

Survive & Thrive Guide[™]
Masks: The SCIENCE of Success

Charles Denham II MD

This article is a narrative summary of the short film entitled *Masks: The SCIENCE of Success* posted on the Med Tac Global website that provides access to free films and resources to families of the Essential Critical Infrastructure Workers of sixteen industry sectors and the general public.¹

“It is critical that we all take the personal responsibility to slow the transmission of COVID-19 and embrace the universal use of face coverings”

Dr. Robert Redfield, CDC Director

“There is no doubt that wearing masks protects you and gets you to be protected”

Dr. Anthony Fauci, National Institute of Allergy and Infectious Diseases Director

“We need to support mask wearing when I’m not in uniform I wear them their white they were very effective, and I think there are a great investment for the American people”

Admiral Brett Giroir, Assistant Secretary Health and Human Services

“It is not an inconvenience it is not a suppression of your freedom”

**Dr. Jerome Adams
U.S. Surgeon General**

“When you’re outside and not have the capability of maintaining distance, you should wear a mask at all times”

Dr. Anthony Fauci, National institute of Allergy and Infectious Diseases Director

This face covering actually is an instrument of freedom for Americans if we all use it.

**Dr. Jerome Adams
U.S. Surgeon General**

“Wear facial coverings were social distancing is not possible.”

**Dr. Alex Azar
Secretary Health and Human Services**

Please... please... please... wear a face covering when you go out in public”

**Dr. Jerome Adams
U.S. Surgeon General**

Survive & Thrive Guide[™]
Masks: The SCIENCE of Success
Charles Denham II MD

I am Dr. Charles Denham Chairman of TMIT Global and cofounder of the Med Tech Bystander Rescue Care Program founded to teach the general public lifesaving skills that dramatically increase survival from the most common emergencies before professional first responders can arrive. I am speaking on behalf of the terrific rapid response team that was assembled after the coronavirus crisis hit our communities. When we found out that there were no resources to help protect the families of critical essential infrastructure workers this team got to work.

So, who are critical essential infrastructure workers? They are our professional caregivers, first responders, and those who keep the food, power, water, and information flowing in our country. They work in sixteen industry sectors identified by the federal government. They have to go to work no matter what.

When we surveyed audiences of three national emergency response webinars, our research confirmed that both our caregiver families and those of the general public could be trained together. Secondly, that they really needed family training to deal with the crisis. Third, that they wanted to be trained together. So, we launched an ongoing coronavirus care community of practice and are producing videos, live webinars, and training certification programs to support them.^{2 3 & 4} SEE:

<https://www.medtacglobal.org/coronavirus-response/>

The Science of Masks

This topic addresses one of the most important things we can do to protect our families, those we love, our communities, and our country – masks. We address the science behind how they work and how you can use them to protect you and your family. Infection risk is just basic math. The greater the number of virus particles you potentially breathe or absorb, the greater the risk for infection and the greater the risk for severe disease. It's a numbers game - in medicine we call this dose or viral load. As a retired radiation oncologist had a high volume of radioactive surgical implant practice and served as a radiation safety officer for a major medical center, I find the principles of radiation safety and infection prevention are very much the same. In radiation safety we follow certain principles to reduce radiation dose. We maintain the most distance from the source, reduce the time close to the source or exposure time, and use barriers that will block the radiation. In the case of infectious agents, physical distance, reduced time close to infected patients, and the use of barriers like masks and face shields reduce the probability of absorption of the virus particles.

It is believed that individuals become infected by the virus entering the body through the wet mucous membranes that are the moist linings of our nose, eyes, mouth, and respiratory system. There are four pillars of safety the public must maintain. Masks have become increasingly recognized as critically important, however there no substitute for social or physical distancing which is most important, handwashing and avoiding touching our faces, and disinfecting high contact surfaces. Although masks are one of these four pillars, they all work together.

In our video by the same name as this brief article, we cover three types of mass that can be used. We cover the most important aspects of what each offer to both those who wear them and those who are in the community. It turns out that all three types of masks benefit everyone.

Survive & Thrive Guide[™]
Masks: The SCIENCE of Success
Charles Denham II MD

Some vocal champions of masks have stated that going without a mask is like drunk driving with a blindfold. You will know who you hurt or who will hurt you but the odds are against you. It has been said that you can no more defy the law of gravity than you can defy the laws of pandemics. If we infect a loved one and they die will never get over it.

Airborne Transmission: Droplets and Aerosols

It helps to understand the size of the Coronavirus. They are smaller than a micron or 1 millionth of a meter. The droplets that can carry the viruses are about 5 microns in size. A human hair might be 100 microns in diameter and a red blood cell might be 7 microns. Our vision as humans is limited to about 40 microns. So, what infects us is just too small to see. We can become infected by breathing droplets expelled by infected patients. Those who breath, talk, sing, cough, or sneeze can expel virus particles that are encased in droplets or what the public might call globs of mucus saliva and water. The bigger globs fall faster so they splash down quickly. Traditionally called droplets by scientists dating back to the 1930's, they were thought to fall rapidly onto anything nearby. Scientists thought they only drop within three to as far 6 feet from those infected. After new technologies were developed to study breath plumes and measure droplet spread, we now understand they may land much farther from the source.

Smaller droplets or globs evaporate faster than they fall, therefore the viruses can linger in the air and drift farther afield. These are called aerosols. On July 6, 2020 an open letter to the World Health Organization (WHO) in the *Clinical Infectious Diseases Journal* entitled *It is Time to Address Airborne Transmission of COVID-19*⁵ was published by 239 researchers regarding the risk for aerosol transmission through micro droplets smaller than 5 microns in size. In their opening paragraph of their commentary, they stated: *"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"*. The WHO responded to the article with an announcement of a briefing paper that will be forthcoming addressing all roots of spread. When released, we will update our repository on our website and include their analysis in our training films as soon as it is available⁶.

Professor Kimberly Prather, one of the researchers appealing to the WHO is the chair of Atmospheric Chemistry at the Scripps Institute of Oceanography published an excellent paper in *Science* on June 26.⁷ We use it as a guide in our film to help us explain the two types of airborne transmission of the coronavirus. She describes airborne transmission as a competition between droplet size inertia, gravity, and evaporation which determines how far it admitted droplets and aerosols will travel in the air. She describes in detail how droplets will undergo gravitational settling faster than they evaporate, thus contaminating high contact surfaces and leading to contact transmission. When we are close to someone and we inhale these larger droplets, it can be very dangerous. Aerosols are smaller and defined as less than 5 microns in size. They will evaporate much faster than they settle and are very buoyant. Thus, they can be affected by air currents which can transport them over longer distances even much farther than 6 feet. They can be inhaled deeply into the lower respiratory track where COVID-19 can do the most damage.

Survive & Thrive Guide™
Masks: The SCIENCE of Success
Charles Denham II MD

Many studies have shown that aerosols can hang in the air for hours. The extent and impact of aerosol spread is being studied and the science of airborne spread will be evolving rapidly, however all of the growing evidence supports it is likely occurring.

The physics of droplet spread, airflow, and the function of barriers are now being intensively studied by many scientists. One paper in the *Journal of Physics of Fluids*⁸ describes the modeling of air flow through and around the edges of mask. The paper underscores the value of masks and importance of fit or the seal between the mask and the face.

The research regarding the effectiveness of masks will continue to expand and will leverage new technologies such as lasers, digital imaging devices, and predictive analytics. For instance, *Florida Atlantic University*⁹ has undertaken a study simulating how far droplets might spread by replicating the physics of a cough. They compared the distance of droplet spread without a mask, with a bandanna alone, and likely projection through a two-layer cloth mask. The press reported this study and showed bandanna fared least well.

Guidelines for Masks

The eventual CDC announcement of recommendations for masks¹⁰ didn't surprise us because those of us in the field knew that the delay was due the lack of availability of masks and not a function of their effectiveness.

In a congressional testimony, Dr. Anthony Fauci was challenged regarding the delay in recommending mask use. **Congressman David McKinley of West Virginia: "Do you now regret not advising people more forcefully to wear masks earlier? Dr. Anthony Fauci: "Okay we are going to play that game. Let me explain to you what happened back then" That should be a yes or no question. No there's more than a yes and no by the tone of your question I don't regret that because let me explain to you what happened at that time there was a paucity of equipment that are healthcare providers needed to put themselves daily in harm's way of taking care of people who are ill we did not want to divert masks and PPE away from them to be used by the people as"** You can see from Dr. Fauci's testimony to Congress it was due to the lack of available masks for caregivers earlier in the crisis.¹¹

The CDC guidelines regarding the use of masks by the public had good evidence. They are based on the risk of asymptomatic patients who may never get symptoms spreading the virus as well as pre-symptomatic individuals who are the early stages of an infection and have just not yet experienced symptoms. It is highly probable that pre-symptomatic patients are a major transmission source of infection potentially representing 45% of the spread even before they have symptoms. The clearly symptomatic patients who know they have some form of illness represent 40% of the transmission spread of the infections. Pauci-symptomatic patients are those who have such mild symptoms that they may not realize it and just push through their activities. It is thought that approximately 10% of the infections come from the environment such as from high contact surfaces and objects. The asymptomatic and pauci-symptomatic patients may be a large group. These numbers are merely estimates and can lead to confusion because the categories are not black and white.

A typical sneeze may unleash as many as 40,000 droplets. These may carry virus particles that can not only cause direct spread to others but may land on surfaces, we come in contact with all the time. A

Survive & Thrive Guide™
Masks: The SCIENCE of Success

Charles Denham II MD

now frequently cited *New England Journal of Medicine* article¹² addressed the persistence of viable virus on high contact surfaces and that it can be suspended in the air and represent an aerosol risk. We are now watching this topic closely. A report from the *University of Nebraska* biocontainment experts¹³ commissioned by the CDC address shedding of the virus by patients and the same potential. Medical studies are addressing the distance that droplets can travel when someone sneezes and the NIH, CDC, and leading universities may continue to influence the national guidelines for the use of masks and modifications of social distancing¹⁴.

A study published by the NIH and picked up by the press on May 13, 2020 reported that speech droplets generated by asymptomatic carriers of the coronavirus are increasingly considered a mode of disease transmission. The study found that loud speech can generate thousands of oral fluid droplets per second and that they can last and stagnant air for 8 to 14 minutes. The conclusion of the authors of the study was that these observations confirm a substantial probability that normal speaking causes airborne transmission in confined environments.¹⁵

A Review of Masks

In our film, we provide a segment from Dr. Sanjay Gupta of CNN who put together a nice concise review of masks¹⁶. *“Now that we know about 25 to 50% of people are fretting-thematically we suggested before cloth facial coverings while the White House recommends we wear facemasks in public some states around the country have started making that mandatory signed an executive order which will require the wearing of masks or face coverings when inside any retail establishments many are left wondering which mask offers the best protection now when we talk about face coverings there are the surgical masks I wear in the hospital to protect patients from my own germs and avoid any splashes and then there are the end 95 respirator masks that must be fit tested in order to protect health care workers during certain procedures it’s the only one of these masks that prevents most very small particles from getting in when used properly we need to keep those masks in their hands then there are the disposable cloth masks which you combine a store and online they are made for surgery or for hospitals but are also widely used the city she has recommended that we all wear cloth facemasks like this one my daughter made this one when we got in public and we can’t physically distance from each other it should come as no surprise that these medical grade masks are more effective but that doesn’t mean we should dismiss the benefit of cloth masks let me show you take a look at this experiment done by researchers at the national institutes of health they use lasers to help show how far spit droplets travel through the air when we talk watch how far those green dots go when he speaks without the lasers these droplets might be invisible to the naked eye but now with the cloth we barely see anything patients come out in the form of the in the for the evening and not me contained range Lydia riba is a professor at MIT who studies the physics behind how diseases spread through coughing sneezing and breathing and then stopped to call in and will make drops further to do so you can see now why wearing a mask in addition to physical distancing is so important your germs can travel far and it should also clean ranks to become a source of contamination and you don’t have to be a whiz with a sewing machine like my daughter in a T-shirt or a bandanna will do ultimately it’s not having some form of barrier with multiple layers I do want to point out the CDC does not recommend face coverings for children under two for anyone who has trouble breathing or for people who can’t remove the cover without assistance and we take off your*

Survive & Thrive Guide™
Masks: The SCIENCE of Success

Charles Denham II MD

mask yet careful not that your eyes your face or anything outside of the mask keep it as clean as possible”.

Dr. Atul Gwande, one of our leading champions of patient safety provides a great review of the science of masks and social distancing in his first of a series of New Yorker magazine articles entitled: *Amid the Coronavirus Crisis, A Regimen for Reentry*¹⁷ on May 13, 2020. He cites a study in *Nature*¹⁸ reporting that surgical masks block 99% of respiratory droplets expelled by people with coronavirus’s or influenza viruses. The construction of the surgical masks is described as melt blown poly propylene fiber fabric that looks like cotton candy under a microscope. Electrostatic charge is applied to the fabric which is one of the functions that captures the viruses. Dr. Gwande cites a study in *Disaster Medicine and Public Health Preparedness*¹⁹ comparing surgical masks to cloth masks that showed that the surgical masks were three times better than cloth masks at blocking outward transmission of respiratory viruses. He further states that the benefit to the wearer may be limited, however laboratory research found they reduce inhalation of respiratory droplets by three quarters for the surgical masks and about half as much for the two layer cloth masks.²⁰ Lastly, Dr. Gwande references an extensive review of the research from an international consortium of scientists.²¹ He suggests that if at least 60% of the population were masks that were just 60% effective in blocking viral transmission which a well-fitting two-layer cotton mask, the epidemic could be stopped. The takeaway is that masks work to reduce transmission to the uninfected from both patients with known infections and those who are asymptomatic or pre-symptomatic. He proposes an expression regarding the basic logic: “I protect you...you protect me”. We highly recommend everyone follow his series in the *New Yorker*.

How Masks and HEPA Filters Work

We are often asked about how masks and HEPA filters (High Efficiency Particle Air filters) work. The science will help make sense of what we are hearing about masks in the press and save airflow on airlines. Masks work by a combination of filtration and electrostatic attraction that catch viruses. An electrostatic charge is put on N95 and surgical masks in the factories this helps them catch germs by attraction. The plus this really works the minus is that we have to be careful about how we might clean them for reuse in case the cleaning process removes the electrostatic charge.

N95 masks catch droplets and viruses with very refined filtration materials there specified to catch 95% of 0.3 micron particles and that’s how they get their name. N95 masks are typically used in hospitals when caregivers are performing medical procedures with clear aerosol risk. They must be fit tested using a method defined by the manufacturers to make sure there is no leakage around the seal of the mask and the face. Due to the resistance they generate without a fit test verification process, a surgical mask may offer more protection for the general public because more airflow may pass through the mask.

An N95 mask with a valve such as an industrial grade mask that lets airflow out will not afford protection to the public. Surgical masks catch droplets and viruses by both electrostatic attraction and filtration through the processes of physical interception and inertial impaction. These are just technical terms for how they physically catch the particles

Survive & Thrive Guide[™]
Masks: The SCIENCE of Success
Charles Denham II MD

Cloth masks only catch droplets and viruses by filtration. That's whether less breathable and less effective. HEPA high-efficiency particulate air filters which are in airliners in certain buildings work by three processes: inertial impaction, interception, and diffusion; but not by electrostatic attraction. We merely cover the highlights of these processes in our film and provide a more detail in our certification courses.

If you must care for a family member at home, remember to follow the directions of their caregiver at first thought it might seem like we would all want and 95 masks however the public has no way to be fit tested, there are not enough to go around, and professional caregivers need them.

If you were to care for someone at home who is sick, remember that you want to reduce the dose or the number of virus particles you might absorb. Your best defenses are distance, speed, and barriers. Keep your distance from the patient, minimize the time in the same room or nearby, and properly use barriers - a mask is a barrier. A good quality surgical mask will offer real protection. Many of our caregivers use them to take care of patients who are positive for coronavirus in our hospitals. As you will see they provide more protection than cloth masks make sure the infected patient wears one.

Summary Review for Certificate Candidates

The following summary review is for those of you who are seeking to do well on our certification courses. The same information applies to our medical, nursing, pharmacy, and college students, our professional first responders including law enforcement and lifeguards, our faith-based medical and security volunteers, our educators and schools at all levels, scout groups, teams and membership organizations and family seeking certificates to reduce insurance costs. The information we review will definitely end up on your quizzes and tests in our *CareUniversity* learning management platform.

In our film we use the graphics adapted from Dr. Prather's excellent article to review the scientific evidence for surgical and cloth masks. We do so because these are the masks that are most likely in use by our families on a daily basis. We address maximum exposure and the risk of droplets that are greater than 5 microns in size. Historically, we believed such droplets fall only 3 to 6 feet away from the person infected. However, recent studies have shown that these large droplets may be propelled much further. Aerosols are less than 5 microns in size, and they float in the air and float much farther than 6 feet or 2 m. Aerosols may represent a large proportion of the spread from presymptomatic and to a lesser degree asymptomatic patients. When we talk about emitting virus particles in the air we talk about viral shedding. Silent shedders are highly contagious before and may peak at the time of first symptoms. Speaking and breathing generate significant aerosols which put the public at risk. Social or physical distancing is based on studies of large respiratory droplets done in the 1930s prior to higher technology measuring capabilities. That's why we know that the 6 feet distance physical distance recommendation is probably a minimum. As we look back, airborne transmission was determined to have played a major role in the SARS outbreak in 2003. The SARS infection was transmitted greater than 6 feet from the index or the first patient infected according to the case studies.

As for minimizing exposure and risk, the N95 masks, surgical masks, and two layer cloth masks all have value to both the wearer and the public. Yes, both the wearer and the public. The public health

Survive & Thrive Guide™
Masks: The SCIENCE of Success

Charles Denham II MD

information here has been confusing and has evolved over time. There is much misinformation on the internet, however all of the leading scientists are in agreement that masks have value.

Every single country that is done well has implemented masks. In every country where the virus is out of control, masks have not been used across the population. Although it took time for the US coronavirus task force leadership acknowledged the value to both the wearer and the public of masks when there was a tremendous surge in multiple Southern states. It became very clear we needed them.

Dr. Deborah L. Birx, the lead epidemiologist on the task force made the following statement at a press conference in Texas: *“We know now that there is scientific evidence that masks both keep you from infecting others but may also partially protect you from getting infected. I think that is a new discovery and a new finding”*.²²

In the words of Dr. Anthony Fauci at a congressional briefing: *“There is no doubt no doubt that wearing masks protects you and gets you to be protected”*.²³

In our film summary review, we recap the evidence. Surgical masks block 99% of respiratory droplets expelled by people with coronavirus or influenza viruses. Surgical masks also reduce inhalation or breathing in of droplet size particles by 75%. Two-layer cloth masks reduce inhalation by half as much as the surgical masks and surgical masks are three times better than cloth masks at reducing expelled transmission of respiratory viruses.

It’s interesting to know that if at least 60% of the population wore masks that were just 60% effective in blocking viral transmission - which by the way a well-fitting two layer cloth mask is, the epidemic could be stopped. A two-layer cloth mask reduces inhalation of the virus by half as much as a surgical mask. Mask wearers were half as likely to get infected during the SARS outbreak.

We have covered a lot of numbers and references in our film and this summary. We have done so to help our medical nursing and scientific colleagues know where the evidence came from, however all the numbers start to swim together in our heads and we need to reduce the evidence to action.

In closing, let’s see if we can summarize what we can use that can properly inform our actions. The goal is to reduce the dose of virus we might breathe or absorb from others and the dose we might deliver to others. The dose is literally the number of viable viral particles to which anyone is exposed.

The most extreme risk to any of us is to be within 6 feet of an infected person for more than 15 minutes. The longer you’re close to somebody breathing the same air and touching the same surfaces, the more you are exposed. If you are in this high-risk group of having been within 6 feet of someone who has been infected, you may get a call from a contact tracer notify you. This means you must quarantine or get a COVID-19 test to assure you are free of disease. Follow the CDC guidelines as to when you can discontinue quarantine or isolation if you become infected.

When it comes to masks, at least where two-layer cloth mask. This likely reduces droplets you exhale and droplets you inhale both by 60%. Although of great value, masks cannot replace social or physical distance. If you wear a surgical mask it will reduce droplets you exhale by 99% and droplets you inhale droplets by 75%. The most protection is with an N95 mask. However, as we have discussed they need to

Survive & Thrive Guide[™]
Masks: The SCIENCE of Success
Charles Denham II MD

be fit tested to deliver optimal performance and professional caregivers have been given the priority for them. Many of our caregivers who are taking care of COVID-19 patients use good quality surgical masks in the hospital.

If you need to care for a loved one at home surgical masks are much better than cloth masks. As our patient safety hero Dr. Gwande has said “I protect you you protect me” is a great message. It is clear however, that no matter what kind of mask you wear if you use it properly you’ll have some protection. That in turn will help protect your family and those you love.

Final Reminders

We end our film with three quick final reminders. First is regarding the fit of the mask. If air is escaping around the edges of the mask, you are defeating its purpose. The better the seal, the better the protection. Second, don’t touch the mask when it’s on and when you remove it do so by the straps and wash your hands immediately after you remove it. You can become contaminated by the very device that is meant to protect you. Third do not be fooled by counterfeit masks that are flooding the market. Make sure if you’re buying an N95 mask or surgical mask that they are approved for medical use. Purchase them from a trusted source.

If you use cloth masks, make sure they are two layers thick and that they can work as a filter. Dr. Jerome Adams, the US Surgeon General has produced a video to demonstrate a quick process to create one from folded fabric. Cloth masks should be made of closely woven fabric. If you hold them up to the sun and can see through them, they are not adequate.

In our certification courses, we show how professional caregivers remove masks they will have to reuse after they’ve cared for someone with known covert 19. We show how to store them for reuse and how to make them last.

We are watching leading organizations including the World Health Organization, National Institutes of Health, specialty organizations and the Centers for Disease Control for updates in their guidelines and will be updating our films and resources accordingly.

An expression we are using is: “Wear a mask - save a life”. The life you save may be your own. For the professional caregivers, scientists, and anyone who wishes to review the evidence based medical and scientific articles that we cite in our films, we post them on our website. We hope they will be shared with families, friends and colleagues.

Our prayers are with you as you proceed through this crisis. We want to express a special thank you to our critical infrastructure workers as well - may God bless you for all you are do for us. We know you are putting your entire families at risk.

In closing, as we say to our Med Tech Bystander Rescue Care Teams - we have to fight the good fight, finish the race, and keep the faith. Everyone IS a patient and everyone CAN BE a caregiver.

Charles R. Denham on behalf of the
Med Tac Bystander Rescue Care Team

Survive & Thrive Guide™
Masks: The SCIENCE of Success

Charles Denham II MD

-
- ¹ CISA. April 17, 2020. Identifying critical infrastructure during covid-19. Available at: <https://www.cisa.gov/identifying-critical-infrastructure-during-covid-19>
- ² Coronavirus – Protecting You & Your Family Coronavirus Survive & Thrive Guide for Caregiver & Critical Worker Families, webinar May 21, 2020. <https://www.medtacglobal.org/coronavirus-response/https://www.safetyleaders.org/webinarmay2020/>
- ³ Pandemic Preparedness: Surfing the Next Wave TMIT Global Research Test Bed High Performer webinar. June 18, 2020 <https://www.safetyleaders.org/webinarjune2020/>
- ⁴ Family Survive & Thrive Guide™: The Latest Best Practices, July 2, 2020 <https://www.medtacglobal.org/march2020webinar/>
- ⁵ Morawska L, Milton D. 6-06-2020. *It is Time to Address Airborne Transmission of COVID-19*. Clinical Infectious Diseases. Available at: <https://academic.oup.com/cid/article/doi/10.1093/cid/cia939/5867798>
- ⁶ World Health Organization Response Regarding Airborne Transmission of COVID-19 07-07-20 <https://www.who.int/emergencies/diseases/novel-coronavirus-2019>
- ⁷ Prather K, Wang C, Schooley R. 6-26-2020. *Reducing transmission of SARS-CoV-2*. AAAS Science. Available at: <https://science.sciencemag.org/content/368/6498/1422>
- ⁸ Dbouk T, Drikakis, D. 16 June 2020. *On respiratory droplets and face masks*. Journal of Physics Fluids 32, 063303 (2020). Available at: <https://aip.scitation.org/doi/10.1063/5.0015044>
- ⁹ Galoustian G. 6-30-2020. *Seeing is believing: effectiveness of facemasks*. Florida Atlantic University News Desk. Available at: <https://www.fau.edu/newsdesk/articles/efficacy-facemasks-coronavirus.php>
- ¹⁰ CDC. 6-28-20. Considerations for Wearing Cloth Face Coverings. Available at: <https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/cloth-face-cover-guidance.html>
- ¹¹ Dr. Anthony Fauci Congressional Testimony – Original Mask Recommendations 06-23-20 <https://www.cnn.com/videos/health/2020/06/23/anthony-fauci-masks-question-vpx.cnn>
- ¹² Huang P. July 6, 2020. *Aerosols, Droplets, Fomites: What We Know About Transmission Of COVID-19*. Reuters. Available at: <https://www.npr.org/sections/goatsandsoda/2020/07/06/887919633/aerosols-droplets-fomites-what-we-know-about-transmission-of-covid-19>
- ¹³ Santarpia J, Rivera D. et al. 6-3-2020 *Aerosol and Surface Transmission Potential of SARS-CoV-2* medRxiv. Available at: <https://doi.org/10.1101/2020.03.23.20039446>
- ¹⁴ Bourouiba L PhD. 3-26-2020. *Turbulent Gas Clouds and Respiratory Pathogen Emissions-Potential Implications for Reducing Transmission of COVID-19*. JAMA Insights. Available at: <https://jamanetwork.com/journals/jama/fullarticle/2763852>
- ¹⁵ Stadnytski V, Bax C, et al. June 2, 2020. *The airborne lifetime of small speech droplets and their potential importance in SARS-CoV-2 transmission*. PNAS. Available at: <https://www.pnas.org/content/117/22/11875>
- ¹⁶ Gupta S. CNN. Which Masks Work and Why. Available at: <https://www.cnn.com/videos/health/2020/06/30/different-types-of-masks-effectiveness-covid-19-gupta-lead-vpx.cnn>
- ¹⁷ Gawande A. May 13, 2020. *Amid the Coronavirus Crisis, a Regimen for Reentry. Health-care workers have been on the job throughout the pandemic. What can they teach us about the safest way to lift a lockdown?* The New Yorker. Available at: <https://www.newyorker.com/science/medical-dispatch/amid-the-coronavirus-crisis-a-regimen-for-reentry>
- ¹⁸ Leung, N, Chu, D, et al. April 3, 2020. *Respiratory virus shedding in exhaled breath and efficacy of face masks*. naturemedicine. Available at: <https://rdcu.be/b49KF>

Survive & Thrive Guide[™]
Masks: The SCIENCE of Success

Charles Denham II MD

¹⁹ Davies A, Thompson K, Giri K, et al. *Testing the Efficacy of Homemade Masks: Would They Protect in an Influenza Pandemic?* Disaster Medicine and Public Health Preparedness - Cambridge University Press. Volume 7(4); 413-418. August 2013. Available at: <https://doi.org/10.1017/dmp.2013.43>

²⁰ Mueller A. et al. 5-18-20. *Quantitative Method for Comparative Assessment of Particle Filtration Efficiency of Fabric Masks as Alternatives to Standard Surgical Masks for PPE.* medRxiv. Available at: <https://doi.org/10.1101/2020.04.17.20069567>

²¹ Howard, J, et al. 4-12-2020. *Face Masks Against COVID-19: An Evidence Review.* Preprints. Available at: <https://doi:10.20944/preprints202004.0203.v1>

²² Dr. Birx CSPAN Press Conference, Dallas Texas 06-30-20 <https://www.c-span.org/video/?c4890214/user-clip-dr-birx-face-masks>

²³ *Dr Fauci Congressional Testimony* CHUCK WILL FIND LINK