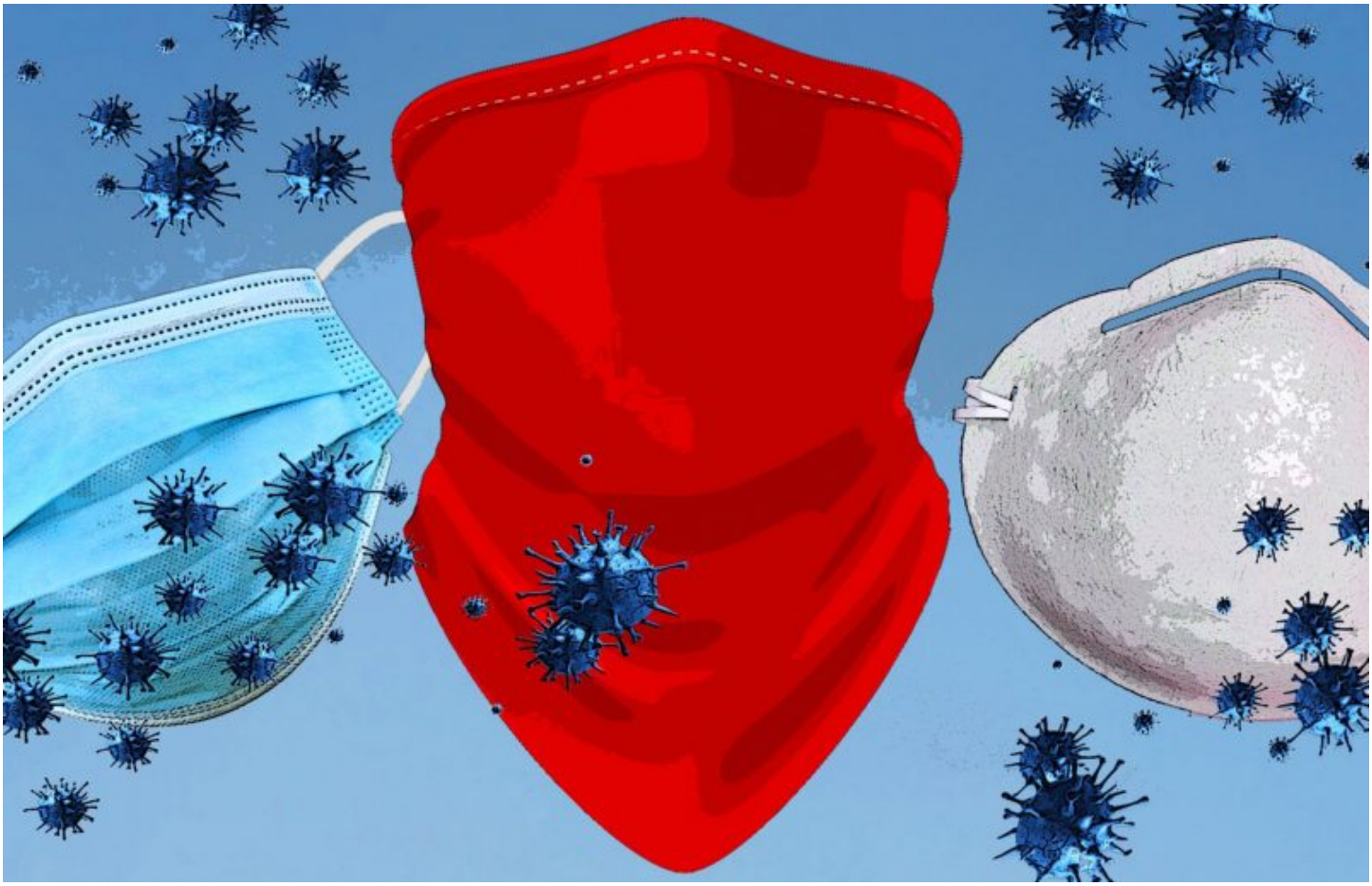
COVID-19 Masks:

How Effective *and* How Safe?



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Note 1: *All of this Report's Table of Contents sections above, are clickable links.*
In the Report, all of the underlined blue text are all also clickable links.

Note 2: *Physicist John Droz, jr is the editor of this report.*
Please Email him with any questions, corrections or additions.

Cover graphic credit.

Chapter 1: Introduction

The COVID-19 pandemic is clearly a complex, technical matter. But the good news is that Science exists **to give us answers to our technical issues**.

As such, every COVID-19 policy (e.g., about masks, vaccinations, therapies, etc.) should be firmly based on real Science. If they are, we will have a high degree of success.

Unfortunately, that is not happening, due to: **a)** bad actors who see this pandemic as an opportunity to make a financial profit or to gain political power, *and* **b)** well-intentioned parties who simply don't understand how to apply real Science to COVID-19 issues.

Currently the main challenger to real Science, is **political science** (*aka* politics). Citizens need to be on high alert for cases where political science is misrepresented as being real Science. That's a primary objective of all of our reports: **to separate the real from the pretender.**

This scientific study concluded that "public health has reneged on its core principles."

Whether masks are good or bad comes down to two questions: **a)** are they meaningfully effective in preventing COVID-19 transmission, *and* **b)** are they safe to wear?

> To answer those questions, we look to **Science**. This report — although scientific — is written for lay persons to be able to understand. Yes, a few parts of it are technical, but the topic is technical, so that's unavoidable.

Science's answer to both questions is **NO**. For a quick overview, just read the "Bottom Lines" at the end of each chapter, plus the Conclusion (Chapter 4), as those are written in plain English.

For those who want to delve deeper into the COVID-19 mask issue, about a hundred links are provided for them to do considerably more research, if that is their inclination.

For citizens who would like to get more educated on other aspects of COVID-19 (e.g., vaccinations, therapies, etc.) our webpage of Science-based COVID info is C19Science.info.

Note: we strongly recommend perusing Appendix A: Some Facts and Figures, *before* reading through the two chapters of studies on **effectiveness** and **safety** (the two primary concerns).

Note that nothing in this report should be misconstrued as giving medical advice. We recommend that for all medical issues that citizens consult with a licensed physician.

For all medical decisions patients should be well-educated — including getting information from different perspectives — so that with their physician they can make informed health decisions. This is essentially what is spelled out in the Nuremberg Code.

Chapter 2: Sample Mask Effectiveness Studies

1. Study: **Mask mandate and use efficacy in state-level COVID-19 containment**
   "We did not observe association between mask mandates or use and reduced COVID-19 spread in US states."

2. 29 Studies: **Masks for prevention of viral respiratory infections among health care workers and the public: PEER umbrella systematic review**
   A meta-analysis review that included 11 studies and 18 random control trials of 26,444 participants. This systematic review found limited evidence that the use of masks might reduce the risk of viral respiratory infections.

3. 16 Studies: **Effectiveness of personal protective measures in reducing pandemic influenza transmission**
   This meta-analyses concluded that regular hand hygiene provided a significant protective effect, and face mask use provided a non-significant protective effect.

4. Study: **Experimental investigation of indoor aerosol dispersion and accumulation in the context of COVID-19: Effects of masks and ventilation**
   This study published by the **American Institute of Physics** found that face masks reduced indoor aerosols by 12% at most — which is not enough to prevent infections.

5. Study: **Non-pharmaceutical Measures for Pandemic Influenza in Non-healthcare Settings-Personal Protective and Environmental Measures**
   The use of face masks, either by infected or non-infected persons, does not have a significant effect on influenza transmission.

6. Study: **Physical interventions to interrupt or reduce the spread of respiratory viruses**
   "There is moderate certainty evidence that wearing a mask makes little or no difference to the outcome of laboratory-confirmed influenza compared to not wearing a mask."

7. Study: **An Overview on the Role of Relative Humidity in Airborne Transmission of SARS-CoV-2 in Indoor Environment**
   Relative Humidity (RH) is an important factor responsible for airborne transmission of SARS-CoV-2 virus. In dry indoor areas, chances of airborne transmission are higher than humid areas. Indoor air at 40 to 60 percent RH is the optimum level for human health. Important to set minimum RH standard for indoor environments.

8. 29 Studies: **Effectiveness of Masks and Respirators Against Respiratory Infections in Healthcare Workers**
   This meta-analysis concluded that evidence of a protective effect of masks or respirators against verified respiratory infection was not statistically significant.

9. Study: **"Exercise with face mask; Are we handling a devil's sword?" – A physiological hypothesis**
   There is no evidence to suggest that wearing a mask during exercise offers any benefit from the droplet transfer from the virus. [This is noteworthy, as the argument is that although masks can not filter out the SARS-CoV-2 virus, that they may be able to filter out droplets that carry the SARS-CoV-2 virus. This study seems to say no.]

10. Study: **A cluster randomized trial of cloth masks compared with medical masks in healthcare workers**
    Penetration of cloth masks by influenza particles was almost 97 percent and medical masks 44 percent — so cloth masks are essentially useless, and "medical grade" masks don't provide adequate protection. This study is the first RCT of cloth masks, and the results caution against the use of cloth masks.
    [Note: influenza particles are over three times the size of the SARS-CoV-2 virus (see here), so it can be inferred that the filter efficiency for the SARS-CoV-2 virus would be worse.]

11. Study: **Surgical face masks in modern operating rooms – a costly and unnecessary ritual?**
    The wearing of face masks by non-scrubbed staff working in an operating room with forced ventilation seems to be unnecessary. [An argument from mask proponents is that wearing a mask protects others from you. This study seems to say no.]

12. Study: **Face mask against viral respiratory infections among Hajj pilgrims…**
    A large randomized controlled trial with 8000± participants, found that face masks "did not seem to be effective against laboratory-confirmed viral respiratory infections nor against clinical respiratory infection."

13. Study: **Simple respiratory protection–evaluation of the filtration performance of cloth masks and common fabric materials against 20-1000 nm size particles**
    "Results obtained in the study show that common fabric materials may provide marginal protection against nanoparticles, including those in the size ranges of virus-containing particles in exhaled breath." [SARS-CoV-2 virus is about .1 micron = 100 nm]

14. Study: **Respiratory performance offered by N95 respirators and surgical masks: human subject evaluation with NaCl aerosol representing bacterial and viral particle size range**
    "The study indicates that N95 filtering face piece respirators may not achieve the expected protection level against bacteria and viruses."

15. Study: **Analysis of the Effects of COVID-19 Mask Mandates on Hospital Resource Consumption and Mortality at the County Level**
    There was no reduction in per-population daily mortality, hospital bed, ICU bed, or ventilator occupancy of COVID-19-positive patients attributable to the implementation of a mask-wearing mandate.

16. Study: **Modeling of the Transmission of Coronaviruses, etc. in Dental Clinics**
The evidence suggests that transmission probability is strongly driven by indoor air quality — specifically ventilation — and the least by respiratory protection *via* mask use.

17. 16 Studies: **Evidence for Community Cloth Face Masking to Limit the Spread of SARS-CoV-2: A Critical Review**
This review looked at the quality of the studies *supporting* masking. "Of sixteen meta-analyses, eight were equivocal or critical as to whether evidence supports a public recommendation of masks, and the remaining supported a public mask intervention on limited evidence, primarily on the basis of the precautionary principle."

18. Study: **Aerosol penetration and leakage characteristics of masks used in the health care industry**
"We conclude that the protection provided by surgical masks may be insufficient in environments containing potentially hazardous sub-micrometer sized aerosols." [Note: the SARS-CoV-2 virus is a sub-micrometer sized particle.]

19. 3 Studies: **Disposable surgical face masks for preventing surgical wound infection in clean surgery**
"We included three trials, involving a total of 2106 participants. There was no statistically significant difference in infection rates between the masked and unmasked group in any of the trials."

20. 2 Studies: **Disposable surgical face masks: a systematic review**
"Two randomized controlled trials were included involving a total of 1453 patients. …in a large trial there was no difference in infection rates between the masked and unmasked group."

21. Study: **Face seal leakage of half masks and surgical masks**
"The filtration efficiency of the filter materials was good, over 95%, for particles above 5 micron in diameter but great variation existed for smaller particles." Coronavirus is .1± microns, therefore these masks would not offer good protection from that virus.

22. Study: **Comparison of the Filter Efficiency of Medical Non-woven Fabrics against Three Different Microbe Aerosols**
"The filter efficiencies against influenza virus particles were the lowest."
[Note: influenza particles are over three times the size of the SARS-CoV-2 virus (see here), so it can be inferred that the filter efficiency for the SARS-CoV-2 virus would be worse.]

23. Study: **Aerosol penetration through surgical masks**
"Although surgical mask media may be adequate to remove bacteria exhaled or expelled by health care workers, they may not be sufficient to remove the sub-micrometer size aerosols containing pathogens." [The SARS-CoV-2 virus is sub-micrometer.]

24. 6 Studies: **Effectiveness of N95 respirators versus surgical masks against influenza: A systematic review and meta-analysis**
This meta-analysis was of six Randomized Controlled Trials (RCTs) involving 9,171 participants. The conclusion: "the use of N95 respirators compared with surgical masks is not associated with a lower risk of laboratory- confirmed influenza. It suggests that N95 respirators should not be recommended for the general public."

25. Study: **N95 Respirators vs Medical Masks for Preventing Influenza Among Health Care Personnel: A Randomized Clinical Trial**
"2371 participants completed the study and accounted for 5180 HCW-seasons. ... Among outpatient health care personnel, N95 respirators vs medical masks as worn by participants resulted in no significant difference in the incidence of laboratory-confirmed influenza."

26. Commentary: **Universal Masking in Hospitals in the COVID-19 Era**
An article in the **New England Journal of Medicine** (written by five physicians) came to the conclusion that face masks offer little to no protection in everyday life.

27. Study: **Masking lack of evidence with politics**
"It would appear that despite two decades of pandemic preparedness, there is considerable uncertainty as to the value of wearing masks."

28. 12 Studies: **Face masks to prevent transmission of influenza virus: a systematic review**
In this meta-analysis of twelve studies, the authors found little data to support the use of face masks to prevent wearers from becoming infected.

29. Study: **Use of surgical face masks to reduce the incidence of the common cold among health care workers in Japan: a randomized controlled trial**
Face mask use in healthcare workers has not been demonstrated to provide benefit in terms of colds symptoms or getting colds.

30. Study: **Effectiveness of Adding a Mask Recommendation to Other Public Health Measures to Prevent SARS- CoV-2 Infection in Danish Mask Wearers**
The COVID-19 infection results between mask wearers and the control group were not statistically significant.

31. CDC: "CDC is not aware of any randomized controlled trials that show that masks, or double masks, or cloth face coverings are effective against COVID-19."

32. Study: **Testing the efficacy of homemade masks: would they protect in an influenza pandemic?**
"Our findings suggest that a homemade mask should only be considered as a last resort to prevent droplet transmission from infected individuals." [Note that droplets are significantly larger than the SARS-CoV-2 virus.]

33. Study: **Evaluating the efficacy of cloth face masks in reducing particulate matter exposure**
"Our results suggest that cloth masks are only marginally beneficial in protecting individuals from particles <2.5 micron." [Coronavirus is .1± micron.]

34. Study: **Assessment of Proficiency of Mask Donning Among the General Public in Singapore**
The survey was administered to 2499 adults, who were given instructions for proper mask use. Subsequently, only 12.6% passed the Visual Mask Fit (VMF) test. This would indicate that the compliance of children would be lower yet.

35. 17 Studies: **The use of masks and respirators to prevent transmission of influenza: a systematic review of the scientific evidence**
Seventeen studies were reviewed in this meta-analysis. "None of the studies we reviewed established a conclusive relationship between mask / respirator use and protection against influenza infection."
[Note: influenza particles are over three times the size of the SARS-CoV-2 virus (see here), so it can be inferred that the filter efficiency for the SARS-CoV-2 virus would be worse.]

36. Study: **Facial protection for healthcare workers during pandemics: a scoping review**
This study used 5462 peer-reviewed articles and 41 grey literature records. Conclusion: "The COVID-19 pandemic has led to critical shortages of medical-grade PPE. Alternative forms of facial protection offer inferior protection."

37. Study: **Particle removal from air by face masks made from Sterilization Wraps: Effectiveness and Reusability**
"We found that 60 GSM face mask had particle capture efficiency of 94% for total particles greater than 0.3 microns." [These are better quality masks than standard cloth masks, so cloth masks would provide little effectiveness for the .1 micron SARS-CoV-2 virus.]

38. Study: **Visualizing the effectiveness of face masks in obstructing respiratory jets**
A few studies have considered the filtration efficiency of homemade masks made with different types of fabric; however, there is no broad consensus regarding their effectiveness in minimizing disease transmission.

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CHAPTER 2, EFFECTIVENESS, BOTTOM LINE:

There are multiple variables involved in the mask situation — from type of mask worn, how well it fits, how often a specific mask is worn, how hygienic the wearer is in general, etc.

Let's look at a worst case scenario: a COVID-19 infected person, three feet away, sneezes on you. *Will a mask meaningfully reduce your chances of getting infected?*

> Clearly any mask will somewhat filter you breathing in the SARS-CoV-2 virus transmitted by aerosol and droplets. However, you will still inhale some of the SARS-CoV-2 virus (the amount would depend on the mask quality).
>
> Further, your face, hair, clothes, hands, etc will all have the SARS-CoV-2 virus on them. Without immediately discarding your clothes and taking a shower, the likelihood of you transmitting the SARS-CoV-2 virus into your respiratory track is almost 100% certain. So the answer to the question (*Will a mask meaningfully reduce your chances of getting infected?*) is **NO**.

Another way to look at the effectivity question is: o*n average, how much is a mask going to reduce the inhalation of the SARS-CoV-2 virus?* Based on the studies cited above (plus the multiple variables involved (also see above), a good scientific guess is:

a) an N95 medical quality mask, 10% to 40%, *and* **b)** cloth mask, 0 to 5%.

In other words, the Science says that the benefit of wearing a mask to protect yourself (or others) from COVID-19, is small — as they are NOT meaningfully effective.

The argument could be made that any reduction of the SARS-CoV-2 virus is a benefit, and indeed it is. The question here though, is: are there any **adverse health consequences** for wearing a mask, especially for children, that would negate any small benefit masks provide?

Only after we know the scientific answer for that, can we approximately determine what the **NET benefit** is for mask wearing.

Chapter 3 provides sample scientific studies about mask safety.

Chapter 3: Sample Mask Safety Studies

1. 24 Studies: **Does Universal Mask Wearing Decrease or Increase the Spread of COVID-19?**
   "A survey of peer-reviewed studies shows that universal mask wearing (as opposed to wearing masks in specific settings) does not decrease the transmission of respiratory viruses from people wearing masks to people who are not wearing masks. Further, indirect evidence and common sense suggest that universal mask wearing is likely to increase the spread of COVID-19."

2. Study: **Results of a Germany-wide registry on mask mouth and nose covering in children**
   "Impairments caused by wearing the mask were reported by 68% of the parents. These included irritability (60%), headache (53%), difficulty concentrating (50%), less happiness (49%), reluctance to go to school (44%), malaise (42%), impaired learning (38%), and drowsiness or fatigue (37%)."

3. Report: **Dangerous pathogens found on children's face masks**
   Concerned parents sent 6 face masks worn by their children to the University of Florida Lab for analysis of contaminants. This June 2021 report, details the findings:
   "The analysis detected the following 11 dangerous pathogens on the masks: *Streptococcus pneumoniae* (pneumonia), *Mycobacterium tuberculosis* (tuberculosis), *Neisseria meningitidis* (meningitis, sepsis), *Acanthamoeba polyphaga* (keratitis and granulomatous amebic encephalitis), *Acinetobacter baumanni* (pneumonia, bloodstream infections, meningitis, UTIs—resistant to antibiotics), *Escherichia coli* (food poisoning), *Borrelia burgdorferi* (causes Lyme disease), *Corynebacterium diphtheriae* (diphtheria), *Legionella pneumophila* (Legionnaires' disease), *Staphylococcus pyogenes serotype M3* (severe infections—high morbidity rates), *Staphylococcus aureus* (meningitis, sepsis)."

4. Report: **Masks, false safety and real dangers: Microbial challenges from masks**
   "Bacteria are on average ten times the size of viruses, and have less penetration through masks. Therefore, at least part of the re-circulated flow of bacteria in aerosolized and droplet exhalation does not escape the vicinity of the oral and nasal environment. Bacteria and other microbes are not only retained in this space, but masks themselves are warm, moist repositories of these microbes."

5. Study: **Virus interactions with bacteria: Partners in the infectious dance**
   A bacteria infection from a mask can make the wearer more susceptible to a SARS-CoV-2 viral (or other) infection, as well as set the stage for more serious adverse COVID-19 outcomes. (See also this and this.)

6. Study: **Headaches and the N95 face-mask amongst healthcare providers**
   "Healthcare providers may develop headaches following the use of the N95 face-mask."

7. Study: **Impact of the COVID-19 Pandemic on Early Child Cognitive Development: Initial Findings in a Longitudinal Observational Study of Child Health**
   They report a cognition drop of 23% since the beginning of the pandemic, and partly blame masks. "Masks worn in public settings and in school settings may impact a range of early developing skills, such as attachment, facial processing, and socio-emotional processing."

8. Study: **Experimental Assessment of Carbon Dioxide Content in Inhaled Air With or Without Face Masks in Healthy Children**
   This randomized clinical trial concluded that: wearing masks leads to impairments attributable to hypercapnia. A recent review concluded that there was ample evidence for adverse effects of wearing such masks. We suggest that decision-makers weigh the hard evidence produced by these experimental measurements accordingly, which suggest that children should not be forced to wear face masks.

9. Study: **Preliminary report on surgical mask induced deoxygenation during major surgery**
   The increased rate of infection in mask-wearers may be due to a weakening of immune function during mask use. Surgeons have been found to have lower oxygen saturation after surgeries even as short as 30 minutes. Low oxygen induces hypoxia-inducible factor 1 alpha (HIF-1). This in turn down-regulates CD4+ T-cells, which are necessary for viral immunity.

10. Report: **Mask mandates may affect a child's emotional, intellectual development**
    This physician writes about some of the emotional and intellectual liabilities that face masks can have on children. Unfortunately, these consequences will not likely be seen until sometime into the future. [Here is a related report.]

11. Report: '**Mask mouth' is a seriously stinky side effect of wearing masks**
    "We're seeing inflammation in people's gums that have been healthy forever, and cavities in people who have never had them before," says dentist Dr. Rob Ramondi. "People tend to breathe through their mouth instead of through their nose while wearing a mask. The mouth breathing is causing the dry mouth, which leads to a decrease in saliva — and saliva is what fights the bacteria and cleanses your teeth." He adds that "saliva is also what neutralizes acid in the mouth and helps prevent tooth decay and gum disease. Gum disease — or periodontal disease — will eventually lead to strokes and an increased risk of heart attacks," says Dr. Marc Sclafani.

12. Video: **Trans Cranial Doppler test to show mask effects on brain blood circulation, etc.**
    This short video shows that even reading a book with a mask on, decreases blood oxygen levels to your brain.

13. Study: **Headaches Associated With Personal Protective Equipment – A Cross-Sectional Study Among Frontline Healthcare Workers During COVID-19**
    Most healthcare workers develop new headaches, or exacerbation of their pre-existing headache disorders.

14. Study: **The adverse skin reactions of health care workers using personal protective equipment for COVID-19**
    95.1% of health care workers had adverse skin reactions to the N95 mask.

15. Report: **Your Mask May Be Causing Candida Growth in Your Mouth**
    "Now that mask wearing is becoming the norm, we're more susceptible to mask-induced skin problems. Maskne (mask acne) is more common, but a candida infection is also possible." [Also see this related article.]

16. Commentary: **Can the Elastic of Surgical Face Masks Stimulate Ear Protrusion in Children?**
    "Pre-adolescent children have undeveloped auricular cartilage with less resistance to deformation; prolonged pressure from the elastic loops of the mask at the hollow or, even worse, at the anthelix level can influence the correct growth and angulation of the outer ear."

17. Study: **An empirical and theoretical investigation into the psychological effects of wearing a mask**
    This study shows that wearing COVID-19 face masks can produce at least four altered behaviors. This could be particularly troublesome for young children, in formative stages.

18. Study: **Effects of surgical and FFP2/N95 face masks on cardiopulmonary exercise capacity**
    "Ventilation, cardiopulmonary exercise capacity and comfort are reduced by surgical masks and highly impaired by FFP2/N95 face masks in healthy individuals."

19. Study: **The physiological impact of wearing an N95 mask during hemodialysis as a precaution against SARS in patients with end-stage renal disease**
    Wearing an N95 mask for 4 hours during this operation significantly reduced PaO2 (Partial Pressure Oxygen) and increased respiratory adverse effects in these patients.

20. Report: **COVID-19: Face Masks and People with Disabilities**
    Universal mask requirements present difficulties for some people with disabilities who cannot wear masks either at all or for an extended period of time. In addition, some people with disabilities cannot communicate effectively with another person if the other person is wearing a mask. Examples include deaf and hard of hearing people and some people with intellectual, developmental, or processing disabilities.

21. Study: **Adolescents' face mask usage and contact transmission in novel Coronavirus**
    Face masks — especially as used by younger people — can have their surfaces become contamination sources, which has health consequences. Students are storing them in their pockets, bags, putting them on tables, people are reusing them etc.

22. Study: **Exercise with face mask – A physiological hypothesis**
"Exercising with face masks may reduce available Oxygen and increase air trapping preventing substantial carbon dioxide exchange. The hypercapnic hypoxia may potentially increase acidic environment, cardiac overload, anaerobic metabolism and renal overload, which may substantially aggravate the underlying pathology of established chronic diseases."

23. Study: **Is a Mask That Covers the Mouth and Nose Free from Undesirable Side Effects in Everyday Use and Free of Potential Hazards?**
"The aim was to find, test, evaluate and compile scientifically proven related side effects of wearing masks. For a quantitative evaluation, 44 mostly experimental studies were referenced, and for a substantive evaluation, 65 publications were found. The literature revealed relevant adverse effects of masks in numerous disciplines. In this paper, we refer to the psychological and physical deterioration as well as multiple symptoms described because of their consistent, recurrent and uniform presentation from different disciplines as a Mask-Induced Exhaustion Syndrome (MIES)… Extended mask-wearing by the general population could lead to relevant effects and consequences in many medical fields."

24. Report: **The Mask Con** — Mask Anxiety is real
Here a psychologist identifies 18 Ways to Manage Mask Anxiety.

25. Short Video: **Mask Production**
This is an Indonesian "factory" that produces a lot of masks. Does this look a hygienic environment? This is what some of us are getting when we purchase online or in stores that sell them in bulk. The unsanitary manufacture of some masks raises these questions:
- Can masks shed fibers or micro plastics that we can breathe in?
- Do these masks excrete chemical substances that are harmful when inhaled?
- Clothing dye can cause reactions, so how do we know that the manufacturing process of these masks do not pose a risk to us?

26. Study: **Respiratory consequences of N95-type Mask usage in pregnant healthcare workers**
"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, and this needs to be taken into consideration in guidelines for respirator use. The benefits of using N95 mask to prevent serious emerging infectious diseases should be weighed against potential respiratory consequences associated with extended N95 respirator usage."

27. Study: **Use of surgical face masks to reduce the incidence of the common cold among health care workers in Japan: a randomized controlled trial**
"Subjects in the mask group were significantly more likely to experience headache during the study period." [Note: the SARS-CoV-2 virus is about three times the size of the most common cold virus, rhinovirus (see here).]

28. Study: **Physiological impact of the N95 filtering face piece respirator on healthcare workers**
"Conclusions: In healthy healthcare workers, the respirator did not impose any important physiological burden during 1 hour of use, at realistic clinical work rates. However, the respirator dead-space carbon dioxide and oxygen levels were significantly above and below, respectively, the ambient workplace standards."

29. Article: **Improper use of medical masks can cause infections**
Children are much more likely to improperly use face masks. Further, the physician here says: "We use N95 masks only in intensive care while caring for patients; it is unnecessary for the citizen to use them under any circumstances."

CHAPTER 3, SAFETY, BOTTOM LINE:

As stated at the end of Chapter 2: there are *multiple* variables involved in the mask situation — from type of mask worn, how well it fits, how often a specific mask is worn, how clean the mask is, how hygienic the wearer is in general, etc.

The *safety* of mask wearing is directly correlated to some of these variables. Unfortunately, there is a reverse correlation with effectiveness: **The higher the mask filtration, the more likely it is that the mask wearer will suffer adverse health consequences.** (See cited studies.)

Some of the potential problematic health consequences from wearing masks that are identified in the studies above are:

- ✓ Headaches
- ✓ Impaired learning and cognition
- ✓ Brain deoxygenation (*unknown consequences*)
- ✓ Difficulty concentrating
- ✓ Increased anxiety and irritability
- ✓ At least four possible psychological problems (*disinhibition, transformation, etc.*)
- ✓ Facial acne and other skin infections
- ✓ Candida/Thrush mouth infections
- ✓ Dental gum disease (*can eventually lead to strokes and an increased risk of heart attacks*)
- ✓ Possible ear mis-development in children
- ✓ Bacterial exposure from a mask (*A bacteria infection would make the wearer more susceptible to catching COVID-19*)
- ✓ A weakening of immune function during mask use
- ✓ Possible aggravation of underlying pathology of established chronic diseases

In other words, the Science says that wearing a mask is NOT safe, especially for children.

Chapter 4: Conclusions

To make relevant conclusions here, we need to carefully assess how well masking meets COVID-19 policy objectives. Those objectives are to minimize the chances of:

— a mask wearer getting infected, from a nearby person with COVID-19, *and*
— a mask wearing individual with COVID-19, infecting a nearby person.

In theory, those objectives are commendable. The fly in the soup is that in our zeal to do *something*, there are other significant considerations that are often not factored in. For example, in implementing any COVID-19 rules and regulations, it is important that they:

- be genuinely based on real Science (e.g., not based on fear),
- be consistent with other health policies,
- not cause any serious health consequences,
- do not unnecessarily extract civil rights from citizens, *and*
- be a scientifically provable net societal benefit.

THIS REPORT'S BOTTOM LINE:
Mask mandates (especially for children in a school setting), violate all five (5) of the above health care policy caveats. In other words, a mask is unlikely to be a Net Benefit to the wearer or the public.

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A quick overview of the COVID-19 mask policy situation:

a) Our main exposures to COVID-19 are from *surface contacts* and *airborne transmission.*
b) Current scientific evidence indicates that aerosol is the main airborne transmission source.
  i) Any cloth or non-medical mask has extremely low effectiveness against aerosols.
  ii) An N95 mask, worn properly, has limited effectiveness against COVID-19 aerosols.
c) The potential health risks for wearing a mask are substantial, particularly for children.
  i) The mortality risk to children, with proper post-infection treatment, is almost zero.
  ii) **The higher the mask filtration, the more negative the mask health consequences**.
  iii) The net effect of wearing a mask, especially for children, is negative.
d) The vaccination status of you or others, has no bearing on mask effectiveness (or safety).
e) If educated adults choose to wear a COVID-19 mask, they should be free to do so.
f) A mask mandate is likely based on good intentions, but there are other (more effective) measures that can be taken to protect the health of citizens, e.g.:
  i) Frequent hand cleaning.
  ii) Social distancing.
  iii) Education regarding the importance of optimizing our immune system.
  iv) Having science-based therapies readily available for newly infected citizens.
  v) Offering citizens the option of getting a vaccination.
  vi) For more details about school suggestions, see here.

Appendix A: Some Facts and Figures

- A meta-analysis is not new research, but rather is an analysis of a collection of studies (e.g., to see if they are in agreement, etc.). Meta-analyses are where we wrote "xx Studies." Since we are simplifying here, we lumped clinical trials and studies together.
- This study states that the SARS-CoV-2 virus is about .1 micron in size. Airborne transmission of this size particle, by itself, would be by aerosol. (See CDC's comments.)
- In some cases the SARS-CoV-2 virus is carried by a larger (e.g., water) molecule. However those larger molecules would normally drop quickly, so go only short distances (a few feet). A sneeze would be an exception, and carry droplets further (6 to 10 feet).
- The current scientific consensus is that most of the airborne COVID-19 transmission is due to aerosols, **not** droplets (e.g., see here and here). This has a major impact on masks — i.e., only very high filtration masks have the possibility of any meaningful effectiveness.
- The CDC's current position is that transmission from surface contamination is secondary to airborne transmission (aerosol and droplets).
- A mask could possibly be: **a)** protecting the mask wearer when they are near an infected person, or **b)** protecting nearby persons, when the mask wearer is infected.
- An N95 mask is designed to filter particles .3+ microns in size (i.e., about three times the size of the SARS-CoV-2 virus).
- An N95 mask will only have very little COVID-19 effectiveness (in either a or b, above) when dealing directly with the very small SARS-CoV-2 virus.
- An N95 mask will have some effectiveness (with both a and b, above) when dealing with a water droplet carrying the SARS-CoV-2 virus.
- The conclusion is that any mask less than N95 (e.g., cloth mask) will have little or no COVID-19 effectiveness in either situation, for both a and b, above.
- Important perspective: more children died in the 2018-2019 flu season, than subsequently died in a comparable period from COVID-19 (e.g., see here). Why didn't schools mandate masks for that higher mortality risk?
- If the policy is to minimize COVID-19 transmission, then other meaningful measures should also be employed (as a package) to be consistent: taking everyone's temperature on entering the building, frequent hand cleaning, and social distancing. **For a school situation**, we've outlined suggested measures in this Report.

Additional informative materials worth reading:

— Masks Don't Work: A Review of Science Relevant to COVID-19 Social Policy.
— Why Masks Don't Work Against COVID-19.
— Understanding Paticle Size and Aerosol-Based Transmission.
— The Face Mask Folly in Retrospect.

Appendix B: What About Conflicting Reports?

Mask proponents may say:

> "You have listed an impressive array of studies that question both the **effectiveness** and **safety** of masks for COVID-19. However, there are some *other* studies that conclude that masks are effective and safe for COVID-19 — and some of these come from government agencies. So what are citizens to do when there are seemingly contradictory studies?"

Here are some observations from a lifelong professional scientist… To begin with we need to be clear that **Science** is not confused here, but rather that **scientists** are conflicted.

Science is a process, and conflicted scientists just means that they are working their way through the process. Our hope is that they will be competent, objective and thorough when foraging their way down a path through this new wilderness. If they are, we will get to our destination with the least amount of trouble and complications. If not, it will be a harrowing, painful, and expensive trip.

Along the way we will almost always encounter situations where some scientists come to different conclusions. In other words, some will say: *we need to go this direction*, while others are saying: *no, we need to go that way*. (Remember the insightful words of Robert Frost.)

So what do citizens do when the experts are giving different directions?

To begin with we need to be clear that the "experts" are not infallible. In fact, experts have a long history of being wrong, and of giving bad advice. As citizens of a democratic society, we have every right to question to basis for policies like mask mandates.

The more that citizens are educated — and question what they are told — the more likely they will know what is the better route for them and their families to take. Although this involves **work** (an out-of-favor four letter word) on the part of citizens, that's what this Report is about: *to minimize the effort needed to get educated on this topic.*

Briefly, to decide which path to take:

i) We need to actually read (at least the abstracts) of both sets of studies. It's a mistake to base conclusions on a journalist's (a non-scientist) translation of a scientific study. In this Report we have provided a link to *every* study cited, so citizens can easily do that.

ii) In reading the studies, we need to make sure that both are making the same assumptions, are looking at the same issues, have adequate sample size, etc.

iii) Assuming that there are no explanations for the discrepancy found above, then we should give considerably more consideration to studies that found problems. From a Science perspective, studies finding problems carry more weight than the opposite.

iv) In this case we are fortunate to have a Meta-analysis of some of the key studies supporting mask use. Its conclusion is that they do not meet scientific standards.

Appendix C: What Does the CDC Say?

When tracking down the basis for mask mandates, almost all roads lead to the CDC.

For example, North Carolina's state health department publishes a Strong Schools Toolkit that has some good recommendations for how NC K-12 schools should deal with COVID-19. Included in that is a mask *recommendation*. As a primary basis for that advice is a reference to AAP (American Academy of Pediatrics). The NC Dept of Health document has **zero references** to scientific studies concerning COVID-19 mask effectiveness or safety. Rather than research scientific mask studies for NC citizens, they are passing the ball to others, like AAP.

So what has AAP done? Here is their "Guidance" page of school COVID-19 recommendations, which includes their position on masks. Specifically they state: "All students older than 2 years and all school staff should wear face masks at school (*unless medical or developmental conditions prohibit use*), regardless of vaccination status." They then list eight reasons for their position.

There are two primary concerns about masks: **effectiveness** and **safety**. In the AAP's list of reasons they cite one (1) study to support their belief about effectiveness. They do not mention **any** safety concerns, and cite **zero scientific studies about mask safety** (!).

Let's look at the AAP's single citation to support mask effectiveness. As a professional scientist for over fifty years, I've looked at thousands of studies and this one citation is not exactly a strong basis for such an important matter. For example, first, it does not follow the format of a typical scientific study (abstract —> conclusions). Second, it is an analysis of a single US county (out of 3500± counties). Third, it has some questionable assumptions that undermine its conclusions. See this analysis of it which says that **at best** this study indicates that masks might reduce COVID-19 infections by two out of **ten thousand** students.

Clearly, based on what scientific studies are publicly available on this topic (see Chapters 2 and 3 of this Report), AAP has done a woefully inadequate job of justifying their mask position. As medical professionals they should be all about **objective** and **comprehensive** investigation into technical matters (e.g., mask effectiveness and safety), before they take a public position on it. They are well-aware of this grossly inadequate effort on their part, so they punt the ball by then saying that they are relying on the CDC for guidance for their guidance…

OK, so what does the CDC (US Centers for Disease Control and Prevention) say? Here is their page about masks. They then reference readers to a page titled "Your Guide to Masks." On that the CDC discusses what type of mask to wear, etc. Surprisingly, until January 14, 2022, the CDC only **approved** cloth (very porous) masks, and had no approval for higher filtration N95 and surgical masks! They also recommend masks for children at least two years old.

To their credit, the CDC does list some scientific studies. Here are some examples of what our senior federal health agency is saying to justify their mask position:

1 - "A study of 60 elementary school children reported no adverse cardiovascular (e.g., heart rate) or pulmonary (e.g., peripheral oxygen saturation) effects among children while wearing a cloth face covering in a classroom for 30 consecutive minutes of instructional time." ***Sixty children for 30 minutes?!!!***

2 - "A separate study observed no oxygen desaturation or respiratory distress after 60 minutes of monitoring among children less than 2 years of age when masked during normal play." ***Sixty minutes for children LESS THAN TWO YEARS OLD?!!! The CDC advises against using masks for children less than two years old, so why would they reference this study?***

3 - "A randomized trial among 40 children aged 3–10 years old scheduled for elective surgery, found that protective surgical face masks could be used safely in the postoperative period." ***Elective surgery is a tiny niche situation that has no relevance to everyday use by children, especially for many hours every day in a classroom.***

4 - "A study of 2-year-old children concluded that they were able to recognize familiar words presented without a mask and when hearing words through opaque masks." ***So what? Again, TWO YEAR OLD children — being tested for word recognition!***

Etc.

What about the other sixteen studies on their list? This comprehensive analysis discussed almost all of them, and found serious flaws in every one. (*Also see * items in Appendix E*.)

For example, the Abaluck (Bangladesh) study included both surgical *and* cloth masks in its conclusions. However, when surgical masks are excluded (as the CDC advises **against** surgical masks) there is no statistical difference between mask and non-mask wearers. [Note: *clicking on the DOI link results in an error — which might mean that the study has been withdrawn*.]

Regarding mask **safety**, the CDC says: "The safety of mask use during low to moderate levels of exercise has been confirmed in studies of healthy adults and adolescents." In other words, the ONLY mask **safety** studies listed by the CDC: **1)** do not pertain to K-8 children, *and* **2)** are just about exercise, a very specialized, short-term activity.

It seems that most of what appears on the CDC website about masks, comes from this one report , where the primary author is a CDC employee — not an MD, but a *data analyst*. What is most disturbing is that there is essentially no acknowledgement of the 100± studies identified herein. They are all posted on NIH, so they would be readily available to a data analyst.

Science is supposed to be **objective** and **comprehensive**. The CDC's published material used to support their mask position is extremely deficient on both counts. The inescapable conclusion is that (regarding masks) the CDC is promoting political science, **not** real Science.

After reviewing the CDC (and other health agencies') information, our conclusion stands: COVID-19 masks have **very low benefit**, and are **high risk**, especially for school children.

Appendix D: Masks and Vaccination Status

Remember that the theoretical objectives for wearing a mask are:

a) to protect you [or your child] from being infected by others, *and*

b) to protect others from being infected by you [or your child].

We've already shown that masks typically offer no net benefit for both situations. The question now is: **does vaccination status (of you or others) change that reality?**

To scientifically answer that question, we need to remember two key facts about COVID-19 vaccines:

— They do **not** provide immunity from being infected with the SARS-CoV-2 virus, *and*

— They do **not** prevent transmission from an infected vaccinated person to someone else.

For a more detailed scientific discussion of COVID-19 vaccines, please read this Report.

To cover all cases, there are sixteen possible scenarios here, so probably the best way to look at the consequences of each is to have a graphic. Below is a simplified representation of the different situations encountered here.

Scenarios #1 & #2 —

You do **NOT** have COVID-19, but OTHERS do. How are YOU affected in each of the following:

OTHERS	Are Not Vaccinated	Are Vaccinated
Do Not Wear a Mask	*some exposure*	*some exposure*
Wear a Mask	*some exposure*	*some exposure*

YOU	Are Not Vaccinated	Are Vaccinated
Do Not Wear a Mask	*some exposure*	*some exposure*
Wear a Mask	*some exposure*	*some exposure*

Scenarios #3 & #4 —

You **DO** have COVID-19, but OTHERS do Not. How are OTHERS affected in each of the following:

OTHERS	Are Not Vaccinated	Are Vaccinated
Do Not Wear a Mask	*some exposure*	*some exposure*
Wear a Mask	*some exposure*	*some exposure*

YOU	Are Not Vaccinated	Are Vaccinated
Do Not Wear a Mask	*some exposure*	*some exposure*
Wear a Mask	*some exposure*	*some exposure*

The exact amount of exposure in each case depends on *numerous* other incalculable variables. The takeaway message here is that regarding masks: **the vaccination status of you (or your child) or others, makes no consequential difference in any scenario.**

Appendix E: Some Sample References

Our webpage of Science-based COVID-19 info: C19Science.info
Our brief report: What Schools Should Do For COVID-19

Short Effectiveness Video: Viral immunologist Dr. Byram Bridle — Do Masks Work?
Short Safety Video: Live Mask Test on Child Using Different Masks
97 Reports about Mask Ineffectiveness, plus 61 Reports Concluding that Masks can be Unsafe
47 plus 32 Studies: Ineffectiveness of COVID masks plus multiple adverse side effects
34 Studies: Analyses of Face Mask Effectiveness and Safety
23 Studies: Masks Don't Work — A Review of Science Relevant to COVID-19 Social Policy
42 Studies: Masks are Neither Effective nor Safe — A Summary of the Science
6 plus 6 Studies: Mask Effectiveness and Mask Safety

Multiple Studies: Association of American Physicians and Surgeons — Mask Facts
Multiple Studies: Are Face Masks Effective? The Evidence *(looks at studies, pro and con)*
Multiple Studies: Masking: A Careful Review of the Evidence
Multiple Studies: Do Masks Work? A Review of the Evidence
Meta-Analysis: Is a Mask Free of Undesirable Side effects and Potential Hazards?
14 Peer-reviewed Studies: Does Mask Wearing Decrease or Increase the Spread of COVID-19?

Study: Masks, false safety and real dangers — Microbial challenges from masks
Physician's Analysis: The Risks vs. Benefits of Face Masks
Analysis: Why Is There No Correlation between Masks, Lockdowns, and Covid Suppression?

Resource: Europe's Top Health Officials Say Masks Aren't Helpful in Beating COVID-19
Resource: Sweden's Top Epidemiologist: We See No Point In Wearing Masks
Resource: Federal Law Prohibits Mandates of Emergency Use COVID Vaccines, Tests, Masks

*Hidden Studies: CDC's own studies (10 Clinical Trials) show masking to be ineffective
*Exposed Studies: Inside 2 New Studies the CDC Claims Prove Masks Save Lives
*Exposed Study: Debunking the CDC's Mask Mandate Study
*Exposed Study: CDC double mask "study" a perfect example of politicized junk "science"
Retracted Study: Effectiveness of Surgical and Cotton Masks in Blocking SARS–CoV-2
Retracted Study: Decrease in Hospitalizations for COVID-19 after Mask Mandates in 1083 U.S. Counties

For reference: the Maryland Dept of Health published a reasonable set of K-12 guidances.
For reference: extract of talk from engineer Stephen Petty, on building solutions.
For reference: there are many studies, reports and articles in the *Media Balance Newsletter* archives. Simply search for "mask" in the 2021 archives and the 2020 archives.

** Add these to what is said in Appendix C about the failings of the CDC…*