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Managed Care & Facilities

## COVID-19 Daily Tracker: June 17, 2020; View into MSA Level Data

Today we are revamping our most granular view of case growth, with a focus on MSA level data. In the past we have been tracking case growth at the local level through county totals. Today we have mapped individual counties to larger MSAs to get a better view of City or regional growth. A full review is contained on pages 16-17 today.

MSA Daily Case Growth	6/1/2020	6/8/2020	6/15/2020	Prior Week Growth	Last Week's Growth	2-Week Growth
1 Los Angeles-Long Beach	972	800	773	-172	-27	-199
2 Phoenix-Mesa	124	520	748	396	228	624
3 Houston	425	383	578	-42	195	153
4 Riverside-San Bernadino	599	478	510	-121	32	-89
5 Dallas	256	346	461	90	115	205
6 Chicago	917	642	422	-275	-220	-495
7 Nashville	232	153	414	-79	261	182
8 Tampa-St. Petersburg-Clearwater	68	178	390	110	212	322
9 Austin-San Marcos	117	168	386	51	218	269
10 Atlanta	330	418	344	88	-74	14
11 Salt Lake City-Ogden	110	146	304	36	158	194
12 Miami	139	209	280	70	71	141
13 Charlotte-Gastonia-Rock Hill	230	251	264	21	13	34
14 Philadelphia	455	318	262	-137	-56	-193
15 Raleigh-Durham-Chapel Hill	89	186	254	97	68	165
16 Indianapolis	73	53	251	-20	198	178
17 Memphis	135	126	215	-9	89	80
18 Orlando	35	84	211	49	127	176
19 Minneapolis-St. Paul	273	234	201	-39	-33	-72
20 Fayetteville-Springdale-Rogers	82	136	195	54	59	113
<b>Sub-Total</b>	<b>5,661</b>	<b>5,829</b>	<b>7,463</b>	<b>168</b>	<b>1,634</b>	<b>1,802</b>

Source: The New York Times and Nephron Research

- **Los Angeles remains the leader in daily case growth, having kept that lead in each of the past 14 days.** Some of this is testing related, some of this is size related (about 12.5mm people) but much of this is due to the continued spread of the virus.
- **Phoenix was a close second yesterday and has shown the highest case growth of any MSA over the past two weeks.**
- **The top 20 MSAs reported 7.5K cases yesterday, making up 32% of the total US growth, with the top 10 making up 21%.**
- **Only 3 of the top 20 MSAs showed lower growth over the past week compared to the week before.** Said another way, weekly growth grew in 85% of the top 20.
- **Three of the top 10 MSAs yesterday were in Texas: Houston, Dallas, and Austin.**
- **We were surprised to see that New York, the largest MSA in the country with 8 separate counties making up the MSA, wasn't even in the top 20 on daily case growth. In fact, NYC set a new low yesterday and the State of NY fell to 9<sup>th</sup> in overall case growth yesterday.** Washington DC, Boston, San Francisco and Detroit are other notable absences.

JUNE 17, 2020

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## COVID-19 Daily Tracker – Summary of Today's Update

*U.S. case growth increased  
1.1% yesterday, up 20bps from  
the prior day*

- **GLOBAL CASES:** Total global confirmed cases of COVID-19 reached 7.94 million on June 16<sup>th</sup>, representing an increase of 1.5% over the prior day. **The US has the most confirmed cases (2.13 million), followed by Brazil (867.6K) and Russia (545.5K).**
- **GLOBAL HOT SPOTS:** We see **increased activity in South America the mid-East, Asia and Russia.** We are watching India closely given implications for the pharma and medical supply chains and note that India, Pakistan and Bangladesh lifted national lock downs two weeks ago.
- **U.S. CASE GROWTH:** We continue to see volatile results with no clear signs of improvement in the US - the % of positives rose and the 7 day moving average is now increasing. There were 2,127,047 cases in the US, an increase of 1.1% from the prior day, with the growth rate up 20bps. New cases ticked up, while daily testing also increased modestly, and **the daily % of positives increased by 100bps to 5.1%** and the percentage of cumulative positive cases as a % of total testing ticked down 10bps to 8.7%. The cumulative percentage was the lowest recorded since we began tracking the data.
- **NEW STATE HOT SPOTS:** This week we are introducing a new section that tracks potential rebounds of activity at the state level. We screen states based on case growth AND increases in the percentage that are testing positive, then show hospitalization data if available. **We highlight states showing the greatest likelihood of being a hot spot includes Arizona, South Carolina, and Louisiana.**
- **CASE GROWTH THRESHOLD:** Examining the trajectory of case growth over the last 14-days, 27 states and D.C. have demonstrated a sustained decline (meaning 27 have yet to sustain a decline or are seeing increases). The five-day trend suggests none of the 27 may be seeing a rebound (down from 2 yesterday) and caution is warranted in another 12 (down from 13 yesterday). **We note that MN, VA, MD and NE have shown the most rebound in the past 14 days.**
- **TESTING THRESHOLD:** 29 states and D.C. have passed as testing has expanded (trailing 7-day average run rate of 3.3mn), but no state has met the CDC draft guidance for 14 consecutive days and only 6 have achieved our less stringent measure of 10 of the last 14 days (23 have met 8 of 14 days). The % positive remains above 10% in AZ and AL and has been increasing the most in AL, AZ, OR, FL and AR over the prior week.
- **HOSPITAL CAPACITY THRESHOLD:** We focus on ICU utilization in aggregate, which yesterday stood at ~5.6K beds, down 2.3% from the prior day. **The rate of ICU as a % of positive cases remained flat at 0.3%.** We are monitoring this closely as we would like to see fewer positive cases require the highest (and least supplied) level of care.
- **PUBLIC HEALTH SYSTEM CAPACITY THRESHOLD:** Testing will never be adequate, reliable and fast enough to identify all cases in real time, **requiring that state and local health agency tracing capability** alongside public health studies determining prevalence and mortality within communities and geographies. **Recent estimates by the CDC suggest the country needs between 30k-100k public health workers near-term, down from initial estimates of 300k.**

## Breaking News Summary

### [Major study finds common steroid reduces deaths among patients with severe Covid-19](#) – STAT

A cheap, readily available steroid drug reduced deaths by a third in patients hospitalized with Covid-19 in a large study, the first time a therapy has been shown to possibly improve the odds of survival with the condition in the sickest patients. Full data from the study have not been published or subjected to scientific scrutiny.

#### **And From Other Sources:**

[Dexamethasone Reduces Coronavirus Deaths, Scientists Say](#) - New York Times

[Inexpensive Steroid Dexamethasone Is The First Drug To Reduce Deaths From Covid](#) - WaPo

[Cheap Drug Is First Shown To Improve COVID-19 Survival](#) – Associated Press

[Dexamethasone Improves Survival In Severe Covid-19 Patients, Study Finds](#) – WSJ

[WHO Moves To Update COVID-19 Guidance After 'Great News' In Drug Study](#) – Reuters

[Show Me The Data: U.S. Doctors Skeptical Of Reported COVID Breakthrough](#) – Reuters

### [How Exactly Do You Catch Covid-19? There Is a Growing Consensus](#) – Wall Street Journal

It's not common to contract Covid-19 from a contaminated surface, scientists say. And fleeting encounters with people outdoors are unlikely to spread the coronavirus. Instead, the major culprit is close-up, person-to-person interactions for extended periods.

### [Record spike in coronavirus cases reported in six U.S. states as reopening accelerates](#) – Reuters

Arizona, Florida, Oklahoma, Oregon and Texas all reported record increases in new cases after recording all-time highs last week. Nevada also reported its highest single-day tally of new cases on Tuesday, up from a previous high on May 23. Hospitalizations are also rising or at record highs.

### [Rising Covid-19 cases and hospitalizations underscore the long road ahead](#) – STAT News

The U.S. is now confronting what public health experts have been warning about but many in the public had not absorbed: the coronavirus pandemic will be with us for many months, and lapses in vigilance will lead to more sickness and death.

### [HHS Resumes Central Role in Pandemic Response Oversight](#) – Wall Street Journal

HHS is taking on more oversight of the nation's coronavirus response as cases in some states climb, an abrupt shift from April when the agency was under fire for its handling of the initial stages of the crisis.

### [What Colorado is getting right about reopening](#) – Politico

Colorado Gov. Jared Polis limited when restaurants and other businesses could reopen, at first only allowing curbside pickups at stores, imposing strict social distancing on salons and other personal services and prohibiting gatherings over 10 people.

### [Texas hits new high for coronavirus cases, hospitalizations](#) – The Hill

Texas Gov. Greg Abbott on Tuesday urged people to stay home as the state registered the highest number of new hospitalizations due to the coronavirus, marking the fifth consecutive day of rising hospitalizations.

### [Schools Shut in Beijing as Coronavirus Flares](#) – New York Times

Beijing raised its level of health alert to the second highest on Tuesday, ordering schools to close and urging people to work from home as China's government pressed to extinguish a spike in coronavirus infections menacing the capital.

### [Under 20s around half as susceptible to COVID-19, study finds](#) – Reuters

People under 20 are around half as susceptible to COVID-19 as people aged 20 or above, according to research published on Tuesday, and clinical symptoms of the pandemic disease appear in only about a fifth of infections in children and teens.

### [US expects insurers to cover COVID vaccine without copays](#) – Associated Press

At a briefing for reporters, a senior Trump administration official said the government has been talking with insurers about offering vaccines at no cost to patients. The industry earlier made a similar commitment to cover testing for the coronavirus without charging copays.

### [U.S. health insurers may balk at paying for coronavirus antibody testing](#) – Reuters

U.S. health insurers may balk at covering tests that look for coronavirus antibodies in some cases, arguing that employers or the government should foot a bill expected to run into billions of dollars. Health insurers have largely escaped the economic pain wrought by the pandemic.

### [As U.S. Nursing-Home Deaths Reach 50,000, States Ease Lockdowns](#) – Wall Street Journal

A Wall Street Journal tally of state data compiling fatalities from Covid-19, notes that deaths among senior-care center staff and residents appear to represent at least 40% of the overall count of more than 116,000 U.S. fatalities related to Covid-19.

### [How — and When — Can the Coronavirus Vaccine Become a Reality?](#) – ProPublica

It's been six months since researchers in China said they had identified a novel coronavirus spreading in the city of Wuhan. Hope and desire for a vaccine to end the global devastation is growing with each passing week.

### [U.S. narrowing support to seven vaccine candidates, expects them to be free for many](#) – Reuters

The Trump administration aims to narrow its financial support to about seven experimental coronavirus vaccines from the 14 it has been working with so far, HHS said on Tuesday.

## Chart of the Day

**Fig. 1: Largest Changes in June Hospitalizations (6/1-6/16)**



Source: The COVID Tracking Project

*We are closely watching the trends in Arizona, South Carolina, and Louisiana*

## State 'Hot Spots'

With nearly all states open today in varying degrees, we are focused on monitoring potentially developing hot spots in the US with states are showing troublesome trends. As we have said before, it's not enough to just focus on new cases because we expect cases to rise with increased testing. We believe a better metric to monitor is the state's rate of positive tests and specifically whether that is rising over the past week. Ultimately, we think the best metric to watch is the number of hospitalizations (that is truly reflective of case progression regardless of testing), and whether we reach a capacity issue, but hospitalization data can be spotty and lags the number testing positive by at least a week. As a result, we are most focused on states that have shown an increase in the percentage of individuals testing positive. **Based on the data over the past 14 days, the states with the most worrisome trend include Arizona, South Carolina, and Louisiana.**

**Fig. 2: Growth in % Testing Positive (2-Week) vs. 7-Day Case Growth W/W vs. 7-Day Testing Growth W/W**

		2-Week Growth % Testing Positive	7-Day Case Growth W/W	7-Day Testing Growth W/W
1	Arizona	6.9%	19%	-5%
2	South Carolina	6.7%	73%	-73%
3	Louisiana	3.1%	52%	38%
4	Oklahoma	2.9%	92%	2%
5	Florida	2.5%	54%	1%
6	Mississippi	1.6%	1%	-30%
7	Alabama	1.6%	109%	17%
8	Nevada	1.6%	36%	10%
9	Wyoming	1.3%	100%	-45%
10	Missouri	1.0%	3%	-8%
11	South Dakota	1.0%	5%	-29%
12	Oregon	1.0%	15%	31%
13	Texas	0.9%	26%	64%
14	Utah	0.8%	-2%	21%
15	Arkansas	0.8%	38%	59%

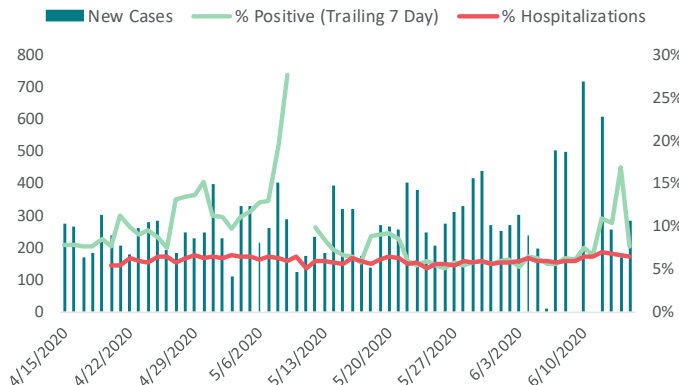
Source: Nephron Research analysis of data from the New York Times

**Arizona:** The state ended the stay at home order beginning on May 16. There were ~796 hospitalizations on May 16 and that has increased to ~1,449 as of June 15. **The % of individuals testing positive (on a 7-day rolling average) is ~16%, which is up 6.9 percentage points since 6/1.** We have seen clear trends in increased positive %s AND a clear trend in hospitalizations.

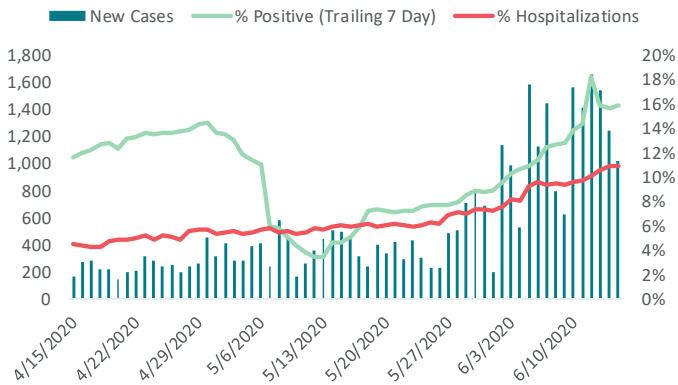
**South Carolina:** This is one of the first states to re-open and is among the states that have the fewest restrictions in place. The state ended the stay at home order on May 4. There were ~536 hospitalizations on June 15, up from 402 on May 31. **The % of individuals testing positive (on a 7-day rolling average) is ~12%, which is up 6.7 percentage points since 6/1.**

**Louisiana:** The state relaxed social distancing policies on May 15. There were ~1,091 hospitalizations on May 15, which has decreased to 568 as of June 15. **The % of individuals testing positive (on a 7-day rolling average) is ~5%, which is up 3.1 percentage points since 6/1.**

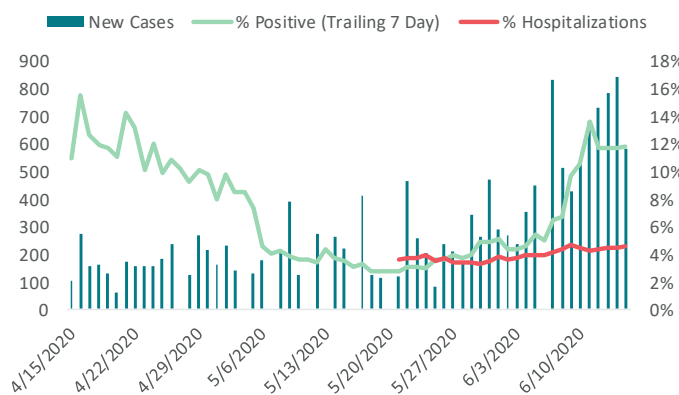
**In the following charts, focus first on the green line which shows the trend in % positives as a leading indicator of problems. Focus second on the red line which shows hospitalizations as confirmation of that troubling trend.**

**Fig. 3: Mississippi Cases vs. % Positive vs. Hospitalization %**

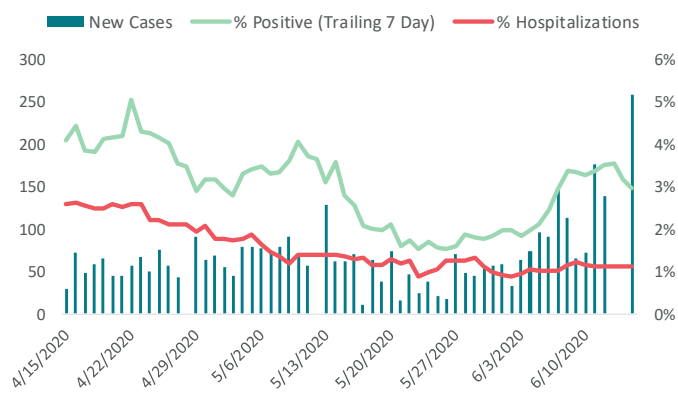
Source: Nephron Research analysis of data from the New York Times and the COVID Tracking Project

**Fig. 4: Arizona Cases vs. % Positive vs. Hospitalization %**

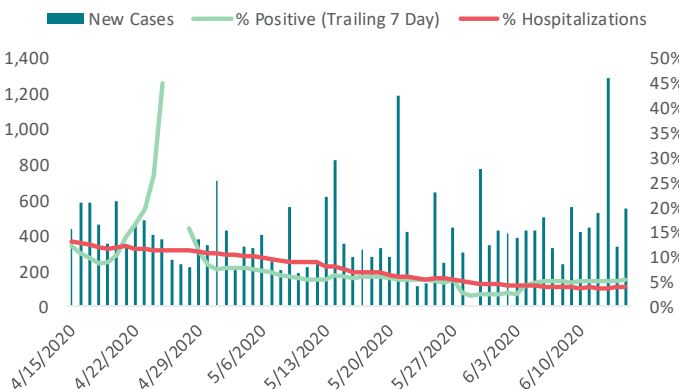
Source: Nephron Research analysis of data from the New York Times and the COVID Tracking Project

**Fig. 5: South Carolina Cases vs. % Positive vs. Hospitalization %**

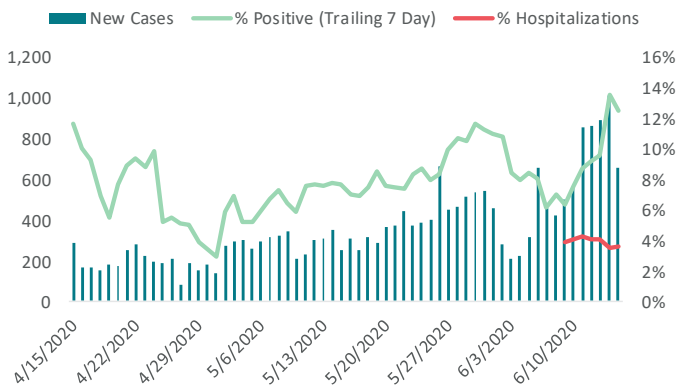
Source: Nephron Research analysis of data from the New York Times and the COVID Tracking Project

**Fig. 6: Oregon Cases vs. % Positive vs. Hospitalization %**

Source: Nephron Research analysis of data from the New York Times and the COVID Tracking Project

**Fig. 7: Louisiana Cases vs. % Positive vs. Hospitalization %**

Source: Nephron Research analysis of data from the New York Times and the COVID Tracking Project

**Fig. 8: Alabama Cases vs. % Positive vs. Hospitalization %**

Source: Nephron Research analysis of data from the New York Times and the COVID Tracking Project



## COVID-19 Daily Tracker: Key Thresholds

Publication of the White House Coronavirus Task Forces' *Guidelines for Opening Up America Again* on April 16<sup>th</sup> was followed by the National Governors Association's publication of *Roadmap to Recovery, A Public Health Guide for Governors* on April 21<sup>st</sup>. As such, we have organized the tracker around the **goals** and **measures** put forth by the White House, National Governors Assoc. and other public health organizations with an eye toward identifying those states that have met the thresholds for reopening the U.S. economy. Given that not all states are waiting until they achieve the suggested measures, we have also begun to more closely track cases in key cities within those states that have relaxed social distancing measures.

**Fig. 9: Within this report we track available readiness and reopening measures**

White House Threshold	NGA State Metric to Consider	Available Measure
<b>Case Identification Trend Goals:</b> Decreasing rate of COVID-19 positive cases, influenza like illness (ILI) and COVID-19 syndromic cases	<ul style="list-style-type: none"> <li>14-day trend for # of positive cases</li> <li># individuals with ILI symptoms</li> <li># of individuals COVID-19 like syndrome cases</li> </ul>	<ul style="list-style-type: none"> <li>State level decline in documented COVID-19 cases over 14-days</li> </ul>
<b>Point of Care Testing Results and Testing Capacity:</b> Decrease in 'percent positive', testing sites can handle asymptomatic cases, decrease in avg time to report test results, state testing capacity	<ul style="list-style-type: none"> <li># of 'percent positive' tests, 14-day trend</li> <li>% of test sites that can screen for asymptomatic cases</li> <li>time from specimen to result</li> <li># of labs reporting need for additional equipment, supplies, reagent, staffing</li> </ul>	<ul style="list-style-type: none"> <li>State level reduction in % positive over 14-days</li> <li>State level # of diagnostic tests per week</li> </ul>
<b>Public Health System Capacity:</b> State ability to safely identify individuals and their contacts who may have been exposed to COVID-19 and prevent transmission	<ul style="list-style-type: none"> <li>% of public health agencies with sufficient contact tracers to support case investigation of every COVID-19 positive case within the state</li> <li>capacity to contact at least 90% of all elicited contacts</li> </ul>	<ul style="list-style-type: none"> <li>Anecdotal datapoints on efforts to ramp tracing and isolation</li> <li>Anecdotal datapoints on digital tracing efforts</li> </ul>
<b>Healthcare Facility &amp; Worker Capacity:</b> Ability to care for all patients, surge capacity, ability to test at-risk healthcare workers	<ul style="list-style-type: none"> <li>% of hospitals that can handle doubling of patient volume with sufficient PPE</li> <li>% of hospitals that can care for all patients without using crisis standards of care</li> <li>% of facilities with testing program for workers</li> </ul>	<ul style="list-style-type: none"> <li>National hospitalization and ICU census</li> <li>Anecdotal datapoints on PPE and crisis standards of care</li> </ul>

Source: White House Guidelines for Opening Up America Again 4/16, National Governors Association Roadmap to Recovery 4/21, Nephron Research Analysis

## Global Perspective

Total global confirmed cases of COVID-19 reached 7.94 million as of June 16<sup>th</sup>, representing an increase of 1.5% relative to the previous day. The US has the most confirmed infections in the world, followed by Brazil, Russia, India, and the UK. Among the five countries with the most infections, the US saw the largest absolute increase in documented cases, with 23.5K (1.1%) additional individuals testing positive for the virus. Brazil had the second highest case growth, with confirmed cases increasing 17.1K (2.0%) d/d. Other key countries we are watching include Turkey, Germany, and France.



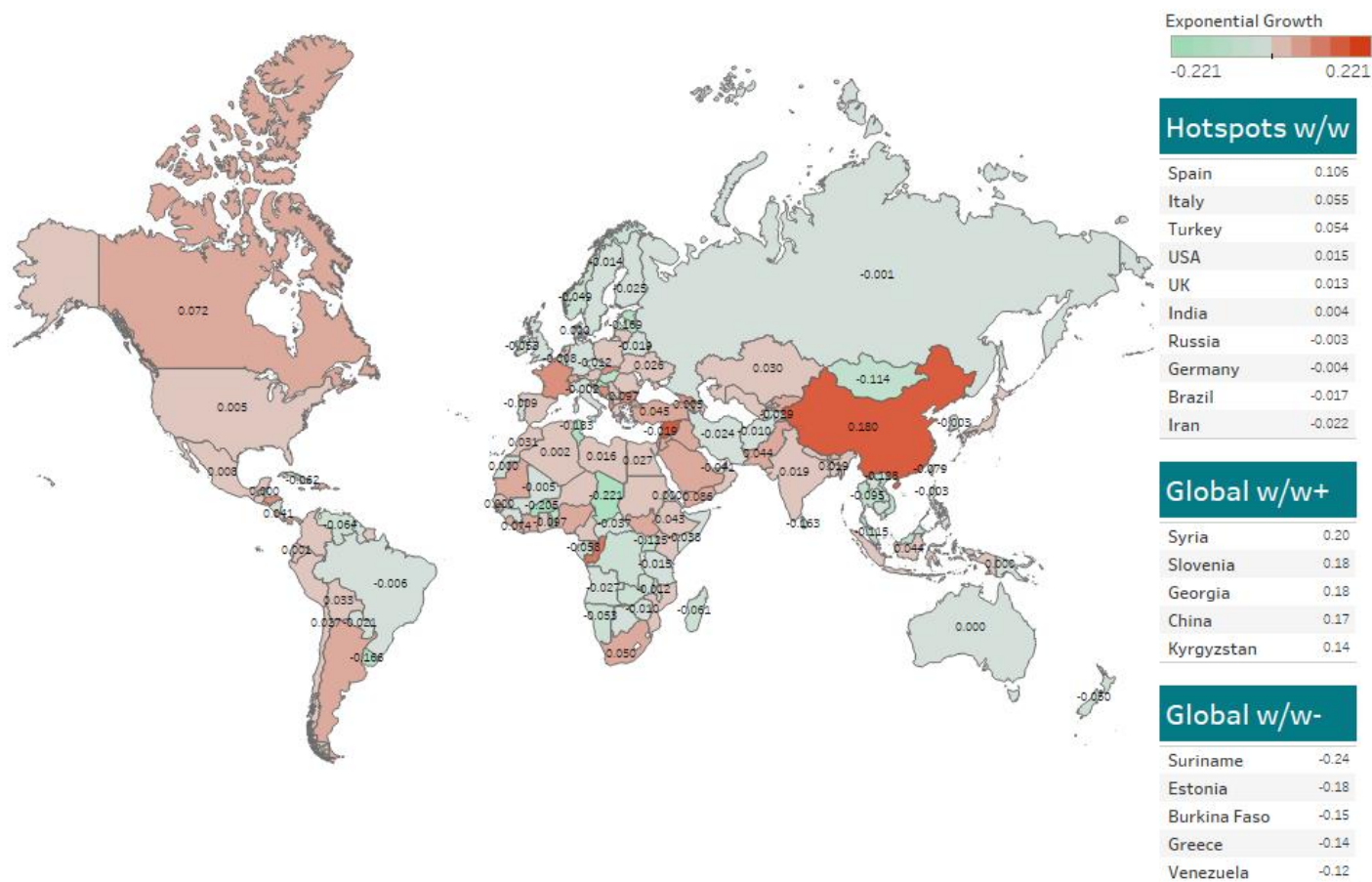
Date	World Total	Top 5 Countries														
		U.S.			Brazil			Russia			India			U.K.		
		Total	D/D	% D/D	Total	D/D	% D/D	Total	D/D	% D/D	Total	D/D	% D/D	Total	D/D	% D/D
2-Jun	6,194,533	1,832,412	23,780	1%	514,849	16,409	3%	423,741	8,863	2%	198,706	8,171	4%	276,336	1,570	1%
3-Jun	6,287,771	1,852,601	20,189	1%	526,447	11,598	2%	432,277	8,536	2%	207,615	8,909	4%	277,989	1,653	1%
4-Jun	6,416,828	1,873,167	20,566	1%	555,383	28,936	5%	441,108	8,831	2%	216,919	9,304	4%	279,860	1,871	1%
5-Jun	6,535,354	1,896,157	22,990	1%	584,016	28,633	5%	449,834	8,726	2%	226,770	9,851	5%	281,665	1,805	1%
6-Jun	6,663,304	1,918,512	22,355	1%	614,941	30,925	5%	458,689	8,855	2%	236,657	9,887	4%	283,315	1,650	1%
7-Jun	6,799,713	1,937,819	19,307	1%	645,771	30,830	5%	467,673	8,984	2%	246,628	9,971	4%	284,872	1,557	1%
8-Jun	6,931,000	1,954,942	17,123	1%	672,846	27,075	4%	476,658	8,985	2%	256,611	9,983	4%	286,198	1,326	0%
9-Jun	7,039,918	1,972,108	17,166	1%	691,758	18,912	3%	485,253	8,595	2%	266,598	9,987	4%	287,403	1,205	0%
10-Jun	7,145,539	1,992,857	20,749	1%	707,412	15,654	2%	493,657	8,404	2%	276,583	9,985	4%	289,144	1,741	1%
11-Jun	7,273,958	2,014,880	22,023	1%	739,503	32,091	5%	502,436	8,779	2%	286,579	9,996	4%	290,147	1,003	0%
12-Jun	7,410,510	2,038,198	23,318	1%	772,416	32,913	4%	511,423	8,987	2%	297,535	10,956	4%	291,413	1,266	0%
13-Jun	7,553,182	2,063,542	25,344	1%	802,828	30,412	4%	520,129	8,706	2%	308,993	11,458	4%	292,954	1,541	1%
14-Jun	7,690,708	2,085,028	21,486	1%	828,810	25,982	3%	528,964	8,835	2%	320,922	11,929	4%	294,379	1,425	0%
15-Jun	7,823,289	2,103,549	18,521	1%	850,514	21,704	3%	537,210	8,246	2%	332,424	11,502	4%	295,893	1,514	1%
16-Jun	7,941,791	2,127,047	23,498	1%	867,624	17,110	2%	545,458	8,248	2%	343,091	10,667	3%	296,861	968	0%
Day/Day	118,502	23,498			17,110			8,248			10,667			968		
% d/d	1.5%	1.1%			2.0%			1.5%			3.2%			0.3%		

Source: Nephron Research analysis of data from the World Health Organization and the COVID Tracking Project

It is also important to note that each country has seen hot spots post relaxation of social distancing measures (something we are watching for in the U.S.) with testing and tracing playing a key role in limiting the extent of these outbreaks (capabilities that are currently lacking in the U.S.).

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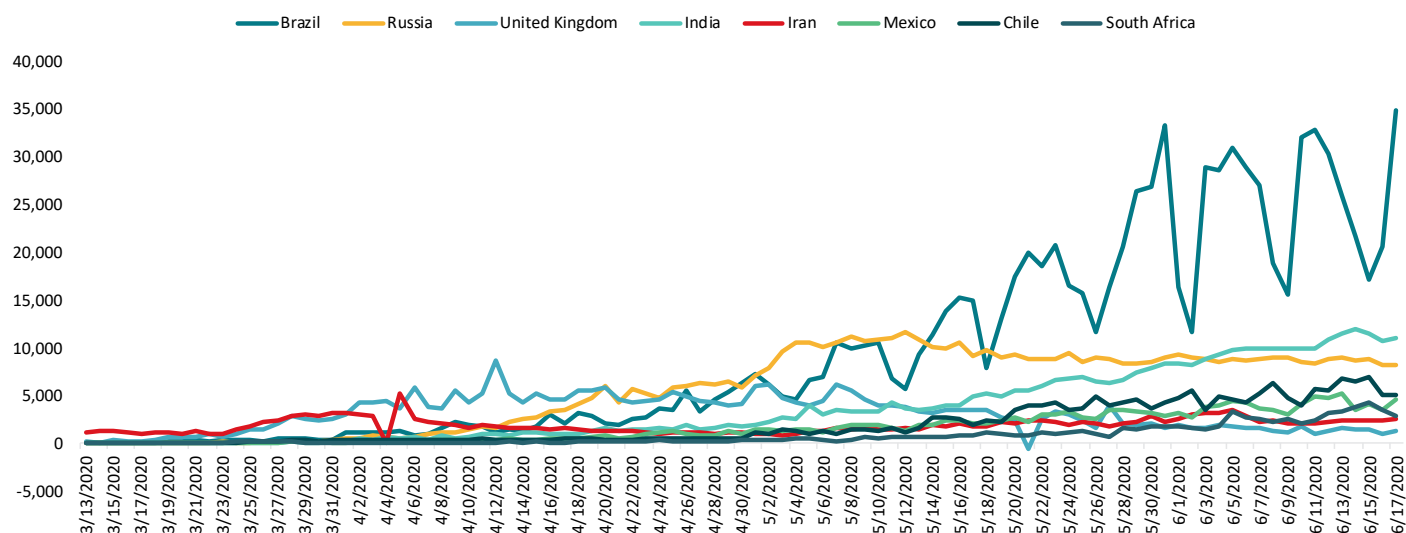
**Fig. 11: Trajectory of Daily Case Growth, Trailing 14-Days (green indicates declining trend/red indicates improving trend)**



Source: Nephron Research analysis of Johns Hopkins Center for Systems Science and Engineering Data

Note: Growth trajectory measured as exponential growth component of prior 14-day average daily case growth

**Next, we wanted to turn our attention to the countries that are the most significant drivers of worldwide case growth.** Among the top 20 countries, the eight highlighted below are the fastest growing by absolute case count and are the most worrisome. **The one country that has stood out is Brazil, which grew by ~34.9K cases over the prior day.** However, case growth / reporting has been very volatile. **India** is the next fastest growing country, with 11.0K new cases yesterday, followed by **Russia** with 8.2K new cases.

**Fig. 12: Daily Growth in Top Countries By Case Count**

Source: Nephron Research analysis of data from OWID

Global deaths reached 434.8K, representing an increase of 3.3K (or 0.8%) relative to the prior day. Among the ten countries with the most confirmed infections, the US saw the largest absolute increase in deaths, recording growth of 713 (0.6%) d/d. Daily growth has been below 1.0K in 19 of the past 24 days. Brazil saw the second largest absolute increase in deaths, with 612 (1.4%) additional individuals passing away from the virus. As of June 16<sup>th</sup>, the US continues to have the highest death toll in the world at 110.7K, followed by Brazil (43.3K), the UK (41.7K), and Italy (34.4K).

**Fig. 13: Global Death Tracker, Top 10 Countries**

Date	World Total	Top 10 Countries									
		U.S.	Brazil	Russia	India	U.K.	Spain	Italy	Iran	Germany	Turkey
2-Jun	376,320	100,562	29,314	5,037	5,598	39,045	29,858	33,475	7,878	8,522	4,563
3-Jun	379,941	101,531	29,937	5,215	5,815	39,369	29,858	33,530	7,942	8,551	4,585
4-Jun	382,867	102,407	31,199	5,384	6,075	39,728	27,940	33,601	8,012	8,581	4,609
5-Jun	387,155	103,255	32,548	5,528	6,348	39,904	27,133	33,689	8,071	8,613	4,630
6-Jun	392,802	103,972	34,021	5,725	6,642	40,261	27,134	33,774	8,134	8,646	4,648
7-Jun	397,388	104,432	35,026	5,859	6,929	40,465	27,135	33,846	8,209	8,668	4,669
8-Jun	400,857	105,087	35,930	5,971	7,135	40,542	27,136	33,899	8,281	8,674	4,692
9-Jun	404,396	105,989	36,455	6,142	7,466	40,597	27,136	33,964	8,351	8,711	4,711
10-Jun	408,025	106,867	37,134	6,358	7,745	40,883	27,136	34,043	8,425	8,729	4,729
11-Jun	413,372	107,803	38,406	6,532	8,102	41,128	27,136	34,114	8,506	8,755	4,746
12-Jun	418,294	108,554	39,680	6,715	8,498	41,279	27,136	34,167	8,584	8,763	4,763
13-Jun	423,349	109,249	40,919	6,829	8,884	41,481	27,136	34,223	8,659	8,781	4,778
14-Jun	427,630	109,607	41,828	6,948	9,195	41,662	27,136	34,301	8,730	8,787	4,792
15-Jun	431,541	109,982	42,720	7,091	9,520	41,698	27,136	34,345	8,837	8,791	4,807
16-Jun	434,796	110,695	43,332	7,284	9,900	41,736	27,136	34,371	8,950	8,800	4,825
Day/Day	3,255	713	612	193	380	38	0	26	113	9	18
% d/d	0.8%	0.6%	1.4%	2.7%	4.0%	0.1%	0.0%	0.1%	1.3%	0.1%	0.4%

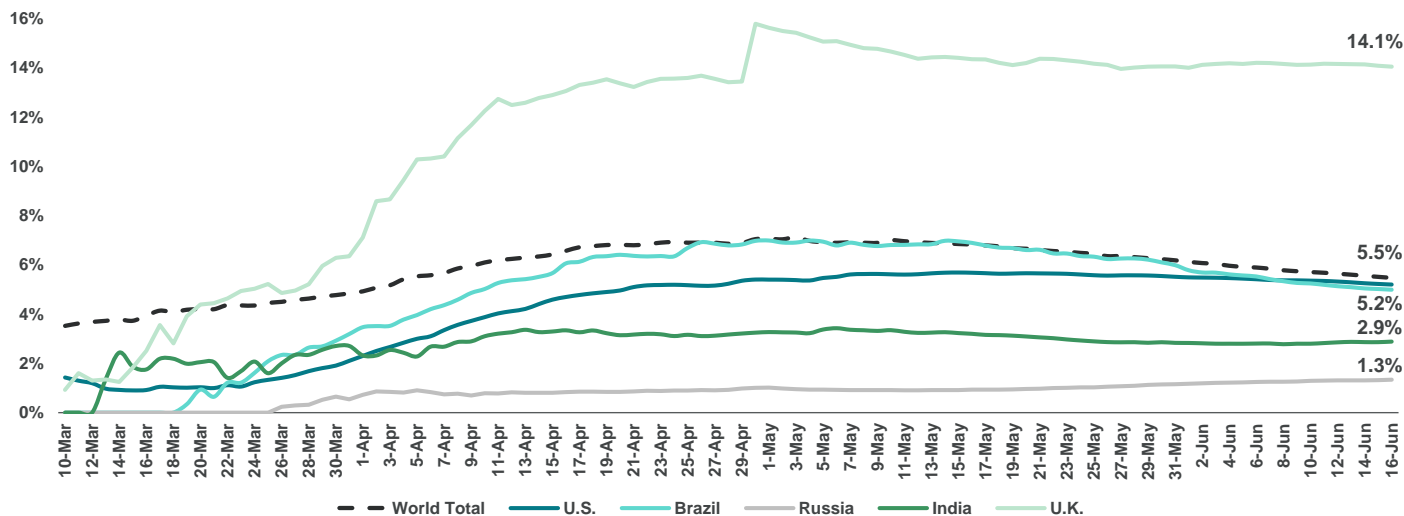
\*Data for the US is sourced from The COVID Tracking Project. All else sourced from the World Health Organization.

Source: Nephron Research analysis of data from the World Health Organization and The COVID Tracking Project

The global case mortality rate has ticked up from 3.5% of confirmed cases on March 10<sup>th</sup> to 5.5% as of June 16<sup>th</sup>. Among the five countries with the most infections, the UK has seen the largest increase in case mortality since March 10<sup>th</sup>. Over the past 99 days, the UK's case mortality rate has increased from 0.9% to 14.1%. In comparison, the case mortality rate in the US, Brazil, India and Russia are tracking materially below the global average. Specifically, the US case mortality has increased from 2.9% on

**March 10<sup>th</sup> to 5.2% as of June 16<sup>th</sup>.** In comparison, India's confirmed death rate has moved from 1.4% on March 13<sup>th</sup> (when the first deaths were recorded), to 2.9% as of June 16<sup>th</sup>. Finally, we note that Russia's case mortality rate has increased from 0.2% on March 26<sup>th</sup> (first recorded deaths) to 1.3% on June 16<sup>th</sup>. That said, there have been questions around the accuracy of the country's reported totals.

**Fig. 14: Historical Case Mortality, Top 5 Countries (by total cases)**



Source: Nephron Research analysis of data from the World Health Organization and The COVID Tracking Project

## State Reopening Threshold: Decline in Cases

**CASE IDENTIFICATION TREND GOAL:** Decreasing rate of COVID-19 positive cases, influenza like illness (ILI) and COVID-19 syndromic cases

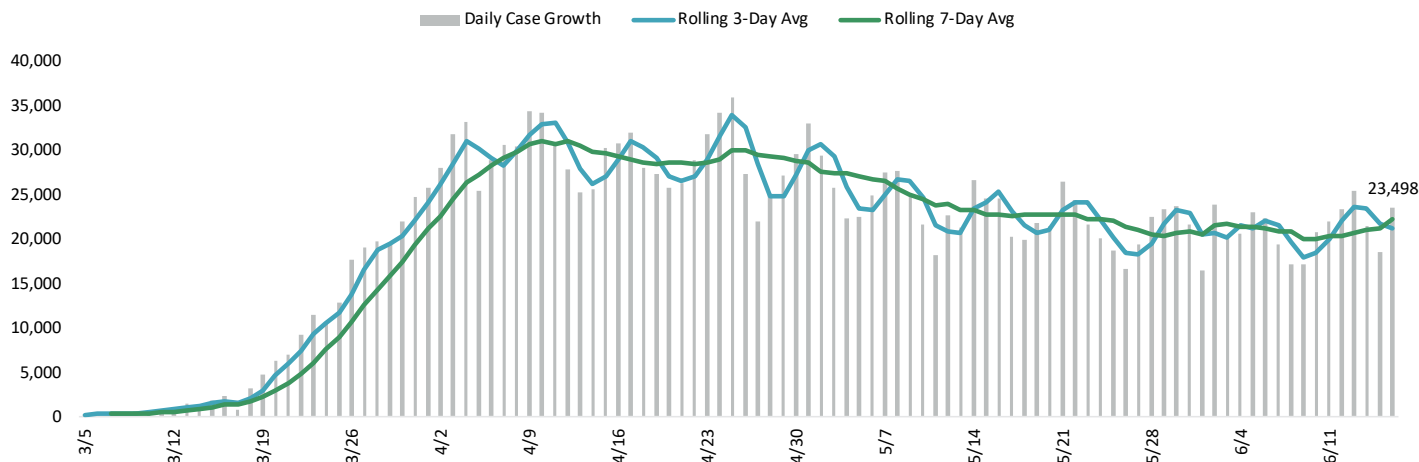
**MEASURE:** Reduction in state level documented COVID-19 cases OR reduction in state level positive COVID-19 tests as a percentage of total for a period of 14-days.

On the face of it, the **decline in cases** would appear to be the simplest measure and one that we would expect to be improving in many states as they are in various phases of re-opening. However, the overall trend of decline has been upset by recent ebbs and flows in testing capacity and reporting that have skewed the data. As such, we train our focus on the trend in **positive tests as a percentage of total**, declines in which may represent a reduction in prevalence and/or an increase in testing (a confounding factor but a positive nonetheless as testing expands beyond those who are symptomatic and healthcare workers).

**The number of new cases trended upward yesterday, while daily testing ticked up as well.** Given the increase in new cases and elevated testing levels, the cumulative % of those testing positive ticked down by 10bps. We view this trend favorably as we would like to see growth in testing while new cases decline (or grow at a slower rate). **We continue to believe the growth in testing is the primary reason we are seeing any elevated positive case results, and vice versa.** Case growth grew by 23.5K yesterday which is below the peak level of adds on April 25<sup>th</sup> of 40.9K adds. We also remind that there tends to be some variation around weekends and coming out of the weekend (for reporting).

*We now examine four key state thresholds for relaxation of social distancing and opening up the economy, beginning with case growth*

*At a national level, increased testing leads to variance but the underlying trend in case growth is declining*

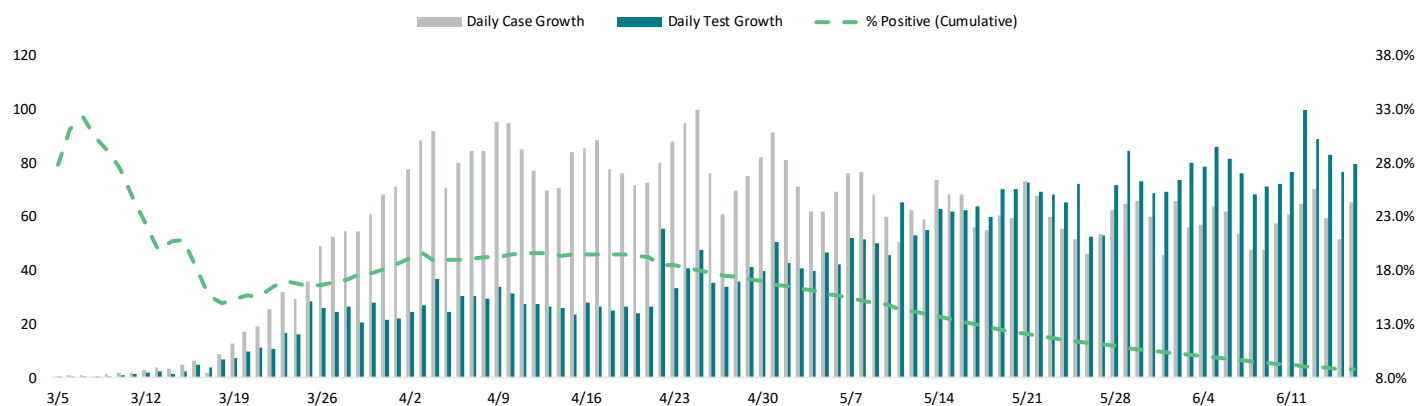
**Fig. 15: National Daily New Positive Case Growth, March 5, 2020 to Present**

Source: Nephron Research analysis of The COVID Tracking Project

Next, we compare the number of new COVID-19 positive cases against the level of new testing. **What we have seen in recent weeks is the positive spread between testing and new cases widening.** Prior to 4/22, there was a larger (negative) spread between the two metrics. As we have previously noted, growth in absolute cases is not the best measure since this is directly correlated with elevated levels of testing. In the chart below, we look at daily case growth indexed to the day of max growth. This provides a better visualization of whether new cases are trending in the positive or negative direction. Similarly, we compare it against the number of daily tests indexed to the day of max daily tests.

*At a national level the trend of positive cases as a percentage of total inflected on 4/22 and has now been declining for 56-days*

In addition, the latest data suggests that the % of positive cases is 8.7%, which is down 10bps from the prior day. **This is the lowest growth rate since we have been tracking the data.** The cumulative percentage of positive cases ticked down again for the 56<sup>th</sup> day in a row as the total testing increased to over 24.4mm tests, up by 465K tests from the prior day. **As expected, as testing began to expand to those that are not symptomatic, we have begun to see a decline in the percentage of positive tests.** We view inflection in this datapoint from increase to decrease as a key leading indicator. The data from 4/22 was the first sign of a meaningful decline in the % of cases that test positive and data from 5/11 shows there was another meaningful inflection point in a positive direction.

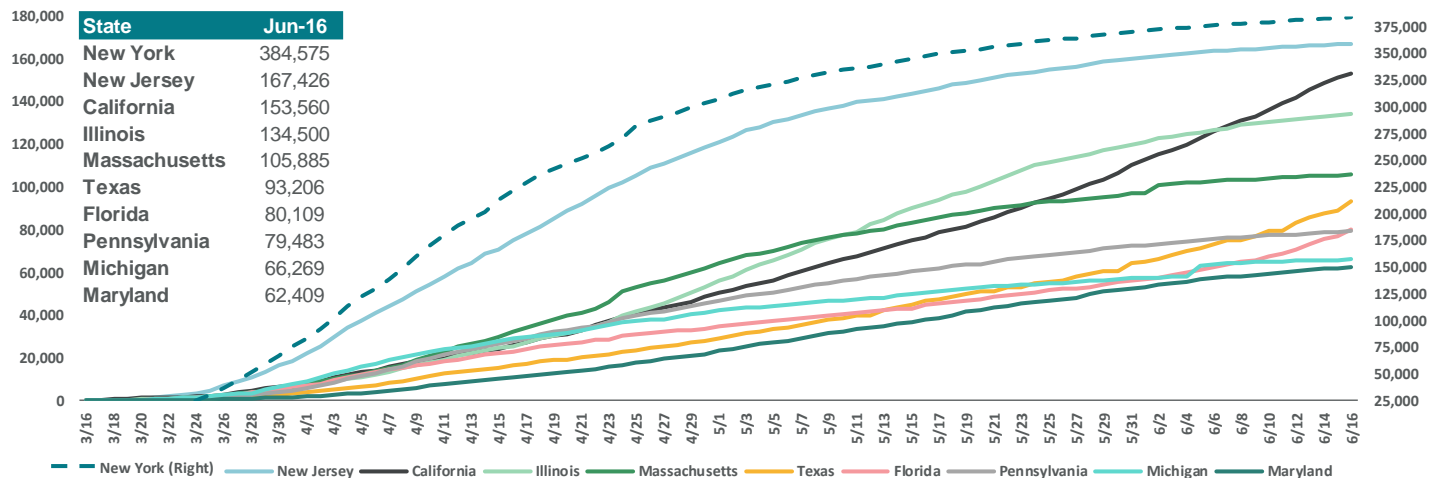
**Fig. 16: Indexed Daily Case Growth vs. Daily Test Growth vs. Cumulative % of Tested Cases that are Positive**

Source: Nephron Research analysis of The COVID Tracking Project

### State Level Data:

New York has the most confirmed cases of any state in the country, with 384.6K cumulative cases as of June 16<sup>th</sup>. There is a significant drop-off between New York (plotted on a separate axis below) and New Jersey, with NJ having 167.4K documented cases (~44% of NY's total). Case totals are less disperse after the top two states, with the third highest state (California) reporting 153.6K cases on June 16<sup>th</sup>, followed by Illinois (134.5K) and Massachusetts (105.9K). For perspective, the barrier of entry into the top ten states is 62.4K cases (Maryland).

**Fig. 17: Top 10 States in the US with Positive COVID-19 Cases**



Source: Nephron Research analysis of The COVID Tracking Project

The following state-level dashboard monitors COVID-19 case growth threshold metrics required for progressing through the three phases of reopening. We have begun tracking two key metrics for monitoring signs of case growth rebounds in open states



Fig. 18: Nephron Research State Case Growth Dashboard

State	Cumulative Cases	Level of Opening Restrictions	Days Since First Open	Cumulative Cases per 100K	% Pos / Daily Test	Consecutive 14-Day Trends	Highest Consecutive 14-Day Trend	14-Day Trend (slope)	Avg Daily Cases (Prior 14-Days)	Current Case Threshold	Highest Historical Case Threshold	5-Day Trend (slope)	Sign of Rebound
Alaska	676	None	53	92	1%	1	1	-0.013		Pass/Phase 1	Pass/Phase 1	-0.217	CLEAR
South Carolina	19,990	Minor	57	384	10%	0	0	+0.087		Fail/Phase 1	Fail/Phase 1	+0.010	
Oklahoma	8,645	Minor	53	219	5%	0	1	+0.078		Fail/Phase 1	Pass/Phase 1	+0.029	
Georgia	59,078	Minor	53	550	7%	0	0	+0.018		Fail/Phase 1	Fail/Phase 1	-0.028	
Montana	614	Minor	51	56	1%	0	2	+0.083		Fail/Phase 1	Pass/Phase 2	+0.091	
Tennessee	31,830	Minor	50	461	5%	0	0	+0.029		Fail/Phase 1	Fail/Phase 1	+0.110	
Mississippi	20,152	Minor	50	674	5%	0	1	+0.018		Fail/Phase 1	Pass/Phase 1	-0.120	
Indiana	40,786	Minor	50	605	6%	2	2	-0.002		Pass/Phase 2	Pass/Phase 2	+0.028	CAUTION
Wisconsin	23,198	Minor	50	396	2%	2	2	-0.039		Pass/Phase 2	Pass/Phase 2	-0.094	CLEAR
South Dakota	5,966	Minor	49	661	4%	2	2	-0.005		Pass/Phase 2	Pass/Phase 2	-0.121	CLEAR
Alabama	26,912	Minor	47	548	14%	0	1	+0.101		Fail/Phase 1	Pass/Phase 1	+0.000	
Wyoming	1,089	Minor	46	192	2%	0	2	+0.122		Fail/Phase 1	Pass/Phase 2	-0.151	
Nevada	11,658	Minor	46	371	4%	0	1	+0.051		Fail/Phase 1	Pass/Phase 1	-0.007	
Texas	93,206	Minor	46	316	8%	0	0	+0.033		Fail/Phase 1	Fail/Phase 1	+0.008	
Utah	14,937	Minor	46	455	8%	0	0	+0.009		Fail/Phase 1	Fail/Phase 1	-0.021	
Maine	2,819	Minor	46	209	1%	2	2	-0.011		Pass/Phase 2	Pass/Phase 2	-0.153	CLEAR
Idaho	3,462	Minor	46	190	3%	1	2	-0.013		Pass/Phase 1	Pass/Phase 2	-0.039	CLEAR
Iowa	24,179	Minor	46	760	3%	2	2	-0.015		Pass/Phase 2	Pass/Phase 2	-0.222	CAUTION
North Dakota	3,124	Minor	46	410	2%	2	2	-0.019		Pass/Phase 2	Pass/Phase 2	-0.143	CLEAR
Florida	80,109	Minor	43	364	8%	0	0	+0.063		Fail/Phase 1	Fail/Phase 1	+0.058	
Arkansas	13,191	Minor	43	434	10%	0	0	+0.048		Fail/Phase 1	Fail/Phase 1	+0.038	
Arizona	39,097	Minor	43	530	18%	0	0	+0.043		Fail/Phase 1	Fail/Phase 1	-0.019	
West Virginia	2,341	Minor	43	132	1%	0	2	+0.014		Fail/Phase 1	Pass/Phase 2	+0.041	
Kansas	11,419	Minor	43	392	5%	0	2	+0.011		Fail/Phase 1	Pass/Phase 2	+0.033	
Missouri	16,414	Minor	43	266	4%	1	1	-0.010		Pass/Phase 1	Pass/Phase 1	-0.024	CLEAR
Nebraska	16,851	Minor	43	863	5%	1	2	-0.048		Pass/Phase 1	Pass/Phase 2	-0.145	CAUTION
Ohio	42,010	Minor	35	358	3%	2	2	-0.009		Pass/Phase 2	Pass/Phase 2	-0.026	CLEAR
Vermont	1,131	Minor	33	180	0%	1	1	-0.078		Pass/Phase 1	Pass/Phase 1	-0.473	CLEAR
Louisiana	47,706	Minor	32	1,027	4%	0	0	+0.040		Fail/Phase 1	Fail/Phase 1	+0.002	
Virginia	55,331	Minor	31	641	4%	2	2	-0.045		Pass/Phase 2	Pass/Phase 2	-0.003	CAUTION
Minnesota	30,882	Minor	29	542	1%	2	2	-0.062		Pass/Phase 2	Pass/Phase 2	-0.474	CAUTION
Michigan	66,269	Minor	25	660	1%	2	2	-0.042		Pass/Phase 2	Pass/Phase 2	-0.134	CLEAR
Colorado	29,299	Moderate	50	501	4%	1	2	-0.043		Pass/Phase 1	Pass/Phase 2	+0.007	CAUTION
Illinois	134,500	Moderate	46	1,062	3%	2	2	-0.056		Pass/Phase 2	Pass/Phase 2	-0.054	CLEAR
Washington	26,158	Moderate	42	335	4%	0	2	+0.094		Fail/Phase 1	Pass/Phase 2	+0.084	
Hawaii	736	Moderate	40	52	1%	0	0	+0.219		Fail/Phase 1	Fail/Phase 1	+0.166	
North Carolina	45,853	Moderate	39	432	6%	0	0	+0.029		Fail/Phase 1	Fail/Phase 1	-0.066	
Delaware	10,403	Moderate	39	1,058	3%	0	2	+0.008		Fail/Phase 1	Pass/Phase 2	+0.022	
Pennsylvania	79,483	Moderate	39	620	4%	2	2	-0.046		Pass/Phase 2	Pass/Phase 2	+0.028	CAUTION
Rhode Island	16,164	Moderate	38	1,530	2%	2	2	-0.048		Pass/Phase 2	Pass/Phase 2	-0.060	CAUTION
Kentucky	12,829	Moderate	36	285	2%	1	2	-0.041		Pass/Phase 1	Pass/Phase 2	+0.119	CAUTION
New Hampshire	5,345	Moderate	36	390	2%	2	2	-0.051		Pass/Phase 2	Pass/Phase 2	-0.051	CLEAR
Oregon	6,098	Moderate	32	142	6%	0	0	+0.047		Fail/Phase 1	Fail/Phase 1	+0.103	
Maryland	62,409	Moderate	32	1,026	5%	2	2	-0.051		Pass/Phase 2	Pass/Phase 2	-0.113	CAUTION
New Mexico	9,845	Moderate	31	470	3%	2	2	-0.050		Pass/Phase 2	Pass/Phase 2	-0.151	CAUTION
New Jersey	167,426	Moderate	29	1,873	1%	2	2	-0.049		Pass/Phase 2	Pass/Phase 2	-0.131	CLEAR
Massachusetts	105,885	Moderate	29	1,518	2%	2	2	-0.070		Pass/Phase 2	Pass/Phase 2	-0.242	CLEAR
Connecticut	45,349	Moderate	27	1,273	3%	2	2	-0.028		Pass/Phase 2	Pass/Phase 2	-0.089	CLEAR
Washington D.C.	9,818	Moderate	18	1,362	2%	2	2	-0.052		Pass/Phase 2	Pass/Phase 2	-0.117	CAUTION
California	153,560	Major	39	385	4%	0	1	+0.017		Fail/Phase 1	Pass/Phase 1	-0.014	
New York	384,575	Major	32	1,978	1%	2	2	-0.040		Pass/Phase 2	Pass/Phase 2	-0.038	CLEAR

Source: Nephron Research analysis of The COVID Tracking Project, CDC Reopening Guidance, State Reopening Data obtained from <https://nyti.ms/2YwojJ1> and <https://wapo.st/2WUCysP>

**Case growth thresholds: 27 states and DC have passed.** Examining the trajectory of case growth over the last 14-days, we find that 27 states and DC have demonstrated a sustained decline. **However, some six weeks after states began to reopen and three weeks after the Memorial Day Holiday and protests in response to the murder of George Floyd began, the daily case growth and five-day trend suggest caution is warranted in 12, with no state showing rebound.**

- The case threshold measure is a 14-day downward sloping trend in new case growth, in line with the suggested measure in the CDC's technical guidance. A state passes phase 2 and phase 3 if the 14-day trend 2 and 4 weeks ago was also downward sloping.
- The sign of rebound after a state has passed the case growth threshold are an increase in 5-Day growth trend and at least one day of new cases/100K greater than 10, also in line with CDC technical guidance.
- It is important to recognize that outlined measures are lagging, not coincident, indicators of virus progression. **The data we see today is reflective of perhaps three weeks ago given that symptoms take several days to emerge and severe symptoms can take two to three weeks to become apparent. It may take 5-6 weeks post open to have a real feel for the impact.**



- MN, VA, MD and NE have shown the most rebound in the past 14 days.
- We note that HI, WY, AL, WA, SC, MT, OK, FL, NV, AR, OR, AZ, LA, TX, NC, TN, GA, MS, CA, WV, KS, UT and DE showed an increase in case growth.

### New York Focus:

In today's review of the data, New York remains the number one state with the most positive COVID-19 cases. **As a reminder, New York State implemented shelter at home and other mandates on March 22<sup>nd</sup>, and the data is now 86 days post that lockdown.** The number of cases per 100K residents in New York has risen to 1,977, compared to 1,974 in the previous day. As of June 16<sup>th</sup>, New York has an estimated 384.6K cases which is up 0.2% from the prior day. **Case growth was relatively flat at 631 d/d, compared to an increase of 620 in the previous day. New York data continues to trend much more favorably,** with 10 of the past 14 days under 1.0K. Though daily results have been volatile, case growth within the state has maintained a general downward trajectory since April 25<sup>th</sup>.

**New Jersey** is the second largest state with 167.4K cases, which is up 0.2% from the prior day. Throughout the state, 1,885 per 100K residents have tested positive for the virus, up from 1,881 in the previous day. **California has the third most cases,** with 153.6K confirmed cases (up 1.4% d/d). Approximately 389 per 100K residents have tested positive within the state. Illinois has the fourth most cases, with 134.5K confirmed diagnoses (up 0.5% d/d) and a prevalence of 1,061 per 100K residents. Rounding out the top 5 is **Massachusetts**, with 105.9K cases (up 0.2% d/d) and a prevalence of 1,536 per 100K. **For perspective, the top 3 states alone represent ~33.2% of all cases in the US, which is down ~22bps from the prior day's data.** The top 5 states now represent 44% of total cases.

*See Appendix for an expanded chart on historical case growth in the top 5 states.*

### County / MSA Level Focus:

**NEW:** In the chart below, we now focus on the Metropolitan Statistical Areas (MSA) to focus on the urban areas with the highest daily case growth. Based on the data as of June 15, 2020, **Los Angeles has the highest daily case growth in the US, surpassing Phoenix and Houston.** Cases in these counties have grown as a percentage of total daily cases in the US. Other cities where the virus is spreading quickly are Riverside, CA, Dallas, TX and Chicago, IL. **We also note that case growth in the top 20 cities accelerated over the past 7 days.** Over the trailing 7 days, there were 1,634 new cases added in these cities, which is well above the 168 new cases that were added in the prior 7 days.

*NEW: In the chart below, we now focus on the Metropolitan Statistical Areas (MSA) to focus on the urban areas with the highest daily case growth.*

**Fig. 19: COVID-19 Daily Case Growth in the Top 20 Counties**

MSA Daily Case Growth	6/1/2020	6/8/2020	6/9/2020	6/10/2020	6/11/2020	6/12/2020	6/13/2020	6/14/2020	6/15/2020	Prior Week Growth	Last Week's Growth	2-Week Growth
1 Los Angeles-Long Beach	972	800	1,178	1,242	1,811	1,601	1,547	995	773	-172	-27	-199
2 Phoenix-Mesa	124	520	408	953	938	957	905	901	748	396	228	624
3 Houston	425	383	452	440	374	449	404	217	578	-42	195	153
4 Riverside-San Bernadino	599	478	554	497	478	484	311	513	510	-121	32	-89
5 Dallas	256	346	450	422	400	448	432	339	461	90	115	205
6 Chicago	917	642	667	490	630	476	465	482	422	-275	-220	-495
7 Nashville	232	153	300	238	115	174	143	164	414	-79	261	182
8 Tampa-St. Petersburg-Clearwater	68	178	112	188	280	213	390	267	390	110	212	322
9 Austin-San Marcos	117	168	249	189	245	213	202	234	386	51	218	269
10 Atlanta	330	418	357	379	493	370	222	105	344	88	-74	14
11 Salt Lake City-Ogden	110	146	152	209	191	203	239	136	304	36	158	194
12 Miami	139	209	224	297	271	324	761	284	280	70	71	141
13 Charlotte-Gastonia-Rock Hill	230	251	116	205	436	559	425	426	264	21	13	34
14 Philadelphia	455	318	331	340	360	375	245	197	262	-137	-56	-193
15 Raleigh-Durham-Chapel Hill	89	186	201	204	397	296	314	184	254	97	68	165
16 Indianapolis	73	53	128	70	62	125	67	77	251	-20	198	178
17 Memphis	135	126	148	137	160	134	139	235	215	-9	89	80
18 Orlando	35	84	100	133	200	176	293	283	211	49	127	176
19 Minneapolis-St. Paul	273	234	217	226	314	273	298	248	201	-39	-33	-72
20 Fayetteville-Springdale-Rogers	82	136	167	97	236	303	161	138	195	54	59	113
<b>Sub-Total</b>	<b>5,661</b>	<b>5,829</b>	<b>6,511</b>	<b>6,956</b>	<b>8,391</b>	<b>8,153</b>	<b>7,963</b>	<b>6,425</b>	<b>7,463</b>	<b>168</b>	<b>1,634</b>	<b>1,802</b>

Source: Nephron Research analysis of The New York Times

Next take the counties with the highest *absolute* number of COVID cases and adjust it to account for the population size. In the chart below, we show the number of positive COVID cases per 1MM in these counties. This speaks to the relative impact of COVID, rather than the sheer absolute number of cases. Surprisingly, despite the number of cases in New York City, the number of cases per 1MM is less than Westchester, NY cases per 1MM. Among the counties with the most cases in the US, Westchester, NY has the highest density of COVID-19 cases per 1MM of population at 35,479 cases, followed by Passaic, NJ with 33,177 cases per 1MM. In all, 16 of the top 20 counties now have more than 1% of their populations that have tested positive. Westchester County is the highest at 3.5% of their population.

**Fig. 20: Top 20 Counties in the US with Positive COVID-19 Cases per 1MM Population**

State	County	3/14/2020	3/21/2020	3/28/2020	4/4/2020	4/11/2020	4/18/2020	4/25/2020	5/2/2020	5/9/2020	5/16/2020	5/23/2020	5/30/2020	6/6/2020	6/13/2020	6/14/2020	6/15/2020
NY	New York City	34	1,085	4,050	8,103	12,380	16,126	18,983	20,911	22,121	23,102	23,765	24,386	24,826	25,175	25,221	25,260
IL	Cook	10	106	507	1,444	2,605	3,960	5,642	7,811	10,033	11,885	13,673	14,974	15,907	16,423	16,486	16,540
CA	Los Angeles	5	35	180	526	884	1,197	1,903	2,480	3,108	3,716	4,388	5,344	6,210	7,174	7,273	7,350
NY	Nassau	58	909	4,081	9,835	16,644	21,505	24,908	26,913	28,025	28,766	29,277	29,705	30,107	30,342	30,366	30,392
NY	Suffolk	28	448	2,802	8,349	13,465	17,705	21,243	23,350	24,693	25,695	26,278	26,772	27,278	27,506	27,536	27,558
NY	Westchester	184	1,434	8,139	13,519	19,358	23,957	28,145	30,621	32,130	33,174	33,984	34,551	35,062	35,402	35,441	35,479
PA	Philadelphia	3	44	448	1,648	3,802	5,690	7,783	9,802	11,288	12,377	13,405	14,285	14,854	15,364	15,364	15,451
MA	Middlesex	40	110	522	1,531	3,023	5,148	7,603	9,337	10,738	11,716	12,553	13,107	14,367	14,367	14,392	14,411
FL	Miami-Dade	3	63	413	1,431	2,487	3,329	4,050	4,649	5,094	5,655	6,144	6,561	7,103	7,962	8,066	8,169
MI	Wayne	5	200	1,324	3,865	6,260	7,701	8,888	9,779	10,267	10,870	11,260	11,591	12,111	12,424	12,446	12,471
AZ	Maricopa	1	11	101	261	422	555	721	986	1,288	1,582	1,823	2,123	2,845	3,966	4,167	4,319
MA	Suffolk	18	73	571	1,645	3,336	5,212	7,597	9,214	10,239	11,070	11,710	12,104	12,837	13,070	13,094	13,094
NJ	Bergen	33	388	1,972	6,179	10,043	13,048	15,810	17,136	18,026	18,500	18,953	19,535	19,837	20,173	20,187	20,219
NJ	Hudson	7	144	1,147	5,192	10,189	14,807	19,880	22,905	24,800	25,768	26,636	27,280	27,585	27,836	27,880	27,908
NJ	Essex	9	134	1,359	4,486	8,770	12,392	15,670	17,833	19,231	20,066	21,359	22,021	22,611	22,949	22,984	22,998
MD	Prince Georges				718	2,115	3,475	5,273	7,743	10,140	12,154	14,677	17,132	18,517	19,514	19,631	19,707
TX	Harris	2	14	95	273	758	990	1,198	1,428	1,661	1,942	2,292	2,601	3,070	3,526	3,571	3,678
NJ	Passaic	4	134	1,212	5,691	10,551	15,814	21,398	26,069	28,751	29,953	31,106	32,081	32,752	33,103	33,133	33,177
NJ	Middlesex	5	72	501	1,600	3,354	4,730	6,251	7,578	8,537	9,005	9,440	9,818	10,053	10,166	10,194	10,212
CT	Fairfield	16	148	963	2,994	5,732	7,805	10,996	12,510	13,813	14,989	15,889	16,433	16,982	17,255	17,286	17,319
<b>Sub-Total</b>		<b>466</b>	<b>5,552</b>	<b>30,386</b>	<b>79,291</b>	<b>136,177</b>	<b>185,147</b>	<b>233,942</b>	<b>269,052</b>	<b>293,982</b>	<b>311,986</b>	<b>328,612</b>	<b>342,405</b>	<b>354,622</b>	<b>363,699</b>	<b>364,717</b>	<b>365,712</b>
<b>Total US Cases</b>		<b>7</b>	<b>71</b>	<b>360</b>	<b>969</b>	<b>1,622</b>	<b>2,230</b>	<b>2,761</b>	<b>3,371</b>	<b>3,751</b>	<b>4,249</b>	<b>4,734</b>	<b>5,183</b>	<b>5,644</b>	<b>6,071</b>	<b>6,138</b>	<b>6,209</b>

Source: Nephron Research analysis of The COVID Tracking Project, US Census Bureau

Focusing on growth in the top 5 counties, New York City has been able to bend the curve. New York City's growth has declined from a peak of 108% on March 18 to just 0.2% on June 15<sup>th</sup>. Case growth has been below 500 in 9 of the past 10 days. While it appears that city case growth has stabilized, we

would expect growth in the number of cases as testing becomes more prevalent. It has been 84 days since the lockdown order to control the spread of COVID19. As a reminder, Governor Cuomo announced on Friday, March 20 that all non-essential travel and in-office work will be banned starting on Sunday, March 22 – essentially announcing sweeping restrictions on movement in New York. Certain regions in the state partially reopened starting on May 15 and NYC began to reopen on June 8.

The other largest COVID counties in New York have stabilized as well. Each of their growth rates were near zero. The daily new cases added in Cook, Illinois moderated, and the growth rate was -0.3% and is the second largest county. In addition, Los Angeles is the 3<sup>rd</sup> largest county in the US with a 1.1% growth rate. Case growth continues to be an imperfect analog for the expanding prevalence of coronavirus (a better measure of the expanding prevalence is testing). We continue to closely monitor case growth post social distancing mandates (IL also put such measures in place on March 21<sup>st</sup> and CA put measures in place on March 19<sup>th</sup>) in the top five counties. See Appendix for an expanded chart on historical case growth in the top 5 counties.

## State Reopening Threshold: Diagnostic Testing Capacity

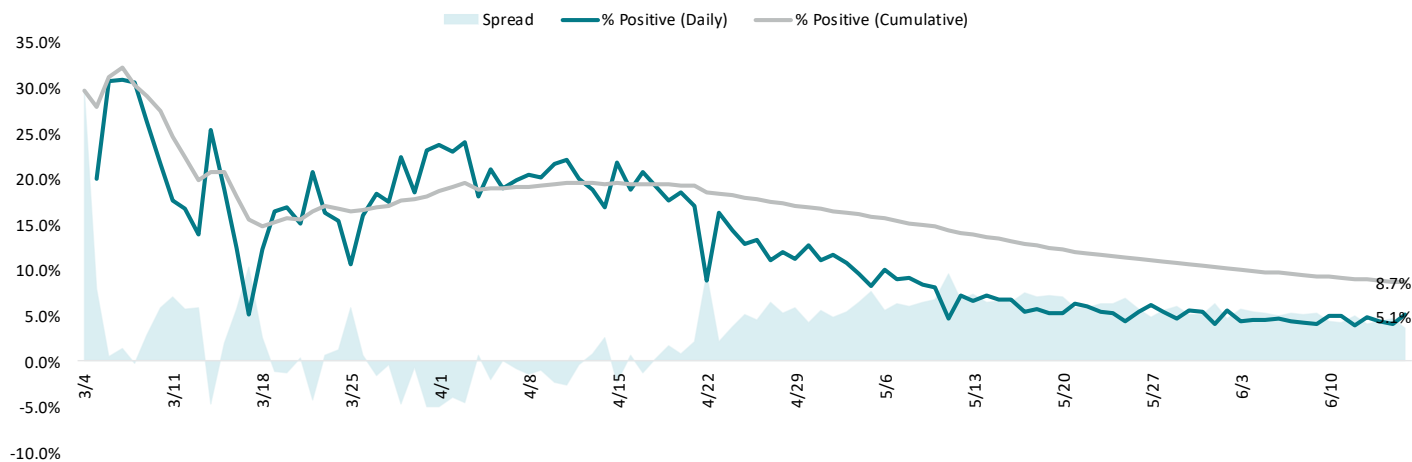
As shown below, 27 states and D.C. have demonstrated a decrease in % positive trend over the last 14-days

**POINT OF CARE TESTING RESULTS & TESTING CAPACITY:** *Decrease in 'percent positive', testing sites can handle asymptomatic cases, decrease in average time to report test results, state testing capacity*

**MEASURE:** Reduction in state level percent positive tests over a 14-day period, percentage of sites that can screen for asymptomatic cases, time to specimen result, number of labs reporting a need for additional equipment, supplies, reagent and staffing.

**ONGOING DEVELOPMENT:** Comingling of diagnostic and serological test reporting clouds testing trend data. While we have previously raised concerns that states such as FL and TX and large institutions such as the V.A. were counting antibody tests alongside diagnostic testing, reporting this week and a change to the CDC's own testing metric definitions suggests the issue is more widespread than we had expected. Specifically, the CDC changed language on its reporting site that had previously stated that only diagnostic tests were included. Beyond the CDC data, it also appears that PA, ME and VT are reporting some level of antibody tests in their numbers. On May 24<sup>th</sup>, we saw lower adjustments to MI, MO, MS and WV to remove antibody tests. We add GA and SC to the list as The COVID Tracking Project reported 74k fewer tests for GA 5/27, and the state now calls out 78k serology tests separately on their state website. SC removed antibody tests from their results 6/11, and according to The COVID Tracking Project, these tests represented ~10-11% of total tests reported, or 25k-28k. As we reach mid-June we expect the vast majority of antibody tests have been removed from the numbers. While we do believe that diagnostic testing capacity has increased substantially over the last several weeks, as validated by the commercial labs, these reporting disclosures serve to obscure the state level data key to policy making.

Given that the increase in testing has served to skew the trend 14-day case growth trend, it makes sense to focus on the trend in positive tests as a percentage of total, which after remaining extremely static even as cases ramped in late March and early April, has begun to decline over the last eight weeks as testing finally began to expand beyond those who were symptomatic and at-risk healthcare workers. As a result, the percentage of those testing positive daily inflected on April 18<sup>th</sup> and the daily percentage has fallen well below the cumulative percentage. The spread was approximately -360bps yesterday with the daily % positive at 5.1% vs. the cumulative % declining 10bps to 8.7%.

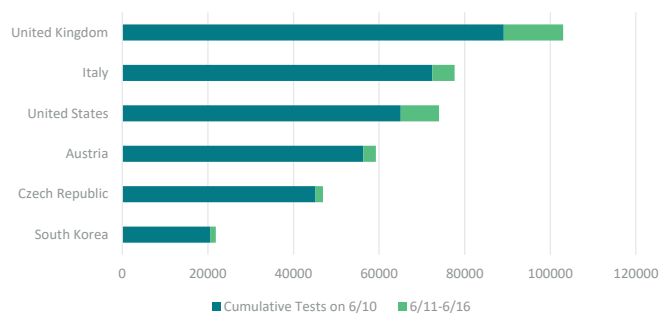
**Fig. 21: Daily % Testing Positive vs. Cumulative % Testing Positive**

Source: Nephron Research analysis of The COVID Tracking Project

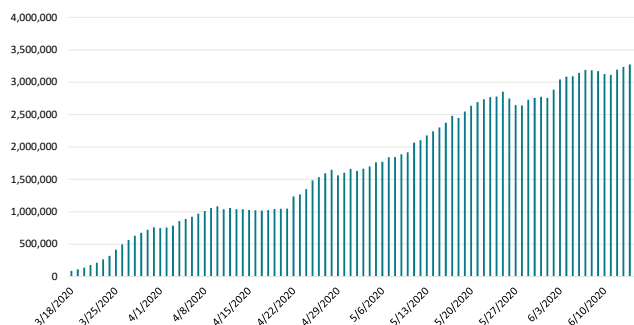
**Notable Change:** After many fits and starts, diagnostic testing is now running at ~3.3mn per week

After spending April 8<sup>th</sup> to 22<sup>nd</sup> stuck at a run rate of ~1mn tests per week, the weekly test rate appears to now be ~3.3mn inclusive of the 465k tests reported yesterday. Given volatility in daily testing numbers, reports of states combining diagnostic and serological tests, and recent news of additional states changing testing measures, we have been careful to not overstate improvement. We've also highlighted several states in the past few days who've reported lower test counts likely tied to separating tests, notably TX, MI, MO, MS, WV, and GA. We also learned that a few states in the Midwest, notably MN, changed the way they count total tests, and now report total tests, not people tested. The states with the largest contribution overall yesterday included: CA (15%), NY (13%) and TX (7.3%), ~35% of the total growth. Other states with large growth included FL (6.5%) and IL (4 %).

- **While testing has improved, further expansion is needed.** A run rate of ~3.3mn, represents an improvement but is still below the 3.5-5.5mn per week that many public health experts and epidemiologists have suggested is required to enable material relaxation of social distancing measures. The American Enterprise Institute (AEI) and Duke Margolis both estimated a need for 750k test per week to start tracing, whereas Center for American Progress (CAP) estimated the need at 2.6mn per day and Harvard Safra put the daily total required at around 900k per day in early May but has noted that 5mn-20mn per day may be required if social distancing interventions prove effective.
- **The U.S. supply chain is experiencing a number of challenges.** The initial challenge of securing an adequate supply of the reagent used in diagnostic kits has now given way to a potential bottleneck from the shortage in the specialized swabs used to test patients. Alternative testing mediums and swabs have been validated, and the U.S. Air Force is flying in Italian test strips three times a week. On April 17<sup>th</sup>, the FDA announced that after reviewing studies from United Health Group and the Gates Foundation it will allow a broader range of swabs to be used in tests and secured a U.S. manufacturer of polyester-based swabs compatible with COVID-19 testing with U.S. Cotton. The new guidelines allow for simple nasal swabs and can be conducted by the patient, dramatically reducing PPE required.

**Fig. 22: Cumulative Tests Completed per 1mn Population**

Source: Nephron Research analysis of The COVID Tracking Project and Country Websites

**Fig. 23: New Tests Completed over Trailing 7-Days**

Source: Nephron Research analysis of The COVID Tracking Project

Note: Data collected is up to date as of 4PM the prior day. Testing numbers compiled afterwards are not reflected in the above chart.

*Author's Note: For incremental commentary on diagnostic and serological testing including the latest testing capacity and goals for manufacturers, labs and pharmacy partners, see the Company Impact section at the end of the report.*

## Testing Dashboard

The following state-level dashboard (the figure on the following page) monitors COVID-19 testing threshold metrics required for progressing through the three phases of reopening.

- As testing has expanded (trailing 7-day average run rate of 3.3mn), 29 states and D.C. have demonstrated a 14-day decline in the trend in % positive.
- No state has met the CDC metric of 14 consecutive days included in draft technical guidance. This metric is a high bar. Yet still we note that only 6 states have achieved our less stringent measure of 10 of the last 14 days. **If we set the bar at a majority of the past 14 days (i.e. 8 days of the last 14) the number of states that pass rises to 23.**
- The % positive remains above 10% in AZ and AL and has been increasing in AL, AZ, OR, FL and AR over the prior week.
- WV, AK, TX and MA were within the top 10 in terms of new daily tests and new cases growth d/d.

Fig. 24: Nephron Research State Testing Growth Dashboard

State	Level of Opening Restrictions	Days Since First Open	Daily Tests per 100k (7-Day Avg)	Avg Daily Tests (Prior 14-Days)	% Pos / Daily	% Pos / Daily Consecutive Days of Decline	% Pos / Daily (Prior 14-Days)	Testing Threshold CDC: 14 of 14	Testing Threshold: 10 of 14	Testing Threshold: 8 of 14
Alaska	None	53	181		1%	3		Fail-10%	Fail-10%	Pass-10%
South Carolina	Minor	57	135		10%	2		Fail-10%	Fail-10%	Pass-10%
Oklahoma	Minor	53	100		5%	0		Fail-10%	Fail-10%	Fail-10%
Georgia	Minor	53	104		7%	3		Fail-10%	Pass-10%	Pass-10%
Montana	Minor	51	137		1%	1		Fail-10%	Fail-10%	Fail-10%
Wisconsin	Minor	50	169		2%	0		Fail-10%	Fail-10%	Fail-10%
Tennessee	Minor	50	244		5%	0		Fail-10%	Fail-10%	Fail-10%
Mississippi	Minor	50	185		5%	2		Fail-10%	Fail-10%	Fail-10%
Indiana	Minor	50	102		6%	1		Fail-10%	Fail-10%	Pass-10%
South Dakota	Minor	49	127		4%	2		Fail-10%	Fail-10%	Fail-10%
Alabama	Minor	47	110		14%	0		Fail-15%	Fail-15%	Fail-15%
Maine	Minor	46	105		1%	2		Fail-10%	Fail-10%	Fail-10%
North Dakota	Minor	46	150		2%	3		Fail-10%	Fail-10%	Fail-10%
Wyoming	Minor	46	103		2%	1		Fail-10%	Fail-10%	Fail-10%
Idaho	Minor	46	62		3%	2		Fail-10%	Fail-10%	Fail-10%
Iowa	Minor	46	148		3%	3		Fail-10%	Fail-10%	Pass-10%
Nevada	Minor	46	177		4%	0		Fail-10%	Fail-10%	Fail-10%
Utah	Minor	46	126		8%	3		Fail-10%	Fail-10%	Fail-10%
Texas	Minor	46	97		8%	0		Fail-10%	Fail-10%	Fail-10%
West Virginia	Minor	43	183		1%	0		Fail-10%	Fail-10%	Fail-10%
Missouri	Minor	43	91		4%	1		Fail-10%	Fail-10%	Fail-10%
Nebraska	Minor	43	123		5%	3		Fail-10%	Fail-10%	Pass-10%
Kansas	Minor	43	86		5%	0		Fail-10%	Fail-10%	Fail-10%
Florida	Minor	43	131		8%	2		Fail-10%	Fail-10%	Fail-10%
Arkansas	Minor	43	187		10%	0		Fail-10%	Fail-10%	Fail-10%
Arizona	Minor	43	118		18%	0		Fail-20%	Fail-20%	Fail-20%
Ohio	Minor	35	95		3%	0		Fail-10%	Fail-10%	Pass-10%
Vermont	Minor	33	197		0%	8		Fail-10%	Pass-10%	Pass-10%
Louisiana	Minor	32	243		4%	1		Fail-10%	Fail-10%	Pass-10%
Virginia	Minor	31	156		4%	2		Fail-10%	Fail-10%	Pass-10%
Minnesota	Minor	29	171		1%	3		Fail-10%	Fail-10%	Pass-10%
Michigan	Minor	25	140		1%	0		Fail-10%	Fail-10%	Fail-10%
Colorado	Moderate	50	76		4%	3		Fail-10%	Pass-10%	Pass-10%
Illinois	Moderate	46	168		3%	3		Fail-10%	Pass-10%	Pass-10%
Washington	Moderate	42	112		4%	1		Fail-10%	Fail-10%	Fail-10%
Hawaii	Moderate	40	66		1%	2		Fail-10%	Fail-10%	Fail-10%
Delaware	Moderate	39	223		3%	0		Fail-10%	Pass-10%	Pass-10%
Pennsylvania	Moderate	39	74		4%	1		Fail-10%	Fail-10%	Pass-10%
North Carolina	Moderate	39	156		6%	2		Fail-10%	Fail-10%	Fail-10%
Rhode Island	Moderate	38	307		2%	0		Fail-10%	Fail-10%	Fail-10%
New Hampshire	Moderate	36	122		2%	1		Fail-10%	Fail-10%	Fail-10%
Kentucky	Moderate	36	115		2%	1		Fail-10%	Fail-10%	Pass-10%
Maryland	Moderate	32	120		5%	3		Fail-10%	Fail-10%	Pass-10%
Oregon	Moderate	32	86		6%	0		Fail-10%	Fail-10%	Fail-10%
New Mexico	Moderate	31	198		3%	0		Fail-10%	Fail-10%	Fail-10%
New Jersey	Moderate	29	227		1%	4		Fail-10%	Fail-10%	Pass-10%
Massachusetts	Moderate	29	126		2%	3		Fail-10%	Fail-10%	Pass-10%
Connecticut	Moderate	27	196		2%	2		Fail-10%	Fail-10%	Pass-10%
Washington D.C.	Moderate	18	198		3%	3		Fail-10%	Fail-10%	Pass-10%
California	Major	39	162		4%	3		Fail-10%	Fail-10%	Pass-10%
New York	Major	32	328		1%	3		Fail-10%	Pass-10%	Pass-10%

Source: Nephron Research analysis of The COVID Tracking Project, CDC Reopening Guidance, State Reopening Data obtained from <https://nyti.ms/2Ywoj1j>

### Initial Efforts to Determine Prevalence

*Given testing limitations, identifying prevalence in populations and geographies is key to slowing the spread*

Given the lack of testing to date, tests have been focused on those who were already symptomatic tests to evaluate prevalence in the broader population have only begun to be conducted. Several state and county public health department have announced plans to test randomly selected residents using antibody tests. These efforts will help discover how many people have actually been infected, recovered and developed immunity to the virus. The answer to that question carries hefty ramifications for health officials – both at the state and national level – considering how to keep the public safe and restart economic activity.

**Recent Development:** *The CDC will conduct an antibody study extending across 25 cities and 18 months*

- In mid-May, the CDC announced plans to launch a study in June or July to test samples from blood donors in 25 cities for antibodies. The study is expected to extend over 18-months with 1,000 donors in each of the cities being tested each month during this period and a second group of 1,000 donors tested at the 18-mo mark in each city. The study should help to expand knowledge of the prevalence of the virus as well as whether the immune response wanes over time. One critique of the study is that those who donate blood tend to be healthy.
- On April 22<sup>nd</sup>, NY Gov Cuomo shared preliminary results of a random antibody test of 3,000 people conducted by public health authorities that could imply roughly 20% of New Yorker City residents currently possess COVID-19 antibodies. The study of 3,000 included 1,300 New York City residents of which 21% tested positive as compared to 17% on Long Island and 12% in Westchester. The results were preliminary and the extent to which the tests taken at grocery and big-box stores is representative of the broader public is a major question. While more study is required, antibody testing will be a key measure in determining when to reopen the state alongside hospital utilization and test capacity.
- On April 20<sup>th</sup> we learned the results of the L.A. county study which found 4.1% (range of 2.8% to 5.6%) of adults tested positive for coronavirus antibodies, suggesting the rate of infection may be 40 times higher than the number of confirmed cases. The antibody tests indicate the death rate from the pandemic could be lower than currently thought but also suggests that the virus is being spread by patients that are asymptomatic. While researchers used a random sample of residents the opt in of the nature has led to a fair amount of criticism and we caution that the results should be ready as a single directional data point that is not so far off from what we have seen in other countries with more rigorous methods).
- A study conducted by Stanford University in Santa Clara County tested 3,330 volunteers for antibodies. The study found that just 1.5% of these volunteers were positive and an adjusted measure accounting for population bias suggested prevalence of 2.5-4%. Again the methods of the study have been criticized and given shortcomings should only be viewed as a directional data point in our view.
- A preliminary scientific study performed in Indiana suggest COVID 19 prevalence of 2.8%. The study tested more than 4,600 people between April 25 and May 1 for viral infections and antibodies. Of this total, more than 3,600 were randomly selected, and an additional 900 volunteered from African American and Hispanic communities. The study found that 1.7% of people tested positive for the coronavirus, while an additional 1.1% screened for antibodies, suggesting population prevalence of 2.8%. Other important findings included: **1)** The infection-fatality rate in Indiana is now estimated to be 0.58%, **2)** Of the people who tested positive, 45% reported no symptoms.

### State Testing Threshold: Healthcare Facility & Worker Capacity

**HEALTHCARE FACILITY & WORKER CAPACITY:** *Ability to care for all patients, surge capacity, ability to test at-risk healthcare workers*

**MEASURE:** Percentage of hospitals that can handle doubling of patient volume within 24-hours with sufficient PPE, percentage of hospitals that can care for all patients without using crisis standards of care, percentage facilities with testing program for workers.

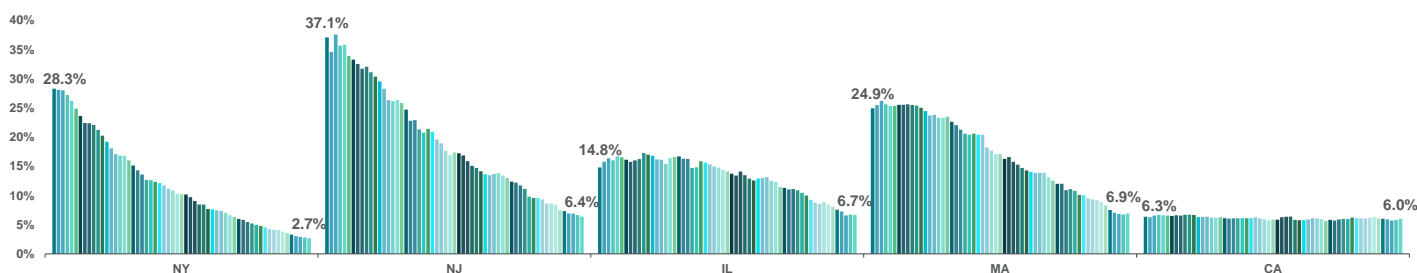
While state-level data on capacity is limited, we have tracked the number of current COVID-19 related-hospitalizations across the top 5 states with the most cases. We plot the number of current hospitalizations against total bed capacity (at the state level), to evaluate COVID-19's impact on



hospital capacity across the hardest hit states. As can be seen below, New York and New Jersey have both seen material, sustained declines in COVID-19 hospitalizations. On April 19<sup>th</sup>, New York had ~16.2K active COVID-19 hospitalizations, representing 28.3% of the state's total bed capacity. Bed capacity utilization has since declined 2,560bps to 2.7% as of June 16<sup>th</sup>. New Jersey has seen an even larger decline, with COVID-19 hospitalizations occupying 37.1% of the state's bed capacity on April 19<sup>th</sup>, compared to 6.4% on June 16<sup>th</sup> (a decrease of ~3,070bps). Over the same time frame, Massachusetts has had a slightly less pronounced decline in utilization, with 24.9% of beds occupied by COVID-19 patients on April 19<sup>th</sup>, compared to 6.9% on June 16<sup>th</sup> (a decrease of ~1,810bps).

In contrast, bed utilization has remained relatively flat in Illinois and California. On April 19<sup>th</sup>, Illinois reported approximately 4.3K COVID-related hospitalizations (~14.8% of beds). On June 16<sup>th</sup>, approximately 1.9K COVID-19 patients were hospitalized, representing 6.7% of the state's total hospital beds. California's capacity utilization has also remained relatively static, with 6.3% of beds occupied by COVID-19 patients on April 19<sup>th</sup>, compared to 6.0% as of June 16<sup>th</sup>.

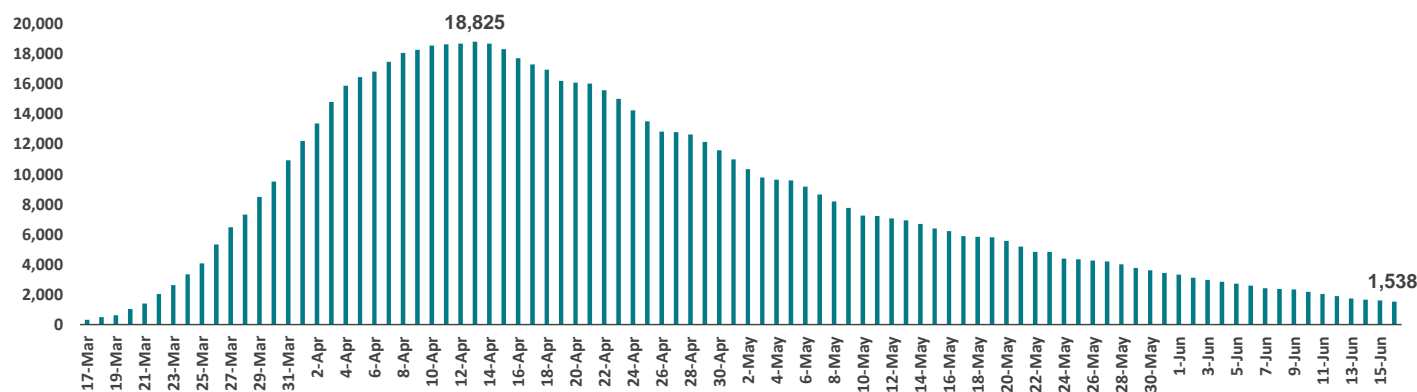
**Fig. 25: Current COVID-19 Hospitalizations as % of State Hospital Beds, April 19<sup>th</sup> – June 16<sup>th</sup>**



Source: Nephron Research analysis of state health department websites

Given the size of New York's outbreak, we take a closer look at the progression of active coronavirus hospitalizations in the state below. As corroborated by the previous analysis, there has been a clear stabilization and decline in net new hospitalizations in New York since early April. The number of individuals within the New York hospital system declined each day from April 13<sup>th</sup> to June 16<sup>th</sup>. As of June 16<sup>th</sup>, there were 1.5K hospitalizations within the state, down from a high of 18.8K on April 13<sup>th</sup>.

**Fig. 26: Total Hospitalizations, New York State**



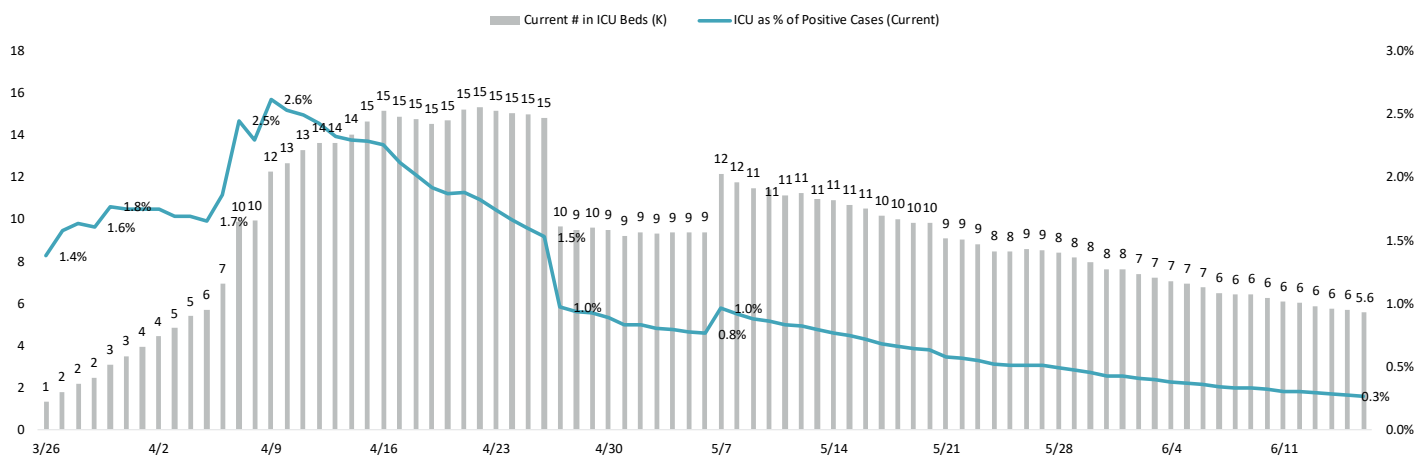
Source: Nephron Research analysis of New York Department of Health

*We are tracking ICU hospitalization rates – with ~0.3% utilization rate among positive cases*

We next track current COVID ICU bed counts. This is important to monitor as we track national demand in the US for the limited set of ICU beds. Based on the data so far, there are ~5.6K ICU beds that are currently in use, which is down 2.3% from the prior day. Based on the current ICU bed

utilization, the ICU rate (the % of positive cases that are now in ICU) is now 0.3% in the US, flat from the prior day.

**Fig. 27: US ICU Patient Count vs ICU Count as a % of Positive Cases**



Source: Nephron Research analysis of The COVID Tracking Project

*The following dashboard monitors state-level inpatient and ICU capacity metrics required for progressing through the three phases of reopening.*

The following dashboard monitors state-level inpatient and ICU capacity metrics required for progressing through the three phases of reopening. To qualify for Phase 1, the CDC recommends that states have less than 80% utilization of both their inpatient and ICU beds. For Phase 2, this threshold moves down to below 75% utilization. Finally, states qualifying for Phase 3 have inpatient and ICU utilization of below 70%. State-level inpatient and ICU utilization is taken from the National Healthcare Safety Network (NHSN), which is referenced by the White House Coronavirus Task Force, the CDC, FEMA, CMS, and state and local health departments. In late May, NHSN's COVID module was updated to reflect a trailing 7-day average of estimated capacity utilization within each state. Previously, the NHSN reflected spot utilization data for only those facilities that reported data (a little more than half the nation's acute care and critical access hospitals). This change will make the NHSN's data more representative of all facilities within a state, while also smoothing out inconsistencies d/d.

As of June 16<sup>th</sup>, a total of 44 states qualify for Phase 3 on the basis of inpatient and ICU utilization (up from 37 previously). This includes New York, New Jersey, California, Illinois, and Massachusetts (the five states with the most recorded cases). Of the states currently qualifying for Phase 3, 14 have seen an increase in inpatient COVID utilization over the two weeks. Five states (AR, MS, TN, WV, and MA) and D.C. have inpatient or ICU utilization above 67.0%, which is relatively close to the 70% cut-off for Phase 3.

In total, 4 states currently qualify for Phase 2 on the basis of inpatient and ICU utilization. Within this group, NV has seen a measurable improvement in COVID-related inpatient utilization over the past 2 weeks (i.e. moving towards Phase 3), while AZ and GA have seen a deterioration. Two states (AL and MD) now qualify for the first phase of re-opening (up from 1 previously). Over the past 14 days, MD has seen COVID inpatient utilization develop favorably, whereas AL has seen higher utilization. Finally, RI is the only state that does not currently qualify for Phase 1 of reopening. However, the state has seen an improvement in COVID-related inpatient utilization over the past two weeks.

In terms of notable changes, we note that D.C. improved to Phase 3 eligibility, while Maryland advanced into Phase 1. Previously, both states had not qualified for any phase of re-opening. In terms of other improvements, TN, MS, SC, WA, MA, and NM all improved from Phase 2 into Phase 3, while

WV from Phase 1 into Phase 3. In contrast, FL dropped from Phase 3 into Phase 2, while AL fell from Phase 2 into Phase 1.

**Fig. 28: Nephron Research Hospitalization Dashboard**

State	Total Inpatient Utilization	Total ICU Utilization	CDC Utilization Threshold	Days Since First Opened	Inpatient COVID Utilization	Net New COVID Admissions per 100K (7-Day Avg)	14-Day Trend (slope)	COVID Bed Utilization (Past 14 Days)
Rhode Island	81.8%	72.0%	Fail/Phase 1	38	5.3%	-0.2	-0.032	
Alabama	68.3%	78.7%	Pass/Phase 1	47	4.2%	0.0	+0.008	
Maryland	78.3%	72.1%	Pass/Phase 1	32	6.9%	-0.5	-0.035	
Arizona	65.6%	72.1%	Pass/Phase 2	43	11.2%	0.5	+0.022	
Georgia	63.9%	72.6%	Pass/Phase 2	53	3.9%	0.1	+0.006	
Nevada	70.1%	69.8%	Pass/Phase 2	46	6.1%	0.0	-0.004	
Florida	63.8%	74.3%	Pass/Phase 2	43	N/A	N/A		
Montana	49.0%	48.6%	Pass/Phase 3	51	0.4%	0.0	+0.195	
Alaska	57.3%	59.8%	Pass/Phase 3	53	1.8%	0.2	+0.062	
Arkansas	50.2%	68.1%	Pass/Phase 3	43	2.7%	0.2	+0.039	
Utah	49.9%	56.7%	Pass/Phase 3	46	5.9%	0.2	+0.032	
Texas	61.5%	62.4%	Pass/Phase 3	46	4.3%	0.2	+0.031	
Wyoming	42.2%	48.8%	Pass/Phase 3	46	0.6%	0.0	+0.026	
South Carolina	65.5%	66.2%	Pass/Phase 3	57	4.9%	0.1	+0.017	
Vermont	57.8%	44.1%	Pass/Phase 3	33	1.4%	-0.1	+0.017	
North Carolina	65.5%	61.7%	Pass/Phase 3	39	3.6%	0.1	+0.016	
Oregon	58.8%	61.9%	Pass/Phase 3	32	2.3%	0.0	+0.012	
Mississippi	63.3%	69.3%	Pass/Phase 3	50	6.6%	0.3	+0.011	
Oklahoma	50.3%	64.0%	Pass/Phase 3	53	1.7%	0.1	+0.004	
South Dakota	47.6%	57.8%	Pass/Phase 3	49	3.4%	0.0	+0.003	
North Dakota	43.9%	32.2%	Pass/Phase 3	46	1.3%	-0.1	+0.001	
Tennessee	60.4%	69.1%	Pass/Phase 3	50	2.7%	-0.3	-0.001	
California	60.8%	62.9%	Pass/Phase 3	39	6.0%	0.0	-0.003	
New Mexico	65.0%	56.3%	Pass/Phase 3	31	4.1%	-0.1	-0.003	
West Virginia	63.9%	69.3%	Pass/Phase 3	43	0.4%	0.0	-0.006	
Missouri	56.4%	59.9%	Pass/Phase 3	43	3.1%	0.0	-0.006	
Louisiana	60.7%	58.2%	Pass/Phase 3	32	3.9%	0.1	-0.007	
Indiana	54.1%	61.5%	Pass/Phase 3	50	5.4%	0.0	-0.010	
Michigan	57.4%	60.6%	Pass/Phase 3	25	2.4%	-0.1	-0.014	
Washington	60.5%	57.7%	Pass/Phase 3	42	2.3%	0.1	-0.015	
Nebraska	54.4%	61.4%	Pass/Phase 3	43	3.8%	-0.1	-0.018	
Kentucky	55.9%	60.0%	Pass/Phase 3	36	2.9%	-0.4	-0.020	
Colorado	56.7%	65.1%	Pass/Phase 3	50	3.4%	-0.1	-0.023	
Maine	64.0%	53.0%	Pass/Phase 3	46	1.0%	0.0	-0.023	
New Hampshire	57.6%	47.0%	Pass/Phase 3	36	3.0%	-0.1	-0.023	
Ohio	54.0%	39.2%	Pass/Phase 3	35	2.0%	-0.1	-0.026	
Virginia	52.8%	58.5%	Pass/Phase 3	31	5.1%	-0.4	-0.029	
Minnesota	55.3%	62.9%	Pass/Phase 3	29	3.4%	-0.2	-0.031	
Pennsylvania	64.9%	62.0%	Pass/Phase 3	39	2.3%	-0.3	-0.034	
Washington D.C.	69.2%	69.8%	Pass/Phase 3	18	9.1%	-1.3	-0.037	
Delaware	62.2%	52.6%	Pass/Phase 3	39	4.2%	-0.3	-0.038	
Illinois	55.8%	51.1%	Pass/Phase 3	46	6.7%	-0.7	-0.039	
New Jersey	56.5%	40.5%	Pass/Phase 3	29	6.4%	-0.7	-0.040	
Iowa	48.2%	48.8%	Pass/Phase 3	46	3.1%	-0.3	-0.041	
Massachusetts	69.5%	67.1%	Pass/Phase 3	29	6.9%	-0.7	-0.042	
New York	64.8%	50.7%	Pass/Phase 3	32	2.7%	-0.6	-0.053	
Connecticut	54.3%	55.1%	Pass/Phase 3	27	2.3%	-0.4	-0.056	
Wisconsin	47.0%	41.4%	Pass/Phase 3	50	2.5%	-0.6	-0.067	
Hawaii	59.5%	63.5%	Pass/Phase 3	40	N/A	N/A		
Idaho	43.3%	48.8%	Pass/Phase 3	46	N/A	N/A		
Kansas	46.8%	50.8%	Pass/Phase 3	43	N/A	N/A		

Source: Nephron Research analysis of the COVID Tracking Project and data from the CDC

**We have not found a consistent data source on the percentage of hospitals that have access to adequate PP&E.** The specific PPE measure for this threshold is the percentage of hospitals that can handle doubling of patient volume within 24-hours with sufficient PPE. Our best sources of information

have been direct hospital interviews and commentary from GPO Premier Inc and the medical distributors. Relative to prior to the COVID-19 pandemic, swab orders are running 20x the normal rate while masks are up 10x, and many incremental PPE categories are up 3-5x. **The 'get healthy' dates on which supply is expected to meet demand are currently targeted for July though augmented supply and volumes from project Air Bridge may enable distributors to meet demand in late May or June.**

## Vaccine Tracker

*Our vaccine tracker profiles the 10 candidates currently in clinical trials*

The threshold metrics outlined above will remain important until such time as therapies are developed that limit the impact of coronavirus to something approximating the impact of the annual flu season or more likely, until a vaccine is developed. The following *Vaccine Tracker* provides important context on vaccine developers, platforms, timing and production.

As of June 17, there are 11 candidate vaccines to treat COVID-19 in the clinical stage of evaluation and 138 candidate vaccines in the preclinical stage. Within the U.S, leading candidates include University of Oxford/AstraZeneca's AZD1222 and Moderna's mRNA-1273, both of which received funding from Operation Warp Speed. Other candidates selected by Operation Warp Speed include Pfizer/BioNTech's BNT162, Johnson & Johnson's Ad26, and a Merck vaccine based on the company's Ebola vaccine. Novavax's vaccine received a contract from the DoD on 06/04. **AZD1222 entered phase 2b/3 testing in the UK on 05/22, making it the most advanced of the 10 candidates globally, and Moderna's vaccine started phase 2 trials on 05/29.**

## Daily Call Outs

- VacEquity Global Health, a joint venture with Imperial College London, enters phase 1/2 trials for their COVID-19 vaccine. This brings the total number of vaccines in clinical trials to 11 globally.
- The U.S government said on Tuesday that they expect insurers to cover the COVID-19 vaccine without copays once it becomes available, so that patients can receive the vaccine at no cost. Previously, the industry had made a commitment to cover testing for COVID-19 without charging copays.

**Fig. 29: Vaccine Candidates in Clinical Trials: U.S.**

United States								
Developer	Vaccine Candidate	Platform Description	Preclinical	1	2	3	4	Manufacturing Goal & Target
<b>Moderna</b> NIAID	mRNA-1273	RNA		FDA Fast-Track Approval May 12	Started May	July (Target)		1B doses/year Emergency authorization in the fall  o6/03 – Operation Warp Speed candidate
<b>BioNTech</b> Pfizer (Global) Fosun Pharmaceuticals (China)	BNT162 3 mRNA candidates	RNA		Phase 1/2 Started April				100M doses in 2021 Emergency authorization in October  o6/03 – Operation Warp Speed candidate
<b>Novavax</b> Emergent BioSolutions – Manufacturer	NVX-CoV2373	Non-Replicating Viral Vector – Subunit; Recombinant Baculovirus; insect origin + Matrix M adjuvant		Phase 1/2 Started May				100M doses by end of 2020; 1B doses by 2021  o6/04 – DoD contract up to \$60M for 10M doses
<b>Inovio Pharmaceuticals</b> Richter-Helm BioLogics – Manufacturer	INO-4800	DNA plasmid with electroporation device (CELECTRA)		Started April	Phase 2/3 July/August (Target)			1M doses in 2020
<b>Johnson &amp; Johnson</b>	Ad26	Non-Replicating Viral Vector – Subunit; Recombinant Adenovirus	Candidate finalized March	July (Target)		September (Target)		100M doses by 2Q of 2021; 1B doses by end of 2021  o6/03 – Operation Warp Speed candidate
<b>Merck &amp; Co.</b> IAVI	No name announced	Replicating viral vector – Live, attenuated recombinant vesicular stomatitis virus (VSV)	Current development	2 <sup>nd</sup> half of 2020 (Target)				05/26 – Received 38M BARDA funding  o6/03 – Operation Warp Speed candidate
<b>Translate Bio</b> Sanofi Pasteur	No name announced	RNA	Started February	2 <sup>nd</sup> half of 2020 (Target)				500M-1B doses by 2021
<b>Sanofi Pasteur</b> <b>GlaxoSmithKline</b>	No name announced	Non-Replicating Viral Vector – Subunit; Recombinant Baculovirus + adjuvant	Started April	2 <sup>nd</sup> half of 2020 (Target)				>1B doses by 2021
<b>Vaxart</b> Emergent BioSolutions Kindred BioSciences Manufacturer	No name announced	Non-Replicating Viral Vector – Oral vaccine platform	Candidate finalized May	Summer (Target)				No information available but aiming for mass production.

Source: Nephron Research analysis of data from the World Health Organization, Regulatory Affairs Professionals Society, STAT News, and company releases

Note: In an effort to shorten the timeline of clinical trials for COVID-19 vaccines, many candidates have entered combined trials (phase 1/2; 3/4), as highlighted in the chart.

**Fig. 30: Vaccine Candidates in Clinical Trials: Europe**

United Kingdom								
Developer	Vaccine Candidate	Platform Description	Preclinical	1	2	3	4	Manufacturing Goal & Target
University of Oxford AstraZeneca <i>Lonza – Manufacturer</i>	AZD1222 <i>Formerly</i> ChADOx1 nCoV-19	Non-Replicating Viral Vector – Attenuated Adenovirus; Chimpanzee Origin		Phase 1/2 Started April		Phase 2b/3 Started May  Phase 3 August (Target)		30M doses by September for the UK; 100M doses by the end of 2020  05/21 - Operation Warp Speed \$1.2B investment; 100M doses by Nov., 300M doses by Jan. 2021 for the U.S  06/04 – 2B dose target from 2 deals backed by WHO
VacEquity Global Health Imperial College London Morningside Ventures	No name announced	Self-amplifying RNA (saRNA)		Phase 1/2 Started June				No information. Distribution will favour Britain and low- to mid-income countries.

Source: Nephron Research analysis of data from the World Health Organization, Regulatory Affairs Professionals Society, STAT News, and company releases

Note: In an effort to shorten the timeline of clinical trials for COVID-19 vaccines, many candidates have entered combined trials (phase 1/2; 3/4), as highlighted in the chart.

**Fig. 31: Vaccine Candidates in Clinical Trials: China**

China								
Developer	Vaccine Candidate	Platform Description	Preclinical	1	2	3	4	Manufacturing Goal & Target
CanSino Biologics Beijing Institute of Biotechnology	Ad5-nCoV	Non-Replicating Viral Vector – Subunit; Recombinant Adenovirus		Started March	Started April 12* <small>*1<sup>st</sup> vaccine to start phase 2 in the world</small>	Early Summer (Target)		70-80M doses/year
Sinopharm Wuhan Institute of Biological Products	No name announced	Non-Replicating Viral Vector - Inactivated SARS-CoV-2		Phase 1/2 Started May				No information
Sinopharm Beijing Institute of Biological Products	BBIBP-CorV	Non-Replicating Viral Vector – Inactivated SARS-CoV-2		Phase 1/2 Started April				200M doses/year
Sinovac	PiCoVacc	Non-Replicating Viral Vector – Inactivated SARS-CoV-2 + Alum Adjuvant		Phase 1/2 Started April				200M doses/year
Institute of Medical Biology, Chinese Academy of Medical Sciences	No name announced	Non-Replicating Viral Vector – Inactivated		Started May				No information

Source: Nephron Research analysis of data from the World Health Organization, Regulatory Affairs Professionals Society, STAT News, and company releases

Note: In an effort to shorten the timeline of clinical trials for COVID-19 vaccines, many candidates have entered combined trials (phase 1/2; 3/4), as highlighted in the chart.

## Four Key Vaccine Questions

1. **When will we have it?** Despite clear efforts to expedite the research, testing, and licensing of a coronavirus vaccine by the U.S government, estimates of timing for a readily available vaccine vary greatly. **Assuming that the leading vaccine candidates are granted emergency use authorization at target date (The University of Oxford/AstraZeneca and Moderna as early as September, BioNTech and Pfizer in October), we may see initial availability for healthcare workers and other high-risk groups this fall.**
2. **Will we have enough?** Given the global impact of COVID-19, it is expected that more than 1 vaccine will be required to address the pandemic and that production must begin well before approval is granted. The Gate's Foundation is providing funds to build factories for 7 coronavirus vaccine candidates, even before a clear winner has emerged. **Former FDA Commissioner Scott Gottlieb captured the prevailing wisdom when he stated It's very hard to get to the point where you're manufacturing at high, high quantities, "I would say that's probably more likely a 2021 event that we're going to have the vaccine available in sufficient quantities to mass inoculate the population." IFPMA Director Thomas Cueni estimated that the world would need some 15B doses to stop the virus, posing significant logistical challenges. Johnson and Johnson's Vice Chairman and Chief Scientific Officer, Paul Stoffels, estimates that about 5-10 vaccines would be needed to meet the initial demand.**
3. **Will it work?** While the enthusiasm around new technologies like Moderna and Pfizer/BioNTech's mRNA vaccines is understandable, it is important to note that the efficacy of these platforms is not well established. Rather, **products with the highest likelihood of success are often those with proven technologies that have a demonstrated safety profile. In the race for a vaccine against COVID-19, the tradeoff is speed vs. probability of success.** The hare to Moderna and Pfizer's tortoises may be Sanofi and GlaxoSmithKline's COVID-19 vaccine utilizing a combination of proven vaccine technology from the two companies which is targeted to be ready by the second half of 2021. Timeline to market is slower, but probability of success is arguably higher. The University of Oxford/AstraZeneca's AZD1222 is uniquely positioned as a proven technology with a twist. **Operation Warp Speed's final five candidates skewed towards novel platforms, with the exception of J&J's AD26.**
4. **And what of Operation Warp Speed?** Operation Warp Speed is a project organized by the Trump administration to accelerate the development and rollout of a **COVID-19 vaccine, with a target of 100M doses by November and 300M doses by January 2021.** The project is jointly overseen by the Department of Health and Human Services and the Department of Defense (DoD). While infectious disease research is supported by the military, DoD's lead in this project is unexpected.
  - On 06/03, the Trump administration announced that it has **selected five companies as the most likely candidates to produce a vaccine for COVID-19. Outside of the University of Oxford/AstraZeneca's AZD1222, the other 4 candidates are: Moderna's mRNA1273, Pfizer/BioNTech's BNT162, J&J's Ad26, a Merck vaccine based on the company's Ebola vaccine.**
  - On 06/04, former FDA chief Scott Gottlieb pointed out that the absence of Sanofi/GSK's candidate and Novavax surprised him. "There's no sort of old-style technology in this mix," Gottlieb said. "I'm surprised that either Sanofi or Novavax, someone who is developing [a vaccine using] an older approach ... wasn't selected. If you want to spread your bets, you probably want to spread your bets across different platforms."



## COVID-19 Drug Therapy Tracker

In this section, we attempt to provide an overview of drug therapy for treatment of COVID-19 that is accessible to generalist investors and supply chain industry participants who lack a background in biology. Note that this *Therapy Tracker* is separate and distinct from our *Vaccine Tracker*, the detailed version of which was published in the COVID-19 Daily Tracker for June 8<sup>th</sup>.

### Overview

**Drug therapy for COVID-19 can be broadly divided into two categories: 1) treatments that target SARS-CoV-2 (antivirals) and 2) treatments that manage the complications associated with COVID-19. The drugs that have received the most coverage for COVID-19, remdesivir, hydroxychloroquine, and chloroquine, have antiviral properties.**

Many people with COVID-19 may be asymptomatic, or exhibit symptoms that are mild and manageable at home. However, some people, especially those with risk factors such as diabetes and heart disease, may develop life-threatening complications that lead to multi-organ failure and death. Core processes that lead to these complications are:

- **Hyper-inflammation (cytokine storm)** – The immune system becomes dysregulated and starts attacking multiple organs, namely the lungs, kidneys, and the heart.
- **Hyper-coagulation (increased clotting)** – The immune system becomes dysregulated and starts damaging blood vessels, leading to blood clots that impair blood flow.
- **Severe hypoxemia (low blood oxygen levels)** – Inflammation of the lungs, coupled with blood clots in circulation, severely impairs the body's ability to absorb oxygen, leading to respiratory failure.

Drug therapies that have been used to manage complications associated with COVID-19 to date have included:

- **Immune therapies** - To reduce inflammation.
- **Anti-thrombotics** - To reduce or destroy blood clots.

### Daily Call Outs

- **As the FDA revoked malaria drugs, HCQ and CQ, for emergency use authorization on Monday, dexamethasone—a cheap and readily available steroid drug—takes the lead for traditionally available drugs.** Preliminary trial data released on Tuesday shows that dexamethasone may reduce deaths in patients hospitalized with severe COVID-19 at a ratio of 1:8, meaning that for every 8 ventilated patients, using the drug may save 1 life.
  - Dexamethasone is the first drug to show survival benefits for COVID-19; in contrast, remdesivir has only shown benefits in reducing recovery time for patients hospitalized with COVID-19.
    - The U.K. government's chief scientist, Patrick Vallance, called the result "tremendous news" and a "ground-breaking development in [our] fight against the disease." Former FDA commissioner, Scott Gottlieb, called this a "very positive finding...although it needs to be validated, it certainly suggests that this could be beneficial in this setting."
  - WHO plans to update COVID-19 treatment guidelines to reflect the results of this study with dexamethasone. While cheap and readily available, dexamethasone is also used for a variety of conditions and we may see downward pressure on the supply chain.

### Three Key Therapy Questions

**1. When will we have it (an effective therapy/therapies) and will it work?** Gilead's remdesivir received emergency use authorization on 05/01 and Russia approved Avigan, their first COVID-19 drug, on 05/31. At present, COVID-19 therapeutics appear to be a trade-off between old, widely available medications with theoretical benefits (e.g. HCQ, CQ), and new medications that are currently being developed (e.g. biologics like Actemra and antibody therapy). It is arguably much easier to run a therapy clinical trial than a vaccine clinical trial (even an expedited trial), so we should expect more therapy candidates for COVID-19 therapy moving forward while we wait for a potential vaccine.

- Another way of putting our views on remdesivir and Avigan in perspective is that we expect we are just scratching the surface relative to the potential for development of treatments for the virus.
- With the widespread speculation and increasing evidence that COVID-19 may be as much a vascular disease as a respiratory disease, antivirals may not prove to be the most effective treatments for COVID-19.
- Antibody therapy against COVID-19 could also change the way COVID-19 patients are cared for – more on this below.

**2. Will we have enough?** We have already seen supply issues with HCQ despite conflicting evidence and access to remdesivir has already proven contentious between countries (and between states here in the U.S). Beyond identifying efficacious treatments, all actors must also take action to expand production.

- **On 06/08, US Department of Health and Human Services said that their last shipment of remdesivir will go out week of June 29.** While Gilead Sciences, who is manufacturing remdesivir, is ramping up production, it is unclear how much will be made available this summer. Gilead has given a general range of product delivery for July and August, which should then significantly expand starting September, October, and through the fall with 500k treatment courses available Oct and another million by Dec.

**3. Drug supply chain and patient implications?** Many of the drugs used to treat COVID-19 are traditionally used to treat rheumatologic disorders like RA and lupus (e.g. HCQ, Actemra). **Shortages of these drugs may lead to access issues for current patients and an increase in demand for more expensive therapies with potential implications for formulary and trend.**

- **Other examples of shifting demand are visible in the antithrombotics being used in hospitalized patients with COVID-19** (at all levels of disease severity), in addition to the outpatient/home setting which could result in pressure as elective procedures return given that these drugs which prevent blood clots are also standard of care for almost all hospitalized patients (COVID and non-COVID).
- **Inhalers are also experiencing shortages.** On April 8<sup>th</sup> the FDA approved the the first generic version of Proventil (albuterol) HFA MDI in response to COVID-19 related shortages for asthmatics (note: not a steroid but used to open up airways to help with breathing).

**Fig. 32: Current COVID-19 Treatment Options**

Drug Therapy	Prevention <i>Pre-Exposure Prophylaxis</i>	Treatment					Route of Administration
		Virus	Complications			Critical Support	
			Hyper-Inflammation Cytokine Storm	Severe Hypoxemia Low Blood Oxygen Levels	Hyper- Coagulability Increased Clotting		
Traditional medications; anti-malarials, antibiotics (azithromycin), antiparasitic, anti-inflammatory (colchicine)							
Hydroxychloroquine (Plaquenil) <i>Sanofi, Novartis, Generics</i>							Oral <i>Tablet</i>
Chloroquine (Aralen) <i>Bayer, Novartis, Generics</i>							Oral <i>Tablet</i>
Hydroxychloroquine + Azithromycin							<u>Azithromycin</u> Oral <i>Tablet and Liquid</i> IV Infusion
Ivermectin (Stromectol) <i>Merck, Generics</i>							Oral <i>Tablet</i>
Colchicine <i>Takeda, Generics</i>							Oral <i>Tablet</i>
Immune-based therapy; biologics (IL-1 and IL-6 inhibitors)							
Tocilizumab (Actemra) – IL6 Inhibitor <i>Roche</i>							IV Infusion Subcutaneous
Siltuximab (Sylvant) – IL6 Inhibitor <i>Janssen</i>							IV Infusion
Sarilumab (Kevzara) – IL6 Inhibitor <i>Sanofi &amp; Regeneron</i>							Subcutaneous
Anakinra (Kineret) – IL1 Inhibitor <i>Swedish Orphan Biovitrum</i>							Subcutaneous
Interferons Interferon-Beta, Interferon-Alfa							Intramuscular Subcutaneous *Varies
Baricitinib (Olmiant) – JK Inhibitor <i>Eli Lilly</i>							Oral <i>Tablet</i>
Immunomodulators: corticosteroids							
Corticosteroids Predisone, methylprednisolone, dexamethasone, hydrocortisone							Oral <i>Tablet and Liquid</i> Intramuscular IV Infusion *Varies

Legend	
	Evidence of clinical benefit
	Insufficient clinical evidence supporting for or against their use and/or trial on-going. Currently explored as an option for treatment.
	Not recommended for COVID-19 outside of clinical trials, or have demonstrated negative clinical trial data.
	No indication

Source: Nephron Research Analysis of data from NIH COVID-19 Treatment Guidelines and EVMS COVID-19 Management Protocol

**Fig. 33: Current COVID-19 Treatment Options (continued)**

Drug Therapy	Prevention <i>Pre-Exposure Prophylaxis</i>	Treatment					Route of Administration
		Virus	Complications			Critical Support	
			Hyper-Inflammation Cytokine Storm	Severe Hypoxemia Low Blood Oxygen Levels	Hyper-Coagulability Increased Clotting		
Antivirals							
Remdesivir <i>Gilead</i>							IV Infusion
Lopinavir-Ritonavir (Kaletra) <i>AbbVie</i>							Oral <i>Tablet and Liquid</i>
Darunavir(Prezista) <i>AbbVie</i>							Oral <i>Liquid</i>
Ribavirin (Moderiba) <i>AbbVie</i>							Oral <i>Capsule and Liquid</i>
Favipiravir (Avigan) <i>Fujifilm</i> <i>*Japan, not available in North America</i>							Oral <i>Tablet</i>
Statins, ACE Inhibitors							
Statins Simvastatin (Zocor), Atorvastatin (Lipitor)							Oral <i>Tablet</i>
ACE Inhibitors Ramipril (Altace)							Oral <i>Tablet and Capsule</i>
Immune-based therapy: convalescent plasma and immune globulins6. Immune-based therapy: convalescent plasma and immune globulins							
COVID-19 Convalescent Plasma							IV Transfusion
SARS-CoV-2 Immune Globulins							IV Transfusion
Antithrombotics (clot busting drugs)							
Low Molecular Weight Heparin Lovenox, Fragmin, Innohep							Subcutaneous
Tissue Plasminogen Activator (tPA)							Intravenous Injection
Other							
Ascorbic Acid (Vitamin C)							Oral Intramuscular Subcutaneous IV Injection

Legend	
	Evidence of clinical benefit
	Insufficient clinical evidence supporting for or against their use and/or trial on-going. Currently explored as an option for treatment.
	Not recommended for COVID-19 outside of clinical trials, or have demonstrated negative clinical trial data.
	No indication

Source: Nephron Research Analysis of data from NIH COVID-19 Treatment Guidelines and EVMS COVID-19 Management Protocol

**Fig. 34: Review of COVID-19 Treatments in Clinical Trials**

Drug Therapy	Prevention <i>Pre-Exposure Prophylaxis</i>	Treatment		Critical Support	Clinical Trial Phase			
		Virus	Complications		1	2	3	4
Remdesivir <i>Gilead</i>							May 1 Emergency Use Authorization	
Gimsilumab <i>Roivant Sciences</i>								
MultiStem <i>Athersys</i>					Phase 1/2 Started April		Phase 2/3 July (Target)	
EIDD-2801 <i>Ridgeback Biotherapeutics</i>					Started April 10	Target June		
SARS-CoV-2 Antibody <i>Eli Lilly + AbCellera</i>					Started June 1			
CYNK-001 <i>Celularity</i>					April 2 FDA Approval to Start Trial			
TJM2 <i>I-Mab</i>					April 3 FDA Approval to Start Trial			

Source: Nephron Research Analysis of data from World Health Organization, STAT News, and company press releases

## State Reopening Threshold: Public Health System Capacity

**PUBLIC HEALTH SYSTEM CAPACITY:** State ability to safely identify individuals and their contacts who may have been exposed to COVID-19 and prevent transmission

**MEASURE:** Reduction in the percentage of public health agencies with sufficient contact tracers to support case investigation of every COVID-19 positive case within the state. Capacity to contact at least 90% of all elicited contacts.

As testing expands, the focus turns to contact-tracing. We are following efforts to develop contact-tracing via state and local health departments and the application of digital solutions that may help expedite the manual process given the need to potentially track tens of thousands of cases. It is important to recognize that testing will never be adequate, reliable and fast enough to identify all cases in real time. As such, it is important that the U.S. substantially expand state and local health agency tracing capability alongside public health efforts to create studies to determine prevalence and mortality within communities and geographies.

- The Association of State and Territorial Health Officials (ASTHO) estimates at least 100k tracers are needed over the next 4-6 weeks to enable the U.S. to open up, we would need 260k to replicate the level of testing in Wuhan. This compares to ASTHO's estimate that the number of trained disease intervention specialists in U.S. state and territorial health agencies was only 2,200 or 1 in 150k Americans at the start of the pandemic. Former CDC director Tom Freidan has suggested as many as 300k tracers may be needed while a recent bipartisan proposal detailed

Contact-tracing is key to any effort to relax social distancing and reopen the economy

below called for hiring of 180k tracers. Current CDC Director Robert Redfield stated in mid-April that the CDC was discussing with state officials the possibility of enlisting and training workers from the U.S. Census Bureau and volunteers from Peace Corps (7k volunteers) and AmeriCorps we see few signs of coordinated federal action.

- **The CDC estimates the US needs between 30k-100k contact tracers to help contain the next wave of the coronavirus.** CDC Director Robert Redfield told Congress 6/4 that the US needs 30k-100k contact tracers, sizeable relative to current levels, but lower than the 300k former CDC director Tom Frieden or ASTHO estimated.
- **Absent a national response, we are closely tracking state efforts alongside early reports of collaboration in the healthcare and tech industry that could lead to national solutions** (national solutions that unlike China leave it to individuals to opt in). In China, Korea, Singapore and Taiwan we saw successful deployment of cellphone-based apps that utilized location data (and credit card data and surveillance camera footage in the case of Korea) to help accelerate the process of tracing and informing individuals of potential exposure. While these apps proved effective, they clearly raise privacy concerns in the U.S. (as they have in Europe).

**Unfortunately, we lack any solid data on the number of public health workers focused on tracing by state to compare to total case numbers and case trajectory. We continue to look for potential data in this area while sharing several anecdotal data points on efforts to ramp tracing and isolation and digital tracing endeavors.**

- **A bipartisan group of former health officials has proposed a \$46.5bn COVID-19 emergency relief plan to expand national conduct testing, tracing and isolation including the hiring of 180k contact-tracers.** The plan, backed by former FDA commissioners Scott Gottlieb (Trump) and Mark McClellan (Bush), as well as former CMS director Andy Slavitt (Obama) and former Senator Bill Frist was sent to Congress April 27. It would allocate \$12bn towards expanding the current contact tracing workforce by 180,000 people, \$4.5bn for turning vacant hotels into self-isolation facilities, and \$30bn to provide income to those who must social distance. It is not clear yet whether the administration or congress will embrace the proposal, but given the strong backing, we are following the plan closely as the next round of COVID-19 stimulus heats up.
- **Many states have already taken action to expand tracers.** Within **New York**, Gov Cuomo plans to hire 17k contact tracers. The Gov stated that 30 tracers are needed for every 100k people in order to adequately follow the path of the virus. The experience of past viral outbreaks suggests that public health workers typically require several hours over 2-4 days to complete a single case and will average 7 cases per day.
  - On May 8<sup>th</sup> it was reported that in **New York City**, Mayor De Blasio will assemble 1,000 disease tracers who will report to the public hospital system, Health and Hospitals, in partnership with the city Health Department which historically conducts contact tracing. It appears the Health Department will lend experts to Health and Hospitals which as a public benefit corporation can more quickly hire the tracers and enter into contract for housing of those that cannot quarantine at home.
  - In **Washington state** Gov Inslee stated that he expects to have 1,500 workers focused solely on contact tracing by the second week of May, inclusive of 700 existing public health workers and 500 National Guard members. **Michigan** has already trained 2,200 volunteers to conduct contact tracing. **Massachusetts** is working with Partners in Health to recruit 1,000 tracers. **Maryland** plans to add 1,000 workers in support of tracing. **Arkansas** has expanded its contact tracing team from 3 to 150 (despite never having a stay at home order). **North Dakota**

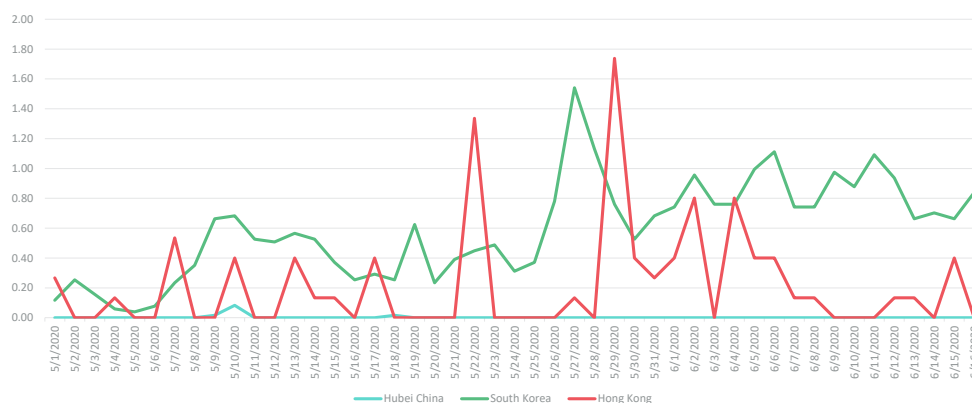
has hired 300 tracers, primarily graduate students earning credit toward masters in public health and plans to expand to 500. **Mississippi** plans to add 20 staff while **Utah** reassigned 30 workers as of mid-April.

*Hong Kong appeared to experience a modest increase in cases after lifting of restrictions*

**Recent activity in Hong Kong demonstrates the importance of post lock down tracing and isolation measures.** Hong Kong was perhaps the country best positioned to respond to COVID-19 given that social distancing became ingrained in society after the SARS epidemic which disproportionately impacted the nation. Swift government action and strict social distancing measures and testing helped limit the spread of COVID-19 in Hong Kong. **Recent data suggests that following the relaxation of work restrictions in March, the number of cases increased with media reports pointing to an influx of expats returning and bringing the virus with them.**

- The experience of Hong Kong, where local health systems are actively tracing the interactions of those who test positive and citizens are submitting to testing and isolation shows us what will be required of the U.S. over the next 18-months (with state and local health departments working in partnership with local health systems).

**Fig. 35: Hong Kong Case Growth per 1mn is not showing the spikes seen by the surge of cases in Singapore**



Source: Nephron Research analysis of Johns Hopkins Center for Systems Science and Engineering COVID data

*It remains to be seen to what extent digital apps will be embraced within the U.S.*

**Given the lack of contact tracing capabilities, digital contact tracing apps could play an important role in limiting the progression of COVID-19 in the U.S. over the next 12-36 months.** In China, Korea, Singapore and Taiwan we saw successful deployment of cellphone-based apps that utilized location data (and credit card data and surveillance camera footage in the case of Korea) to help accelerate the process of tracing and informing individuals of potential exposure. While these apps proved effective, they clearly raise privacy concerns in the U.S. (as they have in Europe) and it is unclear whether the decentralized nature of the U.S. response will render such efforts ineffective.

- **Apple and Google released contact-tracing app software May 20<sup>th</sup>.** Apple Inc. and Google have developed contact-tracing smartphone technology that alerts users if they have come into contact with someone infected with COVID-19 while still preserving privacy. The goal is to provide the groundwork for public health contact-tracing app developers via API that public health organizations can leverage (the API will not be available to private companies). So far, officials from 22 countries and an undisclosed number of US states have received access to the technology.
  - The API will enable apps on the phone to use Bluetooth to determine if the smartphone has come within 30 feet of the phone of someone who later turns out to be infected with COVID-19 (the apps will not track user location or identifying data). Apple and Google have both



stated participation and disclosure of COVID-19 diagnosis will be voluntary due to privacy concerns and that they are preventing governments access to user's health and GPS data. The goal would be for the individual who is alerted to significant exposure (as determined by the app developer) to be tested and isolated - which of course requires that testing is available for this to work – and then share their diagnosis so that others can be alerted.

- State officials in Alabama, North Dakota, and South Carolina have publicly stated plans to adopt the software to release apps soon. While there are significant limitations relating to self-reporting and the fact that COVID-19 can be treated without direct interaction, we view the effort as an important contribution that may help along-side a massive expansion of traditional contact-tracing methods.
- **MIT Safe Paths contact tracing platform.** MIT and Mayo Clinic are working with Facebook and the to create an open source platform that enables jurisdictions and individuals to provide data to public health officials in an anonymized fashion. A phone-based app that collects information using a technique known as differential privacy that can share information publicly without identifying the individuals represented. The app enables individuals to check if they have crossed paths with someone who is later diagnosed positive and allows public health officials to redact individual information when broadcasting location information to protect patients and local businesses.
- **Change Healthcare and Allscripts to contribute to Federal data registry.** On April 9<sup>th</sup>, it was reported that Change Healthcare and Allscripts have committed to donating data to help create a registry of Covid-19 patients by pooling medical records from across the country. The initiative is one of several sources of data the federal government is considering monitoring the spread of coronavirus in the U.S., another person familiar with the matter said. The registry wouldn't include patient names or other identifying details but would include detailed information about their past and current conditions and medications, drawing on data that originates from hospitals, pharmacies and health-insurance companies.
- **LabCorp and Ciox to create data registry for clinical research.** LabCorp and Ciox announced that an agreement to collaborate on a comprehensive U.S.-based COVID-19 patient data registry. This registry will house curated, HIPAA-compliant de-identified data sets to expedite clinical research and analyses related to COVID-19. This patient data registry is expected to enable researchers to better understand and characterize COVID-19 diagnoses and treatments and generate insights that will aid ongoing and future pandemic preparedness and prevention efforts.

## Coverage Universe Commentaries

### Diagnostic Testing

**Commercial lab capacity for diagnostic tests now expanded in excess of 100k+ tests per day.** This expansion has helped to drive testing toward from 1mn tests per week to ~2.0mn+ tests per week, but we are still far from the goal of 5mn tests per week by May. Quest and LabCorp have worked through their backlog and it is now taking Quest 1-2 days to turn around tests (1 day for priority tests). Both Quest and LabCorp are completing about 700k tests a week, or about 42% of the 3.3mn diagnostic tests. However, we say this with caution, as it is unclear if all states are only reporting diagnostic, not serologic, when calculating their total testing levels. The American Clinical Laboratory Association has become increasingly critical of the administration and congress, noting that the clinical labs have excess capacity and stating a need for clear federal goals for testing.

- **FDA clears the way for expanded at-home testing.** On May 7<sup>th</sup>, the FDA responded to a recent study by United Health Group and the Gates Foundation that found self-collection of samples was

*Recent Development: The White House announced new testing goals on April 27<sup>th</sup>*

viable by posting new guidelines allowing companies to develop and market home test kits. The FDA hopes this move will expand capacity and access however it is not clear if test developers will establish contracts with commercial labs or simply provide the test kit and leave it to the consumer to choose a lab and of course for this to work the lab needs to have processing capacity. The Gates Foundation is developing an app that can be used to order the kit and deliver lab results as well as assist with contact tracing.

- **The Trump administration** stated a near term goal to enable each state to test 2% of its population per month on April 27<sup>th</sup> but provided no time frame for achieving this goal of specifics on how the task force will work to address supply chain constraints and lab capacity.
- **Quest** is currently conducting 105k diagnostic tests per day.
- **Lab Corp** is also testing about 105k tests per day, including take home tests. On May 12<sup>th</sup> the company announced expanded availability of its Pixel at home collection test kits beyond healthcare workers to those with COVID-19 symptoms.
- **Walgreens** announced plans to work with Lab Corp to open testing locations in 49 states and Puerto Rico with the ability to test more than 50k per week.
- **CVS Health** announced a plan to have 1,000 testing locations up and running by the end of May with a goal of processing 1.5mn tests per month.
- **Rite Aid** announced May 8<sup>th</sup> that it will significantly expand its COVID-19 testing effort with the addition of 46 no-charge testing sites (total of 71 sites in 12 states), most of which will operate through its stores' drive-through windows, beginning 11-May-20. This will bring total testing capacity to 10,000 tests per day in partnership with BioReference labs.
- **Kroger** announced plans to expand its drive through COVID-19 testing model to 50 locations and perform 100k tests by the end of May (vs 8,000 in 30 locations to date).

## Antibody Testing

An antibody test which identifies the presence of antibodies in blood derived from a simple pin prick could play a key role in determining the true prevalence rate in the population and who is immune to the virus (assuming herd immunity). Such tests detect if a patient has been exposed to the virus, which is different from tests used to diagnose the disease. We see approval and mass production of such tests for clinic and home use as key to enabling the eventual liberalization of shelter-in-place measures. In early April, we began to hear concerns around the accuracy of serology tests that are being used without FDA review under *enforcement discretion policy* adopted by the FDA in March. **At present there are 90 antibody tests on the market but only Cellex and Roche's tests have received government approval and now there is concern that many of these tests may not be accurate.**

- **Antibody test concerns surfaced again on May 13<sup>th</sup> when NYU Langone Health released an initial study of Abbott ID Now that conjectured the test may miss 48% of infections.** The study was preliminary and Abbott has raised objections, but it raises important questions around test quality and reporting (we remain concerned that some labs and hospitals are reporting antibody tests in the diagnostic totals). The Abbott test currently accounts for roughly 15% of the market.
- **The FDA has removed 27 Antibody tests after recently tightening their Policy for Coronavirus Testing Guidance.** The tests were removed either because they did not meet the updated guidance of submitting an EUA request or did not address test issues quick enough.

*Recent Development: Quest and LabCorp are adding and expanding anti-body testing and Roche recently announced FDA EUA for its antibody test*

Following on recent announcements of antibody tests from Abbot, Roche and Cellex, both Quest and LabCorp have begun to perform antibody testing alongside their molecular diagnostic testing. Quest, which is initially utilizing tests from Abbot and EUROIMMUN/PerkinElmer expects to expand from 70,000 antibody tests per day at the end of this week to 150k tests per day by early May with antibody results reported within 1-2 days of collection. LabCorp's capacity now stands at 50,000 antibody tests per day and is expected to increase over the coming weeks and reach 200k per day by mid-May with results reported within 1-3 days. **The hope is that within a month the two clinical labs could be processing 2mn-3mn antibody tests per week.**

- **On May 3<sup>rd</sup> Roche received an FDA emergency use authorization for its new antibody test first announced on April 17<sup>th</sup>.** Shortly after Abbot's announcement in mid-April, Roche announced a high throughput antibody test which received FDA authorization on May 3<sup>rd</sup>. The company now expects to ramp production to 'double-digit' million per month beginning in June (though we note this is a global number whereas Abbot's 20mn goal is within the U.S.) with production reaching 100mn per month by year end.
- **On April 16<sup>th</sup>, Abbot announced it expects to make 4mn antibody tests available on its ARCHITECT system in April ramping to 20mn per month in June. On May 11<sup>th</sup> Abbot announced the availability of a second test on its Alinity I system with 30mn available in May.** These lab-based antibody tests are distinct from the ID NOW rapid molecular point of care diagnostic test discussed above. Both tests utilized the FDA's Emergency Use Authorization pathway. **Abbot now expects to have capacity for 60mn total antibody tests in June.**
- **On April 2<sup>nd</sup>, the FDA approved the first COVID-19 antibody test from Cellex.** Other makers of antibody tests include Becton Dickinson in the U.S. and DiaSorin in Italy.

**On April 14<sup>th</sup>, the FDA approved the first saliva-based coronavirus test under its emergency powers.** The FDA deployed its emergency-use authorization to approve of the test from the Rutgers lab RUCDR Infinite Biologics, informing the university of its approval on Saturday. The new saliva-based test aims to allow for increased testing and safety for health professionals conducting screening and will be available via hospitals and clinics associated with the university with capacity of 10k tests per day. The benefits of the test include safety for those conducting screening as well as lower use of PPE and swabs currently impacted by shortages. While helpful in identifying positives, for now the FDA has directed patients that receive negative results to receive confirmation via a second test.

**On May 16, the FDA issued an EUA to Everlywell for the Everlywell COVID-19 Test Home Collection Kit.** The Everlywell kit allows individuals to self-collect a nasal sample at home and send their swab to either Fulgent Therapeutics or Assurance Scientific Laboratories for test results. Only individuals who have been screened by online questionnaires and had results reviewed by health care providers can participate at this time. The kit is available by prescription only.

## Hospitals

**Given that most states have at least partially reopened, we turn our attention to hospital revenue exposure to states that have been open the longest.** Nearly all states have now at least partially reopened their economies. South Carolina re-opened parts of the economy as early as April 20<sup>th</sup>, followed by Georgia, Alaska and Oklahoma on April 24<sup>th</sup>. Since then we note that 50 states have now partially re-opened (New Jersey is the last state expected to reopen on June 15). **From the hospital perspective, we would like to see higher revenue exposure to states that have re-opened because it means there is a path to a "normal" healthcare environment and lower impact on the economy (assuming they reopen or never went into lockdown).**

Based on states that have re-opened their economy, we estimate that CYH and HCA have the highest acute care revenue exposure to states that have been open the longest (5+ weeks) at 93% and 84%, respectively. This is followed by Universal Health with ~73% of acute care revenues in states that have been re-open for at least 4 weeks.

**Fig. 36: Hospital Acute Care Revenue Exposure to States that have Announced Partial Re-opens**

Plans to Reopen	CYH	UHS	THC	HCA
<b>Sub-Total</b>	<b>\$11,196</b>	<b>\$5,200</b>	<b>\$13,872</b>	<b>\$39,477</b>
% of Acute Care Revenue	100.0%	100.0%	100.0%	100.0%
<b>Open for 2 Weeks or More</b>	<b>\$11,196</b>	<b>\$5,200</b>	<b>\$13,872</b>	<b>\$39,477</b>
% of Acute Care Revenue	100.0%	100.0%	100.0%	100.0%
<b>Open for 3 Weeks or More</b>	<b>\$11,134</b>	<b>\$4,622</b>	<b>\$13,322</b>	<b>\$39,477</b>
% of Acute Care Revenue	99.5%	88.9%	96.0%	100.0%
<b>Open for 4 Weeks or More</b>	<b>\$11,134</b>	<b>\$4,622</b>	<b>\$11,585</b>	<b>\$39,245</b>
% of Acute Care Revenue	99.5%	88.9%	83.5%	99.4%
<b>Open for 5 Weeks or More</b>	<b>\$10,357</b>	<b>\$3,771</b>	<b>\$6,471</b>	<b>\$33,333</b>
% of Acute Care Revenue	92.5%	72.5%	46.7%	84.4%

Source: Nephron Research and CMS

\*Hospital data based on 2017

### Managed Care

From the managed care perspective, we would generally like to see lower revenue exposure to states that have "re-opened," although it's uncertain if there is an adverse effect on long-term medical costs from delays in elective procedures. Based on the near-term impact, lower revenue exposure to states re-opening is a positive on medical costs in 2020. Our analysis below is focused solely on the insurance risk segments including commercial risk, Medicaid and Medicare. Similar to the hospital data, our revenue assumptions for Medicaid and commercial risk is dated back to 2018 but we believe the data is directionally accurate.

Based on states that have been re-open the longest (5+ weeks), we estimate that Humana has the highest exposure at 67%. This is followed by Cigna with 58% of revenues in states that have partially re-opened. United has ~52% revenue exposure respectively, followed by Molina with ~50% exposure. Centene has the lowest exposure at ~42% of segment revenues (commercial risk, Medicaid and MA only) in states that have partially re-opened.

**Fig. 37: MCO Revenue Exposure (Medicaid / Commercial Risk / MA) to States that have Partially Re-Opened**

Plans to Reopen	CVS	Anthem	Centene	Cigna	Humana	Molina	United
<b>Sub-Total</b>	<b>\$57,572</b>	<b>\$82,281</b>	<b>\$81,541</b>	<b>\$17,933</b>	<b>\$61,308</b>	<b>\$14,231</b>	<b>\$142,767</b>
% of Revenue (MA/Medicaid/Comm Risk)	100.0%	100.0%	100.0%	99.1%	99.8%	100.0%	100.0%
<b>Open for 2 Weeks or More</b>	<b>\$51,801</b>	<b>\$80,356</b>	<b>\$79,683</b>	<b>\$17,397</b>	<b>\$61,231</b>	<b>\$14,231</b>	<b>\$137,658</b>
% of Revenue (MA/Medicaid/Comm Risk)	90.0%	97.7%	97.7%	96.2%	99.6%	100.0%	96.4%
<b>Open for 3 Weeks or More</b>	<b>\$45,853</b>	<b>\$80,138</b>	<b>\$74,613</b>	<b>\$16,619</b>	<b>\$58,736</b>	<b>\$12,855</b>	<b>\$131,534</b>
% of Revenue (MA/Medicaid/Comm Risk)	79.6%	97.4%	91.5%	91.9%	95.6%	90.3%	92.1%
<b>Open for 4 Weeks or More</b>	<b>\$42,962</b>	<b>\$74,690</b>	<b>\$69,630</b>	<b>\$16,353</b>	<b>\$53,969</b>	<b>\$11,190</b>	<b>\$126,542</b>
% of Revenue (MA/Medicaid/Comm Risk)	74.6%	90.8%	85.4%	90.4%	87.8%	78.6%	88.6%
<b>Open for 5 Weeks or More</b>	<b>\$27,237</b>	<b>\$36,350</b>	<b>\$33,835</b>	<b>\$10,456</b>	<b>\$40,862</b>	<b>\$7,051</b>	<b>\$74,242</b>
% of Revenue (MA/Medicaid/Comm Risk)	47.3%	44.2%	41.5%	57.8%	66.5%	49.5%	52.0%

Source: Nephron Research analysis of data from CMS and Local State Health Websites

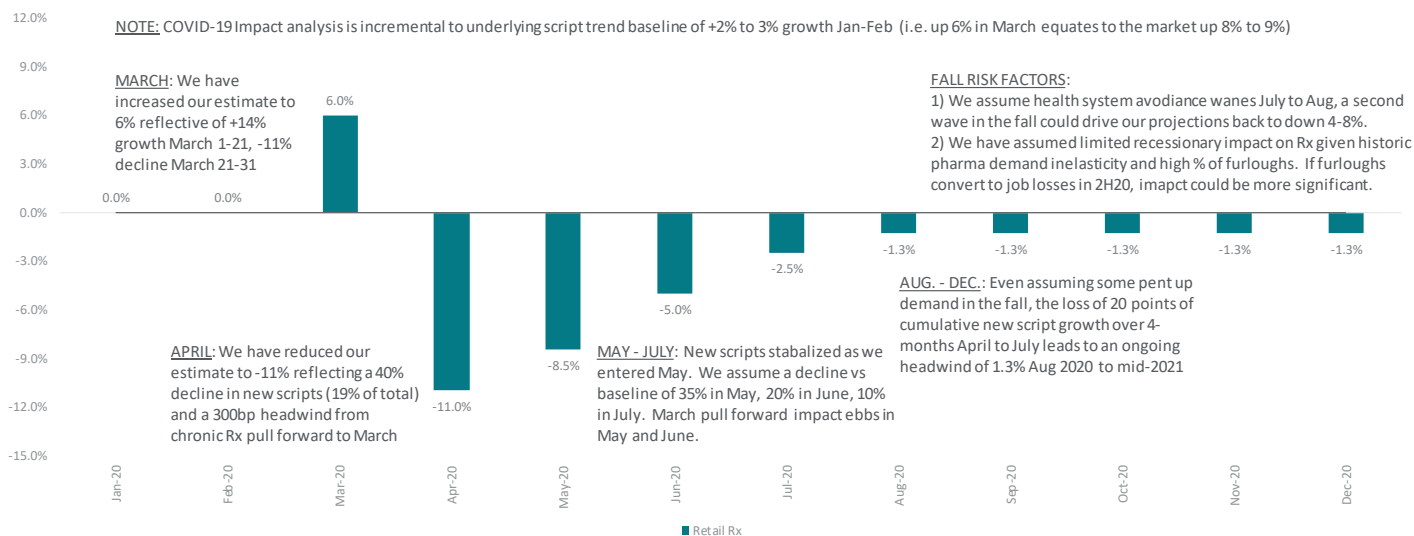
## COVID-19 Pharma and Pharmacy Impact Analysis

The impact of COVID-19 on script demand is like nothing we have seen over the last 20-years. A period of chronic script 'panic buying' March 1-21 gave way to a period of reduced acute script volumes on shelter-in-place orders beginning March 22<sup>nd</sup> and chronic script destocking in April. As we enter May, a new (ab)normal is emerging as the relatively benign impact of destocking begins to lessen and the potentially more malignant impact of a sharp decline in new brand scripts appears to have hit bottom.

- Our estimate of 2020 COVID-19 impact on the retail channel rises to -2.3% from -0.9%. For the full year 2020, we have updated monthly projections for COVID-19 impact segmented by retail, mail, specialty pharmacy and specialty distribution (physician office admin). Integrating March Q earnings datapoints and IQVIA April volumes we now project a full year 2020 -2.3% impact to retail scripts, a +0.8% benefit to mail and a -3.3% impact to specialty distribution.
- IQVIA data for the week ending May 8<sup>th</sup> shows an inflection in new brand scripts. In early May, new to brand scripts and total retail scripts increased week over week for the first time since mid-March (up 5.1% and 1.3%, respectively), in line with our research finding physician office hours and volumes are improving (childhood vaccine volume provides a good indicator). **With a new baseline now established, we expect that the acute centric headwind from reduced office visits and elective procedures will decline from -8% in April to -7% in May, -4% in June and -2% in July.**
- Impact of March panic buying should wane as we progress through May. The early March pull forward and extension of 30 and 90-day chronic scripts was evident in April. **We estimate the April total scripts headwind of 300bp will decline to 150bp in May and 100bp in June.**

*We have updated our projections for COVID-19 impact on retail scripts, arriving at a June Q headwind of -8.2% but a full year 2020 headwind of just -2.2%*

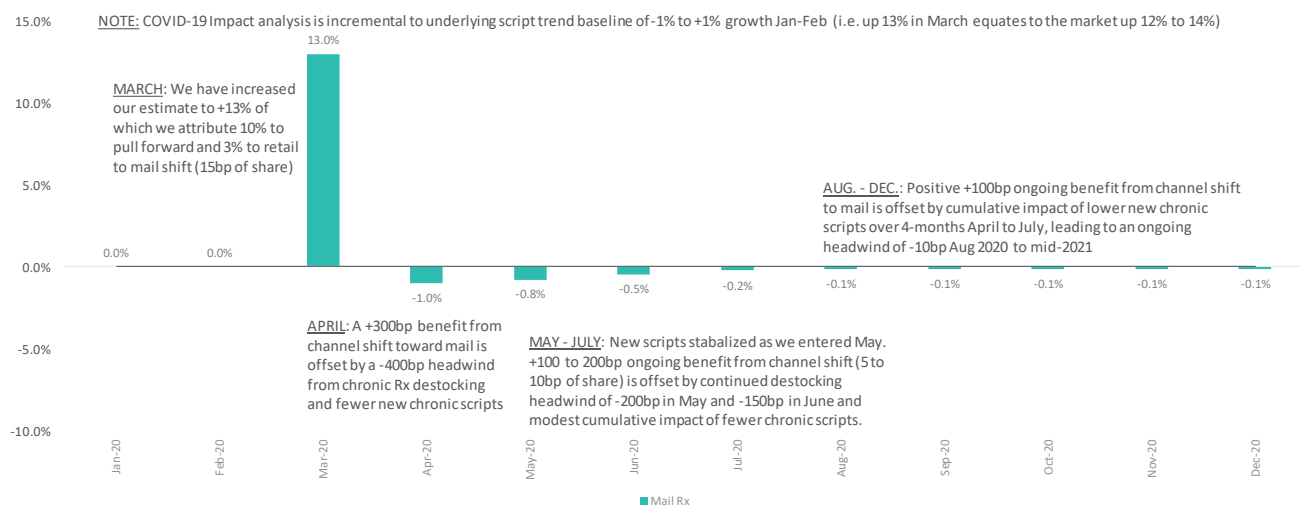
**Fig. 38: Our projection of incremental COVID-19 impact on retail scripts has increased to 2.2% from 0.9% in 2020**



Source: Nephron Research Projections as of 5/18/2020

*We project mail scripts will decline from a 4.3% benefit in March Q to a -0.7% headwind in the June Q and will end 2020 up just +0.8%*

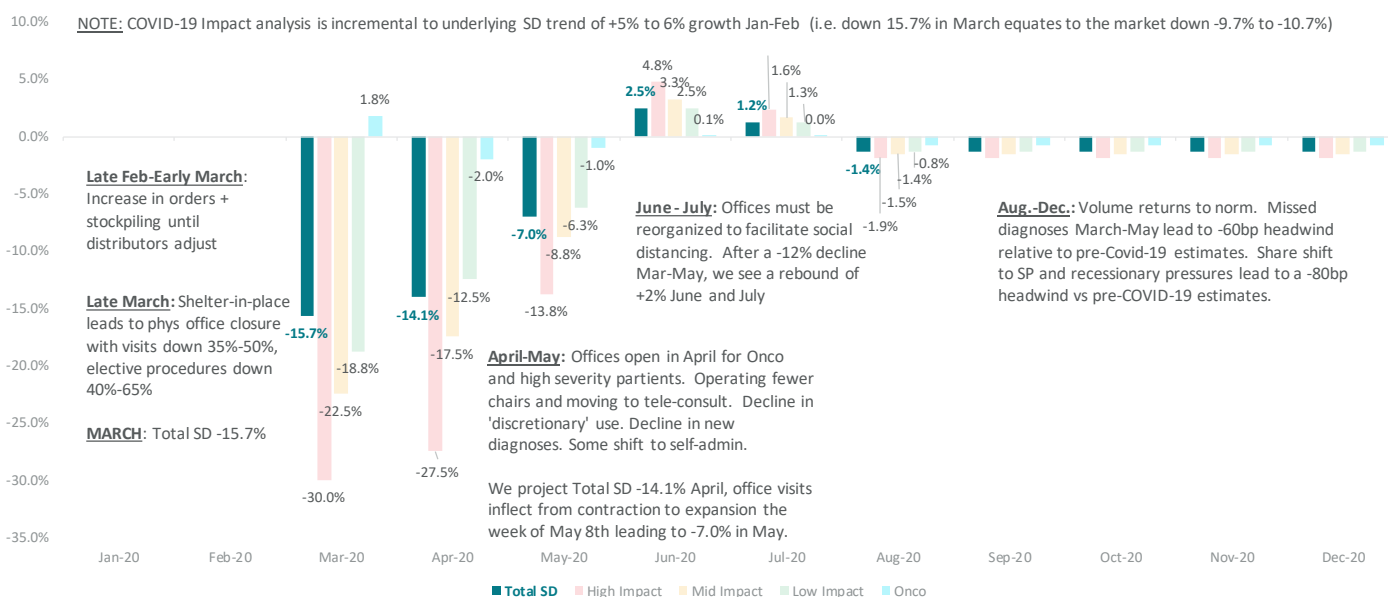
**Relative strength in mail is less a reflection of channel shift than of chronic focus.** While much has been made of the increase in mail in mid-March (peaking at +20.6% vs retail up 12.9%) and the stronger performance post shelter in place (down less than -1% vs retail down -12.6%), **we size the share shift from retail to mail at no more than 15bp.**

**Fig. 39: Our projection of incremental COVID-19 impact on mail scripts suggests only a 15bp benefit for the full year 2020**

Nephron Research Projections as of 5/18/2020

*We project specialty distribution sales declined -15.7% in March and -14.1% in April but will end the June Q down -6.2% and the full year down just -3.3%*

The Nephron Specialty Market Model provides a channel-specific view of the specialty pharmaceutical market, differentiating between specialty distribution (physician office and a portion of hospital administration) and specialty pharmacy (self-administration and a portion of infusion) fulfillment channels while segmenting specialty expenditures across 18 therapeutic categories. For the purposes of modeling the distributors we focus in on the specialty distribution marketplace dominated by **Amerisource** (\$42.4bn 2020 revenue) and **McKesson** (\$30.5bn 2020 revenue) and served also by **Cardinal** (\$20.0bn 2020 revenue) and to a lesser extent **Cigna/ESI** (\$5.2bn 2020 revenue).

**Fig. 40: Our projection of incremental COVID-19 impact on Specialty Distribution remains steady at -3.3% in 2020**

Source: Nephron Research Projections as of 5/18/2020

## Appendix: Trend in COVID-19 Cases, States and Counties

**Fig. 41: Daily Case Growth by State, Past 2 Weeks**

State	6/3	6/4	6/5	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14	6/15	6/16	7-Day Avg.
TX	1,703	1,649	1,693	1,940	1,425	0	2,275	2,504	0	3,923	2,331	1,843	1,254	4,098	2,279
FL	1,317	1,419	1,305	1,270	1,180	966	1,096	1,371	1,698	1,902	2,581	2,016	1,758	2,783	2,016
AZ	983	520	1,579	1,119	1,438	789	618	1,556	1,412	1,654	1,540	1,233	1,014	2,392	1,543
CA	2,377	2,120	3,094	3,115	2,796	2,507	2,170	2,702	3,090	2,702	3,660	3,212	2,597	2,108	2,867
NC	888	1,189	1,289	1,370	921	938	676	1,011	1,310	1,768	1,427	1,443	983	751	1,242
TN	447	298	400	551	310	563	631	486	477	588	415	891	728	670	608
GA	687	953	774	688	589	599	752	731	993	810	1,018	880	733	664	833
AL	209	221	315	656	457	425	497	567	856	865	891	1,014	657	640	784
NY	1,045	1,048	1,075	1,108	781	702	683	674	736	822	916	694	620	631	728
IL	982	929	1,156	975	867	1,382	797	625	766	732	673	672	473	623	652
SC	236	354	448	0	833	514	428	531	682	729	785	840	583	612	680
LA	387	429	427	497	330	234	562	418	442	523	1,288	336	553	534	585
OR	64	75	96	92	146	114	66	72	177	140	0	0	259	462	159
VA	666	951	676	865	1,284	570	487	439	470	564	658	637	380	445	513
OH	442	490	476	353	365	361	325	413	429	420	424	300	428	434	407
NV	105	155	176	194	189	137	244	134	235	279	268	227	106	379	233
MD	807	876	912	712	491	431	500	561	732	416	692	396	331	377	501
PA	512	538	445	701	506	351	493	410	467	66	463	336	323	362	347
IN	475	384	482	419	400	226	410	304	411	398	397	366	521	356	393
MS	302	238	199	10	501	498	0	715	0	608	257	168	283	353	341
UT	295	316	439	546	268	256	237	305	388	325	404	332	295	329	340
WA	180	327	245	264	449	287	312	313	288	137	392	367	296	324	302
NJ	523	462	806	557	271	333	299	550	470	348	441	276	222	323	376
AR	624	0	584	450	325	314	340	288	448	731	0	954	416	274	444
WI	483	492	357	322	264	203	270	285	333	320	272	240	174	266	270
OK	113	102	0	96	147	55	158	117	146	222	225	158	186	228	183
MO	192	290	196	189	111	181	179	274	203	195	225	0	379	225	214
MA	429	471	494	575	304	190	263	267	511	392	336	208	87	195	285
MN	362	403	707	521	385	338	299	346	447	479	377	299	222	189	337
MI	304	206	5,298	444	430	0	585	184	267	223	164	218	31	184	182
KY	225	295	272	310	0	189	232	175	62	0	500	0	202	182	160
CO	211	272	300	255	233	153	182	164	152	148	175	195	113	169	159
IA	39	750	347	326	189	320	249	315	387	399	380	209	127	126	278
NE	266	255	251	262	164	91	118	131	142	290	198	120	92	126	157
NM	224	116	213	319	128	140	122	43	145	276	0	95	102	122	112
CT	112	148	221	358	150	124	87	168	114	228	305	94	147	114	167
RI	107	106	116	0	0	201	49	65	106	85	0	0	146	71	68
DE	27	34	27	72	97	30	48	36	50	67	56	35	76	63	55
ID	27	57	64	57	28	0	50	31	40	42	51	46	0	63	39
WV	30	21	27	12	13	9	16	19	24	21	26	30	9	43	25
SD	95	85	30	90	71	33	52	81	61	77	91	65	30	38	63
WY	5	0	18	6	8	13	10	10	29	18	23	10	0	29	17
ND	33	27	39	71	45	19	21	40	39	36	42	22	21	23	32
DC	130	104	79	70	63	57	85	63	52	65	55	58	32	19	49
AK	18	8	11	12	8	19	10	20	18	14	29	7	3	12	15
ME	41	28	36	42	46	18	18	31	30	54	36	36	17	9	30
HI	1	0	2	9	9	2	1	6	3	7	14	17	5	8	9
MT	2	14	2	-1	5	3	6	7	2	10	15	13	8	5	9
VT	2	36	1	19	17	12	9	11	15	9	6	2	1	3	7
KS	159	0	223	0	0	257	0	162	0	235	0	0	372	0	110
NH	64	46	81	143	0	24	36	53	46	31	42	48	46	0	38
Total	20,189	20,566	22,990	22,355	19,307	17,123	17,166	20,749	22,023	23,318	25,344	21,486	18,521	23,498	22,134

Source: Nephron Research analysis of The COVID Tracking Project



Fig. 42: Trend in COVID-19 Cases for Top 5 States

Date	US Total	Top 5 States																			
		New York				New Jersey				California				Illinois				Massachusetts			
		per 100K	Total	D/D	% D/D	per 100K	Total	D/D	% D/D	per 100K	Total	D/D	% D/D	per 100K	Total	D/D	% D/D	per 100K	Total	D/D	% D/D
30-Mar	174,509	342	66,497	6,984	12%	187	16,636	3,250	24%	16	6,447	739	13%	40	5,057	461	10%	83	5,752	797	16%
31-Mar	199,180	390	75,795	9,298	14%	210	18,696	2,060	12%	19	7,482	1,035	16%	47	5,994	937	19%	96	6,620	868	15%
1-Apr	224,891	430	83,712	7,917	10%	251	22,255	3,559	19%	21	8,155	673	9%	55	6,980	986	16%	112	7,738	1,118	17%
2-Apr	252,871	475	92,381	8,669	10%	288	25,590	3,335	15%	23	9,191	1,036	13%	61	7,695	715	10%	130	8,966	1,228	16%
3-Apr	284,723	529	102,863	10,482	11%	337	29,895	4,305	17%	27	10,701	1,510	16%	70	8,904	1,209	16%	151	10,402	1,436	16%
4-Apr	317,919	584	113,704	10,841	11%	384	34,124	4,229	14%	30	12,026	1,325	12%	82	10,357	1,453	16%	170	11,736	1,334	13%
5-Apr	343,390	627	122,031	8,327	7%	422	37,505	3,381	10%	34	13,438	1,412	12%	89	11,256	899	9%	181	12,500	764	7%
6-Apr	372,226	672	130,689	8,658	7%	463	41,090	3,585	10%	36	14,336	898	7%	97	12,262	1,006	9%	201	13,837	1,337	11%
7-Apr	402,788	714	138,863	8,174	6%	500	44,416	3,326	8%	40	15,865	1,529	11%	107	13,549	1,287	10%	221	15,202	1,365	10%
8-Apr	433,230	768	149,316	10,453	8%	534	47,437	3,021	7%	43	16,957	1,092	7%	119	15,078	1,529	11%	244	16,790	1,588	10%
9-Apr	467,612	822	159,937	10,621	7%	574	51,027	3,590	8%	46	18,309	1,352	8%	130	16,422	1,344	9%	275	18,941	2,151	13%
10-Apr	501,806	877	170,512	10,575	7%	615	54,588	3,561	7%	49	19,472	1,163	6%	141	17,887	1,465	9%	304	20,974	2,033	11%
11-Apr	532,409	928	180,458	9,946	6%	655	58,151	3,563	7%	49	19,472	0	0%	151	19,180	1,293	7%	332	22,860	1,886	9%
12-Apr	560,263	970	188,694	8,236	5%	696	61,850	3,699	6%	55	21,794	2,322	12%	165	20,852	1,672	9%	370	25,475	2,615	11%
13-Apr	585,487	1,003	195,031	6,337	3%	727	64,584	2,734	4%	57	22,348	554	3%	174	22,025	1,173	6%	390	26,867	1,392	5%
14-Apr	611,087	1,039	202,208	7,177	4%	775	68,824	4,240	7%	59	23,338	990	4%	183	23,247	1,222	6%	409	28,163	1,296	5%
15-Apr	641,311	1,099	213,779	11,571	6%	800	71,030	2,206	3%	62	24,424	1,086	5%	194	24,593	1,346	6%	434	29,918	1,755	6%
16-Apr	672,124	1,143	222,284	8,505	4%	848	75,317	4,287	6%	66	26,182	1,758	7%	203	25,733	1,140	5%	467	32,181	2,263	8%
17-Apr	704,103	1,180	229,642	7,358	3%	883	78,467	3,150	4%	70	27,528	1,346	5%	218	27,575	1,842	7%	499	34,402	2,221	7%
18-Apr	732,065	1,217	236,732	7,090	3%	917	81,420	2,953	4%	73	28,963	1,435	5%	230	29,160	1,585	6%	528	36,372	1,970	6%
19-Apr	759,452	1,248	242,786	6,054	3%	960	85,301	3,881	5%	77	30,333	1,370	5%	240	30,357	1,197	4%	552	38,077	1,705	5%
20-Apr	785,263	1,272	247,512	4,726	2%	1,000	88,806	3,505	4%	78	30,978	645	2%	249	31,508	1,151	4%	575	39,643	1,556	4%
21-Apr	811,541	1,294	251,690	4,178	2%	1,040	92,387	3,581	4%	84	33,261	2,283	7%	261	33,059	1,551	5%	598	41,199	1,556	4%
22-Apr	840,413	1,322	257,216	5,526	2%	1,079	95,865	3,478	4%	90	35,396	2,135	6%	277	35,108	2,049	6%	623	42,944	1,745	4%
23-Apr	872,162	1,354	263,460	6,244	2%	1,126	99,989	4,124	4%	95	37,369	1,973	6%	291	36,934	1,826	5%	668	46,023	3,079	7%
24-Apr	906,311	1,396	271,590	8,130	3%	1,151	102,196	2,207	2%	99	39,254	1,885	5%	313	39,658	2,724	7%	739	50,969	4,946	11%
25-Apr	942,312	1,450	282,143	10,553	4%	1,188	105,523	3,327	3%	104	41,137	1,883	5%	330	41,777	2,119	5%	774	53,348	2,379	5%
26-Apr	969,699	1,481	288,045	5,902	2%	1,228	109,038	3,515	3%	107	42,164	1,027	2%	346	43,903	2,126	5%	797	54,938	1,590	3%
27-Apr	991,715	1,501	291,996	3,951	1%	1,252	111,188	2,150	2%	110	43,464	1,300	3%	362	45,883	1,980	5%	819	56,462	1,524	3%
28-Apr	1,016,793	1,517	295,106	3,110	1%	1,282	113,856	2,668	2%	114	45,031	1,567	4%	380	48,102	2,219	5%	846	58,302	1,840	3%
29-Apr	1,043,933	1,541	299,691	4,585	2%	1,309	116,264	2,408	2%	118	46,500	1,469	3%	397	50,355	2,253	5%	874	60,265	1,963	3%
30-Apr	1,073,514	1,565	304,372	4,681	2%	1,336	118,652	2,388	2%	124	48,917	2,417	5%	418	52,918	2,563	5%	903	62,205	1,940	3%
1-May	1,106,557	1,585	308,314	3,942	1%	1,364	121,190	2,538	2%	128	50,442	1,525	3%	442	56,055	3,137	6%	933	64,311	2,106	3%
2-May	1,135,855	1,609	312,977	4,663	2%	1,393	123,717	2,527	2%	132	52,197	1,755	3%	462	58,505	2,450	4%	961	66,263	1,952	3%
3-May	1,161,624	1,627	316,415	3,438	1%	1,427	126,744	3,027	2%	136	53,616	1,419	3%	485	61,499	2,994	5%	988	68,087	1,824	3%
4-May	1,183,985	1,640	318,953	2,538	1%	1,444	128,269	1,525	1%	139	54,937	1,321	2%	504	63,840	2,341	4%	1,002	69,087	1,000	1%
5-May	1,206,383	1,651	321,192	2,239	1%	1,470	130,593	2,324	2%	142	56,212	1,275	2%	521	65,962	2,122	3%	1,020	70,271	1,184	2%
6-May	1,231,333	1,665	323,978	2,786	1%	1,485	131,890	1,297	1%	149	58,815	2,603	5%	538	68,232	2,270	3%	1,045	72,025	1,754	2%
7-May	1,258,833	1,684	327,649	3,671	1%	1,505	133,635	1,745	1%	153	60,614	1,799	3%	559	70,873	2,641	4%	1,070	73,721	1,696	2%
8-May	1,286,417	1,698	330,407	2,758	1%	1,525	135,454	1,819	1%	158	62,512	1,898	3%	582	73,760	2,887	4%	1,093	75,333	1,612	2%
9-May	1,311,125	1,712	333,122	2,715	1%	1,543	137,085	1,631	1%	163	64,561	2,049	3%	600	76,085	2,325	3%	1,113	76,743	1,410	2%
10-May	1,332,709	1,724	335,395	2,273	1%	1,560	138,532	1,447	1%	169	66,680	2,119	3%	613	77,741	1,656	2%	1,129	77,793	1,050	1%
11-May	1,350,908	1,733	337,055	1,660	0%	1,576	139,945	1,413	1%	172	67,939	1,259	2%	623	79,007	1,266	2%	1,138	78,462	669	1%
12-May	1,373,495	1,740	338,485	1,430	0%	1,585	140,743	798	1%	176	69,382	1,443	2%	655	83,021	4,014	5%	1,151	79,332	870	1%
13-May	1,394,677	1,751	340,661	2,176	1%	1,594	141,560	817	1%	180	71,141	1,759	3%	668	84,698	1,677	2%	1,168	80,497	1,165	1%
14-May	1,421,278	1,763	343,051	2,390	1%	1,607	142,704	1,144	1%	185	73,164	2,023	3%	694	87,937	3,239	4%	1,192	82,182	1,685	2%
15-May	1,445,877	1,778	345,813	2,762	1%	1,620	143,905	1,201	1%	190	74,936	1,772	2%	713	90,369	2,432	3%	1,210	83,421	1,239	2%
16-May	1,470,504	1,790	348,232	2,419	1%	1,633	145,089	1,184	1%	194	76,793	1,857	2%	730	92,457	2,088	2%	1,232	84,933	1,512	2%
17-May	1,490,760	1,800	350,121	1,889	1%	1,647	146,334	1,245	1%	200	78,839	2,046	3%	743	94,191	1,734	2%	1,248	86,010	1,077	1%
18-May	1,510,633	1,806	351,371	1,																	

Fig. 43: Trend in COVID-19 Cases for Top 5 Counties

Date	US Total	Top 5 Counties									
		New York City		Cook		Los Angeles		Nassau		Suffolk	
		NY		IL		CA		NY		NY	
14-Mar	6,930	287		51		53		79		41	
15-Mar	8,638	457	170 59%	76	25 49%	69	16 30%	98	19 24%	47	6 15%
16-Mar	10,886	643	186 41%	76	0 0%	94	25 36%	109	11 11%	63	16 34%
17-Mar	11,629	1,340	697 108%	107	31 41%	144	50 53%	131	22 20%	84	21 33%
18-Mar	14,795	2,471	1,131 84%	179	72 67%	190	46 32%	183	52 40%	116	32 38%
19-Mar	19,455	4,408	1,937 78%	279	100 56%	231	41 22%	382	199 100%	178	62 53%
20-Mar	25,695	6,213	1,805 40.9%	412	133 48%	292	61 26%	754	372 97%	371	193 108%
21-Mar	32,572	9,045	2,832 45.6%	548	136 33%	351	59 20%	1,234	480 64%	662	291 78%
22-Mar	41,816	12,305	3,260 36.0%	805	257 47%	421	70 20%	1,900	666 54%	1,034	372 96%
23-Mar	53,256	14,904	2,599 21.1%	922	117 15%	536	115 27%	2,442	542 29%	1,458	424 41%
24-Mar	63,868	17,856	2,952 19.8%	1,194	272 30%	662	126 24%	2,869	427 17%	1,880	422 29%
25-Mar	76,706	21,393	3,537 19.8%	1,418	224 19%	799	137 21%	3,285	416 14%	2,260	380 20%
26-Mar	94,335	25,398	4,005 18.7%	1,904	486 34%	1,216	417 52%	3,914	629 19%	2,735	475 21%
27-Mar	113,359	29,766	4,368 17.2%	2,239	335 18%	1,465	249 20%	4,657	743 19%	3,385	650 24%
28-Mar	133,037	33,768	4,002 13.4%	2,613	374 17%	1,804	339 23%	5,537	880 19%	4,138	753 22%
29-Mar	152,622	37,453	3,685 10.9%	3,445	832 32%	2,136	332 18%	6,445	908 16%	5,023	885 21%
30-Mar	174,509	43,139	5,686 15.2%	3,727	282 8%	2,474	338 16%	7,344	899 14%	5,791	768 15%
31-Mar	199,180	47,439	4,300 10.0%	4,496	769 21%	3,011	537 22%	8,544	1,200 16%	6,713	922 16%
1-Apr	224,891	51,809	4,370 9.2%	5,152	656 15%	3,518	507 17%	9,555	1,011 12%	7,605	892 13%
2-Apr	252,871	57,159	5,350 10.3%	5,575	423 8%	4,045	527 15%	10,587	1,032 11%	8,746	1,141 15%
3-Apr	284,723	63,306	6,147 10.8%	6,473	898 16%	4,566	521 13%	12,024	1,437 14%	10,154	1,408 16%
4-Apr	317,919	67,551	6,245 6.7%	7,439	966 15%	5,277	711 16%	13,346	1,322 11%	12,328	2,174 21%
5-Apr	343,390	72,181	6,430 6.9%	8,043	604 8%	5,940	663 13%	14,398	1,052 8%	12,933	605 5%
6-Apr	372,226	76,876	6,695 6.5%	8,728	685 9%	6,360	420 7%	15,616	1,218 8%	14,473	1,540 12%
7-Apr	402,788	81,803	6,927 6.4%	9,509	781 9%	6,910	550 9%	16,610	994 6%	15,561	1,088 8%
8-Apr	433,230	87,028	5,225 6.4%	10,520	1,011 11%	7,530	620 9%	18,548	1,938 12%	15,844	283 2%
9-Apr	467,612	92,384	5,356 6.2%	11,415	895 9%	7,955	425 6%	20,140	1,592 9%	17,413	1,569 10%
10-Apr	501,806	98,308	5,924 6.4%	12,472	1,057 9%	8,430	475 6%	21,512	1,372 7%	18,692	1,279 7%
11-Apr	532,409	103,208	4,900 5.0%	13,417	945 8%	8,873	443 5%	22,584	1,072 5%	19,883	1,191 6%
12-Apr	560,263	106,763	3,555 3.4%	14,585	1,168 9%	9,192	319 4%	23,553	969 4%	20,816	933 5%
13-Apr	585,487	110,465	3,702 3.5%	15,474	889 6%	9,420	228 2%	24,358	805 3%	21,643	827 4%
14-Apr	611,087	118,302	7,837 7.1%	16,323	849 5%	10,047	627 7%	25,250	892 4%	22,462	819 4%
15-Apr	641,311	123,146	4,844 4.1%	17,306	983 6%	10,496	449 4%	26,715	1,465 6%	23,278	816 4%
16-Apr	672,124	127,352	4,206 3.4%	18,087	781 5%	10,854	358 3%	27,772	1,057 4%	24,182	904 4%
17-Apr	704,103	131,263	3,911 3.1%	19,391	1,304 7%	11,391	537 5%	28,539	767 3%	25,035	853 4%
18-Apr	732,065	134,436	3,173 2.4%	20,395	1,004 5%	12,021	630 6%	29,180	641 2%	26,143	1,108 4%
19-Apr	759,452	136,806	2,370 1.8%	21,272	877 4%	12,341	320 3%	30,013	833 3%	26,888	745 3%
20-Apr	785,263	139,325	2,519 1.8%	22,101	829 4%	13,816	1,475 12%	30,677	664 2%	27,662	774 3%
21-Apr	811,541	142,432	3,107 2.2%	23,181	1,080 5%	15,140	1,324 10%	31,079	402 1%	28,154	492 2%
22-Apr	840,413	145,855	3,423 2.4%	24,546	1,365 6%	16,435	1,295 9%	31,555	476 2%	28,854	700 2%
23-Apr	872,162	150,473	4,618 3.2%	25,811	1,265 5%	17,508	1,073 7%	32,124	569 2%	29,567	713 2%
24-Apr	906,311	155,113	4,640 3.1%	27,616	1,805 7%	18,545	1,037 6%	32,765	641 2%	30,606	1,039 4%
25-Apr	942,312	158,258	3,145 2.0%	29,058	1,442 5%	19,107	562 3%	33,798	1,033 3%	31,368	762 2%
26-Apr	969,699	160,489	2,231 1.4%	30,574	1,516 5%	19,528	421 2%	34,522	724 2%	32,059	691 2%
27-Apr	991,715	162,338	1,849 1.2%	31,953	1,379 5%	20,417	889 5%	34,865	343 1%	32,470	411 1%
28-Apr	1,016,793	164,841	2,503 1.5%	33,449	1,496 5%	20,976	559 3%	35,085	220 1%	32,724	254 1%
29-Apr	1,043,933	167,478	2,637 1.6%	34,880	1,431 4%	22,485	1,509 7%	35,505	420 1%	33,265	541 2%
30-Apr	1,073,514	169,690	2,212 1.3%	36,513	1,633 5%	23,182	697 3%	35,854	349 1%	33,664	399 1%
1-May	1,106,557	172,354	2,664 1.6%	38,668	2,155 6%	24,215	1,033 4%	36,161	307 1%	34,037	373 1%
2-May	1,135,855	174,331	1,977 1.1%	40,227	1,559 4%	24,894	679 3%	36,519	358 1%	34,478	441 1%
3-May	1,161,624	175,651	1,320 0.8%	42,324	2,097 5%	25,662	768 3%	36,780	261 1%	34,855	377 1%
4-May	1,183,985	176,874	1,223 0.7%	43,715	1,391 3%	26,217	555 2%	36,965	185 1%	35,077	222 1%
5-May	1,206,383	178,351	1,477 0.8%	45,223	1,508 3%	27,815	1,598 6%	37,152	187 1%	35,275	198 1%
6-May	1,231,333	180,216	1,865 1.0%	46,689	1,466 3%	28,644	829 3%	37,350	198 1%	35,543	268 1%
7-May	1,258,833	181,783	1,567 0.9%	48,341	1,652 4%	29,427	783 3%	37,593	243 1%	35,892	349 1%
8-May	1,286,417	183,289	1,506 0.8%	50,236	1,895 4%	30,296	869 3%	37,812	219 1%	36,223	331 1%
9-May	1,311,125	184,417	1,128 0.6%	51,674	1,438 3%	31,197	901 3%	38,028	216 1%	36,461	238 1%
10-May	1,332,709	185,357	940 0.5%	52,655	981 2%	31,677	480 2%	38,217	189 0%	36,702	241 1%
11-May	1,350,908	186,123	766 0.4%	53,381	726 1%	32,258	581 2%	38,337	120 0%	36,911	209 1%
12-May	1,373,495	187,250	1,127 0.6%	55,470	2,089 4%	33,180	922 3%	38,434	97 0%	37,062	151 0%
13-May	1,394,677	188,545	1,295 0.7%	56,406	936 2%	34,428	1,248 4%	38,587	153 0%	37,305	243 1%
14-May	1,421,278	190,357	1,812 1.0%	58,457	2,051 4%	35,329	901 3%	38,743	156 0%	37,544	239 1%
15-May	1,445,877	191,600	1,243 0.7%	59,905	1,448 2%	36,259	930 3%	38,864	121 0%	37,719	175 0%
16-May	1,470,504	192,593	993 0.5%	61,212	1,307 2%	37,303	1,044 3%	39,033	169 0%	37,942	223 1%
17-May	1,490,760	193,230	637 0.3%	62,218	1,006 2%	37,974	671 2%	39,136	103 0%	38,117	175 0%
18-May	1,510,633	193,821	591 0.3%	63,690	1,472 2%	38,451	477 1%	39,225	89 0%	38,224	107 0%
19-May	1,532,406	194,550	729 0.4%	64,691	1,001 2%	39,573	1,122 3%	39,295	70 0%	38,327	103 0%
20-May	1,553,875	195,675	1,125 0.6%	66,213	1,522 2%	40,857	1,284 3%	39,368	73 0%	38,411	84 0%
21-May	1,580,365	196,484	809 0.4%	67,551	1,338 2%	42,037	1,180 3%	39,487	119 0%	38,553	142 0%
22-May	1,604,817	197,266	782 0.4%	68,949	1,398 2%	43,052	1,015 2%	39,608	121 0%	38,672	119 0%
23-May	1,626,470	198,123	857 0.4%	70,417	1,468 2%	44,055	1,003 2%	39,726	118 0%	38,802	130 0%
24-May	1,646,571	198,731	608 0.3%	72,010	1,593 2%	44,988	933 2%	39,837	111 0%	38,964	162 0%
25-May	1,665,240	199,301	570 0.3%	73,097	1,087 2%	46,018	1,030 2%	39,907	70 0%	39,090	126 0%
26-May	1,681,811	199,968	667 0.3%	73,819	722 1%	47,822	1,804 4%	39,974	67 0%	39,199	109 0%
27-May	1,701,111	201,051	1,083 0.5%	74,521	702 1%	48,700	878 2%	40,034	60 0%	39,258	59 0%
28-May	1,723,578	201,999	948 0.5%	75,306	785 1%	49,774	1,074 2%	40,140	106 0%	39,359	101 0%
29-May	1,746,943	202,751	752 0.4%	76,266	960 1%	51,562	1,788 4%	40,226	86 0%	39,445	86 0%
30-May	1,770,655	203,303	552 0.3%	77,119	853 1%	53,651	2,089 4%	40,307	81 0%	39,532	87 0%
31-May	1,792,221	203,764	461 0.2%	77,925	806 1%	54,996	1,345 3%	40,396	89 0%	39,643	111 0%
1-Jun	1,808,632	204,377	613 0.3%	78,495	570 1%	55,968	972 2%	40,479	83 0%	39,705	62 0%
2-Jun	1,832,412	204,872	495 0.2%	79,673	1,178 2%	57,1					

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