence. Protects wearer from spreading infection to others.</td>
</tr>
<tr>
<td>N95 Respirators</td>
<td>Yes. Required for caring for COVID-19 patients. Protects wearer from acquiring infection from others.</td>
<td>Yes, but not recommended. PPE being reserved for healthcare workers.</td>
</tr>
</tbody>
</table>

The following slides (created by the NM Human Services Department) present a summary of selected mask-related research and COVID-19, going back to April 2020. COVID-19 research is evolving rapidly and not all mask-related research will be included in this resource. Please note many research studies are not peer-reviewed.
CONSIDERATIONS FOR WEARING MASKS

- Purpose of **face masks** is to keep respiratory droplets from reaching others.
- Masks with one-way valves or vents allow air to be exhaled through a hole, and do not prevent person wearing the mask from transmitting COVID-19 to others.
  - CDC does not recommend the public use one-way valve or vent-masks.
- **Face shield** is primarily used for eye protection for the person wearing it.
  - CDC does not recommend face shields as a substitute for masks.
Masks reduce emission of virus-laden droplets ("source control"), which is especially relevant for asymptomatic or presymptomatic individuals who are estimated to account for more than 50% of transmissions.

Masks also help reduce inhalation of droplets by wearer ("filtration for personal protection").

Multiple layers of cloth with higher thread counts demonstrated superior performance compared to single layers with lower thread counts, in some cases filtering nearly 50% of fine particles less than 1 micron.

Some materials (e.g., polypropylene) may enhance filtering effectiveness by generating triboelectric charge (a form of static electricity) while others (e.g., silk) may reduce fabric wetting, maintaining breathability and comfort.

Difference-in-Difference Estimates

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>Full Sample</th>
<th>Johnson</th>
<th>Sedgwick</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mask Mandate + 21 days</td>
<td>-7.30***</td>
<td>-7.12***</td>
<td>-6.49*</td>
</tr>
<tr>
<td></td>
<td>(1.13)</td>
<td>(1.15)</td>
<td>(3.88)</td>
</tr>
<tr>
<td>Constant</td>
<td>-3.92</td>
<td>-13.46</td>
<td>-15.27</td>
</tr>
<tr>
<td></td>
<td>(5.69)</td>
<td>(9.09)</td>
<td>(9.62)</td>
</tr>
<tr>
<td>Observations</td>
<td>11,424</td>
<td>11,424</td>
<td>9,928</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.24</td>
<td>0.24</td>
<td>0.25</td>
</tr>
<tr>
<td>Number of Counties</td>
<td>84</td>
<td>84</td>
<td>73</td>
</tr>
<tr>
<td>Average New Daily Cases</td>
<td>14.27</td>
<td>14.99</td>
<td></td>
</tr>
<tr>
<td>County FE</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Day FE</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

Note: Non-Enforcers, Late Adopters and Mixed Counties dropped. Standard errors in parentheses.

Source: Do masks matter in Kansas? The University of Kansas. https://mediahub.ku.edu/media/Masks/1_49bb9aid
Researchers suggest universal mask wearing, or masking, reduces the dose of the virus, or the inoculum, for mask-wearer, could lead to more mild or asymptomatic case of COVID-19.

Systematic review of studies prior to widely practiced masking showed a proportion of asymptomatic cases at 15%. With increased rates of masking, a recent narrative review now finds rate of asymptomatic cases at 40-45%.

Two cases from cruise ships found effectiveness of masking. During an outbreak where masking was used, 81% of the passengers remained asymptomatic compared to 18% on a cruise ship that did not having masking.

This study notes that although asymptomatic infection can be problematic in terms of increasing the spread, it can be beneficial in leading to greater community-level immunity with reduced incidence of severe illness.
FAQ: HOW TO CARE FOR YOUR FACE MASK (AND WHY YOU SHOULDN’T HANG IT FROM YOUR REAR-VIEW-MIRROR)

WASHINGTON POST

▪ General guidelines for cloth masks:
  ▪ Daily washings are a must.
  ▪ “Treat your mask like your underwear. You want to change it every day.”

▪ Reusing surgical or N95 masks:
  ▪ Store mask in a clean paper or plastic bag.
  ▪ Remember outside of the mask is contaminated – wash your hands after touching it.

▪ When your mask gets sweaty:
  ▪ A moist mask is a compromised mask.
  ▪ Unlike a N95 mask, cloth masks are designed to allow air to pass through. A sweaty mask will not allow for this airflow and will instead pass between edges of the mask and the wear’s face.

▪ Washing cloth masks:
  ▪ Machine washing with regular laundry is best. Dry using the highest heat setting, but air-drying can work as well.

▪ Sunlight as a disinfectant:
  ▪ No – not the same UV light as used in hospitals to disinfect.
  ▪ For surgical masks and N95, sunlight can degrade the plastic or foam in the masks.

▪ Best way to store a mask:
  ▪ Clean masks should be stored in places where they cannot be exposed to contaminants or where they can potentially spread contaminants.
  ▪ For cloth masks, remove by the ear loops and fold it so inner parts are touching. Wash or sanitize hands immediately after handling your mask.

▪ When to throw out a single-use mask:
  ▪ If visibly soiled, smells, or is degrading/fraying.
Efficacy of face mask in preventing respiratory virus transmission

- Total of 21 studies met inclusion criteria.
- Meta-analyses suggest mask use provided a significant protective effect.
- Use of masks by healthcare workers (HCWs) and non-healthcare workers (Non-HCWs) can reduce the risk of respiratory virus infection by 80% and 47%.
- Protective effect of wearing masks in Asia appeared to be higher than Western countries.
- Masks had a protective effect against influenza viruses, SARS, and SARS-CoV-2.
- In the subgroups based on different study designs, protective effects of wearing masks were significant in cluster randomized trials and observational studies.

EFFECTIVENESS OF CLOTH MASKS: A SYSTEMATIC REVIEW

In this systematic review of 10 studies, cloth masks are not as effective as medical masks but may be better than no masks at all.

▪ Recommendations are to standardize masks with use of materials proven to have high filtration efficacy.

▪ Leakage needs to be minimized as much as possible.

▪ Use of cloth masks should not lead to a neglect of other infection control measures and are not recommended for healthcare workers.

Researchers identified 172 observational studies across 16 countries and six continents, with no randomized controlled trials and 44 relevant comparative studies (n=25 697 patients).

Transmission of viruses was lower with physical distancing of 1 meter or more, compared with a distance of less than 1 meter (n=10 736); protection was increased as distance lengthened.

Face mask use could result in a large reduction in risk of infection (n=2647), with stronger associations with N95 or similar respirators compared with disposable surgical masks or similar (e.g., reusable 12–16-layer cotton masks).

Eye protection also was associated with less infection (n=3713).

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 randomized trials are needed to better inform the evidence for these interventions.

FACE MASK USE BY PUBLIC OFFERS SIGNIFICANT BENEFIT WHEN USED CONSISTENTLY

- Use of face masks in general population offers significant benefit in preventing spread of respiratory viruses, but utility is limited by inconsistent adherence to mask usage.
- Early initiation of mask usage was more effective.
- Masks were more effective in viruses that transmit easily from asymptomatic individuals, an issue with the current pandemic.

Citation: Gupta, M., Gupta, K., & Gupta, S. (2020). The use of facemasks by the general population to prevent transmission of Covid 19 infection: A systematic review. medRxiv.
COMMUNITY-WIDE IMPACT OF FACE MASK USE BY PUBLIC

- Face masks are found to be useful with respect to both preventing illness in healthy persons and preventing asymptomatic transmission.

- 80% adoption of moderately (50%) effective masks could prevent 17–45% of projected deaths over 2 months in New York, while decreasing peak daily death rate by 34–58% absent other changes in epidemic dynamics.

Eikenberry, S. E., Mancuso, M., Iboi, E., Phan, T., Eikenberry, K., Kuang, Y., ... & Gumel, A. B. (2020). To mask or not to mask: Modeling the potential for face mask use by the general public to curtail the COVID-19 pandemic. *Infectious Disease Modelling.*
ADDING NYLON LAYER TO FABRIC MASKS INCREASES PARTICLE FILTRATION EFFICIENCY

▪ Using a modified method of mask fit testing, researchers compared particle filtration efficiency of 10 community-produced fabric mask designs to commercially produced surgical masks.

▪ A nylon stocking over layer improved particle filtration efficiency for all masks, and brought the efficiency for 5 of the 10 fabric mask designs above the 3M surgical mask baseline.

▪ Use of this testing method on a wider range of mask material/designs could optimize PPE given available resources.

OF 25 COUNTRIES WITH HIGHEST NUMBER OF CASES, 16 RECOMMEND AGAINST PUBLIC USE OF MASKS

- Quantitative content analysis of health agency mask guidelines performed in late March among 25 countries with highest number of cases.

- Nine countries recommended masks in public/poorly ventilated places

- Sixteen recommended against it due to masks creating a false sense of security.

- Twelve did not offer recommendations.

This study, not yet peer-reviewed, shows evidence masks enable disinhibition behavior and Americans spend less time at home and more time in moderate to high-risk locations following orders to wear masks.

Mask orders provide a sense of protection, leading people to substitute face mask wearing for other nonpharmaceutical interventions like avoiding time in public.

HOUSEHOLD MATERIALS SELECTION FOR HOMEMADE CLOTH FACE COVERINGS

- Researchers evaluated filtration properties of natural and synthetic materials using a modified procedure for N95 respirator approval:
  - Cotton, polyester, nylon, and silk had filtration efficiency of 5-25%
  - Polypropylene spunbond had filtration efficiency 6-10%
  - Paper-based products had filtration efficiency of 10-20%
- Advantage of polypropylene spunbond is it can be simply triboelectrically charged to enhance the filtration efficiency (from 6 to >10%), without any increase in pressure (stable overnight and in humid environments).
- Cotton, polyester, and polypropylene multilayered structures can meet or even exceed the efficiency of materials used in some medical face masks.


Investing for tomorrow, delivering today.
WANT TO PREVENT ANOTHER SHUTDOWN, SAVE 33,000 LIVES AND PROTECT YOURSELF? WEAR A FACE MASK, DOCTORS SAY

- Public health officials say we must wear masks if we want to keep the economy open and save tens of thousands of lives.

- Initially, CDC said cloth masks were intended to protect other people from a person wearing the mask in case that person is asymptomatic.

- However, there is some evidence the mask benefits the wearer from COVID-19 infection, too.

- An estimated 230,000-450,000 COVID-19 cases were prevented in states that enacted requirements for mask use between 4/8-5/15.

- Face masks increase civil liberties by decreasing asymptomatic viral spread, which will result in more places open sooner.
Dry heat at 100°C for 50 min. from a commercial electric cooker was found to be an appropriate method for decontaminating N95 respirators for reuse.

Temperatures > 100°C were found to reduce respirator integrity while temperatures of < 100°C may require a longer treatment time to effectively decontaminate.

Figure 2. Effect of dry heat decontamination on (a) the particle filtration efficiency and (b) the pressure drop across the filter. All of the experiments were repeated three times.
Retrospective case-control study of 1,050 asymptomatic people in 3 large COVID-19 clusters in Thailand between March and April 2020.

- People who had contact with COVID-19 index patients were questioned on mask wearing, social distancing, and hand hygiene.

- 211 (20.1%) tested positive for SARS-CoV-2 and were classified as cases, while 839 (79.9%) never tested positive and were classified as controls.

- Low odds ratios for developing COVID-19 among those who maintained ≥1m distance from a contact (adjusted OR 0.15, 95% CI 0.04 – 0.63) and who frequently washed their hands (aOR 0.33, 95% CI 0.13 – 0.87).

- Always wearing a mask more protective than sometimes wearing a mask (aOR 0.23, 95% CI 0.09 – 0.60 vs aOR 0.78, 95% CI 0.41 – 1.84, respectively).

** p-value <0.01, * p-value<0.05.
Face mask-wearing by 75% of US population, in absence of other control measures, flattened incidence curve and reduced:
- Infections by 37% (IQR 36.1%–39.4%);
- Hospitalizations by 44.2% (IQR 42.9%–45.8%); and,
- Deaths by 47.2% (IQR 45.5%–48.7%).

Combination of face mask-wearing and targeted shelter-in-place for those aged 50–64 most efficient strategy, decreasing attack rate, hospitalizations, and deaths by over 82%.

Identifying at least 33% of pre-symptomatic and asymptomatic infections can achieve epidemic control when there is 75% face mask-wearing and implementation of targeted shelter-in-place.

Modeling reduction of attack rate, hospitalizations, and at different levels of mask-wearing compliance, compared to no mask-wearing, in the absence of shelter-in-place strategies.
Researchers used cough aerosol simulator with a headform to propel small aerosol particles (0 to 7 µm) into different face coverings.

- N95 respirator blocked 99% of cough aerosol
- Procedure mask: 59%
- 3-ply cloth face mask: 51%
- Polyester neck gaiter: 47% as single layer (60% double layer)
- Face shield: 2%.

Mass of aerosol collected in each size fraction. The graph shows the amount of simulated respiratory aerosol that was collected from the collection chamber in each aerosol particle size fraction after a single simulated cough. The bars show the mean and standard deviation.
EFFECTIVENESS OF FACE MASKS IN PREVENTING AIRBORNE TRANSMISSION OF SARS-COV-2

- Experiment using nebulized mist containing SARS-CoV-2 and human head models, one as spreader unit to simulate mild cough and one as receiver unit to simulate inhalation. Units were situated various distances apart and wore masks of different types in various combinations. Virus “inhaled” into the receiver unit was quantified by plaque assay (live virus) and qRT-PCR (viral RNA).

- Increasing distance between spreader and receiver decreased the number of infectious particles inhaled.

- Cloth and surgical mask-wearing (respectively) at a distance of 50 cm (1.6 feet) resulted in (Figure 2):
  - 57%–58% and 73%–76% decrease in viral load and infectious virus titer, respectively, received when the spreader was masked.
  - 37%–50% and 17%–47% decrease in viral load and infectious virus titer, respectively, received when the receiver was masked.
  - 60%–71% and 68%–76% decrease in viral load and infectious virus titer, respectively, received when both the spreader and the receiver were masked.

Note: Adapted from Ueki et al. Percentage reduction in viral titer and viral RNA with cotton or surgical masks worn by “receiver” alone, “spreader” alone, or both “receiver” and “spreader,” compared with no masks. Licensed under CC 4.0.
ASSOCIATION OF COUNTY-WIDE MASK ORDINANCES WITH REDUCTIONS IN DAILY COVID-19 INCIDENT CASE GROWTH IN A MIDWESTERN REGION OVER 12 WEEKS

Longitudinal study in 5 metro counties in St. Louis, MO, of COVID-19 cases diagnosed between June 12 and September 25, 2020. During the study period, 2 counties instituted mandatory mask policies while the other 3 did not.

- Two counties with mandatory mask policies (M[+]) lower rates of new COVID-19 cases than 3 that did not (M[-]).
  - In 3 weeks preceding mandatory mask policies, average daily percent growth (ADPG) of reported COVID-19 cases similar [0.90% for M(+) vs 1.27% for M(-), p = 0.269].

- At 3 weeks after implementation, ADPG of COVID-19 cases was 1.08% for M(+) counties vs. 2.44% for M(-) counties.

- At 12 weeks after implementation, ADPG of COVID-19 cases was 1.36% for M(+) counties vs. 2.42% for M(-) counties (p <0.001).

Note: Daily average percent growth of reported COVID-19 cases among counties that implemented a mask ordinance on July 3 and those that did not.
Randomized controlled trial of 4,862 adults from April to June 2020 in Denmark to assess if surgical mask use reduced the wearers’ risk for SARS-CoV-2 infection.

Participants in mask group instructed to wear a mask when outside the home during next month.

During the study, mask use was uncommon, there was no official recommendation for mask wearing, and community prevalence was 2%.

42 (1.8%) participants in “mask recommendation” group diagnosed with SARS-CoV-2 compared to 53 (2.1%) participants in control group (OR = 0.82, 95% CI 0.54-1.23, p = 0.33).
Researchers tested 14 different face masks or mask alternatives and one mask material (not shown).

Light scattering properties. (A) Angle distribution (scattering phase function) for light scattered by a water droplet of 5 μm diameter for illumination with green laser light. Note the logarithmic radial scale. 0° is the forward direction, 180° the backward direction. The camera records at around 90°, indicated by the green segment (not to scale). (B) Calculated number of photons recorded by the camera in one frame as a function of the droplet diameter. The red shaded area and the two solid lines indicate the detection thresholds of the camera. For ideal conditions (all photons impinge on a single pixel), camera requires at least about 75 photons per frame corresponding to a droplet diameter of 0.1 μm; for photons distributed over multiple pixels, the threshold is around 960 photons and correspond to a diameter of 0.5 μm.
Droplet transmission through face masks. (A) Relative droplet transmission through corresponding mask. Each solid data point represents mean and standard deviation over 10 trials for 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).
There are 4 reasons to consider critically the information presented in the August 2020 Science Advances study by Fischer et al.:

- **Study tested *how to test masks***, not which are best to use. Researchers noted the experiment should only serve as a demonstration.

- **Study itself had a sample size (n=1)** and did not fully account for manufacturing information of neck gaiters or other masks analyzed.

- **Study only tested talking as a way to produce droplets**. Other methods of transmission should be evaluated (ex. coughing, sneezing, singing).

- **Author notes while measuring droplets is a reasonable measure**, this number doesn’t necessarily reflect spread of infection.