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Mask Facts

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Transmission of SARS-CoV-2

Note: A COVID-19 (SARS-CoV-2) particle is 0.125 micrometers (µm); influenza virus size is 0.08 – 0.12 µm; a human hair is about 150 µm.

*1 nm = 0.001 micron; 1000 nm = 1 micron; Micrometer (µm) is the preferred name for micron (an older term)

1 meter is = 1,000,000,000 nm or 1,000,000 microns

Droplets

- Virus is transmitted through respiratory droplets produced when an infected person coughs, sneezes or talks. Larger respiratory droplets (>5 µm) remain in the air for only a short time and travel only short distances, generally <1 meter. They fall to the ground quickly. [https://www.thelancet.com/journals/lanres/article/PIIS2213-2600\(20\)30245-9/fulltext](https://www.thelancet.com/journals/lanres/article/PIIS2213-2600(20)30245-9/fulltext)
 - This idea guides the CDC’s advice to maintain at least a 6-foot distance.
- Virus-laden small (<5 µm) aerosolized droplets can remain in the air for at least 3 hours and travel long distances. <https://www.nejm.org/doi/pdf/10.1056/NEJMc2004973?articleTools=true>

Air currents

- In air conditioned environment these large droplets may travel farther.
- However, ventilation — even the opening of an entrance door and a small window can dilute the number of small droplets to one half after 30 seconds. (This study looked at droplets from uninfected persons). This is clinically relevant because poorly ventilated and populated spaces, like public transport and nursing homes, have high SARS-

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CoV-2 disease transmission despite physical distancing. [https://www.thelancet.com/journals/lanres/article/PIIS2213-2600\(20\)30245-9/fulltext](https://www.thelancet.com/journals/lanres/article/PIIS2213-2600(20)30245-9/fulltext)

Objects and surfaces

- Person to person touching
- The CDC's most recent statement regarding contracting COVID-19 from touching surfaces: "Based on data from lab studies on Covid-19 and what we know about similar respiratory diseases, it may be possible that a person can get Covid-19 by touching a surface or object that has the virus on it and then touching their own mouth, nose or possibly their eyes," the agency wrote. "But this isn't thought to be the main way the virus spreads." <https://www.cdc.gov/media/releases/2020/s0522-cdc-updates-covid-transmission.html>.
- Chinese study with data taken from swabs on surfaces around the hospital https://wwwnc.cdc.gov/eid/article/26/7/20-0885_article?deliveryName=USCDC_333-DM25707
 - The surfaces where tested with the PCR (polymerase chain reaction) test, which greatly amplifies the viral genetic material if it is present. That material is detectable when a person is actively infected. This is thought to be the most reliable test.
 - Computer mouse (ICU 6/8, 75%; General ward (GW) 1/5, 20%)
 - Trash cans (ICU 3/5, 60%; GW 0/8)
 - Sickbed handrails (ICU 6/14, 42.9%; GW 0/12)
 - Doorknobs (GW 1/12, 8.3%)
 - 81.3% of the miscellaneous personal items were positive:
 - Exercise equipment
 - Medical equipment (spirometer, pulse oximeter, nasal cannula)
 - PC and iPads
 - Reading glasses
 - Cellular phones (83.3% positive for viral RNA)
 - Remote controls for in-room TVs (64.7% percent positive)
 - Toilets (81.0% positive)
 - Room surfaces (80.4% of all sampled)
 - Bedside tables and bed rails (75.0%)
 - Window ledges (81.8%)
 - Plastic: up to 2-3 days
 - Stainless Steel: up to 2-3 days
 - Cardboard: up to 1 day
 - Copper: up to 4 hours
 - Floor – gravity causes droplets to fall to the floor. Half of ICU workers all had virus on the bottoms of their shoes

Filter Efficiency and Fit

*Data from a University of Illinois at Chicago review

<https://www.cidrap.umn.edu/news-perspective/2020/04/commentary-masks-all-covid-19-not-based-sound-data>

- HEPA (high efficiency particulate air) filters – 99.97 – 100% efficient. HEPA filters are tested with particles that are 0.125 μm .
- Masks and respirators work by collecting particles through several physical mechanisms, including diffusion (small particles) and interception and impaction (large particles)
- N95 filtering facepiece respirators (FFRs) are constructed from electret (a dielectric material that has a quasi-permanent electric charge. An electret generates internal and external electric fields so the filter material has electrostatic attraction for additional collection of all particle sizes. As flow increases, particles will be collected less efficiently.
- **N95 – A properly fitted N95 will block 95% of tiny air particles down to 0.3 μm from reaching the wearer's face.** <https://www.honeywell.com/en-us/newsroom/news/2020/03/n95-masks-explained>.
 - **But even these have problems: many have exhalation valve for easier breathing and less moisture inside the mask.**
 - **Surgical masks are designed to protect patients from a surgeon's respiratory droplets, aren't effective at blocking particles smaller than 100 μm .** <https://webcache.googleusercontent.com/search?q=cache:VLXWeZBl7YJ:https://multimedia.3m.com/mws/media/9577300/respirators-and-surgical-masks-contrast-technical-bulletin.pdf+&cd=13&hl=en&ct=clnk&gl=us>
- Filter efficiency was measured across a wide range of small particle sizes (0.02 to 1 μm) at 33 and 99 L/min.
 - **N95 respirators had efficiencies greater than 95% (as expected).**
 - **T-shirts had 10% efficiency,**
 - **Scarves 10% to 20%,**
 - **Cloth masks 10% to 30%,** ←

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- Sweatshirts 20% to 40%, and
- Towels 40%.
- **All of the cloth masks and materials had near zero efficiency at 0.3 μm , a particle size that easily penetrates into the lungs.**
- Another study evaluated 44 masks, respirators, and other materials with similar methods and small aerosols (0.08 and 0.22 μm).
 - N95 FFR filter efficiency was greater than 95%.
 - Medical masks – 55% efficiency
 - General masks – 38% and
 - Handkerchiefs – 2% (one layer) to 13% (four layers) efficiency.
- **Conclusion: Wearing masks will not reduce SARS-CoV-2.**
 - **N95 masks protect health care workers, but are not recommended for source control transmission.**
 - **Surgical masks are better than cloth but not very efficient at preventing emissions from infected patients.**
 - **Cloth masks will be ineffective at preventing SARS-CoV-2 transmission, whether worn as source control or as personal protective equipment (PPE).**

"Masks may confuse that message and give people a false sense of security. If masks had been the solution in Asia, shouldn't they have stopped the pandemic before it spread elsewhere?"

*The first randomized controlled trial of cloth masks. <https://bmjopen.bmj.com/content/5/4/e006577>

- **Penetration of cloth masks by particles was 97% and medical masks 44%, 3M Vflex 9105 N95 (0.1%), 3M 9320 N95 (<0.01%).**
 - **Moisture retention, reuse of cloth masks and poor filtration may result in increased risk of infection.**
 - **The virus may survive on the surface of the face- masks**
 - **Self-contamination through repeated use and improper doffing is possible. A contaminated cloth mask may transfer pathogen from the mask to the bare hands of the wearer.**
- Cloth masks should not be recommended for health care workers, particularly in high-risk situations, and guidelines need to be updated.

*A study of 4 patients in South Korea

<https://www.acpjournals.org/doi/10.7326/M20-1342>

Known patients infected with SARS-CoV-2 wore masks and coughed into a Petrie dish. "Both surgical and cotton masks seem to be ineffective in preventing the dissemination of SARS-CoV-2 from the coughs of patients with COVID-19 to the environment and external mask surface."

*Singapore Study – Few people used mask correctly

<https://www.medpagetoday.com/infectiousdisease/publichealth/86601>

Overall, data were collected from 714 men and women. About half the sample were women and all adult ages were represented. Only 90 participants (12.6%, 95% CI 10.3%-15.3%) passed the visual mask fit test. About three-quarters performed strap placement incorrectly, 61% left a "visible gap between the mask and skin," and about 60% didn't tighten the nose-clip.

*A 2011 randomized Australian clinical trial of standard medical/surgical masks

https://onlinelibrary.wiley.com/doi/epdf/10.1111/j.1750-2659.2011.00198.x?fbclid=IwAR3kRYVYDKb0aR-su9_me9_vY6a8KVR4HZ17J2A_80f_fXUABRQdhQlc8W0

Medical masks offered no protection at all from influenza.

Conclusions from Organizations

The World Health Organization (WHO):

https://apps.who.int/iris/bitstream/handle/10665/331693/WHO-2019-nCov-IPC_Masks-2020.3-eng.pdf?sequence=1&isAllowed=y

"Advice to decision makers on the use of masks for healthy people in community settings

As described above, the wide use of masks by healthy people in the community setting is not supported by current evidence and carries uncertainties and critical risks."

"Medical masks should be reserved for health care workers. The use of medical masks in the community may create a false sense of security, with neglect of other essential measures, such as hand hygiene practices and physical distancing, and may lead to touching the face under the masks and under the eyes, result in unnecessary costs, and take masks away from those in health care who need them most, especially when masks are in short supply."

"Masks are effective only when used in combination with frequent hand-cleaning with alcohol-based hand rub or soap and water."

WHO acknowledges that most people do not use masks properly.

Dr. Nancy Messonnier, director of the Center for the National Center for Immunization and Respiratory Diseases:

<https://www.cdc.gov/media/releases/2020/t0131-2019-novel-coronavirus.html>

"We don't routinely recommend the use of face masks by the public to prevent respiratory illness," said on January 31.

"And we certainly are not recommending that at this time for this new virus."

The Centers for Disease Control and Prevention (CDC)

<https://www.cdc.gov/flu/professionals/infectioncontrol/maskguidance.htm>

In March 5, 2019 regarding the flu: "Masks are not usually recommended in non-healthcare settings; however, this guidance provides other strategies for limiting the spread of influenza viruses in the community:

- cover their nose and mouth when coughing or sneezing,
- use tissues to contain respiratory secretions and, after use, to dispose of them in the nearest waste receptacle, and
- perform hand hygiene (e.g., handwashing with non-antimicrobial soap and water, and alcohol-based hand rub if soap and water are not available) after having contact with respiratory secretions and contaminated objects/materials.

From the New England Journal of Medicine

<https://www.nejm.org/doi/full/10.1056/NEJMp2006372>

"We know that wearing a mask outside health care facilities offers little, if any, protection from infection. Public health authorities define a significant exposure to Covid-19 as face-to-face contact within 6 feet with a patient with symptomatic Covid-19 that is sustained for at least a few minutes (and some say more than 10 minutes or even 30 minutes). The chance of catching Covid-19 from a passing interaction in a public space is therefore minimal. In many cases, the desire for widespread masking is a reflexive reaction to anxiety over the pandemic."

Final Thoughts

- **Surgical masks – loose fitting. They are designed to protect the patient from the doctors' respiratory droplets. The wearer is not protected from others airborne particles**
- People do not wear masks properly. Most people have the mask under the nose. The wearer does not have glasses on and the eyes are a portal of entry.
- **The designer masks and scarves offer minimal protection – they give a false sense of security to both the wearer and those around the wearer.**
- ****Not to mention they add a perverse lightheartedness to the situation.**
- If you are walking alone, no mask – avoid folks – that is common sense.
- Remember – children under 2 should not wear masks – accidental suffocation and difficulty breathing in some
- **If wearing a mask makes people go out and get Vitamin D – go for it. In the 1918 flu pandemic people who went outside did better. Early reports are showing people with COVID-19 with low Vitamin D do worse than those with normal levels. Perhaps that is why shut-ins do so poorly.**

<https://www.medrxiv.org/content/10.1101/2020.04.08.20058578v4>

If you are sick, stay home!

Additional Resource: Healthy People Wearing Masks, Should They or Shouldn't They? This ER nurse with over two decades of experience took a deep dive into the science to find out: <https://jennifermargulis.net/healthy-people-wearing-masks-during-covid19/>

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