



## COVID-19 Science and Medicine Updates

*Compiled by University of Maine faculty and students*

### **Maine Updates – April 14, 2020:**

From Maine CDC:

<https://www.maine.gov/dhhs/mecdc/infectious-disease/epi/airborne/coronavirus.shtml>

Data updated April 13, 2020 at 11:45AM:

Confirmed Cases: 698

Recovered: 273

Hospitalized: 124

Deaths: 19

### **News from Maine:**

Governor Mills moves primary election from June 9 to July 14, 2020

<https://www.maine.gov/governor/mills/news/governor-mills-issues-executive-order-moving-primary-election-july-14th-2020-04-10>

### **News on Cluster of COVID-19 Cases in Maine:**

<https://bangordailynews.com/2020/04/09/news/bangor/a-traveling-salesperson-was-responsible-for-a-cluster-of-maines-early-coronavirus-cases/>

### **Other COVID-19 News:**

**COVID-19 projections:** <https://covid19.healthdata.org/projections>

- April 15th, 2020 (1 day from now) is predicted to be the peak of the U.S.'s lack of resources. It is predicted that the total bed shortage will be 36,654 beds, with total bed shortage in the ICU being 16,323.
- April 16th, 2020 (2 days from now) is predicted to be the peak of deaths (per day) from COVID-19 in the U.S. The number of deaths predicted on that day is 3,130.
- By August 4, 2020, the total number of U.S. deaths from COVID-19 is predicted to be 81,766.
- \*\*These data are assuming FULL social/physical distancing.

Data for Maine are similar:

<https://covid19.healthdata.org/united-states-of-america/maine>

Peak hospital resource use predicted to be TODAY: April 14, 2020

Peak in daily deaths was predicted as YESTERDAY, April 13, 2020

63 COVID deaths are predicted by Aug 4, 2020

## Effects of COVID-19 on various organs

- In addition to causing severe pneumonia, COVID-19 may also lead to damage of other organs such as the heart, liver, kidneys, and may possibly even cause damage to the blood and immune system ([https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(20\)30558-4/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)30558-4/fulltext)).
- Liver function and metabolism appear to be strongly correlated to the severity of COVID-19 infection in patients. It has also been suggested that COVID-19 may additionally attack the muscle, gastrointestinal tract, lymph nodes, and heart (<https://www.medrxiv.org/content/10.1101/2020.04.05.20053819v1.full.pdf>).
- A large contributor to the dysfunction of these organs is that the metabolites and lipid constituents of human plasma appear to be drastically affected and show abnormalities in response to this infection (<https://www.medrxiv.org/content/10.1101/2020.04.05.20053819v1.full.pdf>).
- In a study done in Wuhan, many patients developed sepsis, followed by ARDS, acute cardiac injury, acute kidney injury, and secondary infection. Among survivors, 12% experienced heart failure, 42% experienced sepsis, 36% experienced respiratory failure, and 7% experienced ARDS. (<https://www.thelancet.com/action/showPdf?pii=S0140-6736%2820%2930566-3>).

## What is a Cytokine Storm?

- One of the complications of COVID-19, including in otherwise healthy individuals, is an immune response called cytokine storm. Typically when immune cells are called to action against an invading microbe, some immune cells release chemical messengers called cytokines. As examples, one cytokine is called IL-6, another is IL-1. These cytokines are part of a normal and health immune response.
- However, in some cases the release of cytokines ramps up too much and the immune system is not able to turn off the response. These patients get quite sick, with damage to healthy tissues and organs, but doctors can measure blood levels of indicators such as ferritin or c-reactive protein to determine if a cytokine storm is underway.
- It is not always clear why some patients exhibit a cytokine storm and others don't. Some may be genetic differences, while others may be underlying immune dysregulation.
- Treatments may be steroids or cytokine receptor inhibitor drugs, which prevent cytokines from acting on the body's cells.
- Read more here:

<https://www.knowablemagazine.org/article/health-disease/2020/what-cytokine-storm>

## Effects of working remote during the pandemic

- Many of us are staying confined and working from home, spending countless hours stationary staring at a computer screen and/or participating in Zoom calls. This is more than likely leading to a large decline in physical activity for a majority of people, therefore having psychological and neurological effects. It can be compared to how injured athletes experience what is characterized as "emotional upheaval," and includes sadness, irritation, frustration, anger, etc., because they

are no longer able to keep their normal routine or exacerbate energy as they usually would.

- Lack of movement/regular use of muscles or proper nutrients can also lead to muscle atrophy  
<https://www.sportsmed.org/AOSSMIMIS/members/downloads/education/ConsensusStatements/PsychologicalIssues.pdf>

### **Community responses: effects on small businesses**

- Many small businesses have either closed down, or severely restricted their hours and workers to help slow the spread of COVID-19 and keep their employees safe. Many of the business owners are struggling to figure out how they will maintain payments of their leases, and fear that COVID-19 could put them out of business for good (<https://www.cnbc.com/2020/03/23/how-small-businesses-across-us-are-coping-with-covid-19-pandemic.html>).
- When possible, employers are encouraged to be extremely flexible, allow flexibility in worksites (telework), and support staggered hours to prevent too many employees from being congregated at one time (<https://www.cdc.gov/coronavirus/2019-ncov/community/guidance-small-business.html>).
- Many restaurants have had to close or go to curbside pick up or delivery to limit human interactions. People have been encouraged to “support local” and order food or buy a gift card to these restaurants that they will be able to use at a later time once restaurants are able to open back up. The hope is that by doing this, there will still be an income to keep the restaurants from closing their doors forever (<https://www.forbes.com/sites/aswinpranam/2020/04/04/own-a-small-business-during-covid-19-this-social-venture-can-help/#16bf3b2597d5> , <https://www.cbsnews.com/news/coronavirus-crisis-help-small-businesses/>).
- Communities are coming together in numerous ways; every night at 7pm when all of New York City applauds for the front-line healthcare workers continuously putting their lives at risk (<https://www.npr.org/2020/04/10/832131816/every-night-new-york-city-salutes-its-health-care-workers>); Spectrum is offering free wifi to students who need it for remote learning purposes (<https://www.spectrum.net/support/internet/coronavirus-covid-19-educational-internet-offer>).

### **Maine Resources for Businesses Affected by COVID-19:**

From Maine Small Business Development Centers:

<https://www.mainesbdc.org/mitigate-coronavirus-impact-on-your-business/>

Resources from Coastal Enterprises, Inc:

<https://www.ceimaine.org/covid-19-resources-for-businesses/>

From UMaine’s Innovation and Economic Development office:

<https://umaine.edu/econdev/resources-for-maine-businesses-affected-by-coronavirus/>

## Homelessness and COVID-19:

### Homelessness Issues during COVID-19 - Goals, Lessons Learned, Current Practices

>500,000 homeless persons in the United States as of Fall 2019

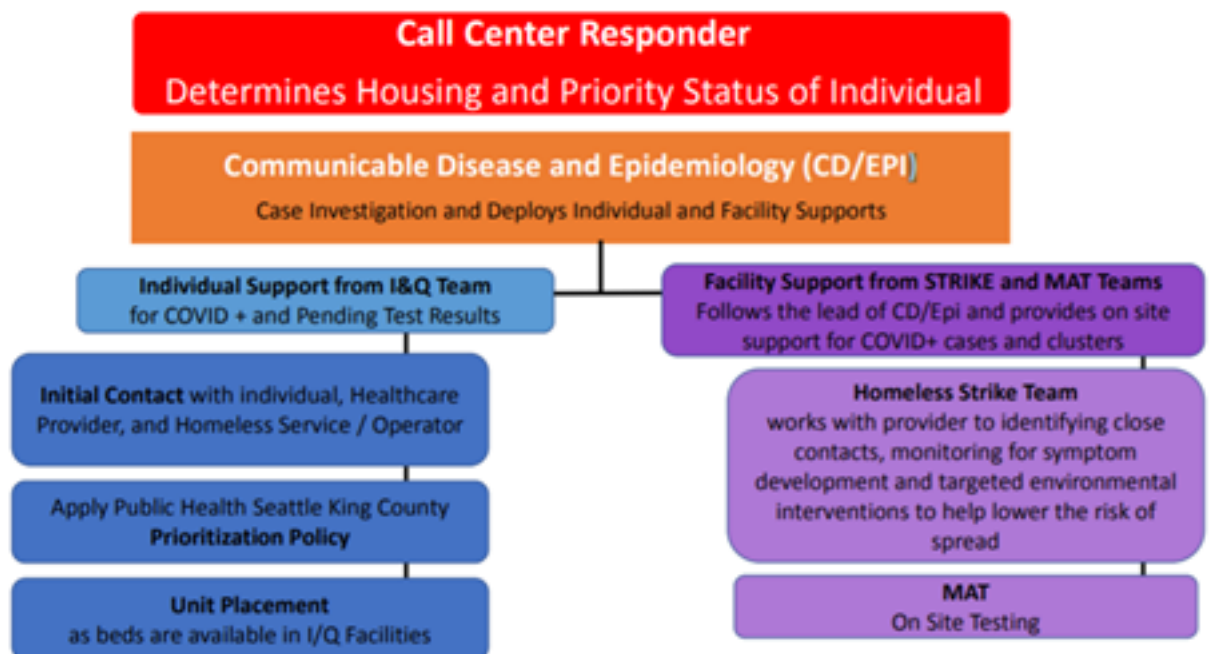
(<https://www.whitehouse.gov/wp-content/uploads/2019/09/The-State-of-Homelessness-in-America.pdf>)

An available tool: “Community-level COVID-19 Homelessness Planning & Response Dashboard” for determining planning and response efforts to address the COVID-19 pandemic.”

[https://endhomelessness.org/wp-content/uploads/2020/03/COVID-paper\\_clean-636pm.pdf](https://endhomelessness.org/wp-content/uploads/2020/03/COVID-paper_clean-636pm.pdf)

- Lessons Learned from Seattle & King County ([https://www.usich.gov/resources/uploads/asset\\_library/USICH\\_Webinar\\_Seattle\\_King\\_County\\_03312020.pdf](https://www.usich.gov/resources/uploads/asset_library/USICH_Webinar_Seattle_King_County_03312020.pdf))
  - High risk, older population with high prevalence of underlying medical conditions. High risk due to congregating at shelters, service facilities
  - King County goals - slow the spread, preserve hospital capacity. Do this by: 1) issue guidance for shelters, 2) communicate with providers, 3) distribute hygiene and sanitation supplies via online ordering, 4) shelter de-intensification, 5) create a team to provide on-site technical assistance
  - Challenges Faced: ensuring appropriate staffings, need may outweigh capacity, determine how to operate during low capacity
  - Lessons Learned: Integrated clinical environmental health lens is key, system for prioritization of sites to pinpoint areas of need, telephonic consultations were successful, standards of practice related to hygiene and sanitation are helpful

#### Flow Chart for Individual and Facility Support



- Team Approach - work with Public Health in Seattle & King County, Dept. of Community and Human Services, Facilities Management Division, Human Services Division, Healthcare for Homeless Network
- United States Interagency Council on Homelessness (<https://www.usich.gov/covid-19/>)
  - Homeless outreach teams should understand how to protect themselves (<https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/prevention.html>)
  - Local health departments - identify where people without housing can be isolated and receive care (Isolation Housing is huge - <https://www.cdc.gov/coronavirus/2019-ncov/hcp/disposition-in-home-patients.html>)
  - Hospitals should ensure they're planning safe discharge of patients if they do not require hospitalization but lack housing
  - Work with law enforcement
  - Feeding Guidelines (<https://nationalmasscarestrategy.org/covid-19-feeding-guidelines/>)
  - Sheltering Guidelines (<https://nationalmasscarestrategy.org/covid-19-sheltering-guidelines/>)
- CDC ([https://www.cdc.gov/coronavirus/2019-ncov/downloads/COVID19\\_Homeless-H.pdf](https://www.cdc.gov/coronavirus/2019-ncov/downloads/COVID19_Homeless-H.pdf))
  - Planning - Identify a list of healthcare facilities, include contingency plans for employee absenteeism, provide prevention supplies (PPE, sanitizer), report cases of respiratory illness, plan for high shelter usage, identify and address potential language, cultural, and disability barriers associated with communicating COVID-19 information
- SF.gov
  - Things that SF is doing: 1) enhancing cleaning in shelters, increasing meal offerings, expanding shelter hours, allowing for single-room occupancy hotels (SROs) (but apparently these are being difficult and many people do not apply for them), and declaring that anyone currently in a shelter will not have to leave because of time limits.
  - “Unsheltered people living in a public spaces, tents, in vehicles, or otherwise unsheltered, should use the City’s public restrooms and newly expanded hand-washing stations frequently. The City also recommends keeping tents at least 6 feet apart and sleeping only one person per tent. The City also is ensuring that the Homeless Outreach Team continues its work on the streets during this health crisis.”

**HOWEVER, problems with SF’s way of doing things are being reported.**

- Statnews.com
  - “I am having a really tough time discharging people from the hospital to anywhere but to the street” – hospitalist in San Francisco
  - 68 cases in SFs largest homeless shelter
  - Shelters stopped admitting new people – down to 1,200 shelter beds to serve 7,600 homeless adults

- To give isolating homeless a place to stay, agencies have enlisted hotels – but many do not qualify for placement in hotels (due to mental health or addiction problems)

## **Serology**

What is serology?

- Serology is used to confirm infection by various bacteria, fungi, and viruses that can be difficult to detect by other methods
- Accomplished through the detection of specific antibodies, or ‘titer’, as a result of harboring an infection with a pathogen

Source:

<https://www.medrxiv.org/content/10.1101/2020.03.17.20037713v1>

<https://forlabinfeksi.or.id/wp-content/uploads/2018/07/3-s2.0-B9780323401616000164-1.pdf>

How is serology testing different from diagnostic testing?

- Serology testing is not well suited for detecting acute infections whereas nucleic acid testing to detect the SARS-CoV-2 genome is widely employed to diagnose COVID-19 disease

Source:

<https://www.medrxiv.org/content/10.1101/2020.03.17.20037713v1>

- An increase in antibody titer may not be detectable for weeks or even months after the initial infection, which may impact sensitivity of serology testing, depending on when the sample is collected
- Some immune compromised individuals may not amount a substantial antibody response to an infection

Source:

<https://forlabinfeksi.or.id/wp-content/uploads/2018/07/3-s2.0-B9780323401616000164-1.pdf>

How are serology tests accomplished?

- Serological testing requires the analysis of blood specimens
- Multiple samples are collected to determine the development of immunity over time following infection
- Samples are then used in a laboratory setting to determine the presence of antibodies for a particular pathogen

Source: <https://forlabinfeksi.or.id/wp-content/uploads/2018/07/3-s2.0-B9780323401616000164-1.pdf>

If serology shouldn't be used to diagnose an active COVID-19 infection, why is it useful?

- We can use serology testing to understand how the immune system responds to SARS-CoV-2
- Through surveying the presence of antibodies, we can more accurately determine the rate of infection in an affected area
- It can be used to accurately determine the infection fatality rate (defined as the number of deaths divided by the total number of confirmed cases), currently large portions of the general public are not being tested for COVID-19 and may not be counted as a confirmed case. Serology testing can determine the true number of infected individuals to better define the proportion of infected individuals that result in fatalities.

- Serological tests can be used to determine a prior infection in individuals, can determine if healthcare workers are already immune and can be deployed to minimize risk of spread to other patients or other healthcare workers
- Can also be used to identify persons who have had a prior infection and have a high antibody response; those who could serve as donors for convalescent or therapeutic serum donors

Source:

<https://www.medrxiv.org/content/10.1101/2020.03.17.20037713v1>

Is serology testing key to 'opening' the country or reducing restrictive measures?

- Experts suggest that there are four 'benchmarks' that will allow for reopening the country:
  1. Hospitals in the state must be able to safely treat all patients requiring hospitalization, without resorting to crisis standards of care
  2. We must be able to test everyone who requires testing
  3. We must have a robust monitoring system in place for confirmed cases and contacts
  4. There must be a sustained reduction in cases for at least 14 days
- While serology is included in testing and in the monitoring system, there are other criteria that must be met for a reopening or relax of restrictions to happen

Source: [https://www.nytimes.com/2020/04/06/upshot/coronavirus-four-](https://www.nytimes.com/2020/04/06/upshot/coronavirus-four-benchmarks-reopening.html)

[benchmarks-reopening.html](https://www.nytimes.com/2020/04/06/upshot/coronavirus-four-benchmarks-reopening.html)

Can individuals who are immunocompromised rely on serology testing?

- One of the difficulties with serology testing is that it relies on the ability to produce a robust immune response to a particular pathogen
- Individuals who are immunocompromised may not produce a high antibody response to COVID19 or other pathogens following infection
- In these situations a false negative result may occur, due to production of antibodies below the level of detection. Molecular diagnostic measures should be used in complement with serology (like RT-PCR) for improved detection of infection.

Source:

<https://reader.elsevier.com/reader/sd/pii/B9781455748013000163?token=132B4480AA7D02F853D21C9518DB44C1E9205E9551A543CF1BA0E326A4700E63BA07D2578203A37734FEA56C027E6302>

Can you become infected with COVID19 again?

- This is currently an active area of research. Some early reports from China have suggested that this may be possible. Up to 14% of recovered individuals retested positive for the virus and had to return to the hospital for evaluation

Source: <https://jamanetwork.com/journals/jama/fullarticle/2762452>

<https://www.ncbi.nlm.nih.gov/pubmed/32118391>

- However, more recent research has demonstrated that individuals who have recovered from the virus may still show a positive test result up to two weeks following recovery, suggesting that people may be virus carriers after they have recovered (met criteria for release from hospital). Further quarantine after hospital release may be necessary as a precaution.

Source: <https://jamanetwork.com/journals/jama/article-abstract/2762452>

- Further, a study based in China using rhesus macaques (monkeys) found that following infection with COVID19, the monkeys were all resistant to reinfection by

the virus. However, it should be noted that this study had a very small sample size of 4 macaques.

Source: <https://www.biorxiv.org/content/10.1101/2020.03.13.990226v1.full.pdf>

What are the different kinds of serology tests?

- Rapid diagnostic test (RDT) – This is a test that is small and portable. It can be used virtually anywhere and delivers a positive or negative result, similar to a pregnancy test. This kind of test can use blood samples from a finger prick, saliva, or a nasal swab to test for the presence of patient antibodies (IgG or IgM) or can be used to detect the presence of viral antigen. While this test is rapid (10-30 min), it does not determine how much antibody is present or whether the antibodies can protect against a future infection.
- Enzyme Linked Immunosorbent Assay (ELISA) – This is generally a laboratory based test and can provide more information than a RDT. This test generally uses whole blood, serum, or plasma from patients. In this type of test a portion of the virus (noninfectious) is coated in a dish, usually the protruding spike protein of the virus. Patient samples are then added to dish and if the patient sample contains antibodies that recognize the spike protein of the virus, they will bind to it. This interaction can then be measured. This test is not as rapid as RDT (1-5 hours) but can be used to detect how much antibody is in a patient sample and if protection against a future infection is possible though it is not as conclusive as a neutralization assay (measures the ability of the antibodies to prevent subsequent infection). Serology tests are not as sensitive as molecular based methods (RT-PCR), and sensitivity does not appear to vary by age group.

Source: <https://www.medrxiv.org/content/10.1101/2020.03.17.20037713v1>

- Neutralization Assay – This test is used in a lab-based setting to determine if patient antibodies can ‘protect’ other cells from infection. To do this, whole blood, plasma, or serum from the patient is needed. Cells are grown in the lab in the presence of the patient sample. Virus is then added to the sample to see if antibodies from the patient can protect the cells from infection. While this test takes the longest amount of time (3-5 days), it can determine the presence of antibodies and also determine if protection from a future infection is possible. However, it may not detect all antibodies in the patient sample because it may miss antibodies that target proteins not involved in replication of the virus.

Source: <http://www.centerforhealthsecurity.org/resources/COVID-19/Serology-based-tests-for-COVID-19.html>

What serology tests are currently available?

- The FDA has approved the use of RDT testing in clinical settings as of April 1, 2020. The sensitivity of this test is 93.8% and is 95.6% specific to SARS-CoV-2. This test is currently the only approved serology test in the US. This test is produced by Cellex Inc and is already being used by the CDC to test individuals in New York and for health care workers throughout the US

Source: <https://pharmaphorum.com/news/us-backs-first-emergency-covid-19-antibody-test-from-cellex/>

- This RDT test does not cross react with:
  - Human coronavirus panel (collected before Oct 2019), HBV, HCV, HIV-1, HIV-2, Adenovirus, Human Metapneumovirus (hMPV), Parainfluenza virus 1-4, Influenza A, Influenza B, Enterovirus 71, Respiratory syncytial virus, Rhinovirus, Chlamydia,



pneumoniae Streptococcus, pneumoniae Mycobacterium tuberculosis, Mycoplasma pneumoniae, EB Virus

- This test can provide false negatives if administered prior to 3 days following infection
- In China RDT (multiple approved and awaiting FDA approval), an at home test kit (awaiting FDA approval), Neutralization assay in development
- Serology tests approved for research purposes in the US:
  - Multiple ELISA assays (US), FDA approved, not for at home testing
  - RDT tests (US), FDA approved, not for at home testing
- There are multiple serology tests in development in the US and are pending approval

Source:

<http://www.centerforhealthsecurity.org/resources/COVID-19/Serology-based-tests-for-COVID-19.html>

What complications can arise from serology testing?

- Important issues to consider are sensitivity and specificity
- Sensitivity is defined by how often the test correctly gives a positive result for people who are positive for the condition that is being tested (true positive)
- Specificity is defined by the ability of the test to identify a negative result for someone who does not have the condition that is being tested (true negative)
- Some serology tests may not be able to distinguish antibodies for SARS-CoV-2 from prior coronavirus infections, for example SARS-CoV-1 (2003 outbreak) or middle east respiratory syndrome (MERS-CoV)

Source: <https://www.healthnewsreview.org/toolkit/tips-for-understanding-studies/understanding-medical-tests-sensitivity-specificity-and-positive-predictive-value/>

**Calculate your Pandemic Footprint, based on your behaviors:**

<https://www.pandemic-footprint.com/>

**NIH is Enrolling for a New Study to Quantify Undetected Cases of Coronavirus**

Blood samples from healthy volunteers are needed, learn more here:

<https://www.niaid.nih.gov/news-events/nih-begins-study-quantify-undetected-cases-coronavirus-infection>

***Talking to Children about COVID-19:***

*Child Mind Institute's Guide to Talking to Kids:*

<https://childmind.org/article/talking-to-kids-about-the-coronavirus/>

*From the National Association of School Psychologists:*

<https://www.nasponline.org/resources-and-publications/resources-and-podcasts/school-climate-safety-and-crisis/health-crisis-resources/helping-children-cope-with-changes-resulting-from-covid-19>

*From Harvard Health:*

<https://www.health.harvard.edu/blog/how-to-talk-to-children-about-the-coronavirus-2020030719111>

*List of Resources for Explaining to Kids, from NY Times:*

<https://www.nytimes.com/2020/03/11/learning/coronavirus-resources-teaching-learning-and-thinking-critically.html>

*Free online children's book PDFs about the virus and pandemic:*

*1. Written by an Infectious Disease professor:*

[https://nosycrowcoronavirus.s3-eu-west-1.amazonaws.com/Coronavirus\\_ABookForChildren.pdf](https://nosycrowcoronavirus.s3-eu-west-1.amazonaws.com/Coronavirus_ABookForChildren.pdf)

*2. Created by WHO:*

<https://interagencystandingcommittee.org/system/files/2020-04/My%20Hero%20is%20You%2C%20Storybook%20for%20Children%20on%20COVID-19.pdf>

***Listen to a UMaine Podcast, the Maine Question, focused on Viruses 101, SARS-Cov-2, and COVID-19, with Professor Melissa Maginnis:***

<https://umaine.edu/podcasts/2020/04/13/s2e7-why-do-viruses-go-viral/>

***Reputable Online Resources with COVID-19 Data:***

*IHME Health Data and Projections:*

<https://covid19.healthdata.org/united-states-of-america>

<https://covid19.healthdata.org/united-states-of-america/maine>

*Johns Hopkins*

<https://coronavirus.jhu.edu/map.html>

*Maine Small Business Resources during COVID*

<http://www.mainstreamfinance.org/covid-19-updates/small-business-updates-and-resources-during-covid-19-outbreak/>

**Questions about the production of these bulletins?**

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