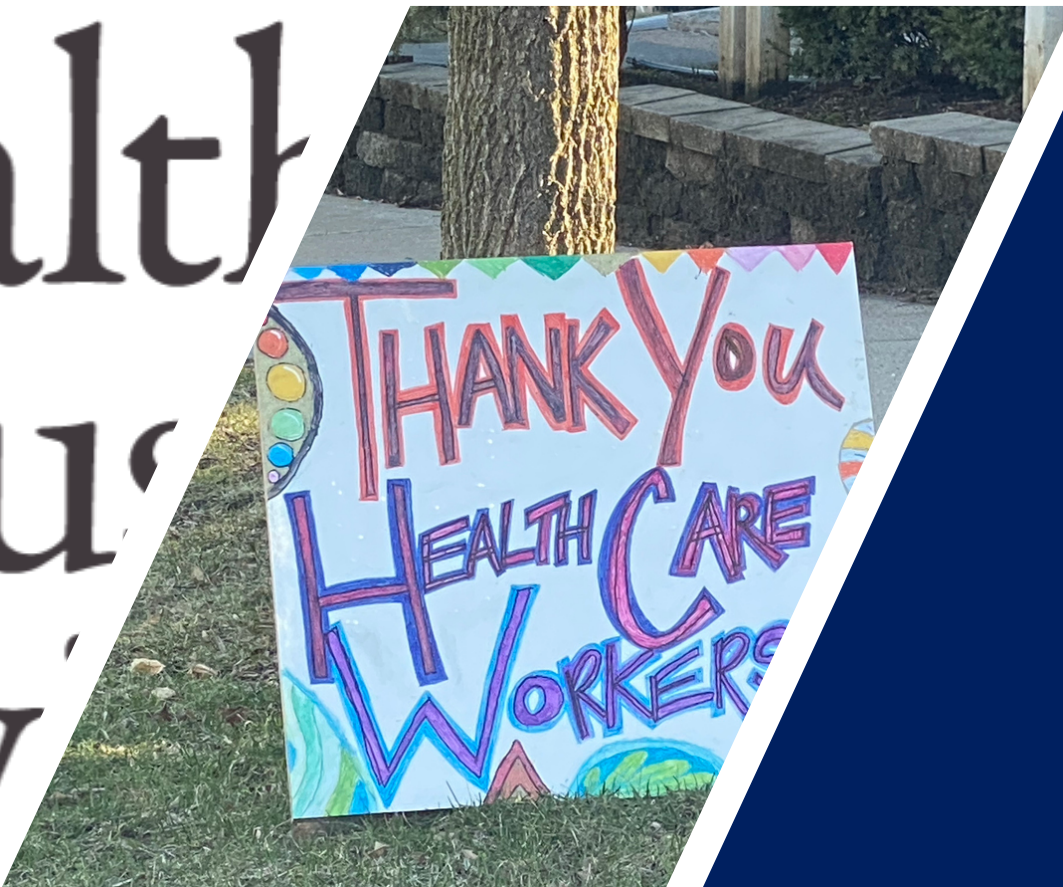




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Issue # 166
Monday, September 21, 2020

COVID-19 Report

Highlights

- Eric Topol, MD posted a helpful summary of the **protocols for the three clinical trials underway in the United States - Astra-Zeneca, Moderna and Pfizer**. Key parameters of these protocols:
 - Pfizer and Moderna plan to administer the vaccine to 15,000 participants, with 15,000 receiving a placebo; Astra-Zeneca plans to administer 20,000 vaccines and 10,000 placebos
 - **Pfizer and Moderna each set the efficacy target - the risk reduction provided by the vaccine - at 60%; AstraZeneca set this at 50%, which is consistent with the WHO standard. Each company set the 95% confidence limit - the minimum acceptable risk reduction - at 30%; this is consistent with the FDA standard for vaccine approval**
 - Each company has identified at least one interim checkpoint during the trial; these checkpoints provide for the possibility of early termination of the trial, in the event of especially-positive results. Pfizer has established 4 interim checkpoints; Pfizer, 2 and Astra-Zeneca, 1
- The Centers for Disease Control and Prevention (CDC) publishes weekly updates of COVID-19 hospitalizations, via its COVID-NET website. This includes a breakdown of hospitalization rates by age group. As of September 12 (latest-published data):
 - **Persons under 18 years of age have 1/10th the hospitalizations per capita as the overall population**
 - Persons aged 65-74 have a 2x rate of hospitalizations per capita; Persons 75-84 have a 3.2x rate; Persons 85 and older have a 5x rate
- Youyang Gu, an MIT-trained data scientist has developed a machine learning-based model to estimate actual infections (versus reported infections that are based on testing results) and to project new infections and deaths. He updates his model on a daily basis. Key results of his model as published on Saturday:
 - **Gu estimate that the infection rate in the United States is now 15.4%** (contrast this with the 2.1% rate based on reported infections). Note: Gu's estimates are consistent with estimates of true infections using antibody testing; **By November 1, Gu estimates this infection rate will grow to 18.3%**
 - **Gu estimates that infections will continue to fall for another several days before leveling-off or increasing slightly through November 1**
- **Deaths each day are projected to continue to decline through November 1: 7-day average daily deaths on September 18 was 799; Gu projects it to fall to 525 by November 1.** By comparison, the 7-day average was 2,207 on April 25 and 1,090 on August 4
- Testing in the United States showed improvement over the past week
- **The 7-day average test volume has increased now on five consecutive days;** on a week-over-week basis, testing as of yesterday was up 24%
- **The test-positive rate declined yesterday, for the 4th consecutive day; On a 7-day average basis, the rate has now declined on six consecutive days**
- New cases and the infection rate has increased for the past week or so:
 - **New daily cases, which had declined for seven weeks, began increasing six days ago; On a week-over-week basis, new cases were up 11.5% yesterday versus one week ago**
 - On a 7-day average basis, the new daily infections per capita rate bottomed-out on September 12 and has risen each day since then; yesterday's rate was back up to the rate last experienced on September 6
- **Despite the upturn in new cases, pressure on the healthcare system from COVID-19 continued to ease:**
 - Inpatient COVID-19 census has declined on five consecutive days and 50 of the past 59
 - ICU COVID-19 census has declined on five consecutive days and 48 of the past 60
- Deaths with the coronavirus continued to decline:
 - **On a 7-day average basis, reported daily deaths have declined on six consecutive days**
 - **There were fewer deaths reported over the weekend than on any weekend since the Independence Day holiday**
 - There are now nearly 21 persons reported as recovered from the virus for each death

There are currently three Phase III clinical trials of a COVID-19 vaccine underway in the United States

Pfizer and Moderna are targeting a 60% “efficacy” (i.e., reduction in infection risk); Astra-Zeneca is targeting 50% (WHO standard: 50%)

All three have established a threshold of a 30% risk reduction (95% confidence interval; consistent with FDA guidance)

Interim checkpoints are used to judge whether sufficient evidence (“events”, infections) is available to end a trial early. Astra-Zeneca has established a single interim checkpoint; Moderna, 2; and Pfizer, 4

COVID-19 Phase III Clinical Trial Protocols

	Pfizer	Moderna	Astra-Zeneca
Sample Size	30,000	30,000	30,000
Participants Getting Vaccine	15,000	15,000	20,000
Efficacy Target	60%	60%	50%
Lower 95% Confidence Interval Target	30%	30%	30%
Number of Events at Completion	164	151	150
Number of Interim Analyses	4	2	1
Number of Events at 1st Interim Analysis	32	53	75

Table: Eric Topol, MD • Created with Datawrapper

Rates of Hospitalizations generally increase with age:

Persons < 18 are hospitalized at 1/10 rate of overall population

Persons 65-74: 2x
Persons 75-84: 3.2x
Persons >85: 5x

Cumulative Rate of Laboratory-Confirmed COVID-19-Associated Hospitalizations in the U.S. (per 100,000)

Rates are per 100,000 Population, As of September 12, 2020

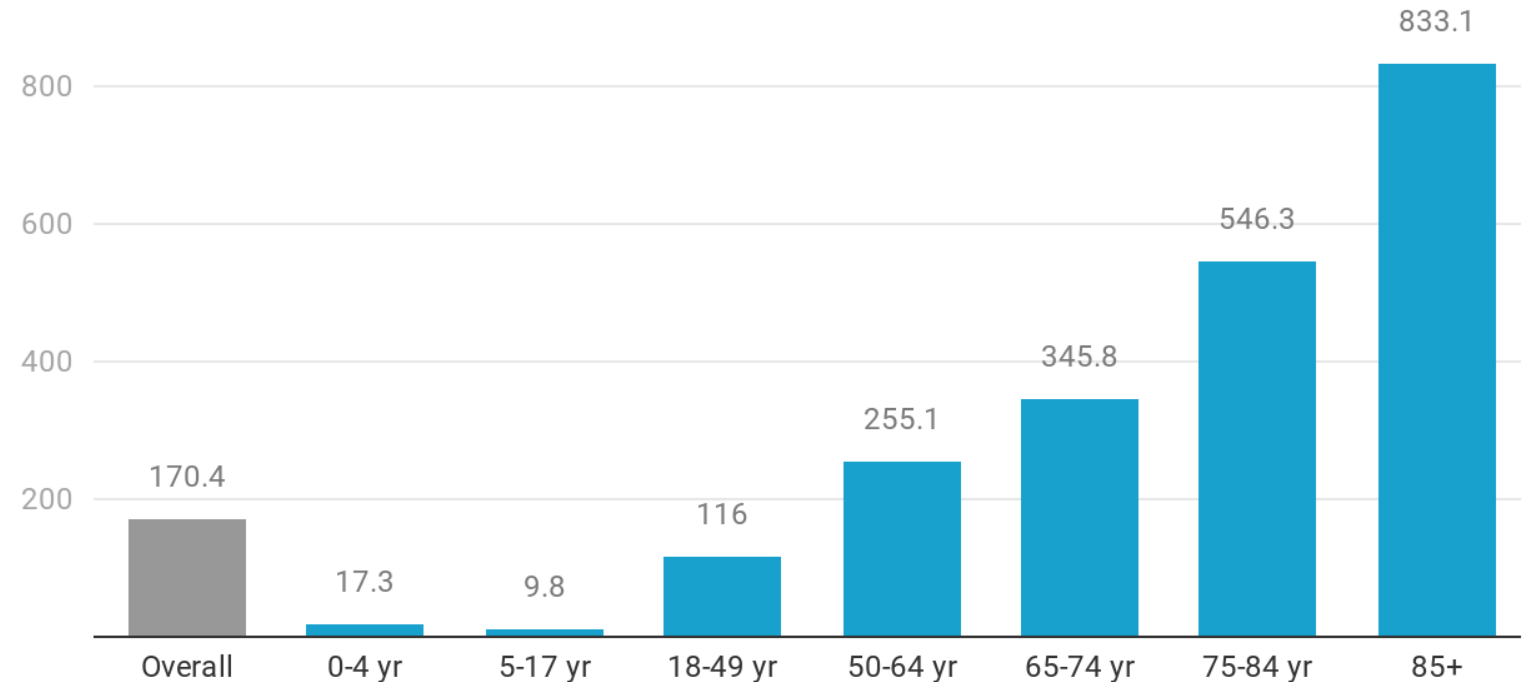


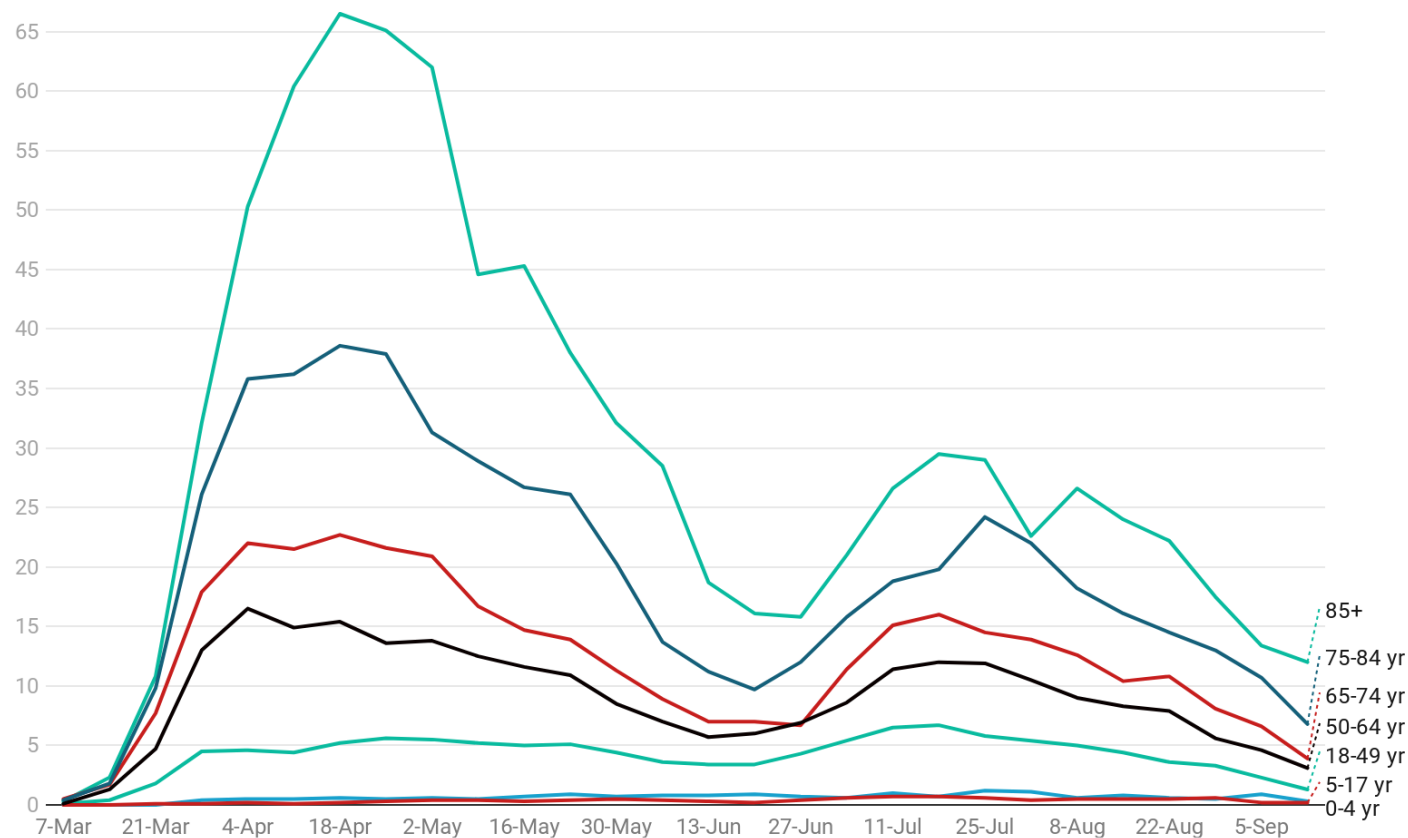
Chart: Health Industry Advisor LLC • Source: CDC: COVID-NET • Created with Datawrapper

Initial spike in hospitalizations tied to the March/April infection surge in Northeast

Second spike tied to the June/July infection spike in Southeast

Laboratory-Confirmed COVID-19-Associated Hospitalizations

Rates per 100,000 Population



COVID-NET covers nearly 100 counties in the 10 Emerging Infections Program (EIP) states (CA, CO, CT, GA, MD, MN, NM, NY, OR, TN) and four Influenza Hospitalization Surveillance Project (IHSP) states (IA, MI, OH, and UT)

Chart: Health Industry Advisor LLC • Source: CDC: COVID-NET • Created with Datawrapper

Gu estimates that an initial peak in new daily infections occurred on March 18

He estimates that a second and higher peak occurred on July 12

New infections have declined since and may begin to level off or increase slightly by November 1

New Infections

Youyang Gu Projections, As of September 18

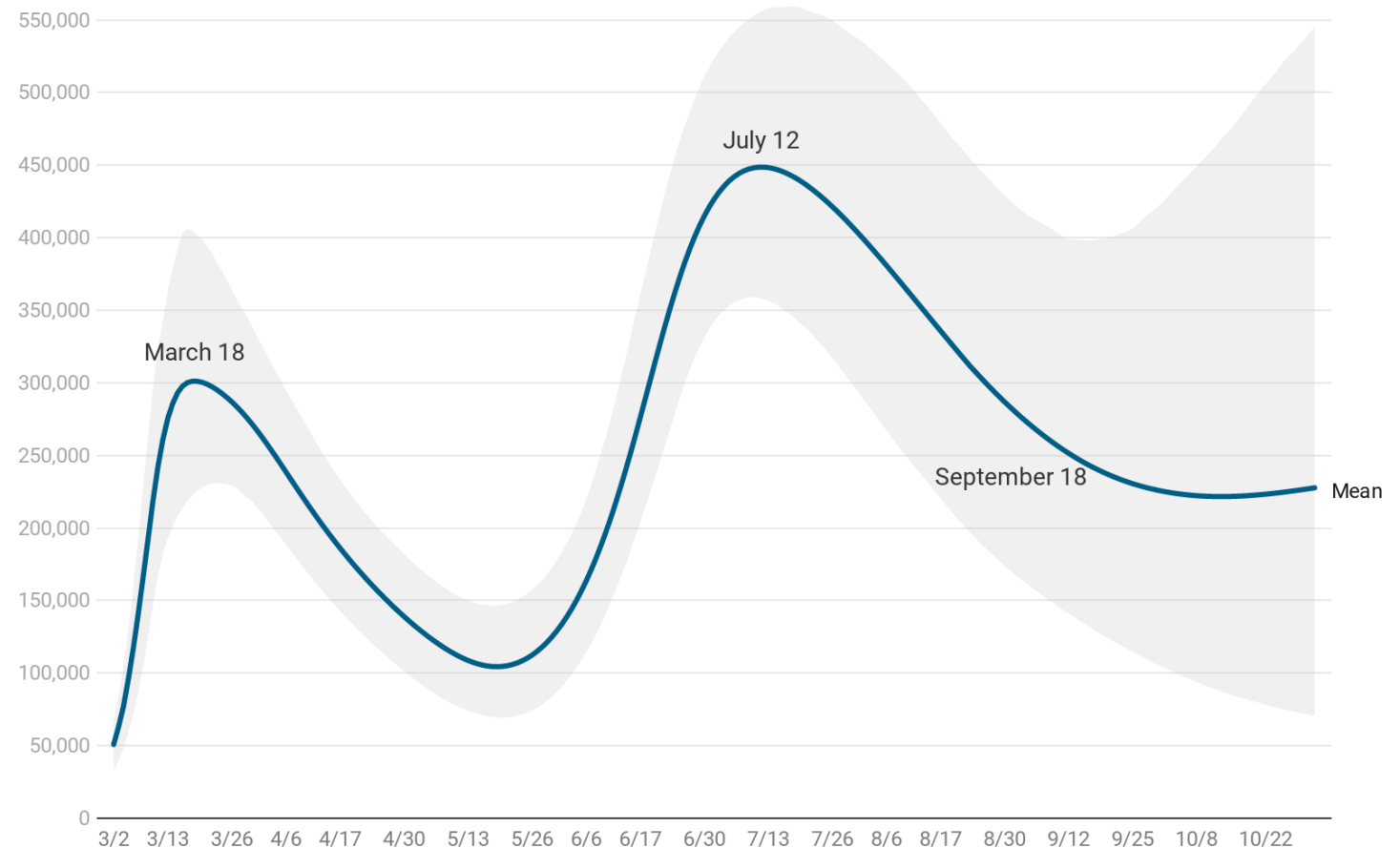


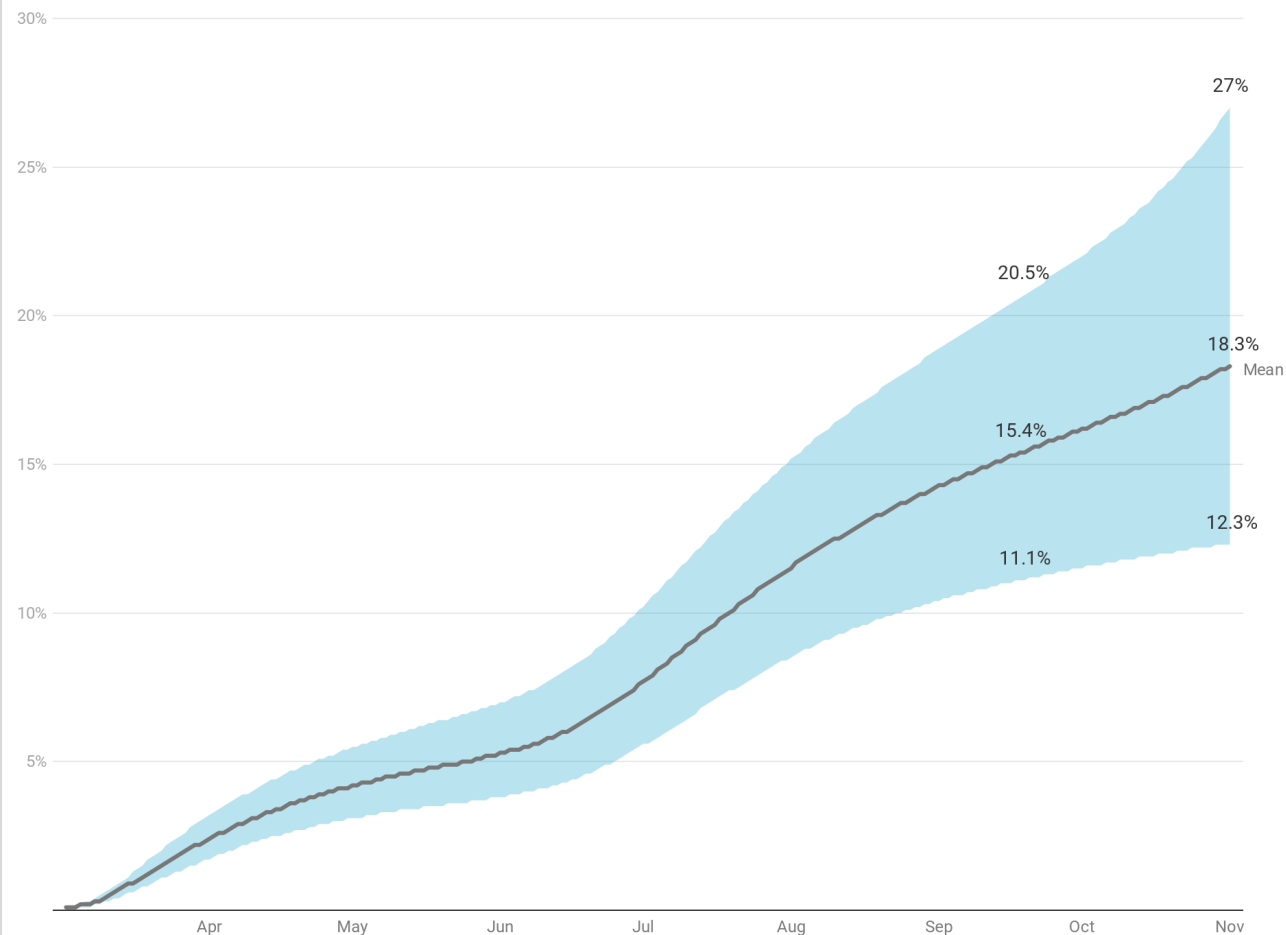
Chart: Health Industry Advisor LLC • Source: <https://covid19-projections.com> • Created with Datawrapper

Gu estimates that 15.4% of the U.S. has now been infected with SARS-CoV-2 virus (range of 11.1-20.5%)

By November 1, he projects that 18.3% of the population will have been infected (range of 12.3-27%)

Estimated Infection Prevalence

Gu Projection Model, As of September 18



From: Gu, Youyang, "Estimating True Infections: A Simple Heuristic to Measure Implied Infection Fatality Rate"

Chart: Health Industry Advisor LLC • Created with Datawrapper

Average daily deaths peaked on April 25 @ 2,207

A secondary peak occurred on August 4 @ 1,090

Deaths are now averaging 799 per day

Gu projects this average will fall further to 525 by November 1 (range of 250-1,009)

Actual and Projected Daily Deaths in the U.S.

Youyang Gu Projections, As of September 18

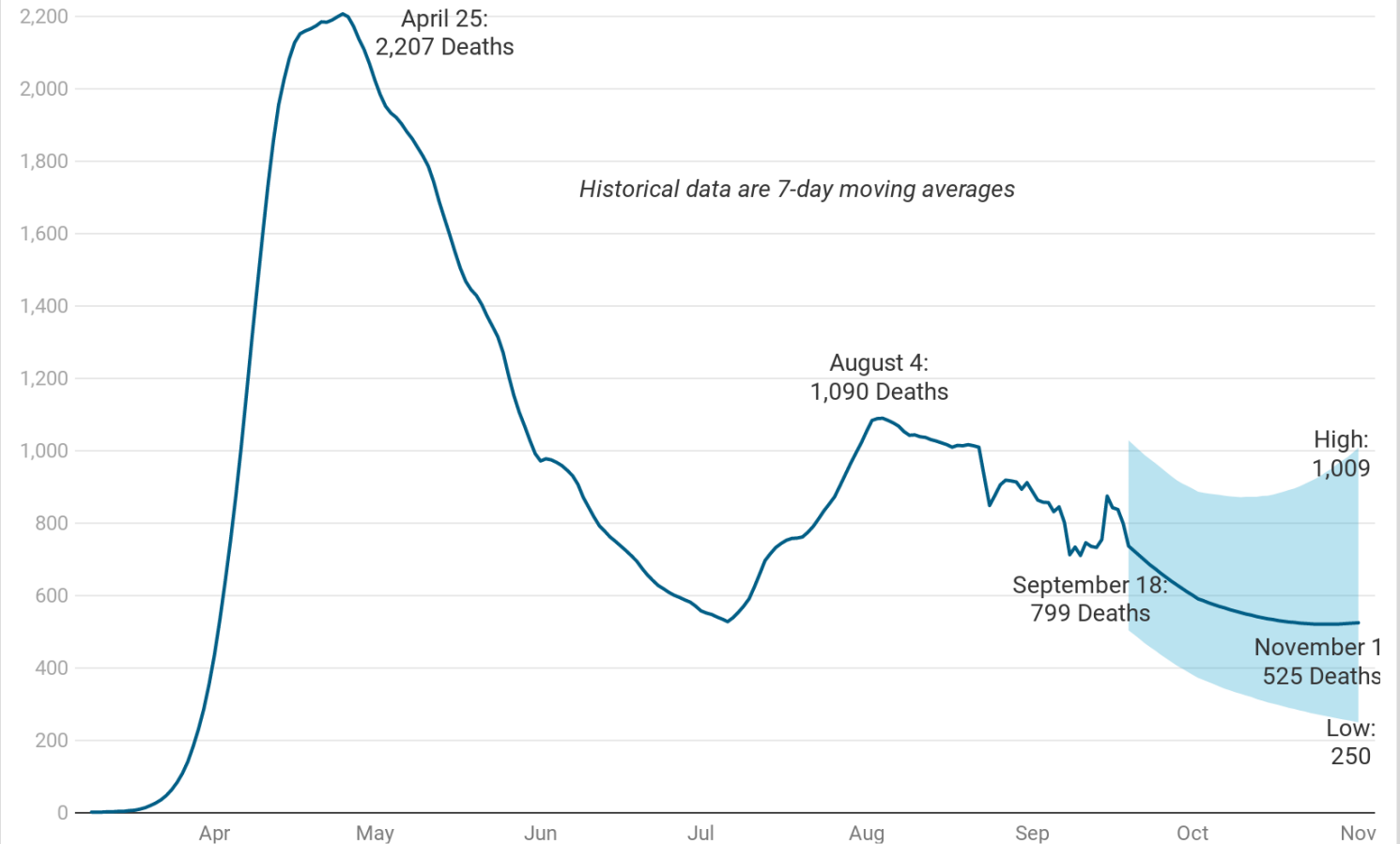


Chart: Health Industry Advisor LLC • Source: <https://covid19-projections.com> • Created with Datawrapper

Gu now projects an additional 24k deaths by November 1 (range of an additional 24k-39k)

Contrast this with IHME's new forecast of an additional 32k deaths by November 1 (range of 23k-40k)

(Note: IHME lowered its November 1 forecast a few days ago by 25k)

Using Gu's estimates, the deaths rate from the virus would be 0.39% as of September 18

Actual and Projected COVID-19 Deaths in U.S.

Youyang Gu Model, As of September 18

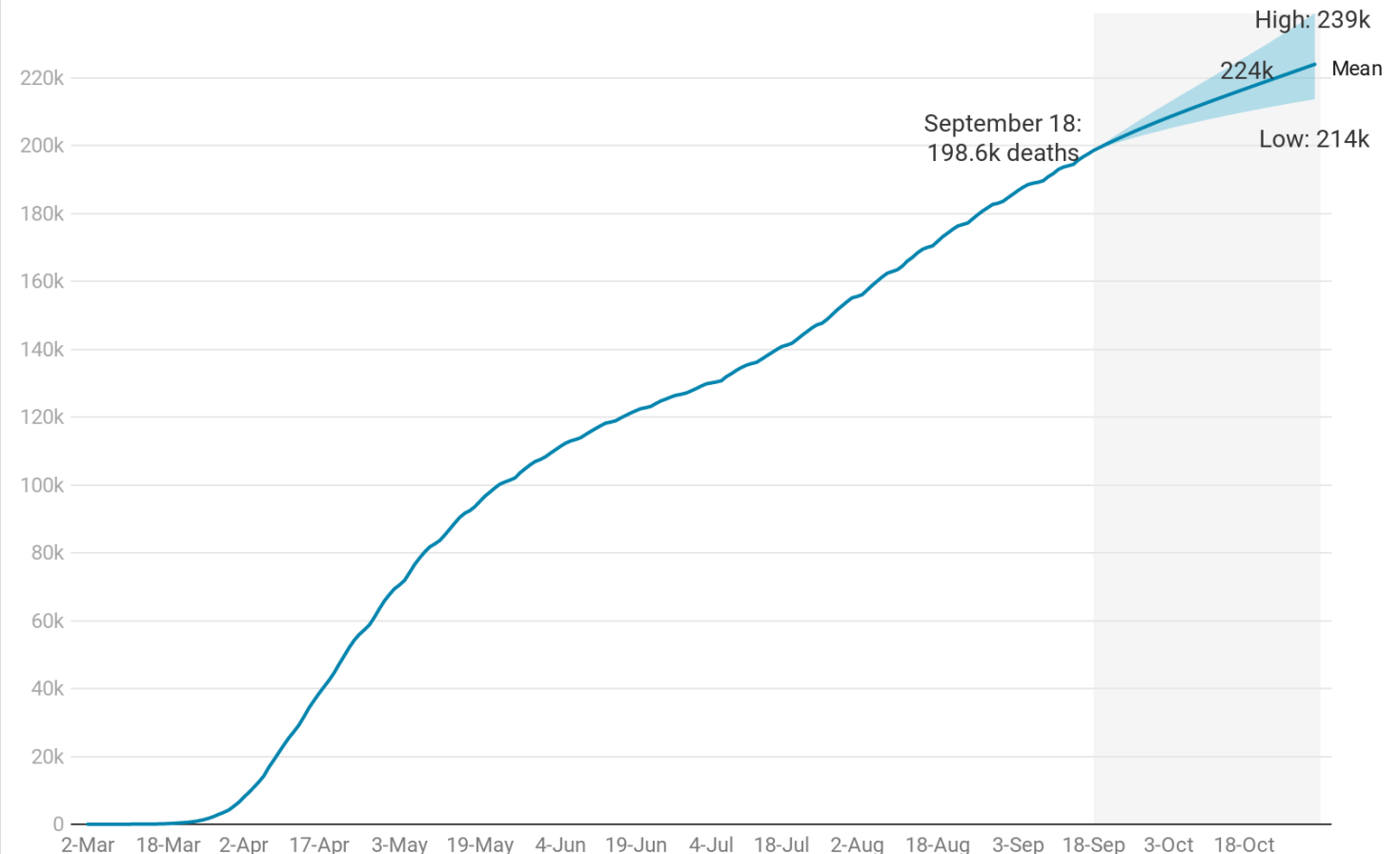


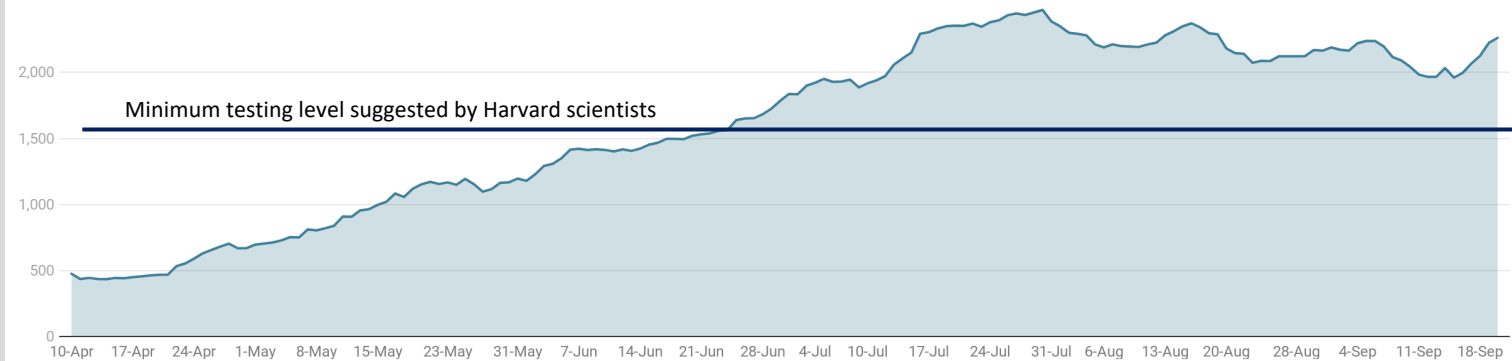
Chart: Health Industry Advisor LLC • Created with Datawrapper

7-day average daily test volume has increased for five consecutive days; week-over-week, volume increased 24%

Test-positive rate moved lower yesterday, for the 4th consecutive day; the 7-day average has declined on six consecutive days

Daily Tests Per 1 Million - United States

Trailing 7-Day Moving Average, As of September 20

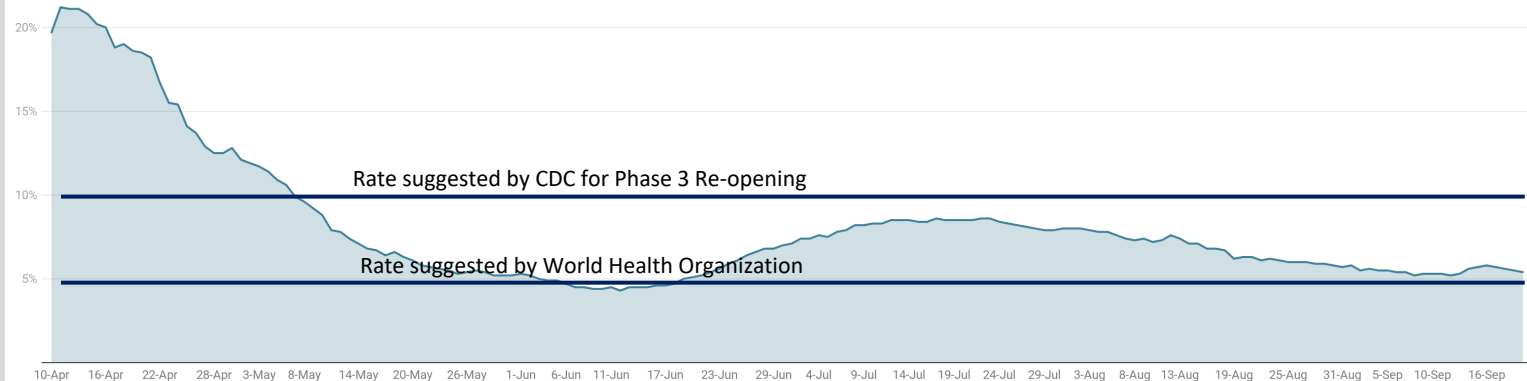


Health Industry Advisor LLC analysis

Chart: Health Industry Advisor LLC • Source: The Atlantic's Covid Tracking Project • Created with Datawrapper

Test-Positive Rate - United States

Trailing 7-Day Moving Average, As of September 20



Health Industry Advisor LLC analysis

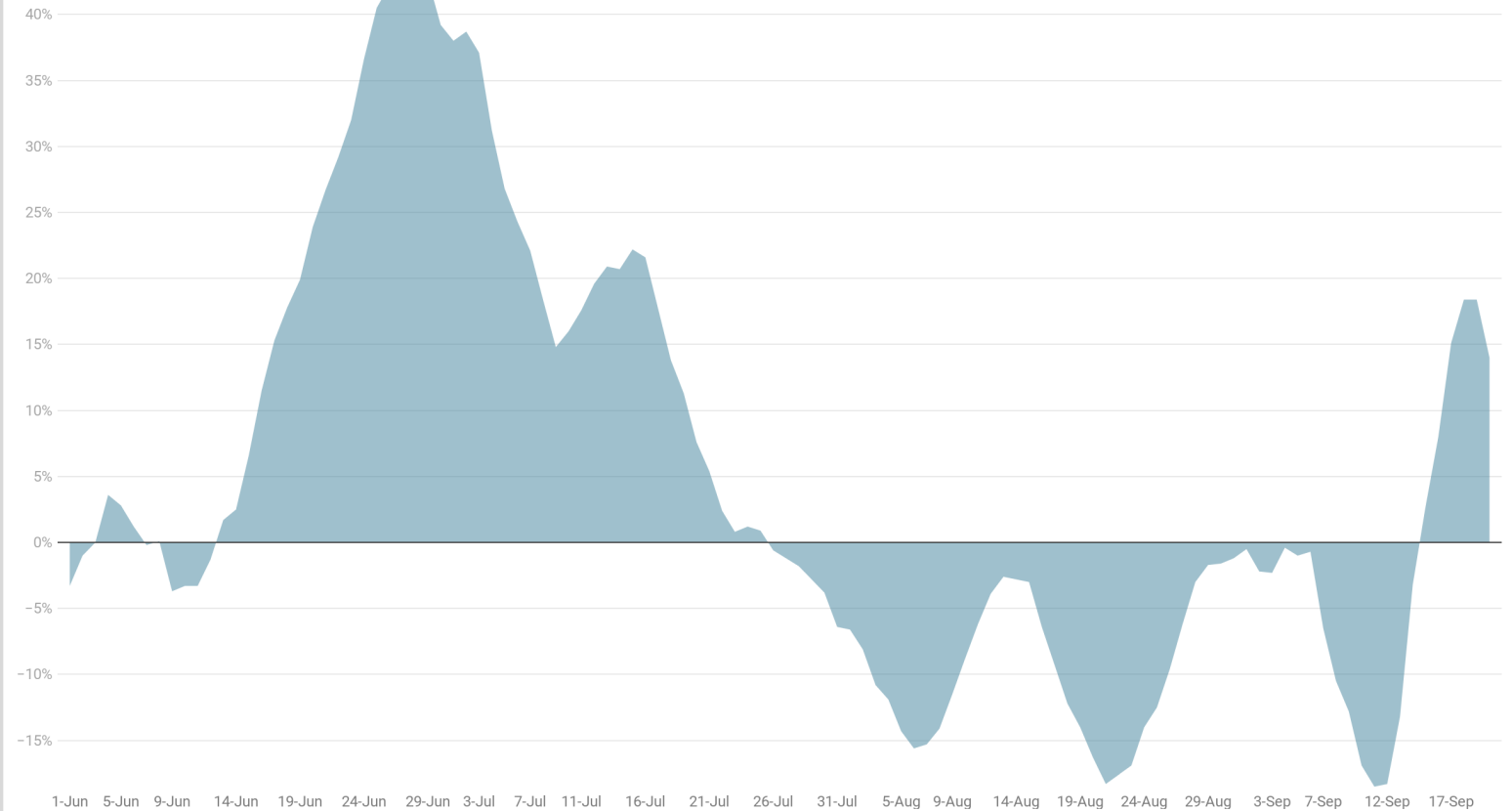
Chart: Health Industry Advisor LLC • Source: The Atlantic's Covid Tracking Project • Created with Datawrapper

Following a seven-week period of decline, new cases began increasing on a week-over-week basis six days ago.

Yesterday, this rate was up 11.5% versus a week ago

Week-Over-Week Change In New Cases

Through September 20



Health Industry Advisor LLC analysis

Chart: Health Industry Advisor LLC • Source: worldometers.info • Created with Datawrapper

Case growth:

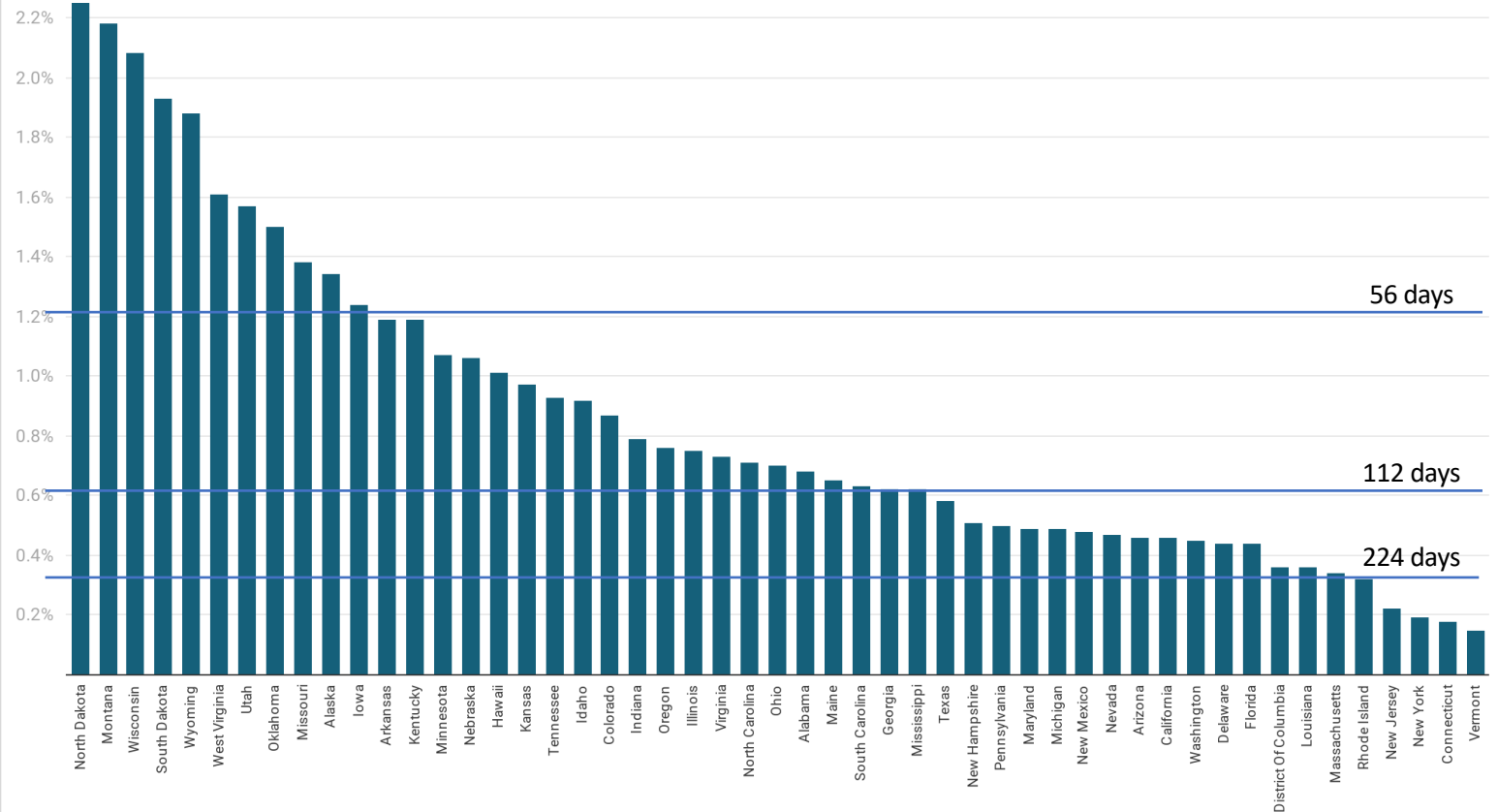
At current rates, cases are doubling every 31 days in North Dakota

Every 456 days in New York

Every 110 days for the United States overall

Growth Rate in Total Cases

Trailing 5-Day Moving Average, Through September 20



Health Industry Advisor LLC analysis

Chart: Health Industry Advisor LLC • Source: worldometers.info • Created with Datawrapper

New cases on the weekend were higher than each of the past four weekends

New Daily Cases

Through September 20

Saturdays & Sundays Highlighted

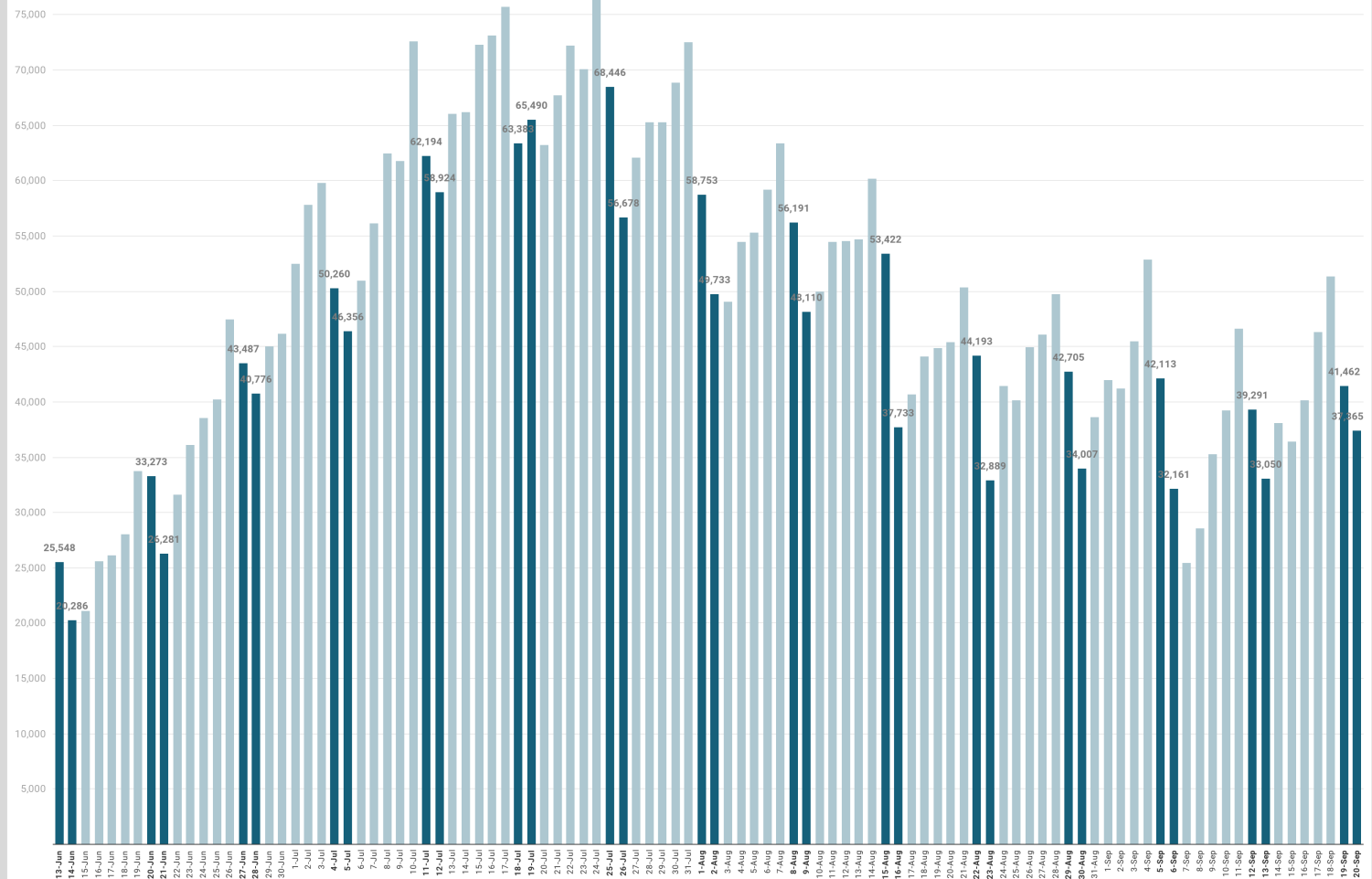


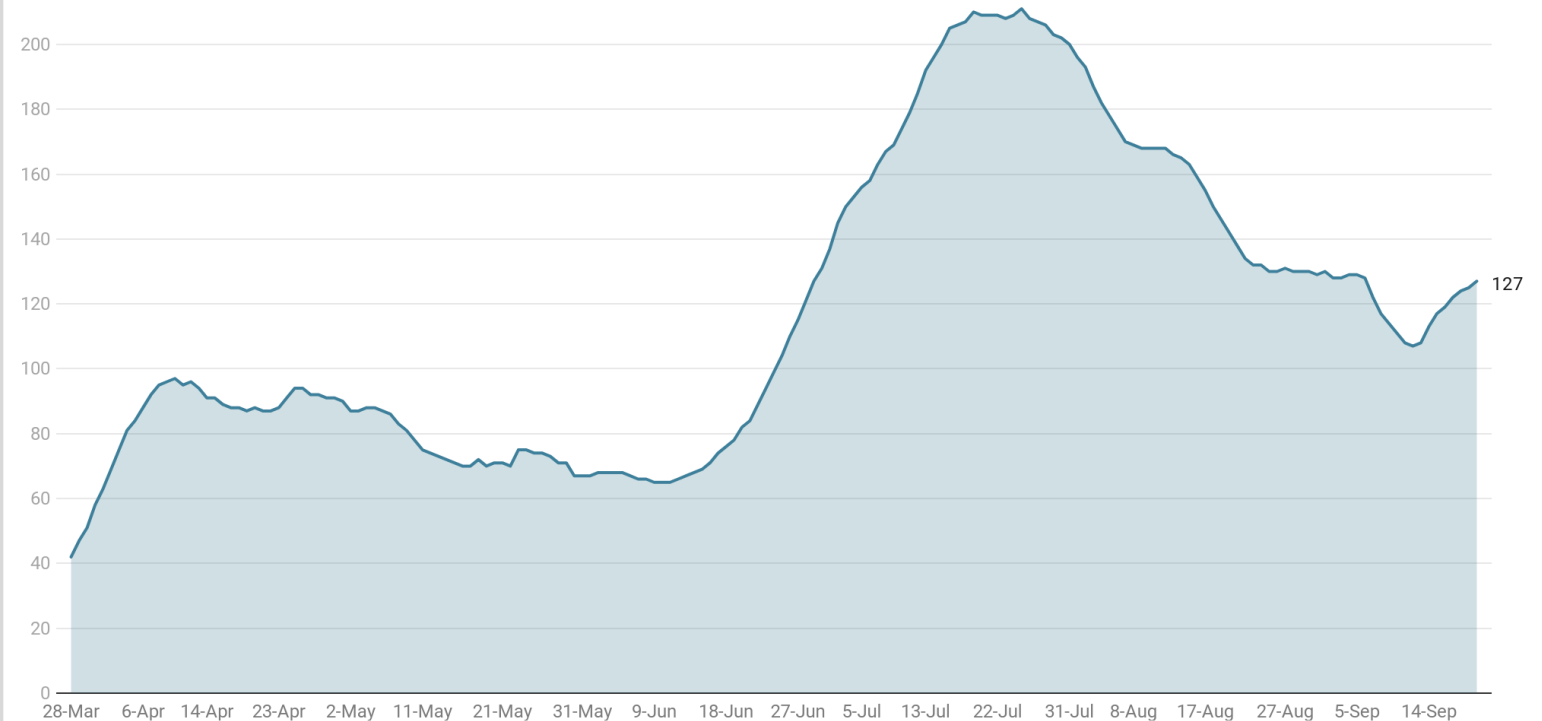
Chart: Health Industry Advisor LLC - Source: eoridometers.info - Created with Datawrapper

New infections per capita in the U.S.* bottomed-out on September 12 and have increased since each day since

The current rate is now back to where it was on September 6

New Infections Per 1 Million Population - United States

Trailing 7-Day Moving Average, Through September 20



Health Industry Advisor LLC analysis

Chart: Health Industry Advisor LLC • Source: worldometers.info • Created with Datawrapper

* - 7-day moving average basis

Vermont's ate is down to 7 new daily infections per million

Wisconsin and Utah have experienced the sharpest increase in new infections per capita over the past two weeks, followed by North Dakota, Nebraska, Wyoming and Oklahoma

Hawaii has experienced the steepest decline in this rate, followed by Louisiana and Mississippi

Change in New Infections / Million Over Past Two Weeks

Trailing 7-Day Moving Average, September 20 v September 6

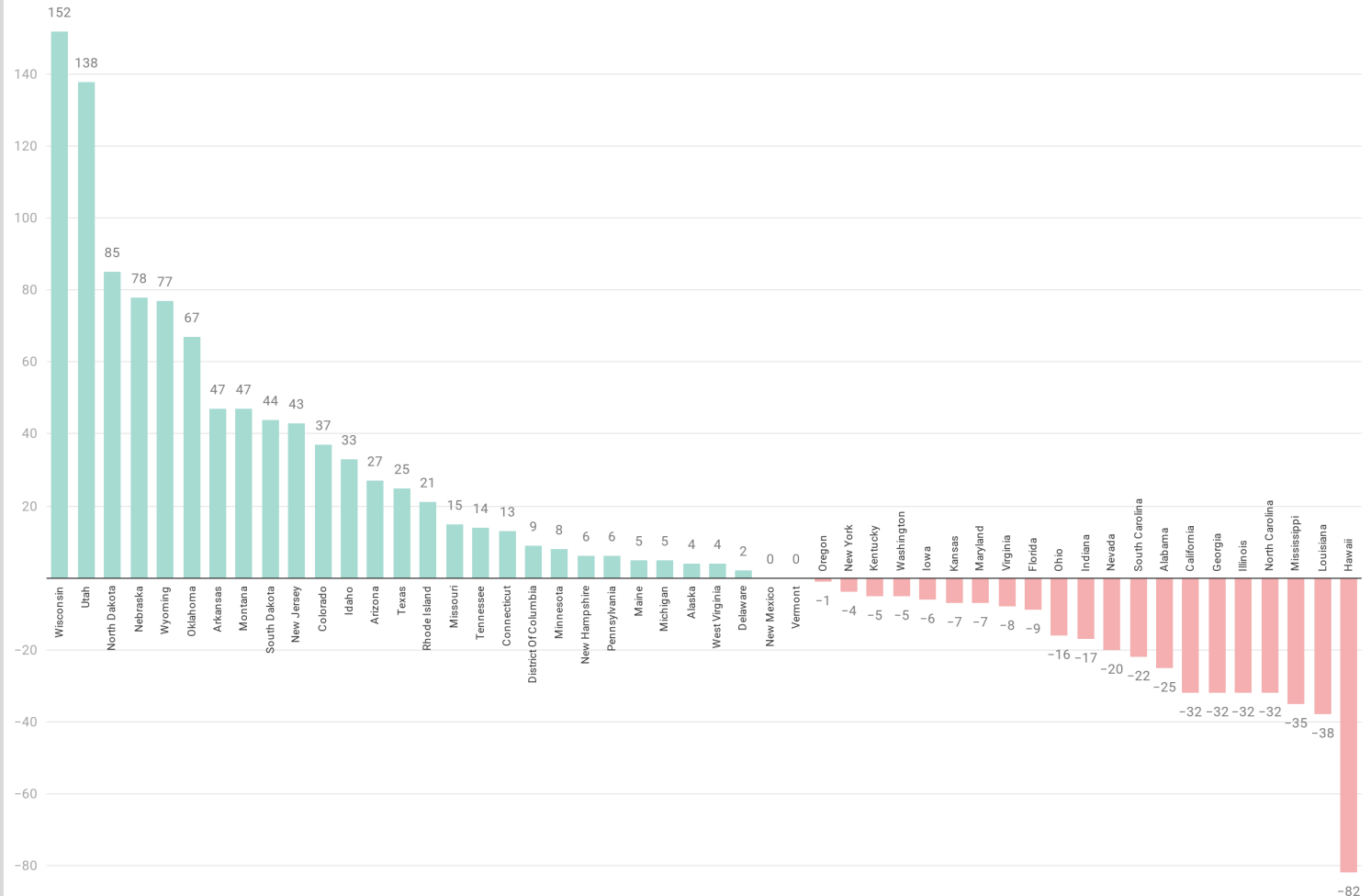


Chart: Health Industry Advisor LLC • Created with Datawrapper

Inpatient and ICU COVID-19 census both declined yesterday

Inpatient census has declined five consecutive days and 50 of the past 59 days, declining 52% in this time

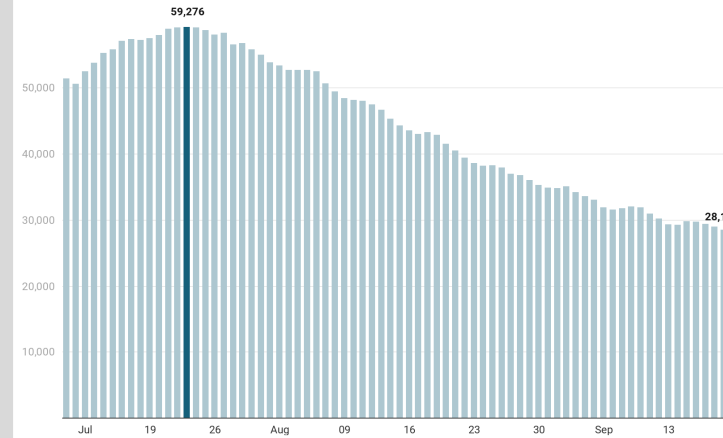
ICU census has declined five consecutive days and 48 of the past 60 days, declining 43% during this time

Ventilator use has declined dramatically throughout the pandemic . . . And continues to decline as a % of patients

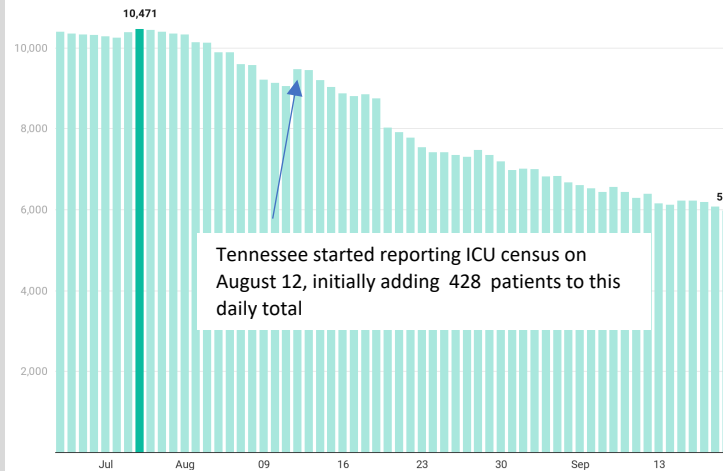
ER visits for COVID-19-like illness, as a % of all ER visits have also declined significantly since early July

Hospital Census: COVID-19 Patients

As of September 20

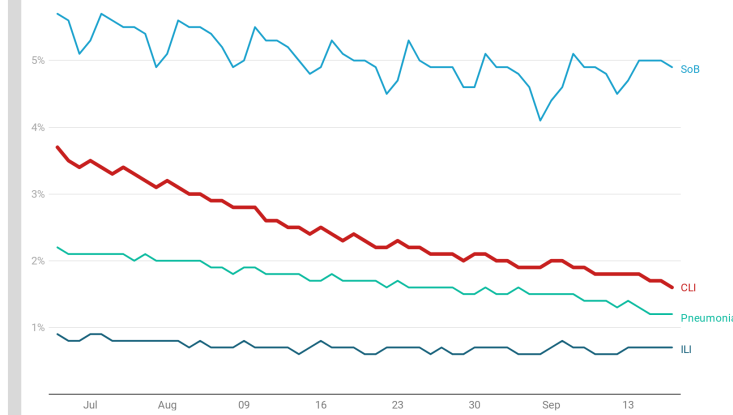


COVID-19 ICU Census



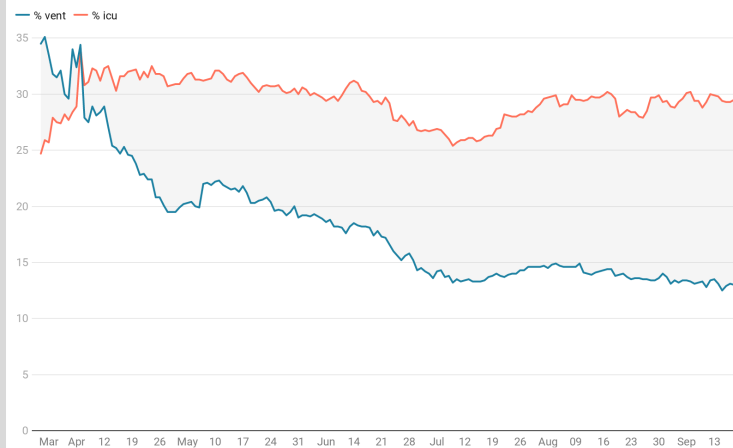
% of Emergency Department Visits for COVID-Like Illness (CLI), Influenza-Like Illness (ILI), Pneumonia & Shortness-of-Breath (SoB)

As of September 17



Severity of Hospitalized Patients

% of patients on ventilators and in the ICU, As of September 20



7-day average daily deaths have declined on six consecutive days

There were fewer deaths reported on the weekend than on any weekend since the 4th of July holiday

Active cases continue to taper, while recoveries from the virus are steadily increasing

There are now nearly 21 persons recovered from the virus for every death

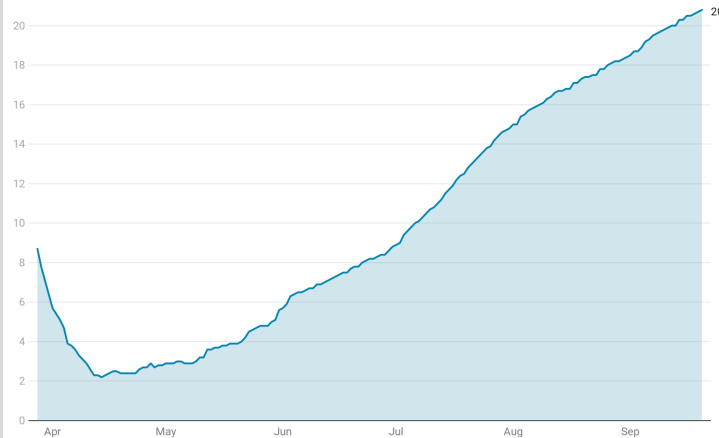
Deaths Reported With Coronavirus in the U.S.

Trailing 7-Day Moving Average, As of September 20



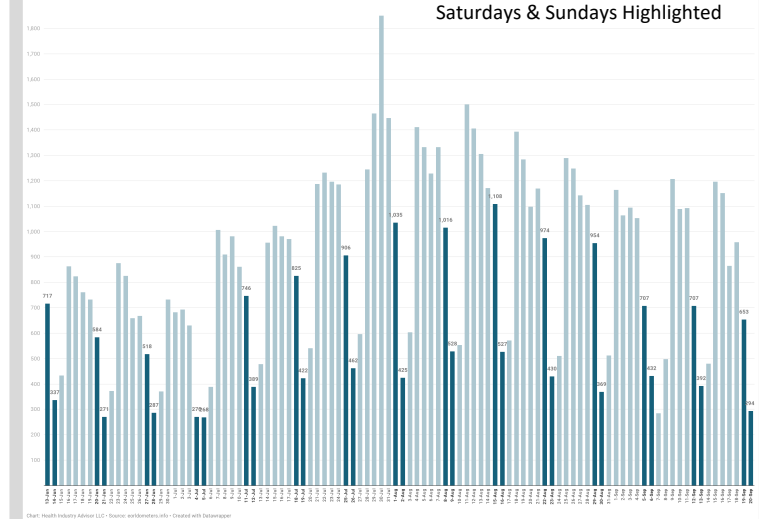
Recoveries: Deaths - United States

As of September 20



New Daily Cases

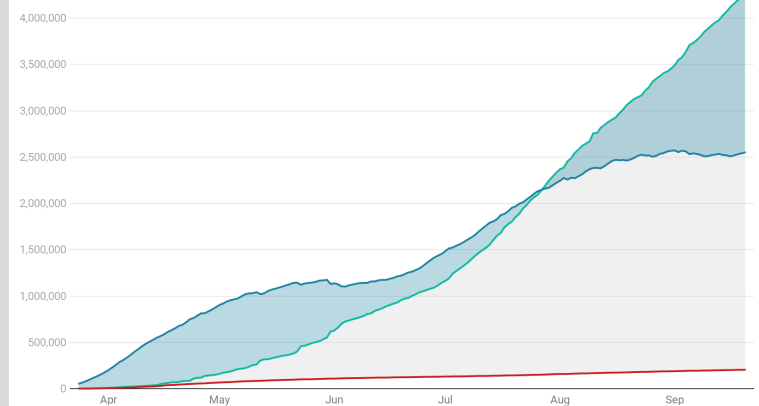
Through September 20



Active Cases v. Recoveries & Deaths

Through September 20

Active Cases Recoveries Deaths



Data Sources

The following data sources are accessed on a daily or weekly basis:

- The Atlantic's Covid Tracking Project: <https://covidtracking.com>
- Worldometers.info: <https://www.worldometers.info/coronavirus/>
- Centers for Disease Control, National, Regional, and State Level Outpatient Illness and Viral Surveillance
<https://gis.cdc.gov/grasp/fluview/fluportaldashboard.html>
- Centers for Disease Control, COVID-19 Laboratory-Confirmed Hospitalizations
https://gis.cdc.gov/grasp/COVIDNet/COVID19_5.html
- Centers for Disease Control, COVID Data Tracker <https://www.cdc.gov/covid-data-tracker/index.html#mobility>
- Institute for Health Metrics and Evaluation, COVID-19 estimate downloads
<http://www.healthdata.org/covid/data-downloads>
- New York Times, Covid-19 data <https://github.com/nytimes/covid-19-data>
- COVID-19 Data Repository by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University
<https://github.com/CSSEGISandData/COVID-19>
- COVID-19 Projections Using Machine Learning, <https://covid19-projections.com>