A Primer on COVID-19

The disease
Placing the disease in context
Information backing up present public health measures
Practical tips on staying safe
And much more

Updated periodically
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Have a question related to COVID-19?

Send your queries to Nichtermark@gmail.com

Your questions contribute to the evolution of this primer
Sections of this Primer

- Facts about COVID-19
- How does COVID-19 compare to seasonal flu and other epidemics and pandemic
- Mortality and severity
- How does COVID-19 Spread?
- Household clustering and super spreader events
- How fast does this virus escalate
- Where are we in the Disease Trajectory
- Likely scenarios moving forward
- Herd Immunity
- Testing: types of tests and what they tell us
- Immunity: how long does it last
- Contact Tracing
- Physical distancing and why it is essential
- Lessons learned from COVID-19 success stories
- Guidelines for reopening society
- What needs to be in place to reopen society
- A few lessons about COVID-10 control
- What to do at home and in your community to stay safe
- Re-entry and reopening schools: When restrictions are relaxed or lifted
- Personal notes, reflections, and concerns
- Misinformation/disinformation & the politicization of COVID-19: data from national surveys and polls
COVID-19

• Coronaviruses cause diseases in mammals and birds. Some cross species to humans causing zoonotic illness. *
• In humans they cause respiratory disease. About a quarter of common colds are caused by Coronaviruses. More serious coronavirus diseases include SARS and MERS.

Why are novel coronaviruses so dangerous?
• Our bodies form antibodies to foreign invaders, such as bacteria or viruses.
• If we have antibodies from a previous exposure, then we can rapidly ramp up the production of those antibodies if we are infected by that same virus at a later date.
• COVID-19 is a severe respiratory illness caused by the virus named SARS-CoV2.** It is a novel virus, which means that no one in the world has antibodies to it because no one has ever been infected by it before.
Facts about COVID-19

What we know at the moment
Subject to updates as the science progresses
Symptoms vary and mimic other common diseases until severe: Here is what we know from early studies in China.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever</td>
<td>87.9%</td>
</tr>
<tr>
<td>Dry cough</td>
<td>67.7%</td>
</tr>
<tr>
<td>Fatigue</td>
<td>38.1%</td>
</tr>
<tr>
<td>Sputum production</td>
<td>33.4%</td>
</tr>
<tr>
<td>Shortness of breath</td>
<td>18.6%</td>
</tr>
<tr>
<td>Muscle pain or joint pain</td>
<td>14.8%</td>
</tr>
<tr>
<td>Sore throat</td>
<td>13.9%</td>
</tr>
<tr>
<td>Headache</td>
<td>13.6%</td>
</tr>
<tr>
<td>Chills</td>
<td>11.4%</td>
</tr>
<tr>
<td>Nausea or vomiting</td>
<td>5%</td>
</tr>
<tr>
<td>Nasal congestion</td>
<td>4.8%</td>
</tr>
<tr>
<td>Diarrhoea</td>
<td>3.7%</td>
</tr>
</tbody>
</table>

Many of the most common symptoms are shared with those of the flu or cold. So it is also good to know which common symptoms of the flu or the common cold are not symptoms of COVID-19. COVID-19 infection seems to rarely cause a runny nose.
The same symptoms are signs of COVID-19 in Europe and the USA

<table>
<thead>
<tr>
<th></th>
<th>COVID-19</th>
<th>Flu</th>
<th>Cold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incubation period</td>
<td>1–14 days</td>
<td>1–4 days</td>
<td>1–3 days</td>
</tr>
<tr>
<td>Symptom onset</td>
<td>Gradual</td>
<td>Abrupt</td>
<td>Gradual</td>
</tr>
<tr>
<td>Fever</td>
<td>Common</td>
<td>Common</td>
<td>Rare</td>
</tr>
<tr>
<td>Cough</td>
<td>Common</td>
<td>Common</td>
<td>Mild to moderate</td>
</tr>
<tr>
<td>Fatigue</td>
<td>Common</td>
<td>Common</td>
<td>Sometimes</td>
</tr>
<tr>
<td>Runny nose</td>
<td>Sometimes</td>
<td>Sometimes</td>
<td>Common</td>
</tr>
<tr>
<td>Nasal congestion</td>
<td>Sometimes</td>
<td>Sometimes</td>
<td>Common</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>Sometimes</td>
<td>Sometimes</td>
<td>Rare</td>
</tr>
</tbody>
</table>
More recent data from the COVID SYMPTOM STUDY

• Analysis of data from the COVID Symptom Study app reveals that there are six distinct ‘types’ of COVID-19, each distinguished by a particular cluster of symptoms emerging at characteristic timepoints in the progression of the illness.

• All people reporting symptoms experienced headache and loss of smell, with varying combinations of additional symptoms at various times.

• The COVID Symptom Study identified skin rash as a key symptom of COVID-19 in up to one in ten cases. It was not a symptom initially monitored.
Six clusters of symptoms

• 1 (‘flu-like’ with no fever): Headache, loss of smell, muscle pains, cough, sore throat, chest pain, no fever.

• 2 (‘flu-like’ with fever): Headache, loss of smell, cough, sore throat, hoarseness, fever, loss of appetite.

• 3 (gastrointestinal): Headache, loss of smell, loss of appetite, diarrhea, sore throat, chest pain, no cough.

• 4 (severe level one, fatigue): Headache, loss of smell, cough, fever, hoarseness, chest pain, fatigue.

• 5 (severe level two, confusion): Headache, loss of smell, loss of appetite, cough, fever, hoarseness, sore throat, chest pain, fatigue, confusion, muscle pain.

• 6 (severe level three, abdominal and respiratory): Headache, loss of smell, loss of appetite, cough, fever, hoarseness, sore throat, chest pain, fatigue, confusion, muscle pain, shortness of breath, diarrhea, abdominal pain.
Severity of cases: Need of breathing apparatus

- only 1.5% of people with cluster 1, 4.4% of people with cluster 2 and 3.3% of people with cluster 3 COVID-19 required breathing support.
- These figures were 8.6%, 9.9% and 19.8% for clusters 4, 5 and 6 respectively.
- nearly half of the patients in cluster 6 ended up in hospital, compared with just 16% of those in cluster 1.
Signs of illness may precede actual symptoms
Pay attention to your senses

• Sudden loss of smell and taste have been documented in approximately 30% of confirmed cases before notable symptoms occurred, and in 50-90% of cases when accompanied by other symptoms (depending on study)

• Smell is being piloted as an early indicator of COVID-19 when combined with other symptoms such as fever *

• Self isolate as soon as you notice loss of smell whether you have other symptoms or not

• Younger patients in particular may demonstrate only a loss of smell or taste, without demonstrating the more commonly recognized coronavirus symptoms of high fever and persistent coughs
Screening Symptoms for COVID-19

• As states reopen, some businesses have begun screening patrons for symptoms
• Most utilize contactless thermometers to ensure individuals entering the area do not have a fever
  • A small survey from the CDC showed that 96% of positive COVID-19 patients had some sort of cough, fever, or shortness of breath
• Fevers don’t tell the whole story
  • Other illnesses may result in a fever
  • Not all COVID-19 patients may exhibit a fever
Screening Symptoms for COVID-19

• Loss of smell may serve as a supplement for temperature checks
  • Even though loss of smell is not the most common symptom, COVID-19 positive individuals were at 6.74 times the odds of reporting loss of smell/taste
  • Using changes in smell/taste and fever as screening tools might be a more effective means of preventing the spread as states open back up

• To better ensure patrons are not sick, some have begun to employ other testing/screening methods
  • Emirates began using rapid blood tests for all travelers - test kits are expensive and require finger-pricks to get blood
  • Rapid antigen tests are developed with short turn around times –these still require time delays that make them feasible for only some types of businesses
What are the symptoms and how does it affect my body?

This video provides a thorough overview of mild-moderate-severe symptoms, and what is happening to the body during this time:

https://www.businessinsider.com/novel-coronavirus-COVID-19-symptoms-day-by-day-2020-3 (covers severity and day to day progression)

• More information on the difference between severity of illness and effects of infection on the body can be found here:
  • Here’s what coronavirus does to the body: nationalgeographic.com/science/2020/02/heres-what-coronavirus-does-to-the-body
CDC: https://www.youtube.com/watch?v=I-Yd-X1WJg&feature=share&fbclid=IwAR1g8OJPSInsSmPGdzAe6G8CIRJjtLQgUcVujZKzbdFE8PQ9502QTtRo4 (good knowledge and recommended practice summary)****
How long does it take to recover from COVID-19

- Preliminary data from China shows that the period from disease onset to recovery ranges according to severity of disease
  - For **mild cases**, recovery is approximately **2 weeks**
  - For **severe/critical cases**, recovery is approximately **3-6 weeks**; however, some other studies have observed illnesses lasting longer than 6 weeks

*Figure 5. Pattern of disease progression for COVID-19 in China*

Note: the relative size of the boxes for disease severity and outcome reflect the proportion of cases reported as of 20
February 2020. The size of the arrows indicates the proportion of cases who recovered or died. Disease definitions are desribed above. Moderate cases have a mild form of pneumonia.
Emerging data on the long-term effects of COVID-19

- Some people recovering from COVID-19 have reported **prolonged symptoms for 60 days or longer**
  - Symptoms range from chronic fatigue, muscle aches, and rashes to kidney and heart problems, brain fog
  - This is even the case for those who had mildly symptomatic disease manifestations *
- Similar long-term effects were observed following the severe acute respiratory syndrome (SARS) pandemic in 2003. In one Hong Kong study, **27% of SARS survivors were found to meet chronic fatigue syndrome** criteria several years after developing SARS
COVID-19 severity: One factor is an uncontrolled inflammatory response

• The immune system works both for us and can in certain instances can work against us
• COVID-19 severity is associated with a Cytokine Storm: Cytokine release syndrome (CRS)
• A cytokine storm occurs when a patient’s immune system overreacts to the virus and inflicts collateral damage on its own organs
  • CRS is an acute systemic inflammatory syndrome caused by excessive or uncontrolled release of proinflammatory cytokines.
  • When the immune system is fighting pathogens, cytokines signal immune cells such as T-cells and macrophages to travel to the site of infection.
  • Cytokines activate these cells, stimulating them to produce more cytokines.
  • Normally, this feedback loop is kept in check by the body.
  • However, in some instances, the reaction becomes uncontrolled, and too many immune cells are activated in one location.
• Cytokine dysregulation occurs in some virulent influenza infections such as H5N1 (avian flu) and COVID-19
• One reason the elderly are more vulnerable for severe COVID-19 is due to “inflammaging” which refers to cell mediated immune senescence. During ageing low-grade inflammation develops which contributes to the pathogenesis of diseases experienced. It is a possible contributor to a CRS.
How does COVID-19 compare to seasonal flu
And other epidemics and pandemics
<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Seasonal Influenza and Viruses</th>
<th>SARS-CoV-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary route of</td>
<td>Droplet</td>
<td>Droplet (airborne, fomite, and fecal-oral</td>
</tr>
<tr>
<td>transmission</td>
<td></td>
<td>transmission possible but less important)</td>
</tr>
<tr>
<td>Overall infectivity</td>
<td>Less contagious</td>
<td>More contagious</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The basic reproduction number (R₀) of both</td>
</tr>
<tr>
<td></td>
<td></td>
<td>viruses is highly dependent on NPIs effective</td>
</tr>
<tr>
<td></td>
<td></td>
<td>in decreasing transmission</td>
</tr>
<tr>
<td>Dynamics of infectivity</td>
<td>Patients are most infectious</td>
<td>Patients are most infectious starting 48 h</td>
</tr>
<tr>
<td></td>
<td>after symptom onset</td>
<td>prior to symptom onset¹</td>
</tr>
<tr>
<td></td>
<td>Both viruses capable of</td>
<td>Both viruses capable of</td>
</tr>
<tr>
<td></td>
<td>asymptomatic transmission, but</td>
<td>asymptomatic transmission, but less than</td>
</tr>
<tr>
<td></td>
<td>during presymptomatic and</td>
<td>during presymptomatic and</td>
</tr>
<tr>
<td></td>
<td>symptomatic phases</td>
<td>symptomatic phases</td>
</tr>
<tr>
<td>Incubation period</td>
<td>1-4 d (median, 2 d)</td>
<td>2-14 d (median, 5 d)</td>
</tr>
<tr>
<td>Risk factors for severe</td>
<td>Advanced age (risk increases</td>
<td>Male sex</td>
</tr>
<tr>
<td>disease</td>
<td>with age)</td>
<td>Obesity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hypertension</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chronic lung disease, cardiac disease, type 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>diabetes, cancer, chronic kidney disease,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>advanced liver disease</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Surgery during incubation period</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Residence in nursing home</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Structural racism, poverty⁴</td>
</tr>
<tr>
<td>Most common clinical</td>
<td>Fever, chills, headache,</td>
<td>Fever, chills, headache, myalgias, cough,</td>
</tr>
<tr>
<td>manifestations</td>
<td>myalgias, cough, nasal</td>
<td>nasal congestion, sore throat, fatigue</td>
</tr>
<tr>
<td></td>
<td>congestion, sore throat,</td>
<td>For both viruses, the majority of infections</td>
</tr>
<tr>
<td></td>
<td>fatigue</td>
<td>are either subclinical or mild</td>
</tr>
<tr>
<td>Pediatric disease</td>
<td>Common, especially high risk</td>
<td>Uncommon, with typically mild disease</td>
</tr>
<tr>
<td></td>
<td>in children &lt;2 y</td>
<td>Multisystem inflammatory syndrome has been</td>
</tr>
<tr>
<td></td>
<td>Children play a leading</td>
<td>observed in children, but is rare</td>
</tr>
<tr>
<td></td>
<td>role in propagating outbreaks</td>
<td>Limited evidence on children as a source of</td>
</tr>
<tr>
<td>Case-fatality rate</td>
<td>0.1%</td>
<td>infection</td>
</tr>
<tr>
<td>Dynamics of symptoms</td>
<td>Symptoms typically peak during</td>
<td>Symptoms can peak during week 2 or 3 of illness</td>
</tr>
<tr>
<td>Vaccine</td>
<td>Multiple approved</td>
<td>No vaccine currently licensed</td>
</tr>
<tr>
<td>Clinical diagnostics</td>
<td>Nucleic acid amplification</td>
<td>Nucleic acid amplification and antigen-based</td>
</tr>
<tr>
<td></td>
<td>and antigen-based assays</td>
<td>assays from respiratory samples</td>
</tr>
<tr>
<td></td>
<td>from respiratory samples</td>
<td>Serologies</td>
</tr>
<tr>
<td>Available antiviral</td>
<td>Neuraminidase inhibitors</td>
<td>Neuraminidase inhibitors</td>
</tr>
<tr>
<td>agents</td>
<td>Cap-dependent endonuclease</td>
<td>Cap-dependent endonuclease inhibitors</td>
</tr>
<tr>
<td></td>
<td>inhibitors</td>
<td>M2 channel blockers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nucleoside analogue (remdesivir)</td>
</tr>
</tbody>
</table>

Abbreviations: NPI, nonpharmacologic intervention; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2.
How serious is COVID-19 compared to the “flu”

While COVID-19 has many of the same symptoms as the flu, there are some very important differences that make our current COVID-19 pandemic more serious.

Each person with COVID-19 infects 2-3 people on average, and the number of days that a person is contagious before feeling sick is much greater in COVID-19 compared to the flu.
Any suggestion of COVID-19 being just like influenza is false. For those aged 20–29 years, the case fatality ratio is around three times higher than that of seasonal influenza in people aged 18–49 years.

<table>
<thead>
<tr>
<th>Age</th>
<th>Flu Case Fatality Ratio</th>
<th>COVID-19 Case Fatality Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4</td>
<td>.01%</td>
<td>.0%</td>
</tr>
<tr>
<td>5-17</td>
<td>.01%</td>
<td>.0%</td>
</tr>
<tr>
<td>18-49</td>
<td>.02%</td>
<td>.0%</td>
</tr>
<tr>
<td>50-64</td>
<td>.06%</td>
<td>.0%</td>
</tr>
<tr>
<td>65+</td>
<td>.83%</td>
<td>.0%</td>
</tr>
</tbody>
</table>

COVID-19 infections are 10 times greater than the “flu” even in the least effected group of individuals > 10 and < 40.
As of June 30th, there are 10,185,374 global cases of COVID-19 with 503,862 deaths.
Selected Global Causes of Deaths Due to Various Causes and COVID-19, Jan-May 2020

- COVID-19: 345,059
- Malaria: 256,795
- Malnutrition: 209,815
- Homicide: 161,965
- Parkinson's: 136,445
- Drowning: 124,410
- Meningitis: 121,365
- Influenza: 82,070
- Maternal: 80,475
- Alcohol: 74,530
- Drugs: 65,540
- Conflict: 64,960
- GI Inf Dz: 63,800
- Hepatitis: 52,055
- Fire: 49,735
- Poisonings: 30,160

Broader perspective
Broader historical perspective

<table>
<thead>
<tr>
<th>EVENT</th>
<th>TOTAL DEATHS</th>
<th>TIME LENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPANISH FLU</td>
<td>675,000~</td>
<td>1 YEAR</td>
</tr>
<tr>
<td>CIVIL WAR</td>
<td>655,000~</td>
<td>4 YEARS</td>
</tr>
<tr>
<td>WORLD WAR II</td>
<td>405,399</td>
<td>4 YEARS</td>
</tr>
<tr>
<td>WORLD WAR I</td>
<td>116,516</td>
<td>1 YEAR</td>
</tr>
<tr>
<td>CORONAVIRUS</td>
<td>97,414+</td>
<td>4 MONTHS</td>
</tr>
<tr>
<td>VIETNAM WAR</td>
<td>58,209</td>
<td>11 YEARS</td>
</tr>
<tr>
<td>DEATH BY VEHICLE 2019</td>
<td>38,800</td>
<td>1 YEAR</td>
</tr>
<tr>
<td>KOREAN WAR</td>
<td>36,516</td>
<td>3 YEARS</td>
</tr>
<tr>
<td>FLU DEATHS 2018-2019</td>
<td>34,200</td>
<td>1 YEAR</td>
</tr>
<tr>
<td>AMERICAN REVOLUTIONARY WAR</td>
<td>25,000~</td>
<td>8 YEARS</td>
</tr>
<tr>
<td>GUN DEATHS 2019</td>
<td>15,292</td>
<td>1 YEAR</td>
</tr>
<tr>
<td>MEXICAN-AMERICAN WAR</td>
<td>13,283~</td>
<td>2 YEARS</td>
</tr>
<tr>
<td>2009 H1N1 Pandemic</td>
<td>12,469</td>
<td>1 YEAR</td>
</tr>
<tr>
<td>OIF IRAQ WAR</td>
<td>4,497</td>
<td>8 YEARS</td>
</tr>
<tr>
<td>OEF AFGHANISTAN WAR</td>
<td>2,216+</td>
<td>19 YEARS</td>
</tr>
<tr>
<td>9/11 TERRORIST ATTACK</td>
<td>2,977</td>
<td>1 DAY</td>
</tr>
<tr>
<td>PEARL HARBOR ATTACK</td>
<td>2,403</td>
<td>1 DAY</td>
</tr>
<tr>
<td>GULF WAR</td>
<td>294</td>
<td>1 YEAR</td>
</tr>
<tr>
<td>OKLAHOMA CITY BOMBING</td>
<td>168</td>
<td>1 DAY</td>
</tr>
</tbody>
</table>

AS OF MAY 23, 2020 10:00 PM BY MARIO HARDY
COVID-19
Mortality and severity
Case fatality rate of the ongoing COVID-19 pandemic

The Case Fatality Rate (CFR) is the ratio between confirmed deaths and confirmed cases. During an outbreak of a pandemic the CFR is a poor measure of the mortality risk of the disease. We explain this in detail at OurWorldInData.org/Coronavirus

Source: European CDC – Situation Update Worldwide – Last updated 2nd July, 13:00 (London time)   OurWorldInData.org/coronavirus • CC BY
Note: Only countries with more than 100 confirmed cases are included.
Demographics explains in part some of the differences in global mortality due to COVID-19

Demography is one factor that explains huge differences in mortality in Italy and S. Korea

- The population of Italy differs from much of the world. According to a UN report in 2015, 28.6% of the Italian population was 60 years old or older. By comparison, in South Korea, 18.5% of the population is at least 60 years of age, ranking 53rd globally.
- In Italy, 90% of the more than 1,000 deaths occurred in those 70 or older.
- By contrast, the outbreak in South Korea has occurred among much younger people. There, only 20% of cases have been diagnosed in those 60 years old and up. The largest affected group is those in their 20s, who account for almost 30% of all cases.
- Other factors must also be taken into account as well.
  - For example, testing policy, contact tracing, and quarantine. In South Korea, the rate of testing was quite high (3,692 tests per million people as of March 8) compared to Italy (826 people per million).

➤ Note: Both countries have excellent health care systems
Mean US mortality is also younger than other Western countries

In hard-hit rich countries, about 60% of all deaths from the disease are among people aged 80 and over. America, however, is an exception.

• Data released on June 16th by the Centers for Disease Control (CDC) show that the country’s death toll skews significantly younger.
  • In the US, people in their 80s account for less than half of all COVID-19 deaths;
  • People in their 40s, 50s, and 60s, account for a significantly larger share of those who die.

• The median COVID-19 sufferer in America is a 48-year-old; in Italy it is a 63-year-old.

Why is America such an outlier

• America has a younger population than Europe does.
  • America’s median age is just 38; Italy’s is 45.

• Another possible reason is that middle-aged Americans may be less healthy than their European peers, and they tend to be more obese.
Who is affected most severely?

- Based on current data, those who are at greatest risk of death due to COVID-19 are:
  - Those 65+ years of age
  - Those with chronic illness like heart disease, diabetes, lung disease, or who are smokers
- Those who are younger than 25 years are the least at risk of death from COVID-19
  - This could largely be due to the children and adolescents having a reduced likelihood of experiencing severe illness.
<table>
<thead>
<tr>
<th>AGE</th>
<th>Number of Deaths</th>
<th>Share of deaths</th>
<th>With underlying conditions</th>
<th>Without underlying conditions</th>
<th>Unknown if with underlying cond.</th>
<th>Share of deaths of unknown + w/o cond.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 17 years old</td>
<td>9</td>
<td>0.06%</td>
<td>6</td>
<td>3</td>
<td>0</td>
<td>0.02%</td>
</tr>
<tr>
<td>18 - 44 years old</td>
<td>601</td>
<td>3.9%</td>
<td>476</td>
<td>17</td>
<td>108</td>
<td>0.8%</td>
</tr>
<tr>
<td>45 - 64 years old</td>
<td>3,413</td>
<td>22.4%</td>
<td>2,851</td>
<td>72</td>
<td>490</td>
<td>3.7%</td>
</tr>
<tr>
<td>65 - 74 years old</td>
<td>3,788</td>
<td>24.9%</td>
<td>2,801</td>
<td>5</td>
<td>982</td>
<td>6.5%</td>
</tr>
<tr>
<td>75+ years old</td>
<td>7,419</td>
<td>48.7%</td>
<td>5,236</td>
<td>2</td>
<td>2,181</td>
<td>14.3%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>15,230</td>
<td>100%</td>
<td>11,370 (75%)</td>
<td>99 (0.7%)</td>
<td>1,551 (24.7%)</td>
<td>25.3%</td>
</tr>
</tbody>
</table>
Severity distribution

The Majority of Infections are Mild
Seriousness of symptoms

- **MILD**
  - Like flu, stay at home
  - 80.9%

- **SEVERE**
  - Hospitalization
  - 13.8%

- **CRITICAL**
  - Intensive care
  - 4.7%

Those Aged 60+ are Most At Risk...
% of deceased (Italy & UK)

- **IT**
  - 0-9: 0.2%
  - 10-19: 0.1%
  - 20-29: 0.2%
  - 30-39: 0.4%
  - 40-49: 0.8%
  - 50-59: 1.7%
  - 60-69: 5.4%
  - 70-79: 9.7%
  - 80-89: 24.4%
  - 90+: 38.6%

- **UK**
  - 0-9: 0%
  - 10-19: 0%
  - 20-29: 0%
  - 30-39: 0%
  - 40-49: 0%
  - 50-59: 0%
  - 60-69: 0%
  - 70-79: 26.6%
  - 80-89: 30.3%
  - 90+: 25.1%

Study of 4,672 confirmed cases in Mainland China
Sources: China Center for Disease Control & Prevention

Study of 3,372 death cases in UK & 21,551 deaths in Italy
Sources: Italian Portal of Epidemiology for Public Health, UK Office of National Statistics
Those Aged 60+ are Most At Risk

% infectees who die

Especially Those with Existing Conditions
% with other serious ailments who die

- cardiovascular disease: 10.5%
- diabetes: 7.3%
- chronic respiratory disease: 6.3%
- abnormally high blood pressure: 6%
- cancer: 5.6%
- no existing conditions: 0.9%

Note: This data comes from the first wave of infections in Wuhan, China, where lung health is poor and smoking rates are high. Coronavirus attacks the lungs.
More Than 40% of U.S. Coronavirus Deaths Are Linked to Nursing Homes

• As of August 13, for states reporting
• 41% OF ALL U.S. DEATHS
• 8% OF ALL U.S. CASES
• At least 68,000 residents and workers have died from the coronavirus at nursing homes and other long-term care facilities for older adults in the United States
• The virus has infected more than 402,000 people at some 17,000 facilities.
Hospitalizations and death: USA May 30

- Among the 1,320,488 cases, outcomes for hospitalization, ICU admission, and death were available for 46%, 14%, and 36%, respectively.
  - Overall, 184,673 (14%) patients were hospitalized, severe outcomes were more commonly reported for patients with reported underlying conditions.
  - Hospitalizations were six times higher among patients with a reported underlying condition than those without reported underlying conditions (45.4% versus 7.6%).
  - The percentage of ICU admissions was highest among persons with reported underlying conditions aged 60–69 years (11%) and 70–79 years (12%).
- Deaths were 12 times higher among patients with reported underlying conditions compared with those without reported underlying conditions (19.5% versus 1.6%).
The most common health problems among hospitalized COVID-19 patients

Based on a study of 5,700 patients in the New York City Area

Of all hospitalized patients, 88% had more than one comorbidity:

<table>
<thead>
<tr>
<th>Comorbidity</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>More than one</td>
<td>88%</td>
</tr>
<tr>
<td>One</td>
<td>6.3%</td>
</tr>
<tr>
<td>None</td>
<td>5.1%</td>
</tr>
</tbody>
</table>

Specific comorbidities of hospitalized patients with available EHR data, from most common to least:

<table>
<thead>
<tr>
<th>Comorbidity</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>53.1%</td>
</tr>
<tr>
<td>Obesity (BMI ≥30)</td>
<td>41.7%</td>
</tr>
<tr>
<td>Diabetes</td>
<td>31.7%</td>
</tr>
<tr>
<td>Morbid Obesity (BMI ≥35)</td>
<td>19%</td>
</tr>
<tr>
<td>Coronary artery disease</td>
<td>10.4%</td>
</tr>
<tr>
<td>Asthma</td>
<td>8.4%</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>6.5%</td>
</tr>
<tr>
<td>Cancer</td>
<td>5.6%</td>
</tr>
<tr>
<td>COPD</td>
<td>5%</td>
</tr>
<tr>
<td>Chronic kidney disease</td>
<td>4.7%</td>
</tr>
<tr>
<td>End-stage kidney disease</td>
<td>3.3%</td>
</tr>
<tr>
<td>Obstructive sleep apnea</td>
<td>2.7%</td>
</tr>
<tr>
<td>History of solid organ transplant</td>
<td>1%</td>
</tr>
<tr>
<td>HIV</td>
<td>0.8%</td>
</tr>
<tr>
<td>Cirrhosis</td>
<td>0.3%</td>
</tr>
<tr>
<td>Hepatitis B</td>
<td>0.1%</td>
</tr>
<tr>
<td>Hepatitis C</td>
<td>0.1%</td>
</tr>
</tbody>
</table>
# How COVID-19 Affects Different U.S. Age Groups

Hospitalization, ICU admission and fatality rates for reported U.S. COVID-19 cases by age group

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Hospitalization</th>
<th>ICU admission</th>
<th>Case fatality</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-19</td>
<td>1.6%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>20-44</td>
<td>2.0%</td>
<td>0.1%</td>
<td>14.3%</td>
</tr>
<tr>
<td>45-54</td>
<td>5.4%</td>
<td>0.5%</td>
<td>21.2%</td>
</tr>
<tr>
<td>55-64</td>
<td>4.7%</td>
<td>1.4%</td>
<td>20.5%</td>
</tr>
<tr>
<td>65-74</td>
<td>8.1%</td>
<td>2.7%</td>
<td>28.6%</td>
</tr>
<tr>
<td>75-84</td>
<td>10.5%</td>
<td>4.3%</td>
<td>30.5%</td>
</tr>
<tr>
<td>&gt;85</td>
<td>6.3%</td>
<td>10.4%</td>
<td>31.3%</td>
</tr>
</tbody>
</table>

* Based on 2,449 COVID-19 patients with a known age. (February 12–March 16, 2020). Source: Centers for Disease Control and Prevention
Mortality and hospitalization by age

- While those between 18 and 49 years of age are starting to hold a greater share of new cases of COVID-19, those 65 and older are at greater risk of death from COVID-19.

  - The week of June 20th almost 40% of people that were hospitalized for COVID-19 were between 18 and 49 years of age.

- Compared with the under-18 year old group, patients aged 18-64 years appear to be at higher risk for hospitalization and ICU admission.
COVID-19 Laboratory-Confirmed Hospitalizations
Preliminary data as of Jun 20, 2020

Covid-19-associated Hospitalizations By Age
- 0-4 yr
- 5-17 yr
- 18-49 yr
- 50-64 yr
- 65+ yr

The Coronavirus Disease 2019 (COVID-19)-Associated Hospitalization Surveillance Network (COVID-NET) hospitalization data are preliminary and subject to change as more data become available. In particular, case counts and rates for recent hospital admissions are subject to lag. As data are received each week, prior case counts and rates are updated accordingly.
Children do not seem to be dying, but can they get very sick?

- **Children are just as likely as adults to get infected***
- In general, children experiencing all coronaviruses do not become as ill as adults
  - During the previous outbreaks of Severe Acute Respiratory Syndrome (SARS) in HK and Middle East Respiratory Syndrome (MERS) in South Korean, very few pediatric patients were reported. Despite a high mortality rate of SARS and MERS in the adults, there were no fatalities in the pediatric patients. Children appeared to have a milder form of the disease caused by the coronaviruses, including COVID-19 (SARS-CoV-2).**

- There is a range of severity and symptoms of COVID-19 in children***
  - Infected children may be asymptomatic or have fever, dry cough and fatigue; some patients experience gastrointestinal symptoms, including abdominal discomfort, nausea, vomiting, abdominal pain and diarrhea. Most infected children have mild clinical manifestations and usually have a good prognosis. Usually they recover within 1–2 weeks after the onset of the disease.

- The idea that this is no big thing for youth is misguided – children can still experience pneumonia and be sick for a few weeks.
Younger adults and stroke

• There have been reports of adults experiencing strokes while sick with COVID-19 coming out of the Netherlands and US.
  • Strokes are usually more common in the elderly; however, these patients with COVID-19 presenting with symptoms of strokes are as young as 30 years old.

• This is due to blood clot formation while sick with the infection. Researchers are not positive what is causing these blood clots to form and travel to the brain.
  • Young adults who experience symptoms of COVID-19 should monitor themselves for neurological symptoms.
  • If you start to experience weakness/numbness on one half of your body/face, trouble walking, trouble speaking, or difficulty concentrating, contact EMS immediately.
Mortality and hospitalization by gender

- Data from China show that among the tens of thousands of people infected there, 2.8 percent of men died from the virus compared with 1.7 percent of women. The median age of the fatal cases among women was five years older than among men.
- The mortality rate is twice as high among men in Italy as it is among women in every age group.
- In the US, hospitalization rate from COVID-19 is slightly higher in men than in women.

Why?
- Could be many factors
  - Differences in rates of smoking by gender
  - Differences in rates of high blood pressure and heart disease by gender
  - Differences in the way that male and female immune systems respond, and/or as a result of hormonal changes.
    - Differences exist: For example, women tend to have more autoimmune disorders than men
    - Gender differences in the microbiota
  - Differences in medication use
COVID-19 Laboratory-Confirmed Hospitalizations
Preliminary data as of May 09, 2020

Characteristics Of Covid-19-associated Hospitalizations

Sex
- Male
- Female

1. Data presented on COVID-19-associated hospitalizations collected through COVID-NET are preliminary and may change as more data are received.
2. The discrepancy between the total number of cases identified to date on ‘Laboratory-Confirmed-COVID-19-Associated Hospitalizations’ (https://gis.cdc.gov/grasp/COVIDNet/COVID19_3.html) and ‘COVID-19-Associated Hospitalizations By Age’ and the number of cases with information on characteristics (including race/ethnicity) differs because the characteristics data are restricted to cases with complete chart reviews. These data will be updated each week as additional chart reviews are completed.
3. The denominator for each characteristic is the total number of patients with non-missing data for that characteristic.
4. Race/Ethnicity is classified as Non-Hispanic White, Non-Hispanic Black, Hispanic and Other. The other category contains Asian/Pacific Islander, Native American/Alaskan Native, Multi-Race, and Other.
More Men Dying of COVID-19 Than Women

Percentage of deaths by gender due to the COVID-19 disease

<table>
<thead>
<tr>
<th>Country</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>58</td>
<td>42</td>
</tr>
<tr>
<td>Iran</td>
<td>59</td>
<td>41</td>
</tr>
<tr>
<td>China</td>
<td>64</td>
<td>36</td>
</tr>
<tr>
<td>Portugal</td>
<td>64</td>
<td>36</td>
</tr>
<tr>
<td>Spain</td>
<td>65</td>
<td>35</td>
</tr>
<tr>
<td>Germany</td>
<td>66</td>
<td>34</td>
</tr>
<tr>
<td>Italy</td>
<td>71</td>
<td>29</td>
</tr>
<tr>
<td>Denmark</td>
<td>71</td>
<td>29</td>
</tr>
</tbody>
</table>

Data as of March 27
Sources: Wall Street Journal, Global Health 50/50
I have read that this virus effects some racial groups more than others

• There is no evidence to date suggesting that any particular racial group constitutes a group at risk because of race-related genetics.

• However, those living and working in environments of risk and engaged in risky behavior related to group norms are more likely to be exposed to this virus.

• Members of particular ethnic groups are more at risk due to difficulties in engaging in physical distancing related to housing, intergenerational contact associated with familial responsibility, and occupation, etc. Demographics and overall health status are also risk factors influencing the crude numbers of people hospitalized and dying.

• You have no doubt heard that COVID-19 is an equal opportunity viral threat. This is only partially true. There are social and structural determinants of both disease transmission and prognosis based on access to resources and health care.
  • For example, African Americans in the USA are far more likely to die of COVID-19. Black Chicagoans account for half of all coronavirus cases in the city and more than 70% of deaths, despite making up 30% of the population.
  • Louisiana, a major US hotspot, was the first southern state to categorize COVID-19 deaths by race. 70% of deaths were among African Americans, despite making up only 33% of the state’s population.
Rate of Black and Latino coronavirus cases, compared with white cases

3 times that of white cases

Source: Centers for Disease Control and Prevention | Note: Data is through May 28.
COVID-19 Laboratory-Confirmed Hospitalizations
Preliminary data as of May 09, 2020

Characteristics Of Covid-19-associated Hospitalizations
Race/Ethnicity
- Non-Hispanic White
- Non-Hispanic Black
- Hispanic
- Other

1. Data presented on COVID-19-associated hospitalizations collected through COVID-NET are preliminary and may change as more data are received.
2. The discrepancy between the total number of cases identified to date on ‘Laboratory-Confirmed-COVID-19-Associated Hospitalizations’ (https://gis.cdc.gov/grasp/COVIDNet/COVID19_3.html) and ‘COVID-19-Associated Hospitalizations By Age’ and the number of cases with information on characteristics (including race/ethnicity) differs because the characteristics data are restricted to cases with complete chart reviews. These data will be updated each week as additional chart reviews are completed.
3. The denominator for each characteristic is the total number of patients with non-missing data for that characteristic.
4. Race/Ethnicity is classified as Non-Hispanic White, Non-Hispanic Black, Hispanic and Other. The other category contains Asian/Pacific Islander, Native American/Alaskan Native, Multi-race, and Other.
The Pandemic's Racial Disparity

Covid-19 deaths per 100,000 people in the U.S. by race or ethnicity (as of July 30, 2020)

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>Deaths per 100,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black or African American</td>
<td>74</td>
</tr>
<tr>
<td>American Indian or Alaska Native</td>
<td>40</td>
</tr>
<tr>
<td>Hispanic or Latino</td>
<td>40</td>
</tr>
<tr>
<td>Asian</td>
<td>31</td>
</tr>
<tr>
<td>White</td>
<td>30</td>
</tr>
<tr>
<td>Native Hawaiian and Pacific Islander</td>
<td>29</td>
</tr>
<tr>
<td>Other</td>
<td>29</td>
</tr>
</tbody>
</table>

Source: The COVID Tracking Project
COVID-19: The racial disparity
Black Miners account for 1.4 percent of the state’s population but make up 23.6 percent of its COVID-19 cases, the highest racial disparity in the nation.

Worst states by rank

<table>
<thead>
<tr>
<th>State</th>
<th>Share of state/city’s population</th>
<th>Share of COVID-19 deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Louisiana</td>
<td>32%</td>
<td>70%</td>
</tr>
<tr>
<td>Illinois</td>
<td>15%</td>
<td>42%</td>
</tr>
<tr>
<td>Michigan</td>
<td>14%</td>
<td>41%</td>
</tr>
<tr>
<td>North Carolina</td>
<td>22%</td>
<td>22%</td>
</tr>
<tr>
<td>Chicago</td>
<td>30%</td>
<td>69%</td>
</tr>
</tbody>
</table>

Sources: 2010 Census, respective state/city health departments

COVID-19’s Devastating Impact On African Americans
African American share of state/city populations and COVID-19 deaths (as of Apr 06, 2020)

- Share of state/city’s population
- Share of COVID-19 deaths
Deaths and Cases Disproportionately Affect African Americans In Most States

PERCENTAGE DIFFERENCE IN SHARE OF DEATHS/CASES, COMPARED WITH AFRICAN AMERICANS’ SHARE OF THE POPULATION

- Insufficient data
- Less than proportional
- More than proportional

DEATHS

CASES
Impact on Native people in the USA

- In 23 states with adequate race/ethnicity data, the cumulative incidence of laboratory-confirmed COVID-19 among AI/AN persons was 3.5 times that among non-Hispanic white persons.

- There is a wide range of COVID-19 rates among different American Indian reservations, but a handful of reservations have many-fold greater infection rates compared to the general U.S. population.

- **The case of New Mexico: As of May 11, 2020**
  - The state’s 23 tribes have borne the brunt of the COVID-19 pandemic. Nearly 60% of people identified to date through testing as infected with the virus are indigenous.
  - Half of the 200 people who had died in New Mexico from COVID-19 were Native Americans, a jarring number for a population that makes up 11% of the state’s population.

- Native Americans in the Phoenix area of Arizona have been infected at four times the rate of their white neighbors.
Why have Native Americans been hit so hard

- Native Americans — particularly those living on reservations — are more prone to contract the virus because of crowded housing conditions that make social distancing difficult.

- Years of underfunded health systems, food and water insecurity and other factors contribute to underlying health conditions that can make the illness more severe once contracted.
I have heard that Blood Type influences COVID-19 risk

• A new study found that those with A blood types had a significantly higher risk of COVID-19 while people with O blood types had a significantly lower risk.

• This study was published on a website where peer review is not necessary and was limited by a low sample size!

• These findings need to be explored further; however, experts believe this is biologically plausible.

• Another study by 23andMe found that O blood types may be protective against the virus.

• These findings are preliminary and there is not enough evidence to cause a false sense of security among those with O blood types (or panic among those with A blood types)!
How does COVID-19 Spread?
How does it spread?

• This virus is spread in large droplets by coughing, sneezing, and even talking

• You are at risk if a person coughing is close to you as droplets descend to surfaces; that is why it’s best to remain 6 feet or more from others
  • When in a place with loud talking and singing six feet may not be enough

• All the surfaces where droplets land are infectious for 24 hours to a week depending on what the surface is made out of:
  • A recent study finds that the virus can survive on hard surfaces such as plastic and stainless steel for up to 72 hours and on cardboard for up to 24 hours.
COVID-19 PANDEMIC

How is the virus transmitted?

**Single sneeze** can produce up to **10,000 droplets**.

**Single cough** can produce up to **3,000 droplets**.

Virus becomes airborne and can remain suspended in the air in very tiny droplets for hours.

If the droplets land on surfaces, the virus may survive for as long as 24 hours on cardboard and up to 3 days on stainless steel and plastic, according to a recent study.

Source: @AJLabs | Last updated: 11:30 GMT, March 24, 2020
### How long the new coronavirus can live on surfaces

<table>
<thead>
<tr>
<th>SURFACE</th>
<th>LIFESPAN OF COVID-19 VIRUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper and tissue paper**</td>
<td>3 hours</td>
</tr>
<tr>
<td>Copper*</td>
<td>4 hours</td>
</tr>
<tr>
<td>Cardboard*</td>
<td>24 hours</td>
</tr>
<tr>
<td>Wood**</td>
<td>2 days</td>
</tr>
<tr>
<td>Cloth**</td>
<td>2 days</td>
</tr>
</tbody>
</table>

| Stainless steel*             | 2–3 days                  |
| Polypropylene plastic*       | 3 days                    |
| Glass**                      | 4 days                    |
| Paper money**                | 4 days                    |
| Outside of surgical mask**   | 7 days                    |

*At 69.8 to 73.4°F (21 to 23 °C) and 40% relative humidity
**At 71°F and 65% relative humidity

Source: New England Journal of Medicine*; The Lancet Microbe**
Secondhand smoke as an analogy for COVID-19 droplets in the air

- **Imagine everyone is smoking**, and you’d like to avoid inhaling as much smoke as possible.*

- In a cramped indoor space, that smoke is going to get dense and heavy fast. If the windows are open, some of that smoke will blow away.

- If fewer people are in the space, less smoke will accumulate, and it might not waft over to you if you’re standing far enough away.

- But spend a lot of time in an enclosed space with those people, and the smoke grows denser.

- The denser the smoke, the more likely it is to affect you. It’s the same with this virus: The more of it you inhale, the more likely you are to get sick.
How does the virus spread?

Protect your nose, mouth, and eyes

• The virus infects you through your nose or mouth via your hands or an infected cough or sneeze onto or into your nose or mouth

• This virus only has cell receptors for lung cells (it only infects your lungs)

• The nose is the primary gateway for the virus entering the body *

• The eye is also a portal for entry and site for virus transmission.

• Some evidence suggests that the virus might spread via a fecal–oral route, but the data is still preliminary and few cases have been documented
  • The virus that causes COVID-19 has been found in the feces of some patients diagnosed with COVID-19. However, it is unclear whether the virus found in feces may be capable of causing COVID-19.
Can the virus remain in the air in aerosol form for some time?

• The primary mode of transmission appears to be the inhalation of respiratory droplets.
  • Surfaces can also be a mode of transmission, but this is less likely.
  • This is why masks are so important!

• Research suggests that the virus may remain in the air for some time
  • For minutes up to three hours,* depending on environmental conditions
  • A Chinese, 48-seat bus study found that the virus infected people in a closed environment with air-conditioning up to 15 feet, suggesting that in some environments the transmission distance of this coronavirus exceeds the commonly recognized safe distance of 6 feet.
  • The aerosol transmission of very small particles is a ongoing focus of attention**
Spread from smaller microdroplets as aerosols

• Because aerosols are smaller, they contain much less virus than droplets do.
  • But because they are lighter, they can linger in the air for hours, especially in the absence of fresh air.

• In a crowded indoor space, a single infected person can release enough aerosolized virus over time to infect many people

• The person does not have to be coughing or sneezing, but just talking loudly
  • Some super-transmitters of viruses do so without doing any of the above for reasons that are not yet clear
Three major transmission patterns

The World Health Organization (WHO) uses the following categories to describe transmission patterns

1. Sporadic cases refers to a small number of cases (one or more) that are either imported or detected locally

2. Clusters of cases refers to cases that are clustered in time, geographic location and or by common exposures;

3. Community transmission refers to larger outbreaks of local transmission that can be defined through different approaches, including big numbers of cases not linkable to transmission chains and multiple unrelated clusters in several areas.
Asymptomatic & mildly symptomatic in relation to disease transmission

• The CDC currently estimates that 20-50% of infections are asymptomatic.

• Several studies have shown that people without symptoms are causing substantial amounts of infection.
  • More than 43,000 people in China had tested positive without immediate symptoms by the end of February and were quarantined.
  • Of the 135 people in the Tianjin cluster, between 62% and 77% contracted the infection from someone who was pre-symptomatic.
  • Between 48% and 66% of the 91 people in the Singapore cluster contracted the infection from someone who was pre-symptomatic.

• Iceland is attempting to test its entire small population and has the means to do so. It has reported that so far 50% of all cases identified are asymptomatic.

• Physical Distancing is important!

• Those who are 60+ must physically distance themselves from youth, someone you know, even your grandchild may be asymptomatic.

• Engage in safe forms of social interaction with loved ones and friends such as sociality through social media, video chatting, and phone calls.
## Asymptomatic novel coronavirus cases

Summary of testing studies from around the world showing the share of people who tested positive for the coronavirus but had no symptoms

<table>
<thead>
<tr>
<th>COHORT</th>
<th>TESTED</th>
<th>PERCENT POSITIVE</th>
<th>SHARE OF INFECTIONS THAT WERE ASYMPTOMATIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diamond Princess cruise ship passengers and crew</td>
<td>3,711</td>
<td>19.2%</td>
<td>46.5%</td>
</tr>
<tr>
<td>Boston homeless shelter occupants</td>
<td>408</td>
<td>36.0%</td>
<td>87.8</td>
</tr>
<tr>
<td>New York City obstetric patients</td>
<td>214</td>
<td>15.4%</td>
<td>87.9</td>
</tr>
<tr>
<td>USS Theodore Roosevelt aircraft carrier crew</td>
<td>4,954</td>
<td>17.3%</td>
<td>58.4</td>
</tr>
<tr>
<td>Japanese citizens evacuated from Wuhan, China</td>
<td>565</td>
<td>2.3%</td>
<td>30.8</td>
</tr>
<tr>
<td>Charles de Gaulle aircraft carrier crew</td>
<td>1,760</td>
<td>59.4%</td>
<td>47.8</td>
</tr>
<tr>
<td>Los Angeles homeless shelter occupants</td>
<td>178</td>
<td>24.2%</td>
<td>62.8</td>
</tr>
<tr>
<td>King County, Wash., nursing facility residents</td>
<td>76</td>
<td>63.2%</td>
<td>6.3</td>
</tr>
<tr>
<td>Arkansas, North Carolina, Ohio and Virginia inmates</td>
<td>4,693</td>
<td>69.8%</td>
<td>96.0</td>
</tr>
<tr>
<td>New Jersey university and hospital employees</td>
<td>829</td>
<td>4.9%</td>
<td>65.9</td>
</tr>
<tr>
<td>Indiana residents</td>
<td>4,611</td>
<td>1.7%</td>
<td>44.8</td>
</tr>
<tr>
<td>Argentine cruise ship passengers and crew</td>
<td>217</td>
<td>59.0%</td>
<td>81.3</td>
</tr>
<tr>
<td>San Francisco residents</td>
<td>4,160</td>
<td>1.8%</td>
<td>52.7</td>
</tr>
<tr>
<td>Tyson Foods Springdale, Ark.</td>
<td>3,748</td>
<td>12.8%</td>
<td>94.6</td>
</tr>
</tbody>
</table>

Sources: Annals of Internal Medicine, Tyson Foods
Incubation period

• 4 to 6* days appears to be the median amount of time, but the range is much larger with some studies suggesting up to 24 days***.

• Existing data suggests that about 97.5 percent of people who develop symptoms of COVID-19 infection will do so within 11.5 days of exposure.

• The researchers estimate that for every 10,000 individuals quarantined for 14 days, only about 101 would develop symptoms after being released from quarantine.**
When are you most contagious if you have a mild to moderate illness

• In COVID-19 peak shedding occurs from the upper airways early on in the infection which makes for a virus much harder to contain than another coronavirus like SARS (where peak shedding occurs deep in the lungs) *

• At peak shedding, people with COVID-19 are emitting more than 1,000 times more virus than was emitted during peak shedding of SARS infection

• Research suggests that peak shedding for COVID-19 occurs before you feel ill. This emphasizes the importance of precautionary measures and helps explains why this is much harder to contain than previous coronavirus outbreaks like SARS and MERS.
How many people will a sick person infect?

Current studies suggest that a person with COVID-19 will infect between 2-3 additional persons without the use of preventative measures, but the range of estimates is around 2-6.5.*

These estimates are likely to change as we progress in the pandemic, and will vary regionally depending on how strict restrictions are.
**New coronavirus**

Most estimates put the fatality rate below 3%, and the number of transmissions between 2 and 4.

Note: Average case-fatality rates and transmission numbers are shown. Estimates of case-fatality rates can vary, and numbers for the new coronavirus are preliminary estimates.
How long do people shed the virus and how does this relate to being contagious?

- **Presence of the virus does not necessarily indicate level of contagion**

What do we know so far?

- **Wuhan data**: Median duration of viral shedding was 20.0 days (IQR 17.0–24.0) in survivors.
  - The longest observed duration of viral shedding in survivors was 37 days.

- A small but important German study found that people with mild infections can still test positive by throat swabs for days and even weeks after their illness.*

- **However, those only mildly sick are most likely not still infectious by about 10 days after they start to experience symptoms, and moderately sick by days 10-11.**
  - The scientists could not grow viruses from throat swabs or sputum specimens after day 8 of illness from people who had mild infection.
  - The researchers found very high levels of virus emitted from the throat of patients from the earliest point in their illness—when people are generally still going about their daily routines. Viral shedding dropped after day 5 in all but two of the patients, who had more serious illness.
Does a high viral load or infectious dose make COVID-19 worse?

• Research has shown that those with severe COVID-19 symptoms often have much higher viral loads than those with minor symptoms.

• We know from influenza that a greater exposure to the virus often causes a more severe illness.
  • However, it is unclear whether a greater exposure to the virus for COVID-19 causes more severe symptoms.
  • It's also important to consider patient characteristics, as people with compromised or weakened immune systems due to extreme stress, exhaustion, or other conditions could cause a lower threshold of exposure needed to cause severe symptoms.
Can children spread the virus that causes COVID-19?

• Contact tracing has demonstrated that children can spread COVID-19, though likely at a reduced rate relative to adults.  

• Children may be less susceptible to the virus, have a milder viral course, or a reduced viral load – all of which would contribute to a lesser role in transmission.

• Children, particularly school-aged children, may have more contacts than adults, thereby expanding their role in transmission in certain settings.

• Dr. Jeffery Shaman, epidemiologist at Columbia University: “...to open schools because of some uninvestigated notion that children aren’t really involved in this, that would be a very foolish thing.”
Is there a possibility of re-infection?

- Dr. Anthony Fauci, and other researchers, have stated that it is likely that someone who gets infected once is immune.
  - Other experts think that one has an intermediate level of protection that dwindles over time, like that of influenza
  - We know from previous coronavirus outbreaks that immunity to the infections decreases as time goes on and that the level of antibodies you develop may be dependent on how severe your illness was (mild illness = very little immunity)

- The question is not just is re-infection possible, but how long immunity lasts. This may vary by the amount of antibodies a person produces after having experienced this coronavirus. At this current time, it is too early to know.
Is there a possibility of re-infection?

• Much remains unknown about the virus and the duration of antibody production and disease resistance. Longitudinal serological studies profiling more symptomatic and asymptomatic individuals are urgently needed to determine the duration of antibody-mediated immunity.

• Reports of patients testing positive for the coronavirus a second time have come out of China, Japan, and South Korea.
  • Some researchers believe this is due to reactivation of the virus and not because of reinfection. I.e. people may almost be completely recovered and then their infection increases again.
  • Other research suggests that asymptomatic individuals may have a weaker immune response to Sars-CoV-2 virus.

• Reports of re-activation have health experts worried that the illness
  • Could remain dormant after an apparent recovery.
  • Or that immunity from one strain of SARS-CoV-2 virus might not protect against all strains.
If you have recovered from Covid-19 (or tested positive and are asymptomatic > 10 days) does this mean you are immune to the virus?

The CDC’s “When to Quarantine” website states: “People who have tested positive for COVID-19 do not need to quarantine or get tested again for up to 3 months as long as they do not develop symptoms again.

What does this mean?

• According to the agency, the guidelines do not refer to a person’s likelihood of catching the virus yet again, rather to the likelihood that testing for re-infection might not yield accurate results.

• The CDC isn’t taking a stance on how long immunity lasts given the uncertain state of scientific evidence
  • There’s no guarantee that people who’ve recently had COVID-19 can’t spread it or catch it.

• The CDC’s new guidelines don’t mean that people who’ve recently had COVID-19 can or should be less concerned about mask wearing or social distancing.

• The CDC still recommends that recovered patients continue to practice social distancing, wear face masks when interacting with people from outside their households, and wash their hands frequently.
Household clustering of cases

&

Super spreading events
COVID-19 often infects multiple household members

We need to be focusing more attention
On the household as a unit of analysis
And as a site of intervention
Infections often cluster in households

- Limited information is known about household clustering in the U.S., but a study in Beijing found that family cluster spread of disease accounted for 57.6% of person-to-person spread.
- Based upon risk models of close contacts with those who developed COVID-19 from Guangzhou, China:
  - 19% of people in the same household can expect to become sick
  - 14% of people who see the sick person regularly, but don’t live in the same household can expect to become sick
- A preprint research paper found that physical distancing reduced COVID-19 transmission outside the household:
  - before physical distancing household transmission was 5%-35% of cases
  - after physical distancing household transmission was 30%-55% of cases
- **Bottom line:** Household transmission is common. If you work in an environment of risk, you need to adopt precautions so you do not bring the virus home to family members, especially family members having a preexisting condition or > 60 years of age.
  - Health care and other essential workers are top of this list.
Family clusters of COVID-19 cases

- SARS-CoV-2 is more transmissible in households than related coronaviruses SARS and MERS
- Older individuals (aged ≥60 years) are the most susceptible to household transmission of SARS-CoV-2.
- Family clusters became the main mode of human-human transmission in China
  - The estimated secondary attack rate among household contacts was 12.4% (95% CI 9.8–15.4) when household contacts were defined on the basis of close relatives and 17.1% (13.3–21.8) when household contacts were defined on the basis of residential address.
  - Compared with the oldest age group (≥60 years), the risk of household infection was lower in the youngest age group (<20 years; odds ratio [OR] 0.23 [95% CI 0.11–0.46]) and among adults aged 20–59 years (OR 0.64 [95% CI 0.43–0.97]).
  - Notably, greater infectivity during the incubation period than during the symptomatic period, although differences were not statistically significant (OR 0.61 [95% CI 0.27–1.38])
Household clusters

• In the China study, adult household contacts were suspected or confirmed to have COVID-19 infection before the study child in 79% (31/39) of cases.
  • The study child developed symptoms before any other household contact in only 8% (3/39) of households.

• In a similar international study of COVID-19 transmission in 31 household clusters from China, Singapore, South Korea, Japan, and Iran, the investigators found that a child was the first (index) case in only three of the 31 (9.7%) household clusters investigated.
  • However, because children are less likely to be symptomatic, they may also be less likely to be identified as the “index” case during a contact tracing investigation and therefore their role in transmission could be underrecognized.
  • This study was also conducted during school closures, so it is likely that the children were less likely to have been exposed first due to remaining physically distant at their homes.
Household contacts and disease transmission

- A study of 59,073 contacts of 5,706 coronavirus disease (COVID-19) index patients reported in South Korea (January 20 – March 27, 2020) found that
  - Of 10,592 household contacts, 11.8% had COVID-19.
  - Of 48,481 non-household contacts, 1.9% had COVID-19.

- A US based study conducted early on in the pandemic likewise found infection rates for symptomatic household contacts in the United States to be 10.5% (95% CI 2.9%–31.4%), significantly higher than for non-household contacts.

- Rates were higher for contacts of children than adults.
  - The study took place in the middle of mitigation and therefore might characterize transmission dynamics during school closure and child isolation.

- Given high rates of preventive behavior the study illustrated that use of personal protective measures and social distancing reduces the likelihood of transmission.
Those who live in multigenerational households are at high risk

- Multigenerational households, especially among those poor with limited house space, are at high risk to infection especially if one or more members must work outside the home in a service-related job where they are routinely exposed to the public, and/or a child is attending school.

- This is especially the households where someone is >65 years of age and/or has a precondition like hypertension, diabetes, COPD, or an immune disorder.

- In the USA this includes >25% of minority group households, groups that have the highest rates of COVID-19 prevalence.

- At present data on COVID-19 cases within such households is limited and scant resources have been allocated to isolate those testing positive from family members if they do not have the wherewithal to do so.
One-in-five Americans live in a multigenerational household

% of population in multigenerational households

Note: Multigenerational households include at least two adult generations or grandparents and grandchildren younger than 25.

PEW RESEARCH CENTER
Whites less likely than other racial and ethnic groups to live in multigenerational households

% of population in multigenerational households

<table>
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<tr>
<th></th>
<th>Total</th>
<th>Asian</th>
<th>Hispanic</th>
<th>Black</th>
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<td>29</td>
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<td>26</td>
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<td>16</td>
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</tbody>
</table>

Note: Multigenerational households include at least two adult generations or grandparents and grandchildren younger than 25. Hispanics are of any race. Asians include Pacific Islanders. Whites, blacks and Asians are single-race only and include only non-Hispanics. “Other” includes non-Hispanics in remaining single-race groups or multiracial groups.

Bottom line

- Household transmission is common.
- If you work in an environment of risk, you need to adopt precautions so you do not bring the virus home to family members, especially family members having a preexisting condition or > 60 years of age.
- This is especially true for health care workers.
- More resources need to be allocated to enabling those with limited means to isolate if they test positive or are ill to protect other household members.
  - Multigenerational households are an immediate priority.
  - Testing and tracing without isolation does little to break the chain of transmission.
Super-spreader events: looking beyond $R_0$

A reproductive number $R_0$ is the average number of people who become infected by an infectious person

- This number while useful can be misleading because it masks the variability of spread from one person to the next. If nine out of 10 people don’t pass on a virus at all, while the 10th passes it to 20 people, the average would still be two.

- Some studies have suggested that 10% of people infected with COVID-19 may be responsible for 80% of all new infections. I.e. **most people pass on the virus to very few people, while others end up spreading it to many**
  - These individuals are more likely to be pre-symptomatic or asymptomatic

- The instances where these occur are called **super-spreader events**
Super-spreader events

A super-spreading event depends as much on circumstance as the biology of an individual who is present (Agent, Host, Environment interaction). In particular:

- Is the individual susceptible to infection? Are they physically distant? Are they wearing a mask? Are they performing activities that would make them breathe more or harder than usual?
- Is the environment indoors or outdoors? Is there adequate ventilation and air circulation?
Super-spreader events

• Most super-spreader events occur in scenarios in which the risk of infection is high. For example:
  • at an indoor venue, especially a poorly ventilated one (meaning air is not being exchanged, diluted, or filtered)
  • Where there are lots of people
  • And those people are talking, chanting, singing, or doing other activities that increase the amount of air that they are breathing and how much air they expel.

• Some examples of where super-spreader events have taken place are restaurants, bars, clubs, choir practices, weddings, funerals, cruise ships, nursing homes, prisons, and meatpacking plants.

• In one database of more than 1,200 super-spreader events, only one incident was classified as outdoor transmission. All the rest were events occurring indoors
Examples of super spreader events

• February 26 – Biogen leadership conference in Boston with 175 attendees. At least 70 (40%) became ill at the conference.
• March 6-11 – Among 92 church goers in Arkansas during this time, 35 (38%) became ill and 3 died. There were an additional 26 cases linked to the church.
• March 17 – A Skagit County, Washington choir member attended choir practice with 122 members and infected up to 53 (43%) people. 3 were hospitalized, and 2 died.
Super-spreader–events need to be thought about in terms of the three V’s:

Venue, ventilation, and vocalization
No Coronavirus 'Spike' from Protests

Since May 25, Philadelphia's COVID-19 case counts fell while Allegheny County showed a small uptick, based on a rolling average of new cases over 14 days. The massive, sustained spikes some feared the protests against police brutality would bring did not happen. Pittsburgh is the county seat of Allegheny County.

14-day totals of new cases per 100,000 population

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Chart: DYLAN PURCELL / Staff • Source: Pa. Dept. of Health

Holding events outside and wearing masks reduces the chances of a super spreader events
How fast does this virus escalate?

Depends on steps taken during trajectory of illness
COVID-19 spreads fast

• Compared to SARS and MERS, COVID-19 has spread strikingly fast: While MERS took two and a half years to infect 1,000 people, and SARS took roughly four months to hit that figure, COVID-19 reached 1,000 cases in just 48 days

• The disease's global fatality rate is estimated to be less than 4 percent, compared to 35 percent for MERS and 10 percent for SARS
Exponential spread: For every two to six days that we delay engaging in physical distancing, the number of infections double

Official line:
• Every person with the COVID-19 virus infects approximately two to four people.
• The infection rate doubles every two to six days (there is a range depending on what policies/programs different countries are implementing)
• That means that if 50,000 people have the virus today, then in 6 days, 100,000 people will have it.
• In another 12 days it’s 400,000 and less than two weeks later it’s over a million people.
• We have 330 million people in the US. The experts expect that 40-70% of people will be infected.
Exponential spread of COVID-19

Total number of confirmed U.S. coronavirus cases at each Tuesday: January to March 10

Jan. 14 — 0
Jan. 21 — 1
Jan. 28 — 5
Feb. 4 — 11
Feb. 11 — 14
Feb. 18 — 25
Feb. 25 — 59
Mar. 3 — 125
Mar. 10 — 1,004
And so on........
Exponential Spread in March, USA

New coronavirus cases announced in the U.S. each day

Source: C.D.C., state and local health agencies, hospitals.
Exponential spread of COVID-19

- Zero cases to 1 million cases: ~100 days
- 1 million to 2 million cases: 12 days
- 2 million to 3 million cases: 13 days
- 3 million to 4 million cases: 12 days
- 4 million to 5 million cases: 11 days
- 5 million to 6 million cases: 10 days
- 6 million to 7 million cases: 8 days
- 7 million to 8 million cases: 8 days
- 8 million to 9 million cases: 6 days
Where are we in the Disease Trajectory?

Based on our evolving experience with COVID-19
The WHO Pandemic Phases

March 29th, 2020 – Cumulative Confirmed Cases

Country by country: how coronavirus case trajectories compare
Cumulative number of confirmed cases, by number of days since 100th case

Graph: FT graphic: John Burn-Murdoch / @jburnmurdoch; Source: FT analysis of Johns Hopkins University, CSSE; Worldometers; FT research. Data updated March 29, 19:00 GMT ©FT
March 28th, 2020 – Cumulative Confirmed Cases

Total confirmed COVID-19 cases

The number of confirmed cases is lower than the number of actual cases; the main reason for that is limited testing.

Source: European CDC – Situation Update Worldwide - Data last updated 27th May, 02:44 (GMT-07:00), European CDC – Situation Update Worldwide

CC BY
August 21st, 2020 – Cumulative Confirmed Cases

Cumulative confirmed COVID-19 cases
The number of confirmed cases is lower than the number of actual cases; the main reason for that is limited testing.

Source: European CDC – Situation Update Worldwide – Last updated 21 August, 11:34 (London time), Official data collated by Our World in Data
CC BY
Where Coronavirus Cases Are Still Growing Fast

Cumulative confirmed COVID-19 cases in selected countries from day 1 after 100+ cases

As of Aug 19, 2020
Source: European CDC via Our World in Data
March 28th, 2020 – Daily Confirmed Cases

Daily new confirmed COVID-19 cases
Shown is the rolling 7-day average. The number of confirmed cases is lower than the number of actual cases; the main reason for that is limited testing.

Source: European CDC – Situation Update Worldwide - Data last updated 23rd Jun, 07:33 (GMT-07:00), European CDC – Situation Update Worldwide CC BY
August 21\textsuperscript{st}, 2020 – Daily Confirmed Cases

Daily new confirmed COVID-19 cases
Shown is the rolling 7-day average. The number of confirmed cases is lower than the number of actual cases; the main reason for that is limited testing.

Source: European CDC – Situation Update Worldwide – Last updated 21 August, 11:34 (London time), Official data collated by Our World in Data
CC BY
March 28th, 2020 – Cumulative Deaths

Total confirmed COVID-19 deaths
Limited testing and challenges in the attribution of the cause of death means that the number of confirmed deaths may not be an accurate count of the true number of deaths from COVID-19.

Source: European CDC – Situation Update Worldwide - Data last updated 20th May, 08:29 (GMT-07:00), European CDC – Situation Update Worldwide CC BY
August 21st, 2020 – Cumulative Deaths

Cumulative confirmed COVID-19 deaths

Limited testing and challenges in the attribution of the cause of death means that the number of confirmed deaths may not be an accurate count of the true number of deaths from COVID-19.

Source: European CDC – Situation Update Worldwide – Last updated 21 August, 11:34 (London time), Our World In Data
CONFIRMED CORONAVIRUS DEATHS BY COUNTRY

United States 170,052
Brazil 107,852
Mexico 56,757
India 50,921
United Kingdom 41,366
Italy 35,396
France 30,410
Spain 28,617

Source: Our World in Data (August 17, 2020, 10am ET): European Centre for Disease Prevention and Control (2020).

August 17 2020
August 21st, 2020 – Daily Deaths

Daily new confirmed COVID-19 deaths

Shown is the rolling 7-day average. Limited testing and challenges in the attribution of the cause of death means that the number of confirmed deaths may not be an accurate count of the true number of deaths from COVID-19.

Source: European CDC – Situation Update Worldwide – Last updated 21 August, 11:34 (London time), Our World In Data
April 21st, 2020 – Streamgraph Distribution

The US now accounts for more than thirty per cent of global daily deaths.
August 20th, 2020 – Weekly Average Streamgraph Distribution

Resurgence in Covid-19 deaths approaching mid-April peak
Daily deaths of patients diagnosed with coronavirus (7-day rolling average)

Latin America now accounts for 43 per cent of average global deaths

Aug 13-19 Average daily deaths 5,632

Mar 15-21 Average daily deaths 393

Peak deaths Apr 10-16 6,754

The US share of average global daily deaths has risen again to 18 per cent

Rest of N America

Rest of Europe

Rest of Middle East

Rest of Asia

Europe

US

India

Brazil

Rest of Latin America

LatAm total Aug 13-19 2,424

Iran

Rest of Africa

EU

UK

US: Aug 13-19 1,025

Rest of N America* Canada, Bermuda, Greenland and St Pierre and Miquelon

* Continents and regions as per World Bank data.
May 18th, 2020 – Weekly Average Streamgraph Distribution

The global Covid-19 death toll is continuing to ease slowly. Daily deaths of patients diagnosed with coronavirus (7-day rolling average).

The US accounts for thirty per cent of average global daily deaths.

Brazil has the highest number of average daily deaths outside of the US.
May 27th, 2020: Total Deaths in the United States

Coronavirus situation in the US
Total deaths as of 5:08pm May 27 BST

[Map showing total deaths in the United States as of May 27th, 2020]
August 21\textsuperscript{st}, 2020 – Total Deaths in the United States
Place of death: USA 8/5/2020

- Total deaths from COVID-19: 142,164
- Healthcare setting, inpatient: 90,792
- Nursing home/long term care facility: 32,682
- Decedent’s home: 7,403
- Healthcare setting, outpatient or emergency room: 5,147
- Hospice facility: 3,664
- Other: 2,281
- Healthcare setting, dead on arrival: 145
- Place of death unknown: 50

Number of deaths
Moving into *Post-Peak* Pandemic

- *New Cases* and *New Deaths* in the US have approximately plateaued at peak levels, with slow drops in both.
  - Some public health researchers suggest that this may be primarily be due to New York’s decrease in new cases (as they were the epicenter in the US)

- A reduction in control measures and physical distancing at this point in time may cause both counts to rise.

- Some US states have not reached their peak transmission; this could continue with the relaxation of restrictions that were put in place.

- Physical distancing and control measures are needed following peak transmission to prevent subsequent and immediate growth of new cases.
Multiple Peaks are likely

• True prevention of subsequent peaks in cases can only be achieved with herd immunity – when enough people are immune from recovery or vaccination.

• Vaccine development is ongoing, though this development may take 12-18 months.
  • It is likely that initial vaccines may only be 40-60% effective like seasonal flu vaccines and it is also likely that getting the virus under control could potentially require several different vaccines *

• Factors that may contribute to subsequent peaks of cases:
  • Relaxation of control measures.
  • Physical, social distancing measures are lifted.
  • Localization of new waves – new locations, climates, populations, and movements of people.
  • Non-permanent immunity.

• Prevention of subsequent waves can be supported with consistent control measures and social distancing.
The demographic of new cases is shifting in the US

• More cases are being reported in the 20-40 age bracket.
• The shift appears to be related to
  • Members of this group refusing to comply with social distancing and mask wearing unless strictly enforced by law, and acting as if the threat of severe disease for them is not worth the social risk of living their best life
  • Members of this group re-entering the work place and exposed to environments of risk

Example is California and Florida:
• June: in California, people under 35 now make up about 44% of new infections in that state, compared with 29% last month
• June: In Florida people under 37 make up about half of that state's newer cases
Seasonal Transmission cannot be assumed

- “Given that countries currently in ‘summer’ climates, such as Australia and Iran, are experiencing rapid virus spread, a decrease in cases with increases in humidity and temperature elsewhere should not be assumed...Changes in weather alone will not necessarily lead to declines in cases without extensive public health interventions.”

- Historical context of the previous 10 influenza pandemics, dating 250 years, demonstrate peaks relative to time of emergence and spread, not seasonality.

- Similarly, pandemic influenza strains have not exhibited the typical seasonal pattern of endemic/epidemic strains that have decreased in summer months.
Likely scenarios
There are three possible scenarios we could encounter

• Because many US states have moved into their post-peak transmission period, it is important that we consider possible scenarios that are likely to occur given that we do not have any pharmaceutical ways of preventing infection and that likelihood of generating herd immunity through active infections or vaccination soon is low.

• Relying strictly on non-pharmaceutical interventions, there are three likely scenarios we should prepare for:

1. Peaks and Valleys
2. Fall Peak
3. Slow Burn
Three Possible Pandemic Curve Scenarios

1. Peaks and Valleys
2. Fall Peak
3. Slow Burn

Here we are
Peaks and Valleys

• In this scenario, we would see an initial wave of cases (the one we are currently experiencing) which is then followed by consecutive drops (valleys) and increases (peaks) in cases.

• Over time, these would gradually diminish.
Fall Peak

• In this scenario, it is predicted that the current peak we are in will be closely followed by a much larger “fall peak” (or winter peak), similar to what we see happen annually with the flu and during the 1918 flu pandemic.

• After this second, more severe fall/winter peak, we would see multiple smaller peaks following until the outbreak diminishes.
Slow Burn

• In this scenario, we would see a severe heightened peak in the spring (where we are currently), and then a gradual, drawn out period of smaller peaks and valleys until the outbreak has diminished.
Which scenario will we see?

• It is important to remember that each of these scenarios is likely given our current situation: we only have non-pharmaceutical interventions like physical distancing, mask use, handwashing, and other preventative hygiene behaviors at our disposal to prevent the spread of infection.

• If some of these restrictions and precautionary measures are relaxed too much or disregarded, we could end up with a scenario similar to Peaks and Valleys but with very significant “peaks” with very little decreases in case counts to reach the “valleys”.
Response will require adaptation over time
Herd Immunity
Herd immunity is key to control in an epidemic like this

- Herd immunity (also known as community immunity) is defined by the CDC as “a situation in which a sufficient proportion of a population is immune to an infectious disease (through vaccination and/or prior illness) to make its spread from person to person unlikely.”

- When someone becomes immune to a pathogen, through vaccination or recovery from illness, that person will no longer spread the pathogen, meaning that person is not the only beneficiary of their immunity.

- Herd Immunity is key to controlling epidemics and pandemics.
An Example of Herd Immunity

Measles

• An outbreak of measles occurred in Milwaukee, Wisconsin in the late 1980s.

• Researchers studied 1,011 adolescent measles cases confirmed between September 1989 and June 1990.¹

• Results showed an “association between immunization coverages and measles attack rate...” in which an increase in vaccination was associated with a decrease in the number in of people who contracted measles.

• Researchers estimated that an immunization coverage of approximately 80% would be sufficient to prevent sustained measles outbreaks in urban communities.
COVID-19 is different from measles as there is no vaccine: So the herd immunity situation is different

- There’s no vaccine for COVID-19 yet – there will probably not be one available to the public for a year or more
- The only option is immunity after recovery from the virus. This means the majority of people will need to catch the virus at some point in time.
  - We will likely need at least 50% of the population to be immune to have herd protection.
- But not at the same time or the health system gets swamped
- The curve everyone is talking about flattening entails spreading out the rate of infection to reduce case load in hospitals for the severely ill.
The graph illustrates the impact of protective measures on the number of cases over time since the first case. Without protective measures, the number of cases increases rapidly, exceeding the healthcare system capacity. With protective measures in place, the curve is shifted to the left, reducing the peak number of cases and keeping the healthcare system within its capacity. This graph is adapted from CDC and The Economist.
LOWER AND DELAY THE EPIDEMIC PEAK

Proactive measures taken early in an epidemic reduce burden on the healthcare system and slow the spread of disease.
Limitations to Herd Immunity for COVID-19

• Currently, it is still unknown whether an infection with COVID-19 results in immunity to reinfection.
  • If it does, we don’t know how long that immunity would last.
    • Memory B cells and circulating antibodies

• The proportion of the population that would need to get COVID-19 in order to develop herd immunity is also unknown.
  • The required percentage of people immune to achieve herd immunity in previous flu pandemics has ranged between 13 and 100%.
  • Some research has suggested that at least 50% of the population (most likely >70%) would need to have been infected AND immune to reinfection to achieve herd immunity for COVID-19.

• Given what we currently know about the death rate of COVID-19, it would be extremely dangerous and result in millions of deaths to try and achieve herd immunity without a vaccine.
  • Therefore, persons should not knowingly attempt to acquire the infection in order to try and gain immunity akin to “chickenpox parties.”
Current lessons from Sweden

- **Sweden has taken a rather unconventional approach to controlling their outbreaks by relying on generating a herd immunity without lockdown measures.**

- With no lockdown measures in place, Sweden’s death rate due to COVID-19 is greater than the rate here in the US with our comparatively relaxed lockdown measures in place.

- Initially, Sweden saw death rates from COVID-19 that were similar to other European nations that had closed down their economies.

- Mid May, the Scandinavian nation’s daily death toll per 1 million people is 8.71 compared to the United States’ 4.59. Sweden’s mortality rate is the highest in Europe.

- Sweden has recorded its highest tally of deaths in the first half of 2020 for 150 years.

- COVID-19 claimed about 4,500 lives in the period to the end of June – a number that has now risen to 5,800 in August – a much higher percentage of the population than in other Nordic nations, though lower than in Britain and Spain.
What would happen if we followed Sweden’s strategy to reach herd immunity?

Using the WHO (65%) and CDC (0.65%) figures, 213 million people in the U.S would need to be infected to achieve herd immunity, leaving 1,385,800 Americans dead. *

COVID-19 testing

Why is testing important
Different kinds of tests tell us different things
What is the Importance of Testing?

• Testing allows confirmed cases to be isolated quickly and known contacts to be identified early, accounting for spread of the illness.¹

• If we limit testing to those who are very ill, we miss those spreading the disease asymptomatically or with minor symptoms.¹

• Effectiveness of testing is evident in South Korea:²
  • Used the WHO validated testing kit
  • Test as many people as possible even with minor suggestive symptoms
  • Contact trace
  • Isolate
Types of Testing

Polymerase Chain Reaction (PCR) and Antigen tests

The swab, spit, and rapid tests

A diagnostic test used in the United States identifies people who are currently spreading the virus. The test does not reveal who has previously been infected.

• PCR for COVID-19 requires a nasal swab, sputum sample, or a spit sample that identifies the specific viral RNA from the COVID-19 virus. It’s the gold standard to see if you are actively infected.

• PCR detects the presence of this virus molecule in a person. It does not detect the disease effect, meaning a person can be PCR positive before they have symptoms.

• Antigen tests for COVID-19 also using nasal or throat swabs and spit samples. Rather than testing for the presence of viral RNA from the virus that causes COVID-19, it tests for the presence of antigens that your immune system uses to recognize the infection (like proteins that are part of the virus). These tests can be completed within hours of having a sample taken so they are known to be rapid tests.
Antigen tests: Another type of test that indicates infection at one point in time

- Antigen tests have been widely used to identify diseases like the seasonal flu and are starting to be used more frequently for COVID-19 testing as well.
- The benefit of these compared to PCR tests is that they are relatively inexpensive and can provide results in minutes.
- How accurate are they?
  - Antigen tests are very specific for coronavirus virus; however, they are not as sensitive as molecular PCR tests.***
  - False positive test results are rare; however, some tests from private companies can be less accurate and have false negatives up to 50% of the time.
  - Before getting an antigen test, always check with the test provider to determine which antigen test it is so you can make sure your test is more accurate (a sensitivity closer to 90% rather than 50%)
- The benefit of the better-quality rapid antigen tests (having a 10% false negative rate) is that they are cheap enough for people to be tested repeatedly.
  - It is unlikely that two false negatives will be experienced if performed a few days apart
Serological (antibody)

The Blood Sample test

A blood-based serological test detects antibodies that people produce after they've become infected. These antibodies can appear in the blood weeks after infection. Antibodies detect the immune system’s response to the presence, not the current presence of the virus.

• This test has epidemiological uses, supporting retrospective case counts, as well as diagnostic uses.

• This test is also used to determine whether someone has immunity, or protection, against a second infection

• It has been employed in China, Taiwan, and Singapore and is currently being deployed in the USA.
Why are there False Negative Diagnostic Tests?
PCR (the swab or spit) and Antigen (the rapid) tests

• A diagnostic test is only valid for a single point in time.
• A “false negative” is when someone who has the disease receives a negative test result.
• There are a number of reasons why a diagnostic test may result in a false negative:
  • It might be too early in the illness, when the amount of virus in the airway or body is still small.
  • It could be a problem with how the swab was done.
  • There could be issues with the handling or transport of the swab.
  • There could be laboratory error.
Why are serological tests so important?
The Blood test

• Identifies people who were not known to be infected:
  • Identifies current, silent infections, as well as those who have recovered.
  • Supports contact tracing.
• Presence of antibodies can mean several things:
  • Ability to care for sick.
  • Potential to donate antibodies through plasma.
  • Return to work, other demands.
• However - *does a positive response for the antibodies mean that a person is actively infected, or that they have been infected in the past?*
Two types of serological tests

The Blood test

**ELISA immunoassay**
- Gold standard, but labor intensive, take longer to receive results, and expensive
- Assesses IgM levels which indicate ongoing, or recent, infection.
- Excellent tests for determining true immunity by antibody titers.
  - “Titers,” or levels of antibodies, provide a quantification of antibody presence (high or low)

**Lateral flow assays**
- Array of rapid turnaround tests that are cheap and usually rely on color change to give you a qualitative “binary” yes or no answer to whether antibodies are present in your blood
  - A common lateral flow assay is a pregnancy test
- Accurate when positive, but have higher false negative rates compared to ELISA
  - Miss cases early on and are not helpful in the first 1~2 weeks of illness, may miss those having suppressed immune systems
- Not great for diagnosing “active” cases of COVID-19 infection, but useful for surveillance of large populations after the fact.
Developing a blood based serological test

Antigens are structural parts of a virus.

In the novel coronavirus, a series of spikes on the outside help the virus spread.

The virus uses these spikes to bind to cells and infect them.

These spikes can be neutralized, or blocked by antibodies.

Antibodies are proteins produced by the immune system to fight infection.

How COVID-19 antibody testing works:

1. Researchers take lab-grown COVID-19 antigens and put them into special plates that immobilize them.

2. Health care workers take a sample of a patient’s blood.

3. Parts of the blood containing antibodies are extracted into a serum.

4. The serum and a detector antibody are added into the special plate mixture. Detector antibodies alert researchers to the presence of virus antibodies.

5. If COVID-19 antibodies are present, they will stick to COVID-19 antigens and block them.

6. The detector antibodies will stick to the COVID-19 antibodies to cause a reaction.

7. The reaction causes the liquid in the plate to turn blue. If the liquid turns blue, it means the patient has had or currently has COVID-19.
We need different types of tests to inform us about the incidence and prevalence of COVID-19

**Incidence**

• The number of *new cases* of a disease divided by the average population at risk during a specific time period.

**Prevalence**

• The number of *existing cases* of a disease in a population at a given time period.
When you hear about test statistics always differentiate between statistics that refer to the incidence or prevalence of the disease

- **PCR tests (the swab) and antigen tests** are helpful in determining where we are currently at in the outbreak because they are important in calculating **incidence rates**, which tell us how many new cases of COVID-19 we are experiencing.

- Serology tests (the blood test) are helpful in determining **prevalence rates**, or how many people have ever had COVID-19. These rates are crucial to determining how close we are to achieving *herd immunity*.

- Because these two tests are measuring different aspects of the outbreak, they should not be combined together into one statistic.
Testing early matters

• While the US is now testing more people per capita than South Korea, there are a few important things to keep in mind:
  • South Korea’s outbreak has been on the decline since early March, with an average rate of less than 9 new cases daily in the past two weeks.
  • In comparison, the US has had an average rate of greater than 28,000 new cases daily over the past two weeks.
• The major difference is the timing and intensity of testing efforts.
  • South Korea began robust testing very early on in their outbreak, which when combined with rigorous contact tracing, helped them to curb their outbreak early on.
Testing early matters

Ramping up testing early on in the outbreak helps to reduce the spread of infection, and shorten the duration of the outbreak
Testing early matters

Whereas waiting to increase testing until the outbreak is already well underway increases the duration and peak of the outbreak.
Testing early matters

• Because South Korea began robust testing efforts early, the average number of daily cases is low so they don’t need to test the same amount of people that we do in the US.

• To give you an idea as to how robust their response was compared to the US:
  • At the height of their outbreak, South Korea was testing 16 times the amount of people as they had confirmed cases. I.e., for each person that was positive, they also tested 15 other people who came back negative.
  • In comparison, on the day we had the most new cases the US only testing 4 times the amount of confirmed cases. I.e., for each person that tested positive, they were also testing 3 other people who came back negative.
  • South Korea’s testing response was 4 times that of the US.
How often should you get retested?

• A crucial part of any reopening plan will include recommendations for retesting, because each test only provides information about a snapshot in time.

• Currently, it is recommended that you get a PCR (the swab or spit) or antigen (the rapid) test if you have been exposed to someone with a known infection and/or are experiencing symptoms consistent with COVID-19.

  • PCR (the swab or spit) tests are fully covered via your insurance provider, or through Medicaid funds the government has allocated to cover the cost of testing for those who are uninsured.
How often should you get retested?

• How often you get retested for COVID-19 will vary depending on your occupation and the availability of tests, among other reasons.

  • Those in occupations with a high risk of infection (like first responders and healthcare workers) would be required to be retested more frequently using PCR (the swab) tests because of their routine and prolonged exposure with people who have COVID-19.

  • Individuals who work in office settings or occupations with the ability to remain physically distant, follow mask wearing recommendations, and institute adequate disinfecting protocols would only need to be retested with a PCR (the swab) test if they have been exposed or are showing symptoms.
Pooled PCR testing (the swab)

As states have reopened, there has been a greater need for testing. One method to address this is via pooled PCR (the swab) testing.

- Pooled PCR (the swab) tests combine parts of individual samples from groups of individuals and test them as one sample using sensitive molecular biological detection methods.
- If the sample comes back positive, then each person’s original sample that was included in the pooled sample is tested individually to determine who among the group has an active infection.
- If the sample comes back negative, then each individual sample does not need to be tested.
- This saves money, time, and significant numbers of test kits and increases the test capacity of the existing laboratory infrastructure.
- Only Useful when the prevalence of COVID-19 cases is fairly low
Pooled testing can contribute to a sense of group responsibility

- When a group that interacts routinely is tested together they get a sense of shared risk as well as shared responsibility to each other.
- This in turn supports a shift from individual behavior change to group norms that support the health of the unit – say people who work together in close quarters.
  - This might translate, for example, to mask wearing, or physical distancing
  - But steps must be taken not to stigmatize one who tests positive
- This also facilitates contact tracing: if one person tests positive in the site, then others know all need to isolate as well as get a PCR test to see if they may have in turn transmitted the virus to family members or other groups they interact with routinely.
How often should I be retested with serology (the blood sample) tests?

• Because serology (the blood sample) tests determine whether you have EVER had the infection and not whether you have an active infection, how often you get retested with serology (the blood sample) tests will be less frequent.

  • Serology (the blood sample) tests detect antibodies to the infection which do not form unless you’ve had the infection or have been vaccinated against it.
  • As outbreaks progress, and a greater proportion of the population has been infected, retesting with these tests will become more important.

• Currently, however, retesting with serology (the blood sample) tests should be relatively infrequent compared to PCR (the swab or spit) tests.
Big questions remain related to testing for COVID-19 immunity

• **How accurate are the tests?** – especially the lateral flow assays that are being developed and sold by many labs with suboptimal oversight
  • Both sensitivity and specificity of tests need to be considered, i.e., what are the rates of false positives and false negatives in these tests.

• We still don’t have a reference point for COVID. **We don’t yet know at what level of antibody production that a person becomes immune and how long that immunity lasts.**
  • One might test positive to a lateral flow assay, but these only measure the presence of antibodies, a low level of antibody response might mean they are not immune from reinfection.
  • Immunity exists on a continuum: Not everybody that gets exposed to the disease produces the same amount of antibodies.

• **What percentage of the antibodies being produced are neutralizing antibodies** (that prevent the disease by binding to the virus), and what percentage are antibodies that just recognize the virus.
Immunity to COVID-19: how long does it last

Antibodies and T cells are both important to consider
Questions remain about the protective effect of antibodies

- It is still unknown having antibodies to COVID-19 would prevent re-infection.
  - We know from outbreaks of related coronaviruses (SARS and MERS) that whether someone develops antibodies and how long those antibodies lasts varies.

- Based on the assumption that those who have the infection are immune from acquiring it again, researchers suggest that **50-70% of the population would need to acquire COVID-19 to provide herd immunity.**
  - Currently only about 5% of the US population would be immune based on this assumption
Immunity and antibodies

• A large study in China found substantial variability in the development of neutralizing antibodies among patients with mild SARS-CoV-2 infection in China.

• Higher antibody levels were seen in men, older patients, and those with indicators of stronger immunologic response.

• However, men, older patients, and those with stronger inflammatory response generally fared worse, suggesting that the higher titers of antibodies do not necessarily lead to higher recovery rate.

• **Take home message:** we can not correlate antibody levels with prognosis. We do not know whether certain groups need higher antibody levels to overcome the illness.
Immunity: the importance of T cells not just antibodies

• Antibodies in people’s blood typically develop after one is exposed to a virus.

• Scientists believe another part of our immune system — T cells, a type of white blood cell that orchestrates the entire immune system — could be just or even more important in fighting against the coronavirus.

• Partial protection to coronavirus depends on “memory” T cells, the part of our immune system trained to recognize specific invaders.

• T cell protection may also be associated with:
  ✓ preexisting immunity to other coronavirus we have experienced before
  ✓ cross protection derived from childhood vaccinations
If you have recovered from COVID-19 (or tested positive and are asymptomatic > 10 days), does this mean you are immune to the virus?

The CDC’s “When to Quarantine” web site states: “People who have tested positive for COVID-19 do not need to quarantine or get tested again for up to 3 months as long as they do not develop symptoms again”*

• This does not mean that you are immune to reinfection.

What does this mean then?

• When you have recovered from COVID-19, even though you are no longer experiencing symptoms, pieces of the virus can still be found in your tissues for up to 3 months after your stopped having symptoms.
• So, if you get tested again within those 3 months, you are likely to come back as positive regardless of whether you have an infection or not.
If you have recovered from COVID-19 (or tested positive and are asymptomatic > 10 days), does this mean you are immune to the virus?

• The CDC isn’t taking a stance on how long immunity lasts given the uncertain state of scientific evidence and is not stating that people who’ve recently had COVID-19 should be less vigilant about wearing a mask or maintaining physical distancing.

• There’s no guarantee that people who’ve recently had COVID-19 can’t spread it or catch it again, so recovered patients should continue to practice social distancing, wear face masks when interacting with people from outside their households and wash their hands frequently.
Would different strains affect COVID-19 vaccine development?

- **Viruses mutate**, and at varying rates (some mutate very quickly while others are fairly stable).

- Current viral genomic research suggests:
  - At least 10 strains of the COVID-19 have been identified.
  - Only small differences between the virus strains that cause COVID-19.
  - They have a slow rate of mutation.

- At the moment, scientists think:
  - It is unlikely differences in mortality and symptom presentation are related to people being infected with different strains of the virus. There may be a difference in how infectious they are.
  - Immunity gained from infection will be across the different strains, but the question is how long that immunity will last.
  - A vaccine developed for SARS-CoV-2 would be a single vaccine, rather than a new vaccine every year like the flu vaccine (more like chickenpox and measles vaccines) and have a long-lasting effect.

- **Nine different types of vaccines are underdevelopment:** see ** for descriptions of various vaccine strategies.
Contact tracing

Why is it an important
Next step after testing
What is contact tracing, and why is it important?

• Contact tracing is a vital public health process in which individuals who may have been exposed to an illness are identified and then notified of their exposure so that they can take necessary precautionary measures (such as testing and self-isolation) to prevent exposing other people.

• This is essential to curbing and preventing outbreaks of infectious diseases. E.g., illnesses that can be passed from person-to-person.
  • If people who have been exposed are informed EARLY, then transmission of the virus to other people can be prevented.
How does contact tracing work?

• Contact tracing is conducted for every disease/illness that health departments have defined as reportable illnesses.
  • Reportable illnesses are those that are of importance for public health due to their abilities to spread throughout the community and potentially cause significant harm.

• When laboratories, physicians, and other healthcare providers identify a person as being positive for a reportable illness, they are required by law to report that information to the health department.
  • At this point, someone from the health department contacts (usually via phone call) you so that they can identify possible exposures that led to your illness and so that you can identify people you were in contact with that could have been exposed due to you also being sick.

• This is all done to prevent others from getting sick.
Contact tracing is generally done through a phone call.
How contact tracing works for COVID-19

• **For COVID-19 contact tracing**, health departments are performing contact tracing for each person who is identified as a case.

• **How are you classified as a case?**
  • Cases are divided into two different categories: Confirmed cases and probable cases.
  • Confirmed cases are people who have **Confirmed Laboratory Evidence** of a COVID-19 infection.
  • Probable cases are people who meet either **Clinical Criteria AND Epidemiologic Evidence** or who meet **Presumptive Laboratory Evidence AND either Clinical Criteria OR Epidemiologic Evidence**.
Laboratory and Clinical Criteria for Cases

• **Laboratory Criteria**
  - Confirmatory Laboratory Evidence = *a positive PCR (the swab) test*
  - Presumptive Laboratory Evidence = *a positive serology (the blood sample) test*

• **Clinical Criteria**
  At least 2 of the following:
  - Fever
  - Chills
  - Rigors (shivering)
  - Myalgia
  - Headache
  - Sore throat
  - Loss of smell/taste

  OR

  At least one of the following:
  - Cough
  - Shortness of breath
  - Difficulty breathing

  OR

  Severe respiratory illness with at least one of the following:
  - Clinical or radiographic evidence of pneumonia
  - Acute Respiratory Distress syndrome

  OR

  No alternative, more-likely diagnosis
Criteria used to determine if someone is a “contact”

• If you receive a phone call from the health department but have not been tested for COVID-19, you were likely identified as a contact.

• Contacts are those who have had some sort of interaction or contact (physical and non-physical) with someone who has tested positive for COVID-19.
  • Generally, includes those who have been within 6 feet of a person for at least 15 mins
  • 15 minutes is a general guideline; may be more or less depending on the situation
    • i.e., those in the same room as an infectious person for an extended period, even if more than 6 feet away, should be treated as a contact
  • Physical contact with droplets (i.e., touched used tissues of someone with COVID-19, touched the same surfaces as an infectious person, etc.)
Contact tracing

• Contact tracing is different than community monitoring.

• In contact tracing, people who may have been exposed are identified by someone who has tested positive for the virus. These people are informed that they may have been exposed (without disclosing the person who tested positive to maintain confidentiality)

• In community monitoring, all individuals in a community are under constant surveillance to identify and isolate people who become sick right away.
Contact tracing and testing

• Both robust contact tracing efforts and robust testing are needed in order to fully understand the outbreak and to prevent surges in cases
  • Contact tracing is effective, but if there isn’t enough testing than we aren’t able to identify everyone who is sick and figure out who they may have exposed.
  • Testing is effective, but if there isn’t a way to contact people who may have been exposed by infected individuals then those who were exposed continue to expose others.
  • BOTH are needed to identify who is infected and to prevent further transmission
What happens in Arizona

- **Here in Arizona**, when you go to get a *swab or spit test* OR a *rapid test* for COVID-19, if you test positive for the virus, those results are automatically reported to the state health department.
  - This is a requirement for all healthcare facilities, as it is classified as a reportable illness.

- Once the health department receives the information of your positive test result, **contact tracers working for the health department will contact you** to ask you questions about your illness and people you were in contact with prior to getting tested.

- They will then use this information to **contact the people you identify and tell them they have been exposed to someone who has tested positive for COVID-19** and that they should get tested and self isolate.
COVID-19 contact tracing faces unique challenges

• Traditional contact tracing relies on contact tracers interviewing you via phone, to identify possible contacts who you may have exposed.
  • If you don’t know everyone you may have been around before you received your test result, all contacts aren’t able to be identified and notified.

• With COVID-19, there is significant lag time that occurs in each step of the process.
  • Because it is so similar to other respiratory illnesses (and because some people experience only a couple symptoms if any at all), people who are sick with the virus often do not seek out testing right away.
  • Then, because of less than optimal testing capacity, once someone gets tested there is often an additional 2-7 days before that person receives their test results.
  • To top it all off, there are not enough contact tracers so that each positive case is followed up when they receive notification of someone testing positive.
Contact tracing apps

• Currently, there are some apps in development that would aid traditional contact tracing.
  • None of these would mandatory, but would be “opt-in” and greatly increase your chances of finding out whether you were exposed EARLY so that you can take necessary precautions to keep your family, friends, and others from also catching the infection.

• These apps would use GPS information from your phone and other people who have the apps to identify everyone that would have been a contact of yours before you received a positive test result.
  • This would shorten the time between you receiving a positive test result and contacts being notified of their exposure.
  • It would also identify and notify people who have been exposed that you wouldn’t normally be able to identify through a phone interview with the health department.
What about contact tracing apps?

• An example of this is the TraceTogether App used by the Ministry of Health in Singapore.

• Resident’s phones that have the TraceTogether app installed communicate with each other by exchanging proximity information with each other when they come into close contact.

• This information is then stored on your phone, and is only shared with the Ministry of Health when a user who was in close contact with you tests positive for COVID-19.
  • The Ministry of Health would then contact you to schedule testing to determine if you have acquired the infection.
  • Proximity information is deleted after 25 days so that you are only notified about recent contacts, and not ones that test positive months after being in contact.
Contact tracing and testing

• Both robust contact tracing efforts and robust testing are needed in order to fully understand the outbreak and to prevent surges in cases:
  • Contact tracing is effective, but if there isn’t enough testing, then we aren’t able to identify everyone who is sick and figure out who they may have exposed.
  • Testing is effective, but if there isn’t a way to contact people who may have been exposed by infected individuals, then those who were exposed continue to expose others.
  • BOTH are needed to identify who is infected and to prevent further transmission through quarantine and isolation.
Difference between quarantine and isolation

Quarantine
• Quarantines are for people or groups who don’t have symptoms but were exposed to the sickness. A quarantine keeps them away from others so they don’t unknowingly infect anyone.

Isolation
• Reserved for those who are already sick. It keeps infected people away from healthy people to prevent the sickness from spreading.
Follow up after contact tracing

• After someone having COVID-19 is identified and others they have come in contact with are contacted and tested, all potential carriers of the disease need to go into isolation.

• Some countries, like Singapore and Hong Kong, have placed those deemed capable of spreading the disease in government isolation centers. Other countries, like the US, have called for self-quarantine measures.
  • The latter is often problematic for those living in tight quarters with others.
  • Harvard’s Edmond J. Safra Center for Ethics has estimated that in the US, 14 percent of infected or exposed people would need somewhere to voluntarily isolate outside their residence because they cannot do so safely at home.

• Isolating those with COVID runs up against core cultural values in many cultures related to
  • The responsibility of family members to care for the ill
  • The perception that social isolation contributes to a negative prognosis
  • Fear of a bad death.

• In such cases, culturally appropriate social support needs to be seen as a primary health concern.
Contact tracing may also be retrospective

• Most contact tracing is prospective, but Japan employs a Track-trace-cluster method that is retrospective.

• Method based on Japan’s TB program and designed to identify the source of a disease and super spreaders that cause a disease cluster
  • Retrospective detective work involving tracing back and establishing a chain of transmission to patient zero
  • The goal is to investigate activities around multiple cases, to determine the place or person that was the common source of transmission.
  • Then find all the people who came into contact with the source.

• This method differs from most contact tracing, which is prospective and tries to identify close contacts to test, and if necessary isolate.
Physical distancing

Why is this essential to mitigate COVID-19
**Physical Distancing Buys Us Time**

- Distancing is currently the only way of slowing down the number of cases and reducing the number of serious cases needing hospitalization.
- Distancing helps prevent healthcare surges - which need to serve not only COVID-19 cases, but a broad range of urgent as well as routine health problems.
- Gives suppliers time to make and distribute essential resources needed by healthcare providers to protect themselves and patients.
- Allows for time to develop:
  - Better clinic and home-based tests for present and past COVID-19 infection.
  - More effective antiviral treatment options, curative and preventative.
  - Vaccine development.
Physical Distancing in the 1918 Pandemic

An important history lesson

The Vital Importance of Social Distancing
How a reduction in social contact can reduce the spread of the coronavirus

<table>
<thead>
<tr>
<th>Normal behaviour</th>
<th>In 5 days</th>
<th>In 30 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Person infects</td>
<td>2.5 people</td>
<td>406 people</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>50% less contact</th>
<th>In 5 days</th>
<th>In 30 days</th>
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<tbody>
<tr>
<td>1 Person infects</td>
<td>1.25 people</td>
<td>15 people</td>
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<table>
<thead>
<tr>
<th>75% less contact</th>
<th>In 5 days</th>
<th>In 30 days</th>
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<tbody>
<tr>
<td>1 Person infects</td>
<td>0.625 people</td>
<td>2.5 people</td>
</tr>
</tbody>
</table>

Source: Signer Laboratory/Gary Warshaw
Chart 23: Model of Cumulative Cases of Coronavirus with Social Distancing Measures Taken One Day Apart

Cumulative cases

Number of days

Social distancing one day later (n+21)

Social distancing started on day n+20

+40%!

Source: Tomas Pueyo
The difference one week makes

• According to an analysis from Columbia University, the U.S. could have avoided at least 700,000 infections if social distancing measures begun on March 15 had actually started on March 8.

• The study estimated that roughly 36,000 deaths from COVID-19 could have been prevented.
  • Two caveats to this calculation are that
    • Few cases had been identified in the USA the week of March 8, making it difficult to persuade the public to engage in social distancing.
    • The percentage of deaths resulting from total infections is an estimate that would need to take into account patient characteristics and hospital capacity.

• In any case, many deaths could have been avoided.
The End of Physical Distancing

• **Persistence is necessary;** ending a lock-down and returning to business too soon will lead to a second surge in cases.

• Experts are considering a potential long-term intervention strategy in the future in which the curve is spread out to keep the curve low so as to avoid overwhelming healthcare capacity.
  • **When the curve appears low:** reduce physical distancing and follow prudent preventive health behavior.
  • **When the curve appears to rise:** return to physical distancing.

• This "lightswitch" approach would need to be carefully monitored with adequate testing and a good surveillance system – something the US does not have at present.
Guidelines for opening society
What do we need in order to lift restrictions and re-open states/the country?

• Without an available vaccine or extensively tested treatment, health departments will need to rely on a combination of robust testing, contact tracing, and isolation of identified people with positive COVID-19 swab tests (NOT blood tests) in order to safely lift restrictions.
• Researchers estimate that the US would need to complete 20-30 million PCR (swab or spit) tests daily to completely reopen the economy while also stopping the epidemic in its tracks.
  • With our current testing capacity, this is not possible, so some restrictions and precautions need to stay in place while testing and tracing is expanded.
How many tests do we need to do to lift restrictions and re-open states/the country?

• Both the Harvard Global Health Institute and the Rockefeller Foundation recommend that in the short term the US needs to ramp up PCR (swab or spit) testing to at least 500,000 people a day or 3 million per week, roughly 1% of the population every week.

• What does this mean for your state?
  • This is a national goal. However, depending on the size of the outbreak in each state, they too should reach certain thresholds before completely reopening and lifting all restrictions.
How many people should states be testing?

• Based on current estimates, each person who has tested positive for the virus that causes COVID-19 via PCR (swab or spit) tests exposes on average 10 other people. The World Health Organization recommends that any country/state should be testing enough people so that the ratio of positive PCR (swab) tests to negative tests is less than 5% before removing the restrictions that are currently in place.
  • This number will vary between states because of the differences in size of each state's outbreak.

• This would essentially mean that each state needs to be testing at least 20 other people for each identified positive case (such that all potential contacts have been identified)

• How do you know if your state is testing enough?
Recommended Testing Limits – How are they determined?

• Using methods developed by the Harvard Global Health Institute, the following chart provides an estimate of where we are at nationally and among select states in terms of meeting regional and national testing goals described previously.

• This method utilizes projected death counts from a well supported and cited model developed by Youyang Gu to estimate the number of cases each state has two weeks prior. This estimated number of “true” cases is then used to determine a minimum number of tests to reach that 5% or less threshold recommended by WHO.

• The following chart will be continually updated to reflect changes in projections and recommended testing thresholds as the epidemic continues.
Which states are meeting the 5% percent positivity recommendation?

<table>
<thead>
<tr>
<th>States <strong>meeting</strong> testing recommendations</th>
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<tbody>
<tr>
<td>Alaska</td>
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<td>Colorado</td>
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<td>Connecticut</td>
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<td>West Virginia</td>
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<td>Wisconsin</td>
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<td>Wyoming</td>
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<td>District of Colombia</td>
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<table>
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<tr>
<th>States <strong>NOT</strong> meeting testing recommendations</th>
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<tbody>
<tr>
<td>Alabama</td>
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<tr>
<td><strong>Arizona</strong></td>
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<td>Arkansas</td>
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<td>California</td>
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<td>Utah</td>
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<td>Washington</td>
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*Meeting vs NOT meeting is based on a rolling 7-day average*
What needs to be in place to Reopen society Gradually

General guidelines
When and How to Reopen After COVID-19

COVID-19 PHYSICAL DISTANCING MEASURES CAN BE LOOSENED WHEN ALL OF THE FOLLOWING CRITERIA ARE MET:

<table>
<thead>
<tr>
<th>Epidemiology</th>
<th>Health Care</th>
<th>Public Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔️ Decreasing cases in the context of increasing testing (or stable testing with decreasing positivity) for at least 14 days</td>
<td>✔️ Ability — including staffing — to double number of patients treated in intensive care units from current census</td>
<td>✔️ All cases interviewed for contact elicitation</td>
</tr>
<tr>
<td>✔️ Decreasing numbers and proportions of cases not linked to a source case (goal less than 3 unlinked cases per 2-week period)</td>
<td>✔️ Ability — including staffing — to screen large numbers of symptomatic patients safely (e.g., outdoor tents, drive-through)</td>
<td>✔️ Contacts elicited for at least 90% of cases</td>
</tr>
<tr>
<td>✔️ Steady decrease in ICU in syndromic surveillance for at least 14 days</td>
<td>✔️ Sufficient PPE for all health care workers even if cases double</td>
<td>✔️ 100% of symptomatic contacts and others with symptoms undergo testing within 12 hours of identification of symptoms</td>
</tr>
<tr>
<td>✔️ Decline in deaths for at least 14 days</td>
<td>✔️ Sufficient face masks to provide to all patients seeking care even if cases double</td>
<td>✔️ Enough hand sanitizer to place at entry and strategically placed in buildings including workplaces</td>
</tr>
<tr>
<td>✔️ Decreasing health care worker infections such that infections are now rare</td>
<td>✔️ More discharges than admissions for COVID-19</td>
<td>✔️ Designated facilities for non-hospitalized COVID-infected people who can’t be safely cared for at home (e.g., because of space constraints, homelessness, medically vulnerable household members, or otherwise)</td>
</tr>
<tr>
<td>✔️ Ensure at least baseline capacity in general health services, including through expansion of telemedicine for COVID-19 and usual care</td>
<td>✔️ Health care facilities enforce policies and redesign to minimize possibility of exposure at triage and all other locations</td>
<td>✔️ Demonstrated ability to convey physical distancing recommendations that change behavior in most residents</td>
</tr>
</tbody>
</table>

Visit PreventEpidemics.org for more.
Prevent Epidemics is a project of Resolve to Save Lives, an initiative of Vital Strategies.
Criteria for reopening society over time

<table>
<thead>
<tr>
<th>Action</th>
<th>4-6 weeks later if no significant increase in cases and criteria remain met</th>
<th>8-16 weeks later if no significant increase in cases and criteria remain met</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wash hands often</td>
<td>Continue</td>
<td>Continue</td>
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<tr>
<td>Cover coughs</td>
<td>Continue</td>
<td>Continue</td>
</tr>
<tr>
<td>Don’t go out if ill</td>
<td>Continue</td>
<td>Continue</td>
</tr>
<tr>
<td>Face mask if ill persons go out</td>
<td>Continue</td>
<td>Continue</td>
</tr>
<tr>
<td>Surface and object cleaning</td>
<td>Continue</td>
<td>Continue</td>
</tr>
<tr>
<td>Enhanced ventilation</td>
<td>Continue</td>
<td>Continue</td>
</tr>
<tr>
<td>Isolation of cases</td>
<td>Continue</td>
<td>Continue</td>
</tr>
<tr>
<td>Quarantine of contacts of cases</td>
<td>Continue</td>
<td>Continue</td>
</tr>
<tr>
<td>Physical distancing to 6 feet when possible – avoid crowding</td>
<td>Continue, pause physical distancing</td>
<td>Pause physical distancing</td>
</tr>
<tr>
<td>Stop visits to nursing homes, hospitals, congregate facilities</td>
<td>Continue</td>
<td>Continue</td>
</tr>
<tr>
<td>Ban all gatherings including religious (above 10, 50 people)</td>
<td>Continue - 10, 50</td>
<td>Allow all gatherings</td>
</tr>
</tbody>
</table>

*People over age 60, including employees and those who are medically vulnerable continue to shelter in place, including employees. Online education/work encouraged whenever possible.
A few lessons about COVID-19 control

That are instructive
Lessons learned from the 1918 flu

• We know that from a previous respiratory virus pandemic that the timing of easing restrictions if vital to preventing a second wave of cases.

• In cities that maintained non-pharmaceutical interventions (physical distancing, closures, etc), a second wave of cases was not observed.

• In cities that opened prematurely at the start of a decline, saw a second wave of cases that was more severe than the first.
Lessons learned from Asian countries doing the best to contain the disease

• What has worked the best in Asia:
  • Early travel restrictions
  • Aggressive testing and screening of contacts
  • Strict quarantine rules
  • Use of social media to get out uniform and consistent messaging
  • Political will to deal with this crises and a clear chain of command

• Which countries:
  • Hong Kong, Singapore, South Korea, Taiwan, Vietnam

➢ What they have in place enabling them to do so
  • Universal healthcare
  • Clear management structures for the public health response
  • Proactive communication protocols to get the population on board
  • Preparedness resulting from experience with containing SARS and other pandemics
Hong Kong and Singapore have limited the spread of coronavirus; S Korea is slowing the rate of infection. Most western countries show a similar trajectory

Cumulative number of cases, by number of days since 100th case

FT graphic: John Burn-Murdoch / @jburnmurdoch
Source: FT analysis of Johns Hopkins University, CSSE. Data updated March 13, 16:00 GMT
© FT
How they beat Covid-19

- Early, common-sense action
  Don’t wait for “more data” or results from complicated models

- Isolate away from home
  Set up facilities to isolate an infected family member away from the rest

- Strong lockdown
  Strict travel restrictions
  Even within the country

- Massive testing
  Face masks for everyone
  The stricter these are, the shorter the lockdown

Normalized daily new COVID-19 cases vs time, 18-day average

Created by Derrick VanGianne, Harvard University.
For more information about government measures taken to stop the spread of COVID-19, visit: endcoronavirus.org.
Current lesson about reopening /relaxing restrictions too soon from South Korea

- Relaxing of restrictions, and timing of reopening is imperative in controlling the spread of infection.

- South Korea had reopened most of their businesses and relaxed restrictions because of their significant decline in daily cases.
  - However, they are starting to re-implement some of their restrictions due to data showing that lifting some of them may have been too soon.

- One bar/club patron has recently tested positive for the virus that causes COVID-19, which has resulted in the shut-down of bars and nightclubs for at least 30 days.
- With the US largely reopened, we have also had reports of similar situations in our own clubs and bars across the country.
Current lessons from Germany

• Germany has also been hard hit by the pandemic. Current data shows they have been one of the most affected countries in the EU and globally along with the US, Italy, UK and others.
  • Because of their aggressive contact tracing and testing efforts, they observed a significant enough decline to begin a phased re-opening of their economy.

• Germany has instituted a sort of “light switch” approach when it comes to controlling their outbreak.
  • Along with their phased reopening, states can lock down at a moments notice when cases increase. This has already occurred in 3 separate regions.
Current lessons from Sweden

• Sweden used an unconventional approach to controlling their outbreaks by relying on generating a herd immunity without lockdown measures (which many proponents of physical distancing and other precautions suggest should occur here in the US).
  • **With no lockdown measures in place, Sweden’s death rate due to COVID-19 was higher than that of the US.**
  • The architect of Sweden’s response has even acknowledged that they their plan was not the best approach

• However, in rushing to reopen businesses as usual, the US has presently surpassed Sweden in terms of per capita mortality and incidence rates.
Current lessons from New Zealand

• Compared to the US, New Zealand took a much stricter approach to reducing the spread of the virus that causes COVID-19.

• When New Zealand only had 6 cases, Prime Minister Jacinda Ardern enacted swift, decisive policies to quarantine any person entering the country and then to restrict all travel into the country altogether.

• In addition to robust tracing and testing, the country provided clear and consistent messaging to its communities as to how to protect themselves and their friends, families, and neighbors (which we have not seen here in the US).

• Because of these efforts, New Zealand has completely stopped local transmission, has reopened businesses, and is in the process of completely eliminating the virus from the country.
Current lessons from US states that have reopened

• All US states have either reopened or began phased plans to reopen their economies by either removing or relaxing restrictions.

• However, across the US we have seen drastic increases in community transmission.
  • States have seen the effects of reopening their economies and the disregard for physical distancing, mask, and handwashing recommendations. States with new case rates that had either plateaued or were on the decline have seen increases in their rate of new cases since reopening.
Current lessons from US states that have reopened

• If precautions and recommendations are continued to not be followed, some of these states may have to implement a second “Stay-at-home” order to curb the spread of the infection and to prevent healthcare systems from becoming overwhelmed.

• With many states still not fully recovered from the first “Stay-at-home” orders, a second implementation could be even more detrimental than the first.

• Arizona is already reaching a critical point wherein we have almost fully utilized our ICU capacities since reopening.
How long will it take to see the possible effects of restrictions being reinstituted?

- A majority of States have seen drastic increases in community transmission of COVID-19 and have had to reinstitute some of the restrictions that they had removed. **Unfortunately, the only way for us to tell if these restrictions are helping is by waiting and monitoring. Only time will tell.**

- **Time is a major contributor.** The fact that it takes on average 4-6 days for someone who gets sick to show symptoms means that there is a delay in when we will be able to see increased transmission. This is further complicated by the additional days that a person who is sick waits before getting tested and the couple days it takes to receive results.

  - This is all dependent on if a person who is infected shows symptoms. We know from previous studies that roughly 25% of people with the infection don’t show symptoms so they will probably never be tested.
How long will it take to see the possible effects of reopening in other states?

• There are also other societal factors that play into how long it will take for us to see any effect of reopening if there is one.
  • If the public chooses to continue to follow physical distancing, handwashing, and mask wearing recommendations and limiting trips into public for only essential activities (such as grocery shopping, doctor appointments, etc.), then we should start to see declines in community transmission.
  • On the other hand, if a proportion of the public continues to try and live life as it was before the outbreaks and disregard these evidence-based recommendations, the likelihood that we will continue to observe amplified community transmission and severity of the outbreak (i.e. a significant increase in the number of new cases and deaths) is much greater.
What are Immunity passports: are they a good idea

• Italy has provided a check list that for exiting from lockdown that requires mandatory antibody blood tests as the country seeks to set up a system of “immunity passports” that indicate you have been exposed to the virus and recovered from COVID-19 if you were symptomatic.

• German researchers are also considering issuing immunity certificates based on an antibody blood test.

• The UK has considered immunity bracelets.
Logistical problems in issuing certificates of immunity: here are three

- **Testing issues**: At present, recovery from the illness and the results of serological tests do not reliably guarantee someone is immune.
  - It is unclear whether antibody production due to COVID-19 equals immunity, and people appear to produce different levels of antibodies.
  - We do not know how long protective immunity lasts after infection, or how often one would have to be retested to verify immunity.

- **Social issues**: Will certification result in a stigmatization of those who are immune or not immune?
  - It could create a two-tiered workforce where antibody-positive workers might be favored for jobs leading to a perverse incentive for people to contract the virus, particularly millennials who might feel their chances of surviving it are high.

- **Political issues**: There may be considerable fallout for undocumented immigrants. If certification requires proof of residency, they might be less likely to test for immunity.
What to do at home and in your community to stay safe

In addition to physical distancing
Create and maintain a social bubble

• Establish a “social bubble” with others who have similar risk tolerance and are committed to maintaining that bubble.

• When outside of that social bubble, wear a mask and practice physical distancing as long as Covid-19 is still a threat.

• Follow the hygiene and safety guidelines in the slides that follow
Young Kids, COVID-19, elders, and play groups

• Data from the epidemic in China: kids get infected at the same rate as the population average
• Kids are less likely to get severely sick than adults, but are just as contagious
• **Parents teachers, and grandparents can get very sick from children**
  • Limit contact with *grandparents > 65 years of age, especially if suffering from a chronic disease like diabetes or respiratory problems or if a smoker
• **Child Play: Form a small playgroup and play outside. Adults should stand > 6 feet away from children other than their own**
  • Don’t go into each other’s homes
  • Playgrounds: COVID-19 virus can live on surfaces for hours or days in a laboratory environment, but there are no data that I am currently aware of regarding survival of the virus on playground equipment.
Wash your hands: learn how and with what

- Standard message: Wash your hands with soap thoroughly for 20 seconds and/or use a greater than 60% alcohol-based hand sanitizer
- **Soap and water is more effective than hand sanitizers**
  - Washing with any water is good, hot water is better —lather up!
  - Washing your hands a lot —apply skin moisturizer so skin does not crack providing a place for virus to lodge
  - Use hand sanitizer when no soap and water alternative
  - Baby wipes are not effective
  - Do not expose your skin to straight bleach solutions or hydrogen peroxide
  - Antibacterial soaps are not recommended —they offer no advantage over other soaps and may negatively affect the skin microbiome
- Whenever you return home from ANY activity that involves locations where other people have been, wash your hands with soap
- Money exchange is a possible route of transmission
  - Wash hands afterward
  - Do not try to launder money by microwave—it does not work
How & When to Wash your hands

How to wash your hands

• **Wet** your hands with water (warm or cold)
• **Lather** your hands by rubbing them together with the soap. Lather the backs of your hands, between your fingers, and under your nails.
• **Scrub** your hands for at least 20 seconds.
• **Rinse** your hands well under clean, running water.
• **Dry** your hands using a clean towel

When to wash your hands

• **After returning from a shop or public space**
• **Before, during, and after** preparing food
• **Before** eating food
• **After** using the toilet
• **After changing diapers or cleaning up a child who has used the toilet**
• **After** blowing your nose, coughing, or sneezing
How often you hand wash makes a difference in spread of respiratory disease caused by virus

• Frequency of hand washing makes a big difference.

• A study conducted at a military boot camp found that a top-down program of hand washing five times a day cut medical visits for respiratory infections by forty-five percent. Research on the 2002 coronavirus outbreak found that washing hands more than ten times a day reduced people’s infection rate by even more.

• Core message: Wash or sanitize your hands every time you go into and out of a group environment, and every couple of hours while you’re in it, plus disinfect high-touch surfaces often – at the very least daily.
Proper handwashing technique is **thorough**:
Clean surfaces you routinely touch – or that are touched by others – often

- Counters, door knobs, steering wheel, bathroom
- Cell phones, computer keyboards
- Use appropriate cleaning products (look up approved list cited in notes)****
  - An effective bleach solution can be made by mixing 1/3 cup or 5 Tablespoons per one gallon of water or 4 teaspoons or 20 cc per quart.

- How about ultraviolet light devices?
  - Only type C are effective and only for smooth surfaces (think cell phone or a screen). UV-C penetrates superficially, and the light can’t get into nooks and crannies. It also irritates skin (not to be used on hands or face)
  - It is unclear if the sun can destroy COVID-19. **No measurable UV-C light from the sun reaches the earth’s surface**
Note of caution about hand sanitizers: check the label about type of alcohol used

Methanol is not an acceptable ingredient for hand sanitizers and should not be used due to its toxic effects

• The FDA notes that “substantial methanol exposure” can result in “permanent blindness, seizures, coma, permanent damage to the nervous system, or death.”

9 Hand Sanitizers Subject to FDA Safety Warning

✓ All-Clean Hand Sanitizer (NDC: 74589-002-01)
✓ Esk Biochem Hand Sanitizer (NDC: 74589-007-01)
✓ CleanCare NoGerm Advanced Hand Sanitizer 75% Alcohol (NDC: 74589-008-04)
✓ Lavar 70 Gel Hand Sanitizer (NDC: 74589-006-01)
✓ The Good Gel Antibacterial Gel Hand Sanitizer (NDC: 74589-010-10)
✓ CleanCare NoGerm Advanced Hand Sanitizer 80% Alcohol (NDC: 74589-005-03)
✓ CleanCare NoGerm Advanced Hand Sanitizer 75% Alcohol (NDC: 74589-009-01)
✓ CleanCare NoGerm Advanced Hand Sanitizer 80% Alcohol (NDC: 74589-003-01)
✓ Saniderm Advanced Hand Sanitizer (NDC: 74589-001-01)
How about doing laundry if I suspect that I or a family member has COVID-19?

- If you’re caring for someone in the house who is sick or you’re cleaning the clothes of a family member who may have been exposed to the coronavirus, consider those clothes contaminated and keep them in a separate laundry bin until it’s time to do the wash.\(^5\)
  - Place a washable or disposable liner in that laundry bin so that you can either launder it or throw it away after you remove the dirty clothes.
  - Use gloves when handling clothes and/or wash hands immediately after
- Wash contaminated clothes and linens as usual, but “launder items using the warmest appropriate water setting for the items and dry items completely”\(^5\)

- Bleach may help inactivate viral microbes in the wash\(^6\)
  - For whites and light colors could add bleach to the load
  - For colors, could use detergent that contains color-safe bleach if appropriate for fabric
- Dryers may be better than hanging the clothes to dry because the heat may also help inactivate any viral microbes. Dry fabrics are less likely to transfer germs than wet ones.
- Clean surfaces of washing machine and the laundry bin with bleach or other household disinfectant after you’ve removed the dirty clothes.
Handwashing and cleaning surfaces are important

But recognize that

The vast majority of cases are contracted through being exposed to air borne droplets

The reason for physical distancing of a least

6 feet ****
Physical Distancing

• The CDC recommends at least 6 feet of distance between individuals to prevent the spread of viral particles from one person to another
• Every time we breathe, speak, or exhale in a similar fashion, droplets leave our mouths. COVID-19 is transmitted through these droplets
  • Larger droplets may fall quickly to the ground
  • Smaller droplets may linger in the air
• This distance may depend on factors such as location and activities
  • Mask wearing behavior
  • Population density within an area
    • Areas with poor circulation may warrant distances further than 6 feet
  • Physical activity/exercise
In terms of the spread of COVID-19

The major risk factors are:

• Close-up, person-to-person interactions for extended periods.
• Crowded events.
• Poorly ventilated areas.
• Places where people are breathing heavily, talking loudly, or singing.
When to mask

• Mask wearing makes precautionary sense, especially in high risk circumstances.
• Wearing a mask will probably make little difference if you’re just walking or biking around town away from high concentrations of people.
• If you are likely to be in close contact with someone infected, a mask cuts the chance of the disease being passed on.
  • Masks are highly recommended for family members who need to care for someone who is ill – ideally both the patient and caretaker should have a mask.
• Wearing a mask may prevent touching of nose and mouth in public
• If you’re showing symptoms of coronavirus, or have been diagnosed, wearing a mask protects others.
• If you are >65, especially if vulnerable due to a precondition, wearing a mask when in public is warranted.
Mask wearing

• If you are asymptomatic and contagious, masks reduce the spread of disease.

• Currently, the **CDC recommends homemade masks** when entering potentially crowded areas, shops, etc.

• If your work in essential industries exposes you to people in close quarters, wear a mask.
Home made masks: what material is most effective?

- Double layers: Overall, double layers do not help much. The double-layer pillowcase captured 1% more particles, and the double-layer shirt captured just 2% more particles.
- Looking at the data, the dish towel and vacuum cleaner bag were the top-performing materials.
- However, the researchers chose the pillowcase and the 100% cotton t-shirt as the best materials for DIY masks due to breathability.
- These materials filter out approximately 50% of 0.2 micron particles, similar in size to the coronavirus.
Mask effectiveness before and after 3 hours

After being worn for 3 hours, homemade mask captured 5% more particles.
Which masks offer little protection?

14 masks tested

- Neck fleeces, also called gaiter masks often used by runners, were the least effective.
  - In fact, wearing a fleece mask resulted in a higher number of respiratory droplets because the material seemed to break down larger droplets into smaller particles that are more easily carried away with air.
    ✓ If you are going to wear a gaiter – double it to approximate the effectiveness of a cotton mask

- Folded bandanas and knitted masks also performed poorly and did not offer much protection.
Face Masks with Valves are Not Recommended for COVID-19

- One-way front valve industrial masks were designed for fire fighters and for those engaged in sanding, sweeping dust, and working on projects that dispense small particles into the air.

- **One-way valves filter air breathed in, however the air going out is unfiltered.**

- **If you wear such a mask you risk spreading the coronavirus to others through infected droplets.**
  - Some masks with valves may actually propel your germs further

- **Masks with valves may look more high-tech, but they do not protect others in the community.**
  - Masks with valves may also give people you come in contact with a false sense of security if they think they are better than other kind of masks.

**Cloth masks : recommended along with surgical masks**
Do not use these kinds of masks with built in exhaust valves: you are placing others at risk.
How about washing masks and reusing them?

• **Surgical masks:** Avoid washing or sterilizing any part of surgical masks using water, alcohol, dish-washing solution, hand wash, soap or any kind of detergent.
  - If outer and inner layer of the surgical mask is damaged, it loses its filtration and water-resistant functions.

• **N95 masks:** Washing these masks with soap and water is much worse than natural “aging.”
  - Washing decreases particle capture by 21%. Cleaning with rubbing alcohol reduced effectiveness by 37%.

• **Homemade Masks:** Wear them, wash your hands after taking them off, and wash them properly
  - You should not reuse a homemade mask without washing it first
  - Recommend making multiple homemade masks and rotating them

• **When taking off masks at home:**
  - If a **disposable** mask, take off mask using ear loops, pull away from face, and discard in a lidded trash can
  - If using a **homemade** mask, remove mask using ear loops, pull away from face, and put place in separate laundry bin
  - **Wash hands immediately using soap and water**
Caution when wearing homemade masks

• If you wear a mask, then you must know how to use it and dispose/clean it properly.
• If used incorrectly, the mask may end up contaminating you.

Three common mistakes:
• Less diligence complying with physical distancing recommendations when wearing a mask
  • 6-feet social distancing is still important even with a mask
• Touching your mask and then your face often.
  • Masks are uncomfortable and people adjust them and take them on and off frequently. This may expose you to the virus more as you touch your contaminated mask and face more often.
• In the process of trying to clean a mask, you may contaminate yourself and your home.
Wearing masks is symbolic: It sends a message to others about health citizenship

- **Civic responsibility**: In Asia, wearing a mask is not seen as just a means of protecting yourself from getting infected, but also seen as an act that minimizes the chance of infecting others with a potential infection harboring in your body
  - This is a sign of health citizenship*

- **If all people wear a mask there is no stigma associated with wearing a mask**
  - In this case, it does not signal that you are a “dangerous other”
  - It rather indicates you are a responsible other
  - Aside from places like Japan, the Czech republic instituted a policy of all citizens wearing masks as a control measure. Both the symbolic and epidemiological significance of this act are noteworthy.
    - In just 10 days, the country went from no mask usage to nearly 100 percent usage, with nearly all the masks made at home with easily accessible materials, like old t-shirts.**

- **Unfortunately, in the USA some “conservative” leaders are attempting to associate the wearing of masks with a loss of freedom and liberty, instead of civic responsibility and health citizenship.**
Surgical vs. N95 masks

• N95 masks are to protect YOU from the secretions of others, and the surgical mask is to protect others FROM you.

• Although surgical masks are in widespread use by the general population, there is no evidence that these masks prevent the acquisition of COVID-19, although they might slightly reduce the spread from an infected patient breathing in your face.

• A well-conducted, large, cluster randomized trial, undertaken largely in US primary care settings, did not identify a meaningful benefit from N95 respirators when compared to surgical masks for the prevention of influenza among staff.**

• N95 masks are most needed by those in hospital settings and are in short supply.
Masks are in short supply for health care workers

- Do not stockpile N95 masks
- Conserve them so those who work in health care settings have adequate protection until the supply is plentiful
Face shields: are they as effective

- Face shields significantly reduce the amount of inhalation exposure to droplet-spread respiratory virus.
  - In a simulation study, face shields were shown to reduce immediate viral exposure by 96% within 18 inches of a cough.
  - After 30 minutes, the protective effect exceeded 80%
  - When the study was repeated at the currently recommended physical distancing distance of 6 feet, face shields reduced inhaled virus by 92%.

- Face shields offer a number of advantages
  - While medical masks have limited durability and little potential for reprocessing, face shields can be reused indefinitely and are easily cleaned with soap and water, or common household disinfectants.
  - They are comfortable to wear, protect the portals of viral entry, and reduce the potential for autoinoculation by preventing the wearer from touching their face.
  - People wearing medical masks often have to remove them to communicate with others around them; this is not necessary with face shields.
  - The use of a face shield allows visibility of facial expressions and lip movements for speech perception. This makes them better to use around the hearing impaired.

- How must face shields be worn: The forehead band should sit approximately 1/2 – 1 inch above the eyebrows, with the bottom of the shield sitting below chin level.

- At present the CDC recommends the wearing of masks and not face shields. Face shields offer an alternative when the wearing of masks is not feasible.
  - Data on the effectiveness of wearing face shields by children is not yet available
EACH TYPE OF PPE HAS **PROS AND CONS**

**Face Shields**
- ✓ Blocks large droplets
- x Doesn’t block aerosols
- ✓ Eye protection
- x Can NOT replace a mask

**Face Masks**
- ✓ Blocks large droplets
- ✓ Blocks small aerosols
- x Eye protection
- ✓ Can be worn by itself

**Mask and Shield**
- ✓ Blocks large droplets
- ✓ Blocks small aerosols
- ✓ Eye protection
- ✓ More protective than masks alone

FACE SHIELDS CAN BE WORN WITH MASKS BUT CAN’T REPLACE MASKS

https://doi.org/10.1080/15458624.2013.877591

WearingPPEIsCaring.org

Wearing Is Caring
Protection against COVID-19 entails doing several things in concert. Mask wearing must be used in combination with other forms of protection and not be seen as a panacea

• An apt analogy may be drawn from road safety
  • Air bags reduce the risk of dying by about 30-40%.
  • When added together with seatbelts, they are synergistic and reduce risk together by 65-70%.
  • We add licensing, speed limits, anti-lock brakes, police enforcement, and other things to achieve very good risk reduction (well into the upper 90s).
  • We need to be even more careful when we drive in more dangerous situations, such as in a snowstorm.

• Protecting yourself (and society) from COVID-19 works exactly the same way: mask + physical distance + lockdown during the surge
<table>
<thead>
<tr>
<th>Chance of Transmission</th>
<th>Asymptomatic COVID-19 Carrier</th>
<th>Uninfected Person</th>
</tr>
</thead>
<tbody>
<tr>
<td>VERY HIGH</td>
<td>![Image]</td>
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<td>VIRTUALLY NONE</td>
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How about wearing gloves?

• Unless you're a health-care worker or, say, a cook with a cut on your hands, it is not recommended that the general public wear gloves.
  • Experts say that gloves don't make sense for most people to wear.

• Using your ungloved hands – and then washing them often – is the best bet for the typical tasks of everyday life.

• Wearing gloves might cause you to practice worse hand hygiene because you keep wearing the now-dirty gloves instead of washing your hands.

• Gloves are only useful when you use them and take them off the right way and in a meaningful way.
  • Many people who take off their gloves actually contaminate their hands with whatever was on the gloves.
Food or food packaging has not been identified as a risk factor for COVID-19 transmission

• Currently there is no evidence to support transmission of COVID-19 associated with food (food itself—not packaging or handling)

• There is likely very low risk of spread from food products or packaging that are shipped over a period of days or weeks at ambient, refrigerated, or frozen temperatures.

• Your biggest risk, especially if you are ordering takeout, is most like the person who delivers your food.
  • physical distancing should still be in place, even if contact is brief.
    Wash hands before eating

• There is also no evidence to support transmission of COVID-19 associated with imported goods and there have not been any cases of COVID-19 in the United States associated with imported goods.
Do not engage in diagnosis by treatment

• Do not take left-over antibiotics you have at home to see if your respiratory illness is bacterial or viral.

• This may alter your microbiome, effect your immunity, and render you more susceptible to a more severe form of COVID-19

• The intestinal microbiota influences the balance between pro-inflammatory and regulatory responses and shapes the host’s immune system
I have heard that medication X might be an effective treatment

• Do not listen to anyone advocating treatment for COVID-19 not qualified to do so!

• Drug side effects and drug interactions have to be taken into account when prescribing medication as well as the health status of those taking them.

• When it comes to medicine prescription, the devil is in the details:
  • Who should/should not take X medication
  • In combination with/without other medications
  • When
  • What dosage

• Do not inject disinfectants or expose yourself to UV-C light; these can cause severe injury and will not treat COVID-19
Case-in-point:

Fearing coronavirus, Arizona man dies after taking a form of chloroquine used to treat aquariums

By Theresa Waldrop, Dave Alsup and Elliott C. McLaughlin, CNN

(Updated: 12:50 PM ET, Wed March 25, 2020)

Here’s what you need to know about chloroquine

See how for spit deplets travel through air when we talk

Wuhan resilient. A second wave is ‘absolutely’ coming

Twins die in pandemics 100 years apart

Tynan temp HR told HR work, you!

(CNN) — A Phoenix-area man is dead and his wife is under critical care after the two took chloroquine phosphate in an apparent attempt to self-medicate for the novel coronavirus, according to hospital system Banner Health.


[4-24-2020] FDA Drug Safety Communication

What safety concern is FDA announcing?

The FDA is aware of reports of serious heart rhythm problems in patients with COVID-19 treated with hydroxychloroquine or chloroquine, often in combination with azithromycin and other QT prolonging medicines. We are also aware of increased use of these medicines through outpatient prescriptions. Therefore, we would like to remind health care professionals and patients of the known risks associated with both hydroxychloroquine and chloroquine. We will continue to investigate risks associated with the use of hydroxychloroquine and chloroquine for COVID-19 and communicate publicly when we have more information.

Hydroxychloroquine and chloroquine have not been shown to be safe and effective for treating or preventing COVID-19. They are being studied in clinical trials for COVID-19, and we authorized their temporary use during the COVID-19 pandemic for treatment of the virus in hospitalized patients when clinical trials are not available, or participation is not feasible, through an Emergency Use Authorization (EUA). The medicines being used under the hydroxychloroquine/chloroquine EUA are supplied from the Strategic National Stockpile, the national repository of critical medical supplies to be used during public health emergencies. This safety communication reminds physicians and the public of risk information set out in the hydroxychloroquine and chloroquine healthcare provider fact sheets that were required by the EUA.

Hydroxychloroquine and chloroquine can cause abnormal heart rhythms such as QT interval prolongation and a dangerously rapid heart rate called ventricular tachycardia. These risks may increase when these medicines are combined with other medicines known to prolong the QT interval, including the antibiotic azithromycin, which is also being used in some COVID-19 patients without FDA approval for this condition. Patients who also have other health issues such as heart and kidney disease are likely to be at increased risk of these heart problems when receiving these medicines.

Have a plan for where and how to get tested and isolate

• Do you know where to get a test?

• Can you isolate at home and how will you protect others you live with while contagious?

• If not, where can you isolate?

• Who will care for you if you are in need of assistance, groceries etc.

• Do you have the things necessary to monitor your symptoms: thermometer, blood pressure, if possible an oximeter?

• Do you know who to call and where to go if your symptoms become serious?
Get a “flu” buddy and prepare your home

• Get a flu buddy (aka “pandemic pal”) and make back-up plans for care of children, pets, and those in need of special assistance

• Prepare a hot zone in your home just in case someone falls ill

• Stock up on essential foods and medicines, etc.
I have COVID-19 symptoms and am concerned I might have COVID-19?

• **Call ahead to your doctor or emergency care facility. Do not walk in or you risk other lives.**
  • Waiting rooms are often full of older patients with heart disease, cancer, and other conditions for whom the coronavirus could be fatal
  • Confirm with your doctor/health provider that your symptoms are consistent with COVID-19
    • Are your symptoms related to allergies? common cold? flu?

• **Common symptoms of COVID-19 from the CDC**
  • Cough
  • Shortness of breath/difficulty breathing
  • Fever
  • Chills
  • Muscle pain
  • Sore throat
  • New loss of taste/smell

• If symptoms are not severe you will be given instructions on how to self-treat at home and monitor your symptoms, and if a test is necessary and available at the time of assessment by phone.
Danger signs of COVID-19

• When to seek emergency medical attention\(^{13}\) (symptoms of coronavirus):
  • Trouble breathing
  • Persistent pain/pressure in chest
  • New confusion
  • Inability to wake or stay awake
  • Bluish lips or face

• When seeking medical attention: call first.
  • Call your doctor or emergency room before going in and tell them your symptoms. They will tell you what to do.

• Wear a facemask: If available, put on a facemask before you enter the health care facility.
• Try to stay at least 6 feet away from other people in the waiting room.
What to do if I test positive for COVID-19 and am waiting to see its severity

• Sleep prone to help improve oxygen saturation
• Move — exercise a little even if you feel lethargic
• Talk to your doctor about taking aspirin and pepcid (not Tagamet and Prilosec)*

• Do not try to treat yourself with drugs you have heard might be effective and try to acquire them on your own. One reason why is because timing in when you take a medication is very important in COVID-19
  • Ask your doctor before taking a medication like the corticosteroid dexamethasone used as an anti-inflammatory and widely cited on the web to have benefits for critically ill COVID-19 patients.
  • The medication is generally used to reduce mortality for patients requiring oxygen
  • It needs to be timed carefully when the virus is in decline and to buffer a hyper immune response (“Cytokine storm”).
What does COVID-19 do to the lungs?

• COVID-19 often begins as an upper respiratory tract infection.
• Among some, the virus travels down the throat and enters the lower respiratory tract.
• If that happens, the virus damages the lung’s tiny air sacs—alveoli—where oxygen enters the blood and carbon dioxide leaves.
• Inflammatory cells and fluid then render the alveoli unable to do their job. This makes it more difficult for oxygen to travel from the lungs into the bloodstream, starving bodily organs (causing acute respiratory distress syndrome).
• When this becomes an acute condition one has to be placed on a ventilator. The ventilator is not a treatment to heal damaged lungs; it gives the lungs a longer time to recover on their own.
Given that COVID-19 affects the lungs, should I be monitoring my oxygen level if I feel ill

• Yes, it is a good idea. A simple finger insert pulse oximeter allows you to do this at home and the device is not costly.

• Notably, people may have silent hypoxia long before they complain of difficulty breathing and think of seeking medical care. Silent hypoxia occurs with COVID-19.

• When you have hypoxia, you compensate for the low oxygen in your blood by breathing faster and deeper: classic signs of pneumonia
  • The body’s physiological response is inflammation as more and more air sacs collapse and the pneumonia worsens until oxygen levels plummet.
  • Fluid builds up and the lungs become stiff, carbon dioxide rises, and patients develop acute respiratory failure.

• One doctor has described what happens in this way:*  
  • Pneumonia is an infection of the lungs in which the air sacs fill with fluid or pus. Normally, develop chest discomfort, pain with breathing and other breathing problems. But when COVID pneumonia first strikes, patients don’t feel short of breath, even as their oxygen levels fall. And by the time they do, they have alarmingly low oxygen levels and moderate-to-severe pneumonia.
Smoking, vaping, and COVID-19

• A recent study* of those who smoked or vaped found that:
  • Depending on which nicotine products they used and how recently they had used them, young people who vaped or smoked, or both, were 2.6 to nine times more likely to receive COVID-19 tests than nonusers.
  • Those who had used both e-cigarettes and cigarettes in the previous 30 days were 6.8 times more likely to be diagnosed with the disease.

• Active smoking and a history of smoking are also associated with severe COVID-19 according to a systematic review and meta-analysis **
  • Smoking modestly increased the risk for severe disease in hospitalized patients with COVID-19, particularly among younger patients without diabetes.

• An associational study of smoking and vaping found that both are associated with a higher risk to COVID-19.

• SMOKING MAKES COVID-19 SYMPTOMS MORE SEVERE:
  • In a study of patients admitted to the hospital due to pneumonia caused by COVID-19, it was found that current and former smokers were significantly less likely to improve over time.
  • Instead, the disease was 14 times more likely to progress to the point where the patients required intensive respiratory assistance.
  • The connection between smoking history and adverse pneumonia treatment outcomes and/or death are well established, which bolsters the observations that current or former smokers are at a far greater risk of severe respiratory outcomes once the virus is contracted.
What else can I do if I feel I am “coming down with something”

• There are additional measures that **may reduce** the risk of infection and the severity of viral respiratory diseases in general:
  • *Care for your throat and engage in practices that support the self-cleaning powers of the respiratory tract. Gargling with salt water or antiviral mouthwash, steam inhalations.*
  • Vitamin D has been previously shown to support general immune health
    • *This does NOT mean that Vitamin D can be used to treat COVID-19, simply that Vitamin D has immuno-supportive effects*
  • Zinc supplements **may reduce the duration of respiratory illness**
    • They are available in capsule, tablet, and lozenge form. One review of seven studies showed that zinc lozenges containing 80-92mg of zinc may reduce common cold duration by up to 33%. Zinc-containing nasal sprays, however, should be avoided.***
Should I get a seasonal flu vaccine if I have not done so? Yes, for three good reasons!

• It is possible to get the “flu” and COVID-19 at the same time and this would increase the severity of your illness.

• As the coronavirus continues to spread across the country, doctors say it's more important than ever to build up herd immunity for other strains of “flu.”
  • This protects the elderly and other vulnerable people.

• It is very important to protect yourself from influenza virus and not put more pressure on the health system with the impending cases of coronavirus.
  • The last thing they need is this double burden.
  • The best time to get a seasonal influenza vaccine is mid September to mid October

• Cross –immunity at some level is a possibility that is presently being investigated for several different vaccines. This has not yet been demonstrated for COVID-19, but cross immunity has been documented for other diseases.
Flu shot safety: delay getting the shot if you could be contagious with COVID-19

- Delay getting a flu shot if you have recently tested positive for COVID-19 and are isolating, or if you are currently experiencing symptoms.
  - It's not a safety issue if a patient is asymptomatic. The concern is for exposure of others in the healthcare setting.
  - A patient who has been exposed to COVID-19 should stay home and self-monitor their symptoms, and get their flu shot once they are out of isolation.
    - This is true even in the case of symptomatic or asymptomatic adults over age 65 at higher risk of influenza hospitalization and death.
- Wait to receive a flu shot until you meet criteria for discontinuing COVID-19 isolation.
How about pets, can they catch or pass on the virus

• Previous studies of SARS found that cats can be infected and pass it on to other cats. But there was no indication during the SARS pandemic that SARS-CoV became widespread in house cats or was transmitted from cats to humans.

• COVID-19 can be passed onto cats, but there is not data suggesting it can be passed on from cats to humans.

• It is possible for humans to pass the virus onto their cats.
  • The US Centers for Disease Control and Prevention recommends that people with COVID-19 limit contact with their pets, including avoiding stroking them, being licked and sharing food.

• Do not wash your pets with caustic solutions of bleach, etc.
Re-entry and reopening schools

When restrictions are relaxed or lifted
Ending the lockdown and opening businesses does not mean returning to life as usual

• The same precautions need be followed.
• This is not a time to relax one’s preventive health practices.
• Herd immunity is no where near reached.
• The new normal is a safe normal.
Should we be reopening schools?

[ * See additional slide set on this topic]

• There is no straightforward answer as to whether we should be rushing to reopen schools for in-person instruction.

• Communities use three basic metrics for assessing the virus’s spread and consider trends over the course of two weeks.
  • COVID-19 cases
  • Hospitalizations
  • How many tests for SARS-CoV-2 are coming back positive.

• There is no threshold level of COVID-19 spread in a community that guarantees the safety of sending kids back to school.

• But if SARS-CoV-2 is under control, that reduces the risk that there will be outbreaks when schools reopen.
  • One widely cited metric that community control exists is COVID-19 test results less than 5 percent in the previous two weeks
When should we reopen schools?

• The decision to reopen schools should be based on how well the spread of the virus is in the community they serve.

• If the outbreak is largely under control (have a less than 5% positivity rate) and has seen a consistent decline in new cases, in-person instruction could probably resume as long as strategies to decrease the risk of infection in both children and adults at the school are implemented.
  - They should also have a strategy in place to monitor the infection status among their students and the number of children who have become ill with COVID-19 so that they can isolate classrooms or institute temporary closures if transmission among their students and staff increases.

• If the positivity rate of COVID-19 is still greater than 5% in a community, then in-person instruction should NOT begin again.
Why schools have to be closed
Returning to school decisions involve far more than the chances of a child becoming very ill.

Mildly ill or asymptomatic children/youth can transmit the virus to others at greater risk.

Levels of contagion are being investigated by age group, the health status of children, household, and environmental factors.

All of whom place a burden on the healthcare system and medical staff.
Social activities and levels of risk

<table>
<thead>
<tr>
<th>LOWEST RISK</th>
<th>MODERATE RISK</th>
<th>HIGHER RISK</th>
<th>HIGHEST RISK</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HOME ALONE OR WITH HOUSEMATES</strong></td>
<td><strong>OUTDOOR ACTIVITIES</strong></td>
<td><strong>OUTDOOR GATHERINGS</strong></td>
<td><strong>INDOOR GATHERINGS</strong></td>
</tr>
<tr>
<td>- Stay home as much as possible.</td>
<td>- Wash your hands and don't touch your face.</td>
<td>- Wash your hands and don't touch your face.</td>
<td>- Wash your hands and don't touch your face.</td>
</tr>
<tr>
<td>- Try to allow only people you live with into your home.</td>
<td>- Stay at least 6 feet from people you don't live with.</td>
<td>- Stay at least 6 feet from people you don't live with.</td>
<td>- Stay at least 6 feet from people you don't live with.</td>
</tr>
<tr>
<td>- Wash your hands.</td>
<td>- Wear a mask.</td>
<td>- Wear a mask.</td>
<td>- Wear a mask.</td>
</tr>
<tr>
<td>- If you're sick, stay home and isolate from housemates.</td>
<td>- Avoid shared surfaces, like swings or benches.</td>
<td>- Don't share food, toys, and other items, and avoid shared surfaces.</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>- Participate in events like these infrequently.</td>
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Adapted from Julia Marcus, Harvard, and Eleanor Murray, Boston University
How about attending a political rally outdoors wearing a mask and trying to physically distance?

Data from 315 large cities where BLM protests were held found that participation in such rallies is not associated with COVID-19 surges 14 days latter*

Parties and indoor rallies — Not Protests — Are Causing Spikes In Coronavirus**
Transportation safety

• Practice hand hygiene and respiratory etiquette.

• Before you leave, wash your hands with soap and water for at least 20 seconds or use hand sanitizer with at least 60% alcohol.

• Once you reach your destination, wash your hands again with soap and water for at least 20 seconds or use hand sanitizer.

• Avoid touching your eyes, nose, and mouth with unwashed hands.

• Cover your coughs and sneezes with a tissue or use the inside of your elbow. Throw used tissues in the trash and wash your hands immediately.

• Practice social distancing.

• During travel, try to keep at least 6 feet (2 meters) from people who are not in your household — for example, when you are waiting at a bus station or selecting seats on a train.

• Wear cloth face coverings.

• Wear a cloth face covering when physical distancing is difficult.
  • Note: Cloth face coverings should not be placed on:
    • Babies and children younger than 2 years old
    • Anyone who has trouble breathing or is unconscious
    • Anyone who is incapacitated or otherwise unable to remove the cloth face covering without assistance

• Cloth face coverings are meant to protect other people in case the wearer is unknowingly infected but does not have symptoms.
Airplane travel

How to reduce risk?

• A window seat may reduce risk as you will have fewer people in a 6-foot radius around you.

• Bring wipes to disinfect anything you may need to touch.

• Check with airline ahead of time for sanitizing and distancing policies.

• Wear a mask and bring hand sanitizer.

• Air circulation systems on most planes are quite good. They have high-efficiency particulate air (HEPA) filters and high rates of air exchange
  • This still does not protect you from what is happening immediately around you
  • Some experts think using the air nozzle above your seat is an effective way to reduce your risk of infection. However, it is advisable not to direct the stream of air at your face.
Restaurant risk

- The more an individual interacts with others, and the longer that interaction, the higher the risk of COVID-19 spread. The risk of COVID-19 spread increases in a restaurant or bar setting as follows:

  - **Lowest Risk:** Food service limited to drive-through, delivery, take-out, and curb-side pick up.
  - **More Risk:** Drive-through, delivery, take-out, and curb-side pick up emphasized. On-site dining limited to outdoor seating. Seating capacity reduced to allow tables to be spaced at least 6 feet apart.
  - **Even More Risk:** On-site dining with both indoor and outdoor seating. Seating capacity reduced to allow tables to be spaced at least 6 feet apart.
  - **Highest Risk:** On-site dining with both indoor and outdoor seating. Seating capacity **not** reduced and tables **not** spaced at least 6 feet apart.
Now that you are out and about

Toilet safety

- When out and about or at work, the safest toilets are toilets with the least traffic, fewest occupants at one time, and greatest distance between people at stalls and sinks.

- Public restrooms are confined, high-traffic spaces that no doubt will contribute to the transmission of coronavirus.

- Wear a mask when in a toilet (especially one with high traffic/heavy usage)

- Wash hands (or use hand sanitizer) after using a toilet.
  - Common sense, but studies have found that a majority of people do not, in fact, wash their hands after using a toilet.

- Wash hands when changing a baby, don’t just use a wet wipe as these are not sanitizers.
Toilet safety

- Viral RNA is detectable in fecal samples from cases of COVID-19, indicating that the virus sheds into the stool.
  - Viral gastrointestinal infection and potential fecal-oral transmission can last even after viral clearance from the respiratory tract

- Whether or not fecal-oral transmission of COVID-19 is common requires additional investigation.
  - At the moment, research indicates that the virus is being shed in feces, leading some to argue that the presence of virus in the sewer system is a marker of its presence in a population.

- To reduce the chance of dangerous toilet plume, virus, and bacteria escaping from the toilet into the air, always close the lid of the toilet (if available) and then flush.
  - 80% of particles that escape from fecal matter into the air can be prevented by closing the lid of a toilet when flushing.
Toilet safety: hand dryers

• Researchers at the University of Connecticut and Quinnipiac University in 2018 confirmed suspicions that hand dryers inhale bacteria from the air and deposit them on your freshly washed hands.
  • Petri dishes exposed to bathroom air for two minutes, hand dryers off, grew no more than one colony of bacteria. Petri dishes exposed to hot hand-dryer air for 30 seconds grew up to 254 colonies of bacteria.

• Use touchless paper-towel dispensers wherever possible

• On your way out, after drying your hands, use a fresh paper towel to open the restroom door.
Air-conditioning

• Poor ventilation within a confined indoor spaces contributes to the spread of COVID-19

**How about air-conditioning?**

• Airconditioning in confined spaces redistributes small particles of the virus and may be a factor in the spread of COVID-19

• However, the chances of getting sick from particles being spread from one room to another through the central air conditioning system of a building seems unlikely.

• In places like Hong Kong, Singapore and South Korea, where many people live in high-rises, and there have been no documented reports of infection due to air conditioning between apartments
The escalating use of air conditioning (AC) globally results in conditions favoring increased person-to-person transmission of airborne infections. AC draws people indoors with little outside air and recirculates air inside.

Time indoors in crowded spaces is associated with COVID-19 spread.
As a rule follow the Three Cs

Avoid
Closed and poorly ventilated spaces, crowds and close contact
University openings: An (un)natural experiment

Different universities are opening with differing sets of guidelines related to testing, wearing masks, social distance and so on.

We will need to wait and see what happens bearing in mind that universities can only implement rules and regulations on campus - not off campus where students spend much of their time.

It will be important to monitor not only cases among students, but the impact of opening universities on the communities at large.
Personal notes

Reflections
Role of educators in the time of COVID-19
Role of Health social scientists and invitation to join a COVID-19 collective
Personal Notes

• We need to get past fear-based messaging to community-based messaging and messaging that appeals to our sense of global as well as local health citizenship.
• COVID-19 needs to be treated as a family and community disease – if it is, the pandemic will be controlled faster – We learned this with Ebola. We need to provide those who need to self-quarantine with the resources to enable them to do so.
• We need to get into the weeds with a “devil in the details” approach to keeping ourselves safe.
• **Above all else: stay put, cocoon**
• “Social distancing” does not mean social disconnection – this is a time for community building, not social isolation at the personal or country level. We are in this together.
COVID-19 is a test of family and cultural values, health citizenship, and the politics of responsibility.

• It is also a time for thinking about serious health care reform and the need for safety nets enabling public health recommendations to be implemented quickly by the average citizen and sustained economic support during the crises for all, especially the most vulnerable.

• We must be prepared for periodic pandemic and reemerging disease threats. They are really not all that uncommon!!!!

• Pandemics need to be considered in stages: preparedness-response-recovery
This is not a one-time, unforeseen pandemic – we need to invest in preparedness and rapid response systems. We must be prepared for a future in which emerging and re-emerging diseases are expected.
It is important to think about the impact of COVID-19 in terms of a larger health care footprint.
Your responsibility as a university professor

- Aside from staying safe yourself, making sure your students are not compelled to be in spaces where they are going to be exposed
  - For example, university students without internet who may go to coffee shops to get online
  - Provisions for them to get internet to complete classes
- Educating youth about why their physical distancing is so important to containing this disease and preventing the swamping of our health care system which is ill prepared for a large surge
  - Making this an ethical and citizenship issue
- Dispelling the impression that “youth will only get a mild case with flu-like symptoms which is no big deal”
  - Note: More young people are being admitted to hospital in Italy with coronavirus, as the outbreak continues...this follows a first wave of the elderly being hit hard
If you are an engaged anthropologist what can you do

Action items: here are a few examples

• Social determinants of health: Beyond looking at rates of disease by group, consider the ability of specific groups in specific home, community, and work environments to adhere to public health physical distancing guidelines
  • Identify constraints and opportunities for reducing risk
    • What may be done to reduce risk of contagion that is feasible
    • What resources would make a big difference
    • Move the discussion from groups at risk and risky behaviors to environments of risk***

• Identify what information sticks and does not stick given all that is out there and changing on a day by day basis – Participate in translational research efforts and identifying / supporting local spokespeople who are trusted and can act as filters of information
As an engaged anthropologist what can you do

• Remind everyone that the household is an important unit of analysis: the families of both the ill and health care providers whose families themselves may be seen as dangerous to interact with and be indirectly stigmatized.

• **Consider opportunities for social connection and support** for different types of people at this time of high risk contagion so physical distancing does not become social isolation over what is likely to be a several month social isolation trajectory.

• Document “what if” scenarios as a means of getting people to engage in anticipatory problem solving.
  • For example, given different contexts, what would you do if you live alone and fall ill—how would you get resources?
  • What would you do if your children or grandchildren fell ill?
  • Given X means of employment, what is the best ways of protecting yourself while getting to work and while at work, and so on.

• **Work with your community to get out practical scenario driven advice.**
For working lists of engaged health social science research priorities during COVID-19 and join a crowd source collective

See
Arhe.medanthro.net
MedanthCOVID-19.org
AAA communities platform
https://www.facebook.com/groups/128678891021711/
Concerns

✓ Youth will blow this illness off and not social isolate
✓ Elders will not self isolate because they want to be close to their families and grandchildren
✓ People will try and escape hot spots by leaving and going to other “safer” places or places with better medical care and thus spread the illness
✓ Malicious messages mislead the public, undermine trust, and foster epidemic fear
✓ Confusing and contradictory messages by political leaders will lead to confusion and distrust of messages at a time when transparency and evidence-based problem solving is needed
Survey data

Supports concerns about disinformation and Misinformation

&

The large political divide in the USA reflected in Public response to COVID-19
Targeted misinformation and disinformation by Trolls and Bots as a form of bioterrorism

### The Online Coronavirus Threat

Known coronavirus-related malicious online threats, by type*

- Malicious spam emails: 199,379
- Malicious files: 81,315
- Malicious URLs: 22,767

* Threats detected from January 1 to March 27, 2020.
Source: Trend Micro

### The Countries Targeted Most by Malicious Coronavirus Spam

Countries targeted by largest share of global malicious spam emails with 'coronavirus' in the subject

- United Kingdom: 20.8%
- France: 11.5%
- United States: 8.2%
- Italy: 5.9%
- Belgium: 5.2%
- Germany: 5.1%
- India: 4.9%
- Netherlands: 3.5%

* January 1 to March 27, 2020.
Source: Trend Micro
Survey of 959 New Hampshire residents, conducted by Carsey School researchers in July 2020
Political partisanship may be our undoing if it undermines public health dictates. Will reason prevail?
Most U.S. adults say individual actions affect spread of the virus a great deal

% who say the actions of ordinary Americans affect how the coronavirus spreads in the U.S. a great deal

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>White</th>
<th>Black</th>
<th>Hispanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ages 18-29</td>
<td>52</td>
<td>58</td>
<td>62</td>
<td>61</td>
</tr>
<tr>
<td>30-49</td>
<td>59</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50-64</td>
<td>61</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>65+</td>
<td>63</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Postgrad</td>
<td>71</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>College grad</td>
<td>67</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Some college</td>
<td>59</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HS or less</td>
<td>51</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rep/Lean Rep</td>
<td>44</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dem/Lean Dem</td>
<td>73</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Whites and blacks include only those who are not Hispanic; Hispanics are of any race.

PEW RESEARCH CENTER

About seven-in-ten Americans say masks should be worn in public places at least most of the time

Thinking about the coronavirus and your own local area, when people in your community go to public places where they may be near others, how often do you think they should wear a mask? (%)

<table>
<thead>
<tr>
<th>Always</th>
<th>Most of the time</th>
<th>Some of the time</th>
<th>Rarely</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>48</td>
<td>23</td>
<td>17</td>
<td>7</td>
</tr>
</tbody>
</table>

Total:

<table>
<thead>
<tr>
<th>Rep/Lean Rep</th>
<th>Dem/Lean Dem</th>
</tr>
</thead>
<tbody>
<tr>
<td>29</td>
<td>63</td>
</tr>
<tr>
<td>23</td>
<td>23</td>
</tr>
<tr>
<td>25</td>
<td>10</td>
</tr>
<tr>
<td>14</td>
<td>10</td>
</tr>
<tr>
<td>9</td>
<td>10</td>
</tr>
</tbody>
</table>

Note: No answer responses not shown.

PEW RESEARCH CENTER
**Wide partisan differences on the role of testing and spread of coronavirus**

% of U.S. adults who say each of the following

<table>
<thead>
<tr>
<th></th>
<th>Conservative Republican</th>
<th>Mod/lib Republican</th>
<th>Mod/cons Democrat</th>
<th>Liberal Democrat</th>
<th>U.S. adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social distancing measures are helping a lot to slow the spread of coronavirus</td>
<td>47</td>
<td>38</td>
<td>76</td>
<td>76</td>
<td>59</td>
</tr>
<tr>
<td>______ is a major reason why there are new cases of coronavirus in the U.S.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coronavirus spreads more easily than other infectious diseases</td>
<td>58</td>
<td>47</td>
<td>78</td>
<td>78</td>
<td>68</td>
</tr>
<tr>
<td>There is not enough testing for coronavirus</td>
<td>31</td>
<td>30</td>
<td>82</td>
<td>82</td>
<td>58</td>
</tr>
<tr>
<td>Not enough people are following social distancing measures</td>
<td>36</td>
<td>31</td>
<td>72</td>
<td>72</td>
<td>57</td>
</tr>
</tbody>
</table>

Note: Respondents who gave other responses or who did not give an answer are not shown. Republicans and Democrats include those who “lean” toward the parties.
“Trust in Medical Scientists Has Grown in U.S., but Mainly Among Democrats”

PEW RESEARCH CENTER
Figure 8

Majorities Willing To Share Test Results Using Smart Phone App

If you were tested for coronavirus, would you be **willing** or **unwilling** to use an app for your phone to share the results with public health officials in order for them to track the spread of the outbreak?

<table>
<thead>
<tr>
<th>Total</th>
<th>Willing</th>
<th>Unwilling</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>68%</td>
<td>29%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Partisans</th>
<th>Willing</th>
<th>Unwilling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Democrats</td>
<td>81%</td>
<td>17%</td>
</tr>
<tr>
<td>Independents</td>
<td>69%</td>
<td>27%</td>
</tr>
<tr>
<td>Republicans</td>
<td>57%</td>
<td>41%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Willing</th>
<th>Unwilling</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-29 year olds</td>
<td>78%</td>
<td>19%</td>
</tr>
<tr>
<td>30-49 year olds</td>
<td>71%</td>
<td>28%</td>
</tr>
<tr>
<td>50-64 year olds</td>
<td>62%</td>
<td>35%</td>
</tr>
<tr>
<td>65+ year olds</td>
<td>63%</td>
<td>33%</td>
</tr>
</tbody>
</table>

Hope is a good thing. But wishful thinking is not an antidote to COVID-19. Better to err on the side of caution and prepare for a next possible wave, than drown in the undertow.
Majority of Republicans now say ‘the worst is behind us’ in coronavirus outbreak

% who say, in thinking about the problems the country is facing from the coronavirus outbreak, the worst is ...

<table>
<thead>
<tr>
<th></th>
<th>TOTAL</th>
<th>REP/LEAN REP</th>
<th>DEM/LEAN DEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>April</td>
<td>73</td>
<td>56</td>
<td>87</td>
</tr>
<tr>
<td>June</td>
<td>59</td>
<td>61</td>
<td>76</td>
</tr>
<tr>
<td>April</td>
<td>26</td>
<td>42</td>
<td>13</td>
</tr>
<tr>
<td>June</td>
<td>40</td>
<td>38</td>
<td>23</td>
</tr>
</tbody>
</table>

Note: No answer responses not shown.
Growing gap between white and black adults in views of whether the worst of the pandemic is still to come

% who say, in thinking about the problems the country is facing from the coronavirus outbreak, the worst is still to come

Note: Whites and blacks include only those who are not Hispanic; Hispanics are of any race.

PEW RESEARCH CENTER
Perceptions do not match reality

COVID-19 fatigue leads many people to want to believe the disease is running its course when it is actually steadily increasing or re-emerging as a result of early reopening of society too soon or becoming lax in physical distancing and the wearing of masks, etc.

This could be Arizona
The United states does not have a homogenous “Culture of health.” Disputes over relaxing restrictions are likely to index other cultural and political divides.
A majority of the public prioritizes restrictions to stop the virus even at the expense of the economy

Percent of adults

- Use restrictions to prevent spread
- Remove restrictions to help economy

Overall
- 72%
- 27%

Democrats
- 92%
- 7%

Independents
- 71%
- 26%

Republicans
- 46%
- 53%

"Poor" economy
- 84%
- 14%

"Good" economy
- 50%
- 48%

Question: [Using restrictions to prevent the coronavirus from spreading, even if it hurts the economy / Removing restrictions in order to help the economy, even if more people get the coronavirus] Which do you think is the bigger priority for your community?
Source: AP-NORC poll conducted July 16-20, 2020, with 1,057 adults age 18 and older nationwide.
Republicans far more comfortable than Democrats going to salons, restaurants, indoor events, parties

% who say, given the current situation, they would feel comfortable ...

<table>
<thead>
<tr>
<th>Activity</th>
<th>Dem/Lean Dem</th>
<th>Total</th>
<th>Rep/Lean Rep</th>
</tr>
</thead>
<tbody>
<tr>
<td>Going out to the grocery store</td>
<td>73</td>
<td>79</td>
<td>87</td>
</tr>
<tr>
<td>Visiting with a family member or close friend inside their home</td>
<td>68</td>
<td>77</td>
<td>88</td>
</tr>
<tr>
<td>Going to a hair salon or barbershop</td>
<td>37</td>
<td>53</td>
<td>72</td>
</tr>
<tr>
<td>Eating out in a restaurant</td>
<td>28</td>
<td>44</td>
<td>65</td>
</tr>
<tr>
<td>Attending an indoor sporting event or concert</td>
<td>11</td>
<td>23</td>
<td>40</td>
</tr>
<tr>
<td>Attending a crowded party</td>
<td>8</td>
<td>18</td>
<td>31</td>
</tr>
</tbody>
</table>


PEW RESEARCH CENTER
The Nationalities Most Eager To Take A Covid-19 Vaccine

% who agree/disagree they would take a Covid-19 vaccine if it was available*

<table>
<thead>
<tr>
<th>Country</th>
<th>Agree</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>97</td>
<td>3</td>
</tr>
<tr>
<td>Brazil</td>
<td>88</td>
<td>12</td>
</tr>
<tr>
<td>India</td>
<td>87</td>
<td>13</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>85</td>
<td>15</td>
</tr>
<tr>
<td>South Korea</td>
<td>84</td>
<td>16</td>
</tr>
<tr>
<td>Canada</td>
<td>76</td>
<td>24</td>
</tr>
<tr>
<td>Japan</td>
<td>75</td>
<td>25</td>
</tr>
<tr>
<td>Spain</td>
<td>72</td>
<td>28</td>
</tr>
<tr>
<td>United States</td>
<td>67</td>
<td>33</td>
</tr>
<tr>
<td>Germany</td>
<td>67</td>
<td>33</td>
</tr>
<tr>
<td>France</td>
<td>59</td>
<td>41</td>
</tr>
<tr>
<td>Russia</td>
<td>54</td>
<td>47</td>
</tr>
</tbody>
</table>

* May not add up to 100% due to rounding
n=19,519 adults in 27 countries (Jul 27-Aug 07, 2020).
Source: Ipsos MORI
A Third Of Americans Unwilling To Get Covid-19 Vaccine

Share of U.S. adults willing to get an FDA approved, no cost vaccine for Covid-19

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Americans</td>
<td>35%</td>
<td>65%</td>
</tr>
<tr>
<td>Democrats</td>
<td>19%</td>
<td>81%</td>
</tr>
<tr>
<td>Independents</td>
<td>41%</td>
<td>59%</td>
</tr>
<tr>
<td>Republicans</td>
<td>47%</td>
<td>53%</td>
</tr>
<tr>
<td>18-29 years old</td>
<td>24%</td>
<td>76%</td>
</tr>
<tr>
<td>30-49 years old</td>
<td>36%</td>
<td>64%</td>
</tr>
<tr>
<td>50-64 years old</td>
<td>41%</td>
<td>59%</td>
</tr>
<tr>
<td>65+</td>
<td>30%</td>
<td>70%</td>
</tr>
</tbody>
</table>

n=7,632 (July 20-August 02, 2020)
Source: Gallup
Black Americans are more skeptical of experimental treatments, potential COVID-19 vaccine than Hispanic and white adults

% of U.S. adults who say ...

Benefits outweigh the risks of allowing more access to experimental treatments before completion of clinical trials

<table>
<thead>
<tr>
<th></th>
<th>Black</th>
<th>Hispanic</th>
<th>White</th>
<th>U.S. adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>41%</td>
<td>53%</td>
<td>63%</td>
<td></td>
<td>59%</td>
</tr>
</tbody>
</table>

They would definitely/probably get a COVID-19 vaccine if it were available today

<table>
<thead>
<tr>
<th></th>
<th>Black</th>
<th>Hispanic</th>
<th>White</th>
</tr>
</thead>
<tbody>
<tr>
<td>54%</td>
<td></td>
<td></td>
<td>74%</td>
</tr>
</tbody>
</table>

Note: Whites and blacks include those who report being only one race and are non-Hispanic. Hispanics are of any race.

PEW RESEARCH CENTER
School’s out

United States, poll of 1,500 adults, July 19th-21st 2020

Parents who want their children to attend classes this autumn, %

- Postgraduate
- Some college
- College graduate
- High school or less

North-east
- Midwest
- West
- South

Republican
- Independent
- Democrat

Source: YouGov

The Economist
Older U.S. adults see COVID-19 outbreak as a major threat to their personal health; younger Americans say it is a major threat to their finances

% who say the coronavirus outbreak is a major threat to ...

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Personal Financial Situation</th>
<th>Personal Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>All adults</td>
<td>41%</td>
<td>38%</td>
</tr>
<tr>
<td>Ages 18-29</td>
<td>40%</td>
<td>26%</td>
</tr>
<tr>
<td>30-49</td>
<td>43%</td>
<td>34%</td>
</tr>
<tr>
<td>50-64</td>
<td>46%</td>
<td>43%</td>
</tr>
<tr>
<td>65+</td>
<td>32%</td>
<td>49%</td>
</tr>
</tbody>
</table>


PEW RESEARCH CENTER
Since last fall, more Americans say the government should do more to help those in need

% who say the government ...

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Among Rep/Lean Rep</th>
<th>Among Dem/Lean Dem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Should do more to help the needy, even if it means going deeper into debt</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>49</td>
<td>58</td>
<td>27</td>
</tr>
<tr>
<td>Can't afford to do much more to help the needy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>48</td>
<td>40</td>
<td>72</td>
</tr>
</tbody>
</table>

Note: No answer responses not shown.

PEW RESEARCH CENTER
Many Americans say government isn’t doing enough to help during pandemic

A new AP-NORC poll finds that 8 in 10 Democrats say the government is not doing enough to help the financial situation of individual Americans during the pandemic. About half as many Republicans say the same.

In response to the coronavirus outbreak, the government is doing ____ to help the financial situation of Americans.

<table>
<thead>
<tr>
<th></th>
<th>Too little</th>
<th>Too much</th>
<th>Right amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Democrats</td>
<td>82%</td>
<td>4%</td>
<td>12%</td>
</tr>
<tr>
<td>Republicans</td>
<td>41%</td>
<td>18%</td>
<td>40%</td>
</tr>
<tr>
<td>All adults</td>
<td>66%</td>
<td>10%</td>
<td>23%</td>
</tr>
</tbody>
</table>

Results based on interviews with 1,075 U.S. adults conducted August 17-20. The margin of error is ±4.1 percentage points for the full sample.

Source: AP-NORC Center for Public Affairs Research
More think their country has handled COVID-19 well, with the exceptions of the U.S. and UK

% who say their own country has done a ___ job dealing with the coronavirus outbreak

<table>
<thead>
<tr>
<th>Country</th>
<th>Bad</th>
<th>Good</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>11%</td>
<td>88%</td>
</tr>
<tr>
<td>U.S.</td>
<td>52</td>
<td>47</td>
</tr>
<tr>
<td>Denmark</td>
<td>5</td>
<td>95</td>
</tr>
<tr>
<td>Germany</td>
<td>12</td>
<td>88</td>
</tr>
<tr>
<td>Netherlands</td>
<td>13</td>
<td>87</td>
</tr>
<tr>
<td>Italy</td>
<td>25</td>
<td>74</td>
</tr>
<tr>
<td>Sweden</td>
<td>29</td>
<td>71</td>
</tr>
<tr>
<td>Belgium</td>
<td>39</td>
<td>61</td>
</tr>
<tr>
<td>France</td>
<td>41</td>
<td>59</td>
</tr>
<tr>
<td>Spain</td>
<td>47</td>
<td>54</td>
</tr>
<tr>
<td>UK</td>
<td>54</td>
<td>46</td>
</tr>
<tr>
<td>Median</td>
<td>29</td>
<td>71</td>
</tr>
<tr>
<td>Australia</td>
<td>6</td>
<td>94</td>
</tr>
<tr>
<td>South Korea</td>
<td>14</td>
<td>86</td>
</tr>
<tr>
<td>Japan</td>
<td>43</td>
<td>55</td>
</tr>
<tr>
<td>14-COUNTRY</td>
<td>27</td>
<td>73</td>
</tr>
</tbody>
</table>

Note: Those who did not answer are not shown. In Australia and Canada, the question was asked about “COVID-19.” In Japan, it was asked about “novel coronavirus,” and in South Korea, it was asked about “Corona19.”


PEW RESEARCH CENTER
Poll: Compared to other countries, how would you describe health care in the United States?

- National adults: 42% One of the best/Above average, 21% About average, 35% Below average/One of the worst, 0% Unsure
- Democrats: 22% One of the best/Above average, 22% About average, 55% Below average/One of the worst, 0% Unsure
- Republicans: 74% One of the best/Above average, 17% About average, 8% Below average/One of the worst, 0% Unsure
- Independents: 40% One of the best/Above average, 25% About average, 33% Below average/One of the worst, 0% Unsure

Poll: Compared to other countries around the world, how would you describe the United States’ response to the COVID-19 pandemic?

- National adults: 24% One of the best/Above average, 19% About average, 56% Below average/One of the worst, 1% Unsure
- Democrats: 6% One of the best/Above average, 6% About average, 88% Below average/One of the worst, 0% Unsure
- Republicans: 51% One of the best/Above average, 34% About average, 14% Below average/One of the worst, 2% Unsure
- Independents: 23% One of the best/Above average, 18% About average, 59% Below average/One of the worst, 0% Unsure

Source: PBS NewsHour/Marist Poll National Adults. Interviews conducted July 27 through July 28, 2020, n=1658 MOE +/- 3.3 percentage points.*National Registered Voters: n=1539 MOE +/- 3.4 percentage points.
Growing partisan differences over trust in medical scientists and scientists since the COVID-19 outbreak

% of U.S. adults who have a great deal of confidence in each group to act in the best interests of the public

<table>
<thead>
<tr>
<th></th>
<th>Medical scientists</th>
<th>Scientists</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2019</td>
<td>2020</td>
</tr>
<tr>
<td>Rep/lean Rep</td>
<td>32%</td>
<td>37%</td>
</tr>
<tr>
<td>Dem/lean Dem</td>
<td>31%</td>
<td>53%</td>
</tr>
</tbody>
</table>

Note: Respondents who gave other responses or who did not give an answer are not shown.
Source: Survey conducted April 20-26, 2020.
“Trust in Medical Scientists Has Grown in U.S., but Mainly Among Democrats”
PEW RESEARCH CENTER
Majority of Americans think scientists should take an active role in policy debates about scientific issues

% of U.S. adults who say scientists should ____ when it comes to public policy debates about scientific issues

- Take an active role: 60
- Focus on establishing sound scientific facts: 39

% of U.S. adults who say that scientific experts are ____ at making good policy decisions about scientific issues than other people

- Usually better: 47
- Neither better nor worse: 45
- Usually worse: 7

Note: Respondents who did not give an answer are not shown.
“Trust in Medical Scientists Has Grown in U.S., but Mainly Among Democrats”

PEW RESEARCH CENTER
Overall, 43% in U.S. say evidence from public health experts has a great deal of influence on their state’s policies

% of U.S. adults who say their state/federal government’s policies to control the spread of coronavirus are influenced ____ by evidence from public health experts

<table>
<thead>
<tr>
<th></th>
<th>A great deal</th>
<th>A fair amount</th>
<th>Not too much/Not at all</th>
</tr>
</thead>
<tbody>
<tr>
<td>Their state government</td>
<td>43</td>
<td>40</td>
<td>17</td>
</tr>
<tr>
<td>Federal government</td>
<td>26</td>
<td>49</td>
<td>24</td>
</tr>
</tbody>
</table>

Note: Respondents who did not give an answer are not shown.  
“Trust in Medical Scientists Has Grown in U.S., but Mainly Among Democrats”

PEW RESEARCH CENTER
Top election issues
By party

<table>
<thead>
<tr>
<th>Issue</th>
<th>Biden supporters</th>
<th>Trump supporters</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economy</td>
<td>72</td>
<td>88</td>
<td>79</td>
</tr>
<tr>
<td>Health care</td>
<td>48</td>
<td>84</td>
<td>68</td>
</tr>
<tr>
<td>Supreme Court appointments</td>
<td>61</td>
<td>66</td>
<td>64</td>
</tr>
<tr>
<td>The coronavirus outbreak</td>
<td>39</td>
<td>82</td>
<td>62</td>
</tr>
<tr>
<td>Violent crime</td>
<td>48</td>
<td>74</td>
<td>59</td>
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<tr>
<td>Foreign policy</td>
<td>57</td>
<td>57</td>
<td>57</td>
</tr>
<tr>
<td>Gun policy</td>
<td>50</td>
<td>60</td>
<td>55</td>
</tr>
<tr>
<td>Race and ethnic inequality</td>
<td>24</td>
<td>76</td>
<td>52</td>
</tr>
<tr>
<td>Immigration</td>
<td>46</td>
<td>61</td>
<td>52</td>
</tr>
<tr>
<td>Economic inequality</td>
<td>28</td>
<td>65</td>
<td>49</td>
</tr>
<tr>
<td>Climate change</td>
<td>11</td>
<td>68</td>
<td>42</td>
</tr>
<tr>
<td>Abortion</td>
<td>35</td>
<td>46</td>
<td>40</td>
</tr>
</tbody>
</table>

Note: Based on registered voters.
PEW RESEARCH CENTER
Bottom line: When called for, stay put, cocoon. Check in on your family, friends, neighbors. Don’t just think of yourself.

Your grandparents were called to war. You're being called to sit on your couch. You can do this.
Bottom line

• The only approach to flattening the curve of COVID-19, until we develop, test, and distribute a vaccine or find a cure:
  • Test: widely and routinely, with the right test for identifying active cases, past cases, antibodies produced by those who have been ill
  • Contact trace: effectively with buy-in from the public
  • Quarantine and Isolate: provide and support viable isolation options for all who need to do so to keep others safe; physically isolate and socially support

• All three need to be done in concert or the approach does not work, all are equally important*
  • All three steps require trust by diverse members of society and a sense of health citizenship based on evidence based public health that eclipses partisanship
    • Society is composed of different cultural groups and each has to buy into a common strategy for the greater good