



Cloth Masks: What the Research Says

By Chet Zelasko, PhD

After reading about cloth masks, listening to numerous videos that so-called experts have put out, and getting more irritated all the time, I decided to pick a social media post and examine it point by point. While there were numerous referrals to studies, there were no scientific citations given. In one video, the citations were displayed on the screen and after freeze-framing numerous times, I picked up more citations there.

What this type of post does is remind me of the old style snake-oil salesman. They sneer at the pharmaceutical industry. They're condescending to other medical and scientific experts. And then they take what they call "research studies" and either completely misrepresent them or misinterpret the results to feed their narrative.

I finally had enough. Too many people seem to think this is a new topic, but it's not; researchers have been examining the effects of various kinds of masks for over 12 years—since the SARS-1 epidemic. So I spent several days tracking down the research, reading the articles, and writing my response. What follows is the narrative from one of the posts together with my response based on reading the study in the actual citation. As you'll see, things don't quite match up. Here are the facts from scientific research about wearing cloth masks during this or any other viral pandemic.

Claims from Social Media

"In Epidemics 2017, a meta-analysis concluded that masks had a non-significant protective effect."

No citation was given for the statement, but I tracked it down. According to the article, the randomized controlled trial included in the analysis suggested that the use of face masks is effective. [Epidemics 20 (2017) 1–20.]

From another article cited in the Epidemics article: "Results suggest that household transmission of influenza can be reduced by the use of non-pharmaceutical interventions, such as face masks and intensified hand hygiene, when implemented early and used diligently. Concerns about acceptability and tolerability of the interventions should not be a reason against their recommendation." [Suess et al. BMC Infectious Diseases 2012, 12:26.]

"In the Annals of Internal Medicine, April 2020, 'neither surgical nor cotton masks effectively filtered SARS-CoV-2 during coughs by affected people'."

This is the actual quote from the study on only four patients: "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." The re-writing of the conclusions means something slightly different from what was written. [<https://doi.org/10.7326/M20-1342>]

It's important to know **the article was retracted** because the methodology used could not precisely assess the viral load. [<https://doi.org/10.7326/L20-0745>.] To date, it hasn't been re-submitted.

“According to University of New South Wales, the widespread use of masks by healthcare workers may put them at increased risk of respiratory illness and viral infections, and their global use should be discouraged.”

There was no citation. The statement was not found in the press release or the research paper itself.

This is the actual quote: “However, as a precautionary measure, cloth masks should not be recommended for healthcare workers, particularly in high-risk situations, and guidelines need to be updated.” This applies to healthcare workers working with the most infectious patients. They should not be wearing cloth masks in a high-risk hospital setting unless more appropriate masks aren’t available.

[<http://dx.doi.org/10.1136/bmjopen-2014-006577>]

In response to many questions by healthcare workers about masks, the authors of that 2015 paper have published this:

“Health workers are asking us if they should wear no mask at all if cloth masks are the only option. Our research does not condone health workers working unprotected. We recommend that health workers should not work during the COVID-19 pandemic without respiratory protection as a matter of work health and safety. In addition, if health workers get infected, high rates of staff absenteeism from illness may also affect health system capacity to respond. Some health workers may still choose to work in inadequate PPE. In this case, the physical barrier provided by a cloth mask may afford some protection, but likely much less than a surgical mask or a respirator.”

“In the British Medical Journal 2015, ‘Over three times the risk of contracting influenza-like illness if a cloth mask is used versus no mask at all.’ Contaminated masks and masks holding moisture and pathogen retention can increase the risk of infection.”

This is the same article talked about in the prior comment. What it goes on to say in the 2020 update is that cloth masks should be washed between shifts. During breaks, the masks can be sanitized with alcohol or other disinfectants to reduce the risk of exposure. Again, this applies only to healthcare workers in close hospital settings. They should be wearing respirators if possible. But it doesn’t say a cloth mask is worse than no mask at all—it’s just not as effective, which we already knew.

“A 2016 study in the Journal of Exposure Science & Environmental Epidemiology found 97% of particles penetrated cloth masks, and 44% of particles penetrated medical masks. They reported that cloth masks are only marginally beneficial in protecting individuals from particles less than 2.5 micrometers.”

This study was examining the size of particulates of diesel engines and pollution for workers who worked in such facilities. Particulates are different from droplets, viruses, or anything related to COVID-19 transmission. [J Expo Sci Environ Epidemiol 27, 352–357 (2017). <https://doi.org/10.1038/jes.2016.42>. Difference in date due to epub versus journal publication.]



“As referenced in the New England Journal of Medicine, the size of coronavirus particles varied between 0.06 micrometers and 0.14 micrometers. Cloth and surgical masks do not have a fit test. When worn, gaps around the edges allow small particles to enter the respiratory system.”

Cloth masks are not designed to prevent the wearer from getting the virus; they're designed to potentially slow down the spread of the virus from the wearer to others. Combined with social distancing, they're effective. If we could all wear N95 masks, that may be better, but for now those must be reserved for healthcare workers due to their scarcity.

“According to the May 2010 edition of PLoS One, lack of eye protection was a primary risk factor of SARS-CoV transmission.” [Risk Factors for SARS Transmission from Patients Requiring Intubation: A Multicentre Investigation in Toronto, Canada. PLoS ONE 5(5): e10717. doi:10.1371/journal.pone.0010717.]

The statement is not implied in the article. This is what was actually stated with the important portion bolded: “Our highest estimated healthcare workers risk in GEE models was eye or mucous membrane exposure to body fluids (OR = 7.3), while in CART analysis, the primary healthcare workers-related risk factor was whether or not eye protection was worn. This should not be interpreted as meaning that conjunctival (eye) contact in particular is a primary mode of spread of SARS CoV: when exposure to droplet spray occurs, it is generally not possible to distinguish exposure to eyes versus other mucous membranes. **Absence of eye protection results in exposure of facial skin, and transmission could subsequently be from facial skin to hand to other mucous membrane.** It's also possible that absence of eye protection is a marker for reduced adherence to other precautionary measures for which adherence is not adequately captured by self-report.”

“Wearing a mask for seven hours straight may not be safe. Carbon dioxide (CO2) rebreathing has been recognized as a concern in the Ergonomics Journal.” [Ergonomics. 2013;56(5):781-90. doi: 10.1080/00140139.2013.777128.]

The two statements are not connected. It's a technical study on how CO2 in respiratory protective devices may build up. This has no relationship to wearing cloth masks.

“The CDC has also admitted that CO2 slowly builds up in the mask over time. This build-up can cause a condition called Hypercapnia. Essentially, CO2 poisoning can cause mild symptoms of drowsiness or a headache. More severe symptoms can cause shortness of breath and even death.”

Just like the prior post, the statements are not related. In the first part, the best I could find was that there was some build up in N95 respirators that may impact healthcare workers over long shifts. There's no application to cloth face masks. The remaining part of the statement is simply a definition and description of hypercapnia—again, not related to wearing cloth face masks.

“On May 6th, 2020, the New York Post reported the death of two boys dying within a week of each other while wearing a face mask during gym class.”

The death of the boys is true; they were students in Chinese phys ed classes. There's no proof the masks were the definitive cause of the deaths. In one case, the student was wearing an N95 mask, something that's not recommended during high-intensity activities. This is more about poor teaching, not cloth face masks.

“In February, the CDC said they don’t recommend people use face masks.”

Then, when more data was available, they changed their position. At that time the World Health Organization also advised people to wear a mask only if they’re displaying symptoms of coronavirus or “taking care of a person with a suspected 2019-nCoV infection.” That’s what all scientists do—they give you the best advice they have at that time and then improve on it as more information becomes available. There’s also a possibility that the CDC was concerned about reserving enough medical face masks for healthcare workers at that time before cloth masks became widely available.

Here is a link to see the [latest mask recommendations by the WHO](#). When the data changed, the WHO changed the recommendations as did the CDC.

“There is zero scientific evidence that wearing a mask, especially for more extended periods, protects us. However, several studies found significant problems with wearing one. Side-effects range from headaches to increased airway resistance, carbon dioxide accumulation, hypoxia, to more severe complications.”

There’s no scientific evidence to support those statements; they’re just someone’s unfounded guess.

“In the Head and Neck Pain Journal, most healthcare workers develop de novo PPE-associated headaches or exacerbation of their pre-existing headache disorders.”

This was taken from the journal Headache; there’s no journal named Head and Neck Pain Journal. [Headache. 2020 May;60(5):864-877. doi: 10.1111/head.13811] This was a study in Singapore, a survey not an actual testing of headache. What it fails to mention is that these were people who had pre-existing headache disorder and wore PPE including an N95 respirator greater than four hours per day. This has nothing to do with wearing a cloth face mask.

“When a person is infected with a respiratory virus, they will expel some of the virus with each breath. Wearing a mask creates a situation in which the individual continually breathes back in their viruses—breathing viruses back in raises the concentration of the virus in the lungs and nasal passages. It has been studied that those with a higher number of viral particles can develop a more severe illness.”

I could find no studies in any journal to confirm these statements. If it hasn’t been studied with N95 respirators or surgical face masks, it most definitely hasn’t been studied in cloth face masks. The final statement is most likely true but not in relation to the wearing of a cloth face mask.

“A recent study out of China published in the Lancet Journal reported a strong association between COVID-19 disease severity and the amount of virus present in the nose.”

I checked every study from China published in any of the Lancet journals. There are only two that published data on the viral load and collection locations. There was a single nasal sample collected in the study. Even if that single sample were considered, the sputum contains the highest viral load. The study also demonstrated that viral load was not predictive of severity of disease; it was how long the virus was present. Again, this has nothing to do with wearing a cloth face mask. [Lancet Infect Dis. 2020 Apr; 20(4): 411–412, Lancet Infect Dis. 2020 Jun; 20(6): 656–657]

“The Antimicrobial Resistance & Infection Control Journal demonstrated that breathing through N95 mask materials have been shown to impede gaseous exchange and impose an additional workload on the metabolic system of pregnant healthcare workers. The benefits of using an N95 mask to prevent serious emerging infectious diseases should be weighed against potential respiratory consequences associated with extended N95 respirator usage.”

This study was very well done. I especially liked the exercise data that mimicked the actual work environment of the healthcare workers. While the above quote is taken verbatim from the article, this next paragraph, to me, is the most significant part of the article.

“There were however no changes in the maternal and fetal heart rates, finger-tip capillary lactate levels and oxygen saturation, and rating of perceived exertion at the work intensity investigated.”

In short, what that means is that while the pregnant healthcare workers had to work a little harder during the study, there were no consequences to the mother or the baby. And again, this was done with N95 masks and has absolutely nothing to do with wearing a cloth face mask. [Respiratory consequences of N95-type Mask usage in pregnant healthcare workers—a controlled clinical study. Antimicrob Resist Infect Control 4, 48 (2015)]

“Wearing a mask could put you at a greater risk of getting COVID-19. Regular cloth or surgical masks irritate the user, causing the user to touch their face with dirty hands more often. Also the coronavirus spreads in droplets, which most masks do not block. These masks can actually trap droplets inside, increasing risk instead of reducing it.”

This was an opinion, not the result of any scientific study. There’s no question that touching the mask regularly could transfer a virus to the hands; that’s why frequent hand washing or sanitizing is required when wearing a cloth mask. But there’s no evidence that it increases someone’s risk of getting COVID-19. And think about this statement: the mask doesn’t block droplets but traps them inside. That’s not even logical. The mask either stops the droplets or it doesn’t, regardless of which way they’re traveling.

“Masks also hamper oxygen intake; the body and the immune system require optimal levels of oxygen to feed cells and fight off illness, including COVID-19. When studied, surgeons who wore surgical masks had a decrease in blood O2 saturation and an increase in pulse rates of the surgeons after the operations due to surgical mask usage.”

First, where did they find surgeons not wearing masks during surgery? That statement alone strains credulity.

The initial statement is simply an opinion based on commonly known physiological facts. Tying it to surgeons and surgical masks is inappropriate. I found the actual citation with those conclusions in a 2008 study cited below. But I also found another article published in 2012 that demonstrated under mild exercise conditions, similar to what might be found during surgery, low to moderate work rate is not associated with clinically significant physiological impact or significant subjective perceptions of exertion or heat. [Neurocirugia (Astur). 2008 Apr;19(2):121-6, Respir Physiol Neurobiol. 2012 Apr 15;181(1):29-35]



“According to the Journal of Biomedicines, our oxygen concentration is closely associated with cell survival and immune functioning, making one more susceptible to illness.”

This standalone statement is true. It has nothing to do with wearing a cloth mask.

“Blocking air even partially puts excess stress on thoracic muscles and the diaphragm, causing a person to feel out of breath. Wearing a mask can also make a person feel anxiety and panic. Claustrophobia and a feeling of suffocation must be acknowledged, especially among individuals who have Post-Traumatic Stress Disorder and other mental health issues.”

There are no citations that show any scientific proof of the many statements. I did find a single study that examined anxiety with the use of two masks: the N95 respirator and elastomeric half-face mask with dual-cartridges. There was a slight increase in anxiety with the dual-cartridge mask but none with the N95 respirator. There's no research to suggest panic, claustrophobia, or PTSD have any negative impact from wearing any type of face mask. Again this has nothing to do with wearing a cloth face mask.

“According to the Americans with Disabilities Act, if wearing a mask poses a mental or physical risk, there are exemptions.”

This is false. This is a statement from the Department of Justice: “The ADA does not provide a blanket exemption to people with disabilities from complying with legitimate safety requirements necessary for safe operations.”

“So, in summary, mask-wearing can be dangerous and is shown over and over again to be ineffective. It appears masks are more effective in helping to spread illness, by providing a surface for viruses to collect on, such as carrying a petri dish in front of your face.”

This summary is simply a statement that's not based on a single actual fact. What this represents is an attempt to use selective statements from research studies that the author does not cite in order to negatively influence readers from wearing cloth face masks or any other mask, for that matter. This is opinion unsupported by any facts. And if there are viruses floating around, I'd think you'd rather they accumulate on a mask rather than your face.

The Video

I decided to examine three studies from a video that says cloth face masks do not work. Here is what I found:

Study 1: N95 Respirators vs Medical Masks for Preventing Influenza Among Healthcare Personnel. JAMA. 2019;322(9):824-833. doi:10.1001/jama.2019.11645

This was a comparison between N95 respirator and the medical mask in a large randomized study of over 4,000 healthcare workers. The conclusion was that there were no differences between the use of either mask in the number of healthcare workers who were infected with a wide variety of viruses. It does not say they were not effective, just that one was no better than the others. This has no relationship to the use of cloth face masks as recommended during the current pandemic.

Study 2: Effectiveness of N95 respirators versus surgical masks against influenza: A systematic review and meta-analysis. J. Evid. Based. Med. doi.org/10.1111/jebm.12381

This study was a meta-analysis to examine the exact same question as the prior study: is there a difference between the N95 respirator and the surgical mask in preventing healthcare workers from catching a viral or bacterial infection? There were no statistically significant differences in preventing laboratory-confirmed influenza, laboratory-confirmed respiratory viral infections, laboratory-confirmed respiratory infection, and influenza-like illness using N95 respirators and surgical masks. Again, this has no relationship to the use of cloth masks.

Study 3: <https://bmjopen.bmj.com/content/5/4/e006577>

This was the same study used earlier regarding the use of cloth masks in hospital settings. You can re-read what was stated but in the update to the 2015 study, the researchers suggest that if the hospital runs out of PPE, then cloth masks are better than nothing.

The Bottom Line

I researched and wrote this paper to help readers make a decision about wearing a mask based on what they may have heard and what the research actually says. There are people who've not read the research but have an opinion on this topic. What is worse are the people who've actually read the research yet attempt to deceive by misstating the actual results of the research or not fully explaining what the research was really about.

I also found more studies that clearly support the use of masks in social situations to reduce the spread of viruses such as COVID-19. I've already written about the research in several Memos, beginning July 3, 2020, and the papers I found only strengthen the argument for cloth masks.

Here's the deal: there are three actions we can take to positively influence our little part of the world.

- First, wear a mask, cloth or otherwise, every time you enter a social setting. Every time. If it gets too damp, change to another one and wash it before using it again. If you can't, take some alcohol hand cleaner or alcohol spray and soak the inside and outside of the mask. Let it dry for a few minutes before putting it on, and make sure the alcohol is dry so you don't inhale it. It's important to use correct procedure when wearing or removing a mask, as shown in this video: [How to Safely Wear and Handle a Mask](#)
- Second, if you're going to be in a social setting where you may be in a group, social distance at least five to six feet except for people you live with, even if you're outdoors. I think most people do that in conversations anyway, but it's more important than ever now.
- Third, wash your hands frequently, especially if you've touched your mask. If you can't, use an alcohol-based hand sanitizer. It kills the virus on contact.

That's it. Be smart and if we all do it, we can keep the stores and restaurants open and maybe send the kids back to school. If we don't, things will get worse until the virus runs its course, and that could take years. You don't want that and I don't want that.

The research is absolutely clear in my opinion: wear the damn mask.

Dr. Chet Zelasko is dedicated to helping men and women get healthy and fit. As a health and fitness consultant with a PhD in Exercise Physiology and Health Education from Michigan State University, he provides health information based on the most recent research and delivers it in a way that's easy to understand. Whether in person during seminars, in audio recordings, or in the written word, he makes sense out of the health news people hear so they can make better health choices and achieve optimal health. He's conducted research and been published in peer-reviewed journals. He is certified by the American College of Sports Medicine as a Health and Fitness Specialist and has taught in ACSM certification workshops throughout the United States; he also belongs to the American Society of Nutrition. Although Grand Rapids, Michigan, is home, he has presented seminars on health to groups all over North America, Mexico, and the Caribbean and has written extensively on the health benefits of a good diet, regular exercise, and targeted supplementation.

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