Health Industry Advisor, llc

"Strategic Guidance in an Era of Unprecedented Change"

COVID-19 Dashboard

Issue # 53

Monday, May 18, 2020

Day's Highlights

"Strategic Guidance in an Era of Unprecedented Change"

Measure	Desired Change	Yesterday in the U.S.
Number of Tests	Increase	421,000 tests – most of any day
Test-Positivity Rate	Decline	5.0% for the day; 6.3% for past 7 days
Number of Cases	Plateau	New Cases down 10.9% week-over-week
Deaths % of Total Cases	Decline	Steady at 6.0%
Number of Deaths / 1M Population	Plateau	274.9
Recoveries : Death	Increase	3.81

- The U.S posted its highest single test day yet, with 421,000. Only 5% were positive.
- Connecticut, Illinois, New Jersey, New Mexico, North Dakota, New York and Rhode Island are each testing above the minimum 152 per million per day suggested by Harvard scientists; Michigan and Mississippi are slightly short of this benchmark
- For the past week only 11 states (AZ, DE, IA, IL, KS, MA, MD, MN, PA, SD and VA) and the District of Columbia failed to meet or beat the World Health Organization's suggested threshold of 10% or fewer test-positive results (IA, KS and SD were marginally above the threshold). By that measure, the remaining states appear to be adequately testing for the virus.
- Only 3 states – Arizona, North Carolina an North Dakota reported their highest new daily infection rate yesterday (trailing 7-day moving average)
- We are monitoring states that have met criticism for re-opening early, particularly Florida and Wisconsin. (In Wisconsin, the state Supreme Court invalidated the Governor's stay-home order last week. Bars in the state subsequently re-opened Wednesday evening.) While both states showed slightly higher new infection rates over the weekend, both still report relatively low test-positive and new infection rates.
- Russia now as the second most cases in the world. It should be noted, however, that it finally broke the exponential growth pattern in cases on or about May 2 and its new daily cases have subsided since May 13.

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COUNTRY-BY-COUNTRY INFORMATION

Countries Included

- In Mid-March, we began tracking the twenty countries with the most coronavirus cases; in mid-April, we expanded it to the thirty countries with the most cases
- Since that time, 13 countries have moved ahead of South Korea in total cases
- We continue to track the 30 countries, which still account for 89.4% of total cases worldwide
- Case and death information is sourced from the World Health Organization, which is accessed daily; analysis by Health Industry Advisor LLC

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Country-by-Country

Comparative Statistics

"Strategic Guidance in an Era of Unprecedented Change"

As of May 17

Country	Total Cases	Rank	Cases per 1M Population	Rank2	Deaths	Rank3	Death Rate	Rank4	Deaths per 1 Million Population	Rank5	5-day Moving Average Case Growth Rate	Rank6	Tests per 1M Population	Rank7	New Daily Infections Per 1M Population (5-Day M.A.)	Rank8
USA	1,527,664	(1)	4,615	(5)	90,978	(1)	6.0%	(14)	274.9	(9)	1.6%	(13)	35,903	(13)	69.1	(4)
Austria	16,242	(29)	1,803	(20)	629	(25)	3.9%	(20)	69.8	(18)	0.3%	(25)	39,710	(8)	5.9	(23)
Belgium	55,280	(15)	4,770	(4)	9,052	(7)	16.4%	(1)	781.0	(1)	0.6%	(20)	57,302	(4)	27.1	(14)
Brazil	241,080	(5)	1,134	(24)	16,118	(6)	6.7%	(11)	75.8	(17)	6.3%	(2)	3,462	(25)	52.7	(8)
Canada	77,002	(14)	2,040	(16)	5,782	(10)	7.5%	(10)	153.2	(12)	1.6%	(14)	33,567	(14)	30.9	(12)
Chile	43,781	(19)	2,290	(14)	450	(26)	1.0%	(27)	23.5	(22)	6.7%	(1)	18,346	(18)	111.5	(2)
China	82,947	(13)	58	(30)	4,634	(13)	5.6%	(16)	3.2	(29)	0.0%	(30)	N/A	N/A	0.0	(30)
Ecuador	33,182	(21)	1,881	(18)	2,736	(17)	8.2%	(9)	155.1	(11)	1.8%	(11)	5,301	(24)	29.3	(13)
France	179,569	(7)	2,751	(12)	28,108	(4)	15.7%	(2)	430.6	(5)	0.2%	(27)	21,218	(15)	5.7	(24)
Germany	176,651	(8)	2,108	(15)	8,049	(8)	4.6%	(18)	96.1	(14)	0.4%	(22)	37,585	(11)	8.1	(21)
India	95,698	(11)	69	(29)	3,025	(16)	3.2%	(21)	2.2	(30)	5.2%	(4)	1,548	(28)	3.0	(26)
Iran	120,198	(10)	1,431	(23)	6,988	(9)	5.8%	(15)	83.2	(15)	1.6%	(12)	8,022	(23)	21.4	(15)
Ireland	24,112	(26)	4,883	(2)	1,543	(21)	6.4%	(12)	312.5	(8)	0.7%	(18)	52,488	(5)	32.3	(11)
Israel	16,617	(27)	1,920	(17)	272	(28)	1.6%	(26)	31.4	(21)	0.1%	(29)	57,733	(3)	2.3	(27)
Italy	225,435	(6)	3,729	(6)	31,908	(3)	14.2%	(4)	527.7	(3)	0.4%	(24)	48,698	(6)	15.0	(19)
Japan	16,285	(28)	129	(28)	744	(24)	4.6%	(17)	5.9	(25)	0.4%	(23)	1,900	(26)	0.6	(28)
Mexico	47,144	(17)	366	(25)	5,045	(12)	10.7%	(7)	39.1	(20)	5.4%	(3)	1,271	(29)	15.2	(18)
Netherlands	43,995	(18)	2,568	(13)	5,680	(11)	12.9%	(5)	331.5	(7)	0.5%	(21)	16,809	(20)	11.4	(20)
Pakistan	40,151	(20)	182	(27)	873	(23)	2.2%	(25)	4.0	(27)	4.2%	(7)	1,631	(27)	6.3	(22)
Peru	92,273	(12)	2,799	(11)	2,648	(18)	2.9%	(22)	80.3	(16)	5.1%	(5)	19,156	(16)	108.2	(3)
Portugal	29,036	(24)	2,848	(10)	1,218	(22)	4.2%	(19)	119.4	(13)	0.8%	(17)	58,828	(2)	20.4	(16)
Russia	281,752	(2)	1,879	(19)	2,631	(19)	0.9%	(28)	17.5	(23)	3.9%	(8)	45,614	(7)	68.7	(5)
Saudi Arabia	54,752	(16)	1,573	(22)	312	(27)	0.6%	(29)	9.0	(24)	5.0%	(6)	14,457	(22)	64.4	(6)
Singapore	28,038	(25)	4,793	(3)	22	(30)	0.1%	(30)	3.8	(28)	2.6%	(9)	15,773	(21)	114.8	(1)
South Korea	11,050	(30)	216	(26)	262	(29)	2.4%	(24)	5.1	(26)	0.2%	(26)	38,371	(10)	0.5	(29)
Spain	277,719	(3)	5,940	(1)	27,650	(5)	10.0%	(8)	591.4	(2)	0.6%	(19)	64,977	(1)	39.9	(10)
Sweden	30,143	(23)	2,985	(9)	3,679	(15)	12.2%	(6)	364.3	(6)	2.0%	(10)	17,589	(19)	54.0	(7)
Switzerland	30,587	(22)	3,572	(8)	1,881	(20)	6.1%	(13)	219.6	(10)	0.1%	(28)	39,247	(9)	4.7	(25)
Turkey	149,435	(9)	1,772	(21)	4,140	(14)	2.8%	(23)	49.1	(19)	1.1%	(16)	18,874	(17)	18.3	(17)
UK	243,695	(4)	3,590	(7)	34,636	(2)	14.2%	(3)	510.2	(4)	1.5%	(15)	36,696	(12)	51.6	(9)

Note: China does not report test volumes

Virus Progression

This graphic on the following page illustrates when the country first recorded 100 total cases (start of the "contagion" phase); when growth stopped following an exponential pattern (start of the "containment" phase); and, when peak total cases were recorded (start of the "recovery" phase). It uses symbols to indicate when average daily case growth rates fell (and were sustained) below certain benchmarks, as well as when deaths stopped growing exponentially.

Legend:

Phase

Contagion	100th Case to End of Exponential Growth
Containment	End of Exponential Growth to Peak Active Cases
Recovery	Post-Peak Active Cases
Clear	Per IHME Standard, clear to relax social distancing

Daily Case Increase (5-Day Moving Averge)

- ▲ Stabilized < 35%
- ■ Stabilized < 20%
- ● Stabilized < 10%

Death Rate

- □ No Longer Increasing Exponentially

Peak Infections

- ▢ Peak 7-Day Average New Daily Infections

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Country-by-Country

Virus Progression

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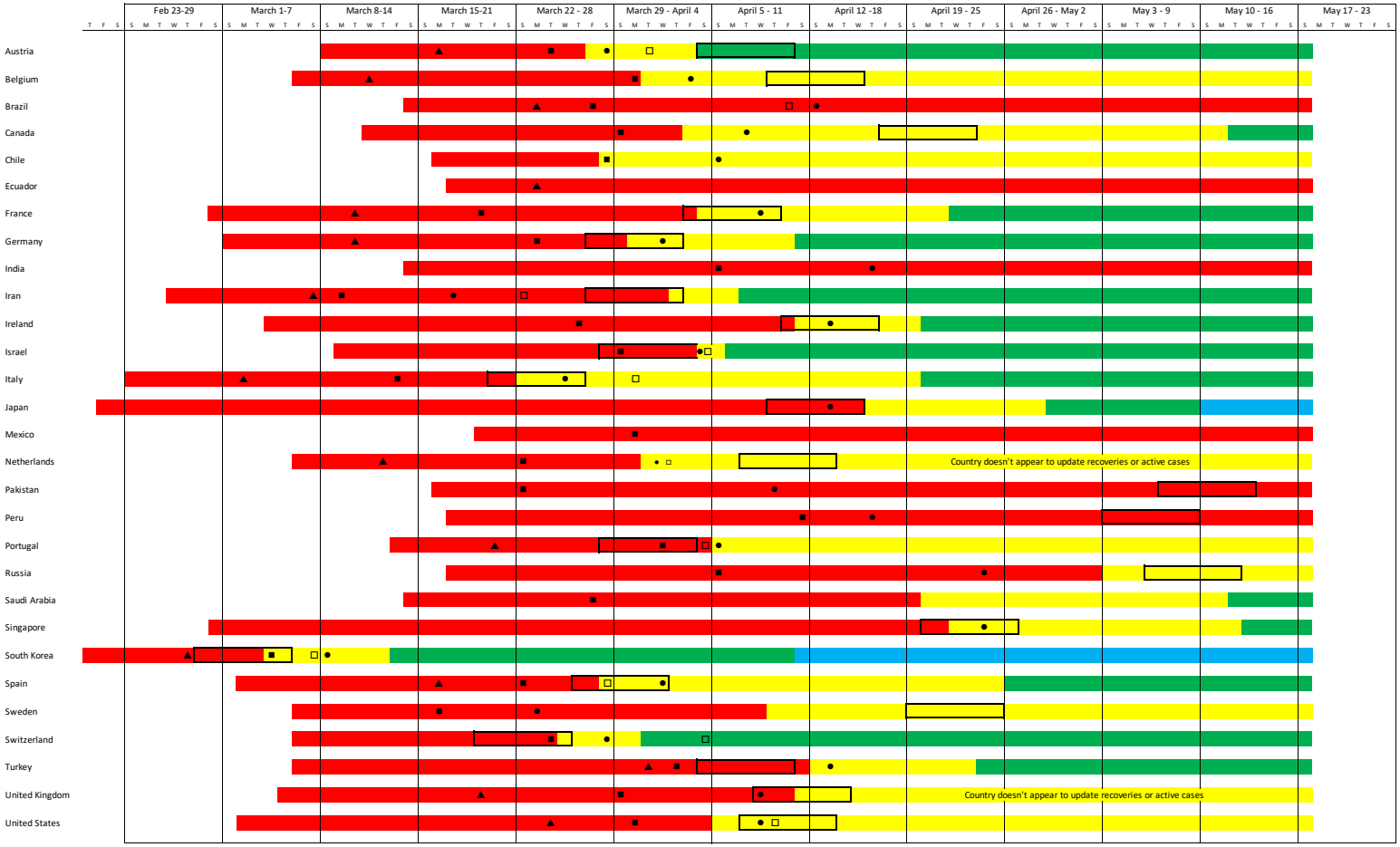

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Country-By-Country
Listing of Countries By Total Cases

When we first expanded our tracking to 30 countries in mid-April, they represented the most countries with cases in the world. Since that time, Austria, Israel, Japan and South Korea have dropped in the rankings. These countries have moved up:

- **Bangladesh**
- **Belarus**
- **Columbia**
- **Dominican Republic**
- **Indonesia**
- **Kuwait**
- **Poland**
- **Qatar**
- **Philippines**
- **Romania**
- **South Africa**
- **UAE**
- **Ukraine**

The original 30 still account for ~90% of all cases worldwide.

Countries making large upward movement are highlighted

	Total Cases							
Rank	Country	16-May	Rank	Country	6-May	Rank	Country	27-Apr
1	USA	1,527,664	1	USA	1,263,092	1	USA	1,010,356
2	Russia	281,752	2	Spain	253,682	2	Spain	229,422
3	Spain	277,719	3	Italy	214,457	3	Italy	199,414
4	UK	243,695	4	UK	201,101	4	France	165,842
5	Brazil	241,080	5	France	174,191	5	Germany	158,758
6	Italy	225,435	6	Germany	168,162	6	UK	157,149
7	France	179,569	7	Russia	165,929	7	Turkey	112,261
8	Germany	176,651	8	Turkey	131,744	8	Iran	91,472
9	Turkey	149,435	9	Brazil	126,611	9	Russia	87,147
10	Iran	120,198	10	Iran	101,650	10	China	82,830
11	India	95,698	11	China	82,883	11	Brazil	66,501
12	Peru	92,273	12	Canada	63,496	12	Canada	48,500
13	China	82,947	13	Peru	54,817	13	Belgium	46,687
14	Canada	77,002	14	India	52,987	14	Netherlands	38,245
15	Belgium	55,280	15	Belgium	50,781	15	India	29,451
16	Saudi Arabia	54,752	16	Netherlands	41,319	16	Switzerland	29,164
17	Mexico	47,144	17	Saudi Arabia	31,938	17	Peru	28,669
18	Netherlands	43,995	18	Switzerland	30,060	18	Portugal	24,070
19	Chile	43,781	19	Ecuador	29,420	19	Ecuador	23,240
20	Pakistan	40,151	20	Portugal	26,182	20	Ireland	19,648
21	Ecuador	33,182	21	Mexico	26,025	21	Sweden	18,926
23	Switzerland	30,587	22	Sweden	23,918	22	Saudi Arabia	18,811
24	Sweden	30,143	23	Pakistan	23,214	23	Israel	15,555
26	Portugal	29,036	24	Chile	23,048	24	Austria	15,274
27	Singapore	28,038	25	Ireland	22,248	25	Mexico	14,677
28	Ireland	24,112	26	Singapore	20,198	26	Singapore	14,423
35	Israel	16,617	29	Israel	16,310	27	Pakistan	13,915
36	Japan	16,285	31	Austria	15,684	28	Chile	13,813
37	Austria	16,242	32	Japan	15,253	29	Japan	13,614
44	S. Korea	11,050	38	S. Korea	10,806	35	South Korea	10,738
	Others	507,753		Others	356,176		Others	263,943
	World	4,799,266			3,817,382		World	3,062,515
	30 countries' share	89.4%			90.7%			91.4%

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Country-By-Country

Tracking Russia's Virus Progression

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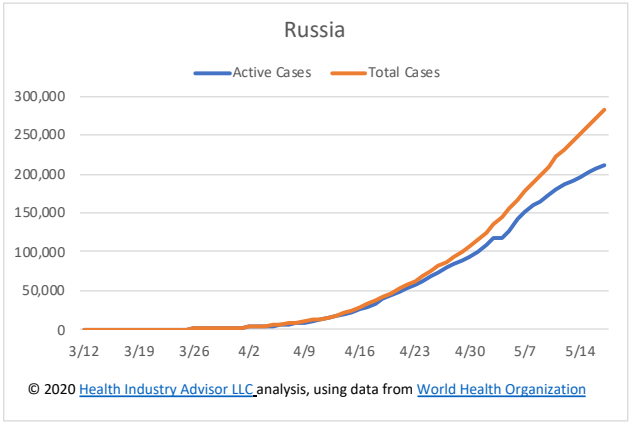
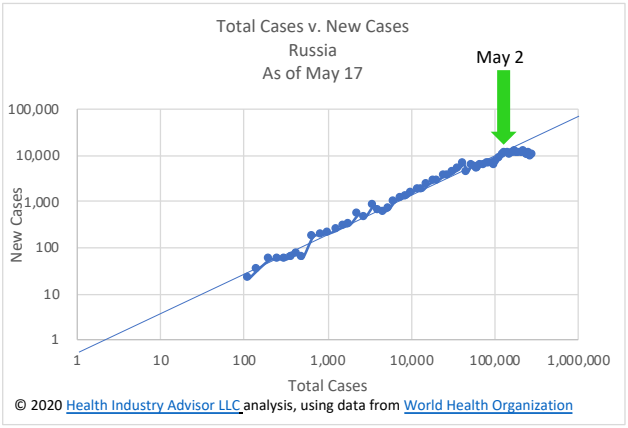
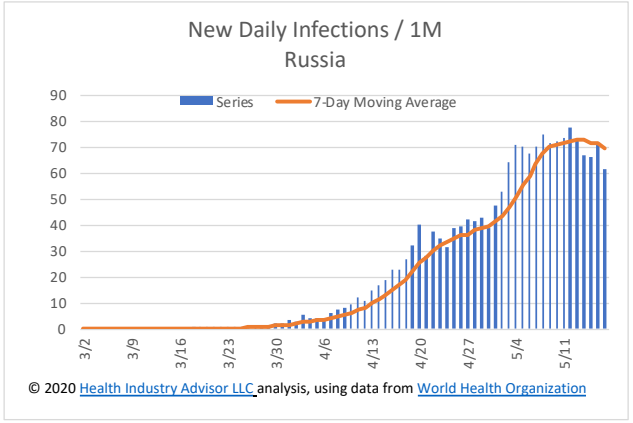
Russia now has the second highest number of cases in the world, up from 9th just 3 weeks ago



Russia's cases, however, ceased growing exponentially on or about May 2



Further, new daily cases (trailing 7-day moving average) peaked on May 13



Country-by-Country

Cases & Cases Per Capita

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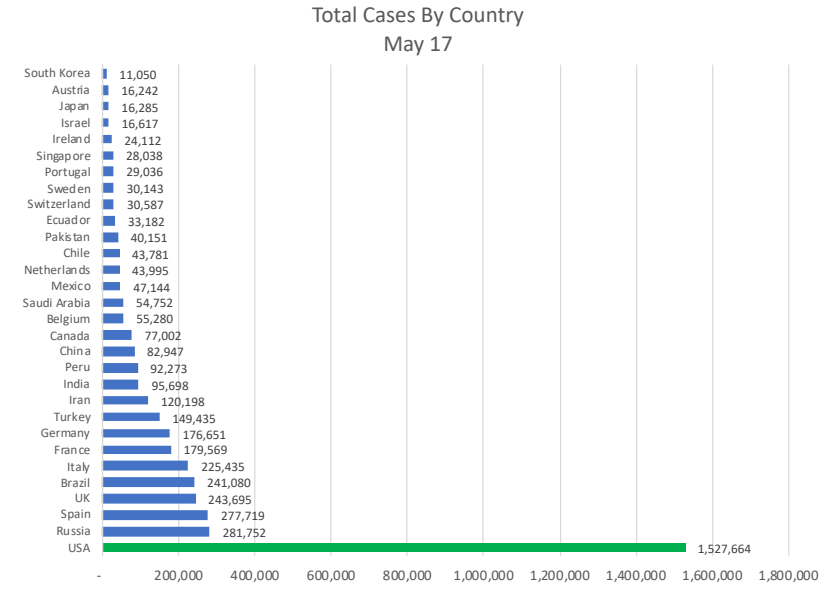
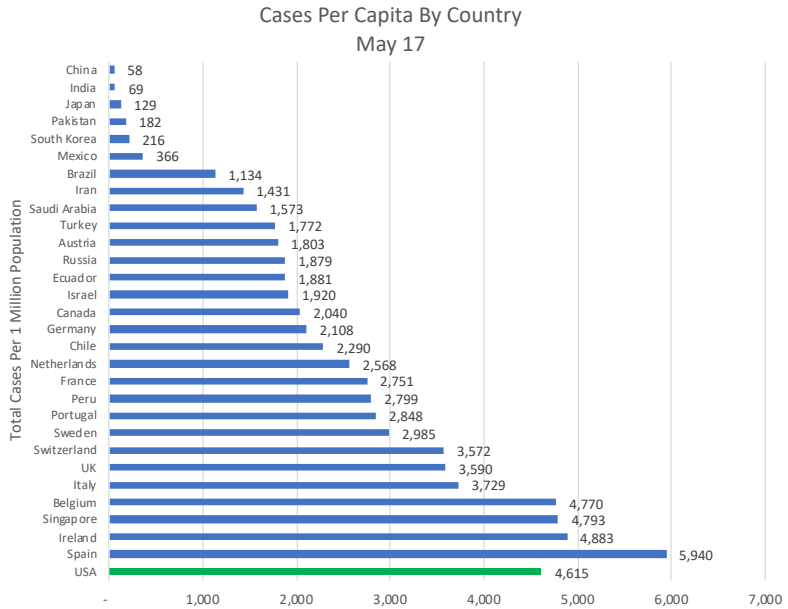
Chile, India, Mexico, Peru, Russia and Saudi Arabia are moving up in the ranks of most cases; Austria, Israel, Japan and South Korea are dropping

Cases per capita remain the highest in European countries, Singapore and the US.





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Country-by-Country

Deaths Per Cases & Per Capita

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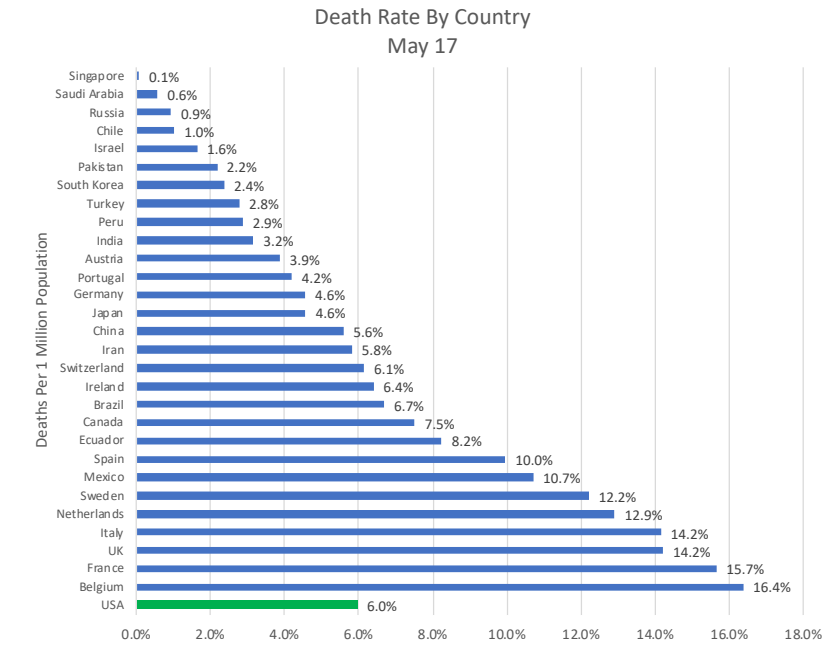
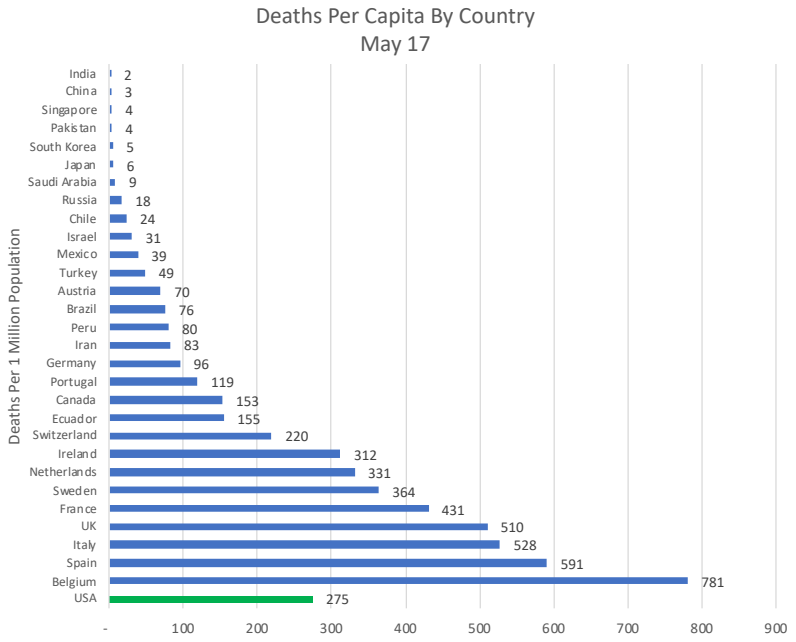
Death rates per case and per capita are the highest in Belgium, France, Italy and the UK. Rates in the US are in the middle of this group of countries





Country-by-Country

Tests Per Capita & Case Growth Rate

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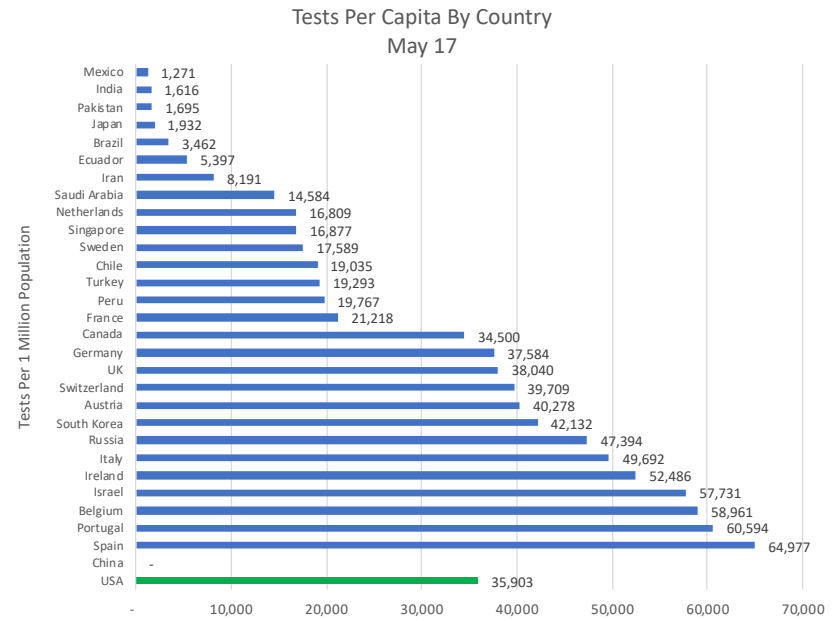
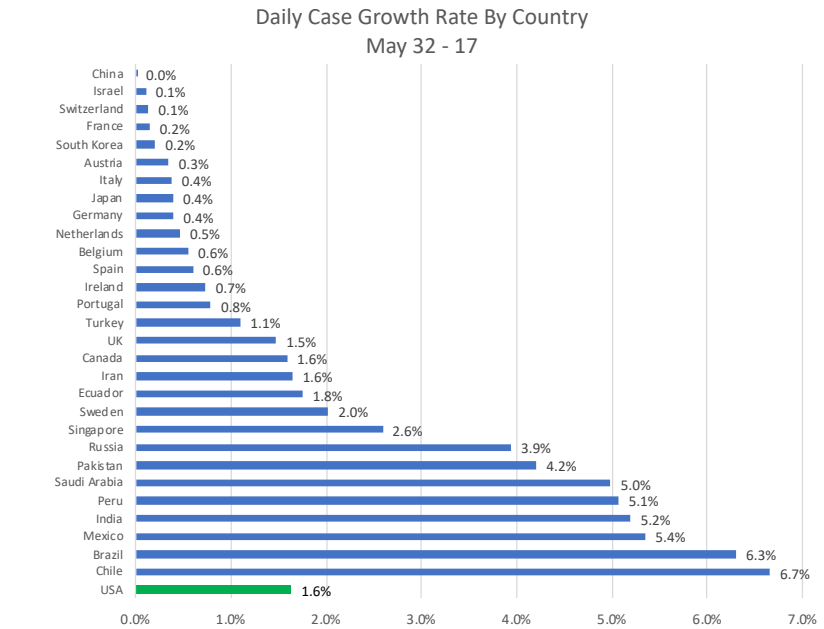
Testing per capita varies widely among these countries. The US, while ramping up testing over the past several weeks, still lags that of many European countries.



Case growth among the hardest-hit countries has fallen sharply over the past month



Country-by-Country

New Daily Infection Rate

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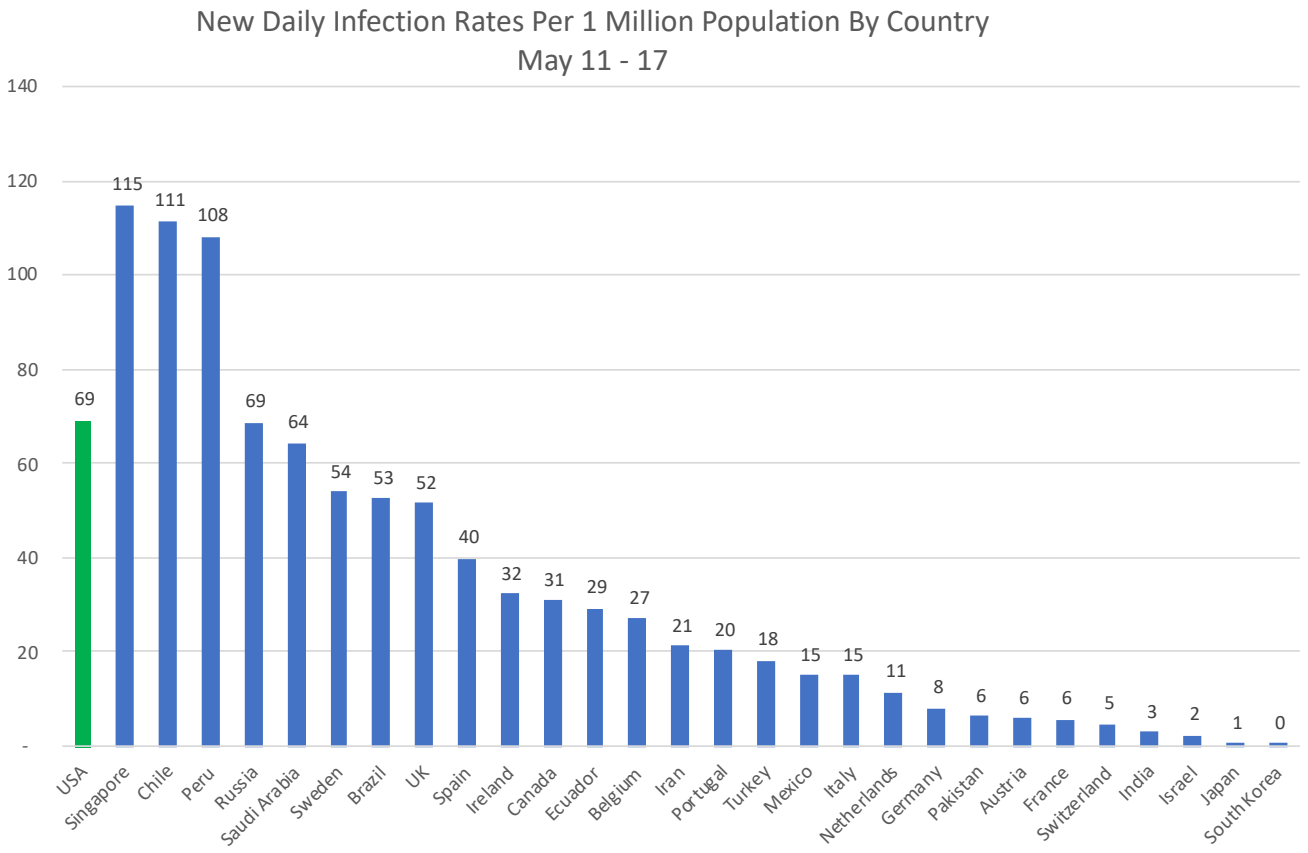
New daily infection rates are declining in most of the hardest-hit countries. Singapore is high but, declining.

Even in countries with newly-emerging virus-spread - Brazil, India, Mexico and Saudi Arabia - infection rates appear relatively low. Chile and Peru are the exceptions.



UNITED STATES & STATE-BY-STATE INFORMATION

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State-by-State

Comparative Statistics

"Strategic Guidance in an Era of Unprecedented Change"

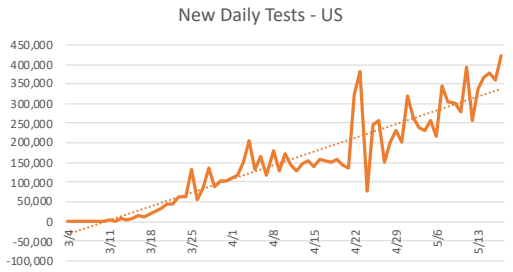
State	Total Cases	Rank	Cases per 1M Population	Rank2	Deaths	Rank3	Death Rate	Rank4	Deaths per 1 Million Population	Rank5	5-day Moving Average Case Growth Rate	Rank6	Tests per 1M Population Past 7 days	Rank7	New Daily Cases Per 1M Population (5-Day M.A.)	Rank8
Alabama	11,771	(26)	2,400.7	(28)	488	(25)	4.1%	(30)	99.5	(25)	2.4%	(19)	843	(33)	54.8	(27)
Alaska	396	(51)	541.3	(49)	10	(50)	2.5%	(42)	13.7	(50)	0.7%	(47)	1,423	(15)	3.3	(48)
Arizona	13,937	(23)	1,914.8	(35)	680	(21)	4.9%	(18)	93.4	(27)	3.5%	(5)	275	(50)	55.3	(25)
Arkansas	4,759	(39)	1,577.0	(41)	98	(40)	2.1%	(46)	32.5	(46)	2.7%	(9)	931	(31)	35.4	(36)
California	80,265	(5)	2,031.4	(34)	3,289	(8)	4.1%	(31)	83.2	(30)	2.5%	(17)	1,011	(25)	44.6	(32)
Colorado	21,938	(17)	3,809.5	(17)	1,215	(16)	5.5%	(11)	211.0	(14)	1.7%	(32)	619	(44)	55.4	(24)
Connecticut	37,419	(12)	10,495.4	(5)	3,408	(7)	9.1%	(2)	955.9	(3)	1.7%	(30)	1,619	(7)	154.9	(6)
Delaware	7,670	(33)	7,876.7	(7)	290	(33)	3.8%	(34)	297.8	(12)	2.6%	(14)	1,442	(14)	179.4	(3)
District Of Columbia	7,123	(35)	10,092.8	(6)	383	(28)	5.4%	(14)	542.7	(5)	1.9%	(27)	1,408	(16)	172.3	(4)
Florida	45,588	(9)	2,122.6	(33)	1,973	(11)	4.3%	(27)	91.9	(28)	1.7%	(33)	751	(39)	33.2	(38)
Georgia	37,701	(11)	3,550.9	(20)	1,609	(14)	4.3%	(28)	151.5	(16)	1.6%	(36)	1,448	(13)	56.4	(23)
Hawaii	640	(49)	452.0	(50)	17	(48)	2.7%	(41)	12.0	(51)	0.2%	(51)	444	(48)	0.8	(51)
Idaho	2,419	(43)	1,349.8	(43)	73	(42)	3.0%	(39)	40.7	(43)	1.1%	(45)	361	(49)	15.1	(45)
Illinois	94,191	(3)	7,433.1	(8)	4,177	(6)	4.4%	(24)	329.6	(10)	2.6%	(16)	1,713	(5)	185.5	(2)
Indiana	27,778	(16)	4,126.1	(16)	1,751	(12)	6.3%	(8)	260.1	(13)	2.0%	(25)	790	(36)	77.5	(17)
Iowa	14,651	(22)	4,643.6	(14)	351	(29)	2.4%	(44)	111.2	(24)	2.6%	(15)	1,180	(21)	121.9	(10)
Kansas	7,951	(31)	2,729.2	(23)	195	(36)	2.5%	(43)	66.9	(35)	1.9%	(28)	446	(47)	48.9	(30)
Kentucky	7,688	(32)	1,720.8	(38)	334	(31)	4.3%	(26)	74.8	(33)	2.3%	(21)	1,367	(17)	39.9	(35)
Louisiana	34,432	(13)	7,406.7	(9)	2,491	(9)	7.2%	(4)	535.8	(6)	1.4%	(41)	1,515	(9)	87.0	(15)
Maine	1,687	(45)	1,255.0	(46)	70	(43)	4.1%	(29)	52.1	(39)	2.7%	(10)	27	(51)	26.7	(41)
Maryland	38,804	(10)	6,418.5	(10)	1,992	(10)	5.1%	(16)	329.5	(11)	2.6%	(13)	827	(34)	146.9	(8)
Massachusetts	86,010	(4)	12,376.4	(3)	5,797	(3)	6.7%	(7)	834.2	(4)	1.6%	(35)	1,489	(11)	168.9	(5)
Michigan	51,142	(7)	5,120.9	(13)	4,891	(4)	9.6%	(1)	489.7	(7)	1.3%	(44)	1,592	(8)	57.3	(21)
Minnesota	15,668	(21)	2,778.2	(22)	731	(19)	4.7%	(20)	129.6	(19)	4.6%	(1)	1,000	(26)	111.4	(11)
Mississippi	11,296	(27)	3,795.5	(18)	521	(23)	4.6%	(21)	175.1	(15)	2.7%	(11)	1,513	(10)	86.2	(16)
Missouri	11,057	(28)	1,801.6	(36)	604	(22)	5.5%	(12)	98.4	(26)	1.6%	(38)	966	(29)	24.4	(43)
Montana	468	(50)	437.9	(51)	16	(49)	3.4%	(37)	15.0	(48)	0.3%	(49)	693	(42)	1.3	(50)
Nebraska	10,348	(29)	5,349.4	(11)	123	(39)	1.2%	(48)	63.6	(37)	3.5%	(4)	1,482	(12)	150.1	(7)
Nevada	6,857	(36)	2,226.2	(31)	350	(30)	5.1%	(17)	113.6	(23)	1.7%	(34)	1,012	(24)	35.2	(37)
New Hampshire	3,596	(42)	2,644.7	(24)	172	(37)	4.8%	(19)	126.5	(20)	2.1%	(24)	1,187	(20)	55.2	(26)
New Jersey	148,197	(2)	16,684.7	(2)	10,366	(2)	7.0%	(5)	1,167.1	(2)	0.8%	(46)	2,817	(2)	131.7	(9)
New Mexico	5,938	(37)	2,831.9	(21)	265	(35)	4.5%	(23)	126.4	(21)	2.6%	(12)	2,148	(3)	73.2	(19)
New York	359,847	(1)	18,497.7	(1)	28,325	(1)	7.9%	(3)	1,456.0	(1)	0.6%	(48)	1,692	(6)	106.0	(12)
North Carolina	18,659	(19)	1,779.1	(37)	684	(20)	3.7%	(35)	65.2	(36)	3.6%	(3)	774	(37)	50.7	(28)
North Dakota	1,900	(44)	2,493.2	(27)	43	(47)	2.3%	(45)	56.4	(38)	3.9%	(2)	1,941	(4)	76.7	(18)
Ohio	27,929	(15)	2,389.3	(29)	1,628	(13)	5.8%	(9)	139.3	(17)	2.0%	(26)	728	(40)	47.0	(31)
Oklahoma	5,310	(38)	1,341.9	(44)	288	(34)	5.4%	(13)	72.8	(34)	2.3%	(20)	993	(28)	26.0	(42)
Oregon	3,623	(41)	859.0	(47)	137	(38)	3.8%	(33)	32.5	(45)	1.5%	(40)	638	(43)	13.4	(46)
Pennsylvania	65,816	(6)	5,141.1	(12)	4,503	(5)	6.8%	(6)	351.7	(9)	1.4%	(42)	541	(45)	64.3	(20)
Rhode Island	12,674	(24)	11,963.8	(4)	499	(24)	3.9%	(32)	471.0	(8)	1.8%	(29)	2,877	(1)	188.8	(1)
South Carolina	8,816	(30)	1,712.3	(39)	385	(27)	4.4%	(25)	74.8	(32)	2.1%	(23)	995	(27)	32.3	(39)
South Dakota	3,987	(40)	4,506.8	(15)	44	(46)	1.1%	(50)	49.7	(40)	1.7%	(31)	753	(38)	95.9	(14)
Tennessee	17,388	(20)	2,544.6	(25)	298	(32)	1.7%	(47)	43.6	(42)	1.5%	(39)	1,326	(18)	50.2	(29)
Texas	48,677	(8)	1,678.8	(40)	1,360	(15)	2.8%	(40)	46.9	(41)	3.1%	(8)	943	(30)	43.3	(34)
Utah	7,238	(34)	2,257.7	(30)	80	(41)	1.1%	(49)	25.0	(47)	2.4%	(18)	1,080	(22)	44.0	(33)
Vermont	940	(47)	1,506.4	(42)	54	(45)	5.7%	(10)	86.5	(29)	0.3%	(50)	511	(46)	3.0	(49)
Virginia	30,388	(14)	3,560.2	(19)	1,009	(18)	3.3%	(38)	118.2	(22)	3.3%	(7)	792	(35)	105.6	(13)
Washington	19,283	(18)	2,532.3	(26)	1,016	(17)	5.3%	(15)	133.4	(18)	1.3%	(43)	713	(41)	31.4	(40)
West Virginia	1,490	(46)	833.7	(48)	67	(44)	4.5%	(22)	37.5	(44)	1.6%	(37)	1,027	(23)	10.2	(47)
Wisconsin	12,543	(25)	2,154.3	(32)	453	(26)	3.6%	(36)	77.8	(31)	3.4%	(6)	904	(32)	57.0	(22)
Wyoming	754	(48)	1,302.8	(45)	8	(51)	1.1%	(51)	13.8	(49)	2.2%	(22)	1,239	(19)	22.7	(44)
United States	1,527,664		4,615.3		90,978		6.0%		274.9		1.6%		1,083		69.1	

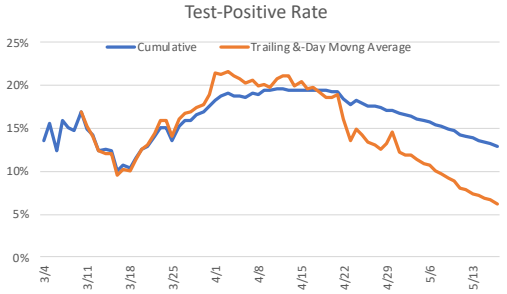
United States

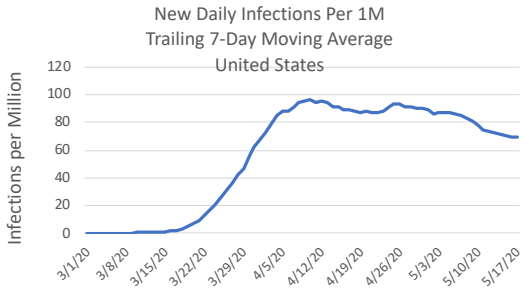
Overall Statistics

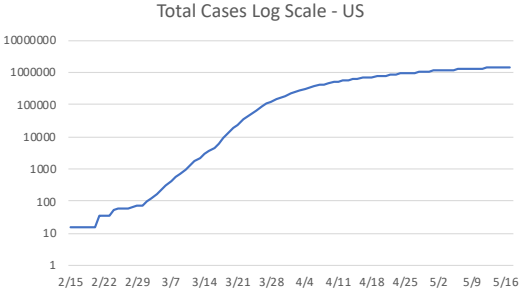
"Strategic Guidance in an Era of Unprecedented Change"

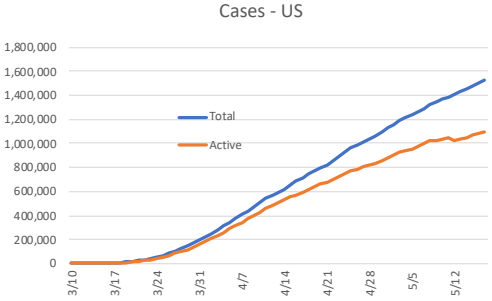
With significantly increased testing, the US is now meeting the WHO standard of <10% test-positives. This suggests that asymptomatic cases are being captured and that we have a better view of true infection rates.
Further, new daily infections continue to decline; the death rate seems to have stabilized.

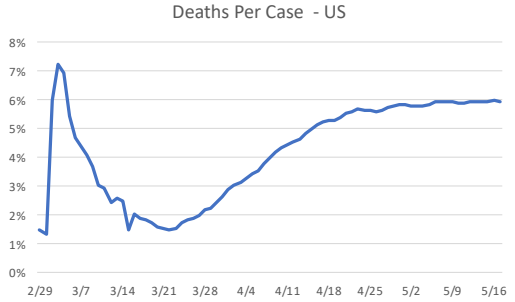












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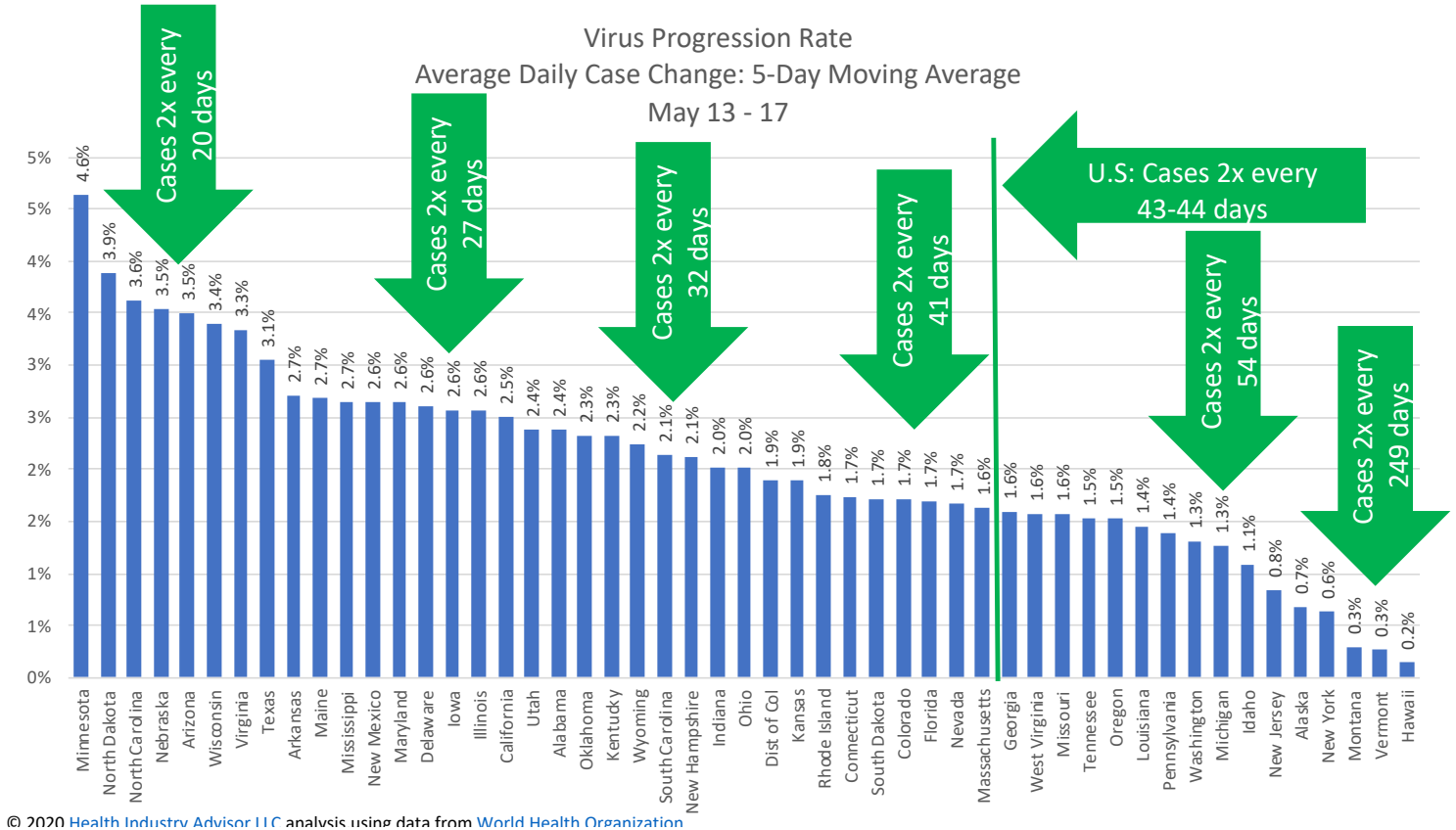
State-by-State

Average Daily Case Growth

"Strategic Guidance in an Era of Unprecedented Change"

Just 1 month ago, cases in every state were doubling every 1 – 3 weeks.
Now, they would take 2 weeks to more than 1 year to double



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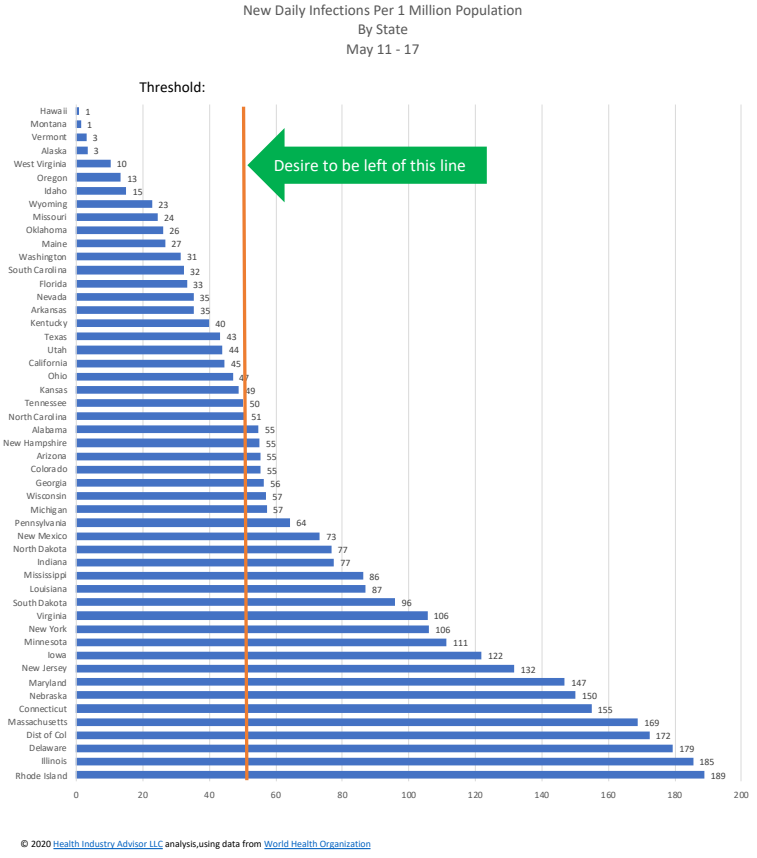
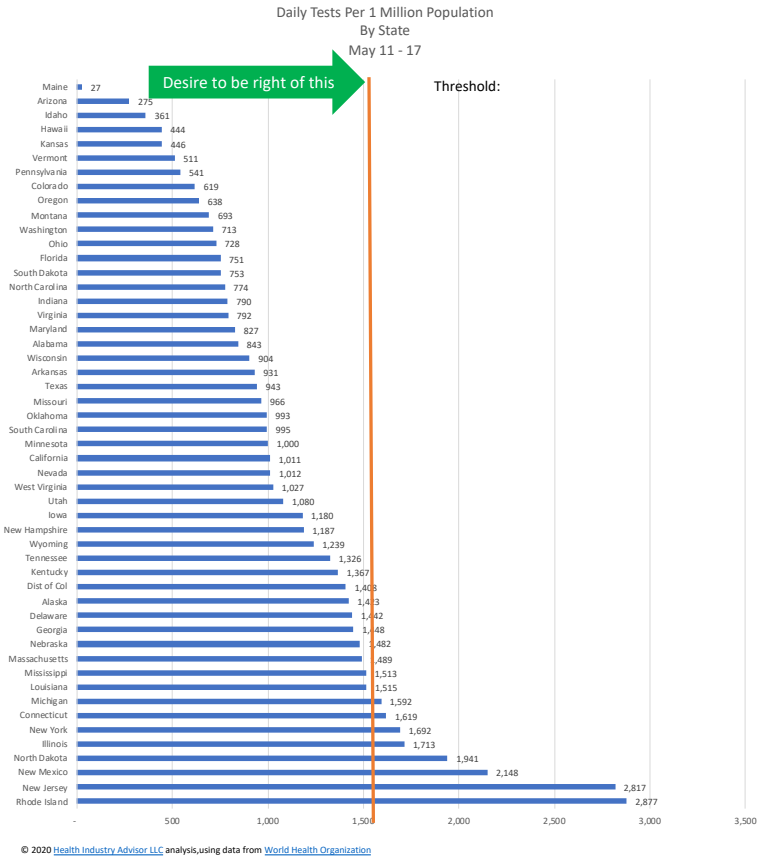
State-by-State

New Daily Infections & Tests Per Capita

"Strategic Guidance in an Era of Unprecedented Change"

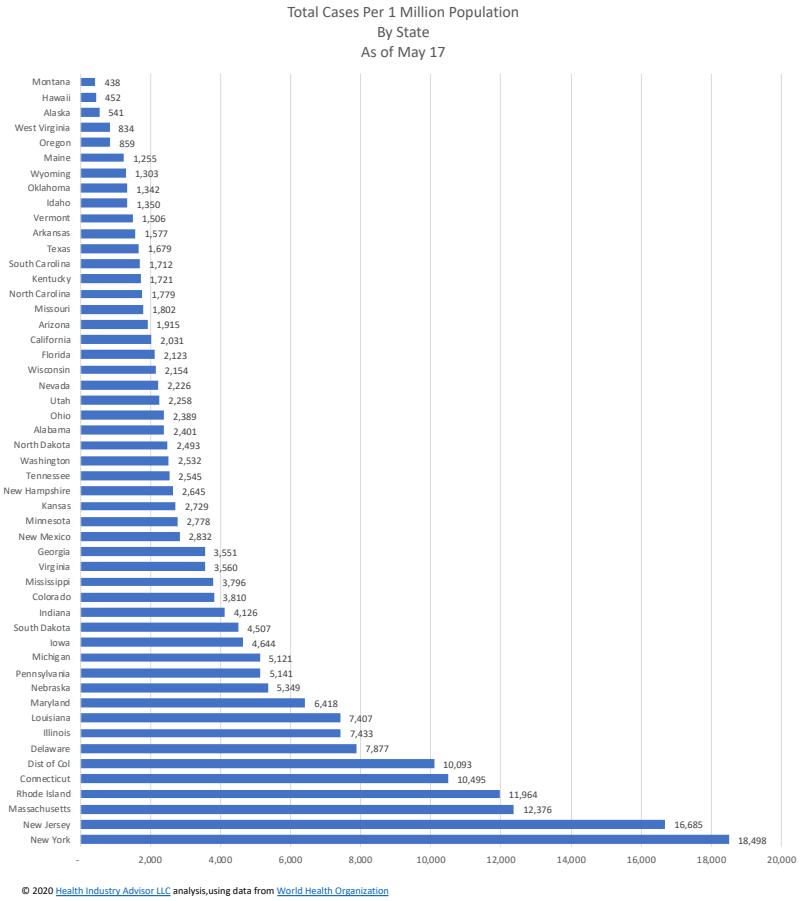


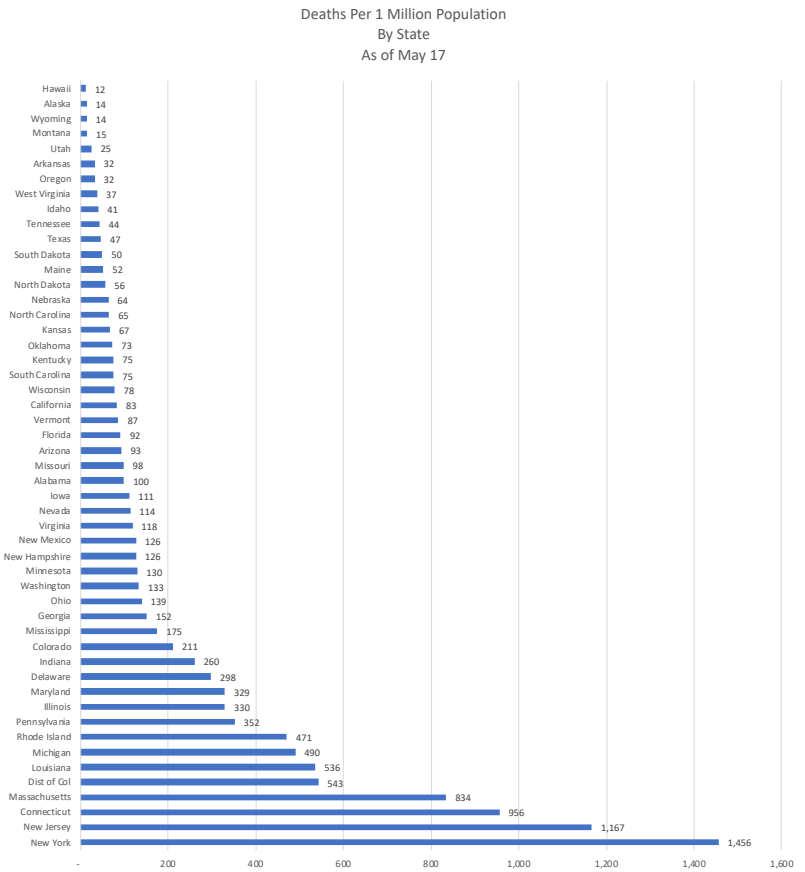


State-by-State

Cases & Deaths Per Capita

"Strategic Guidance in an Era of Unprecedented Change"



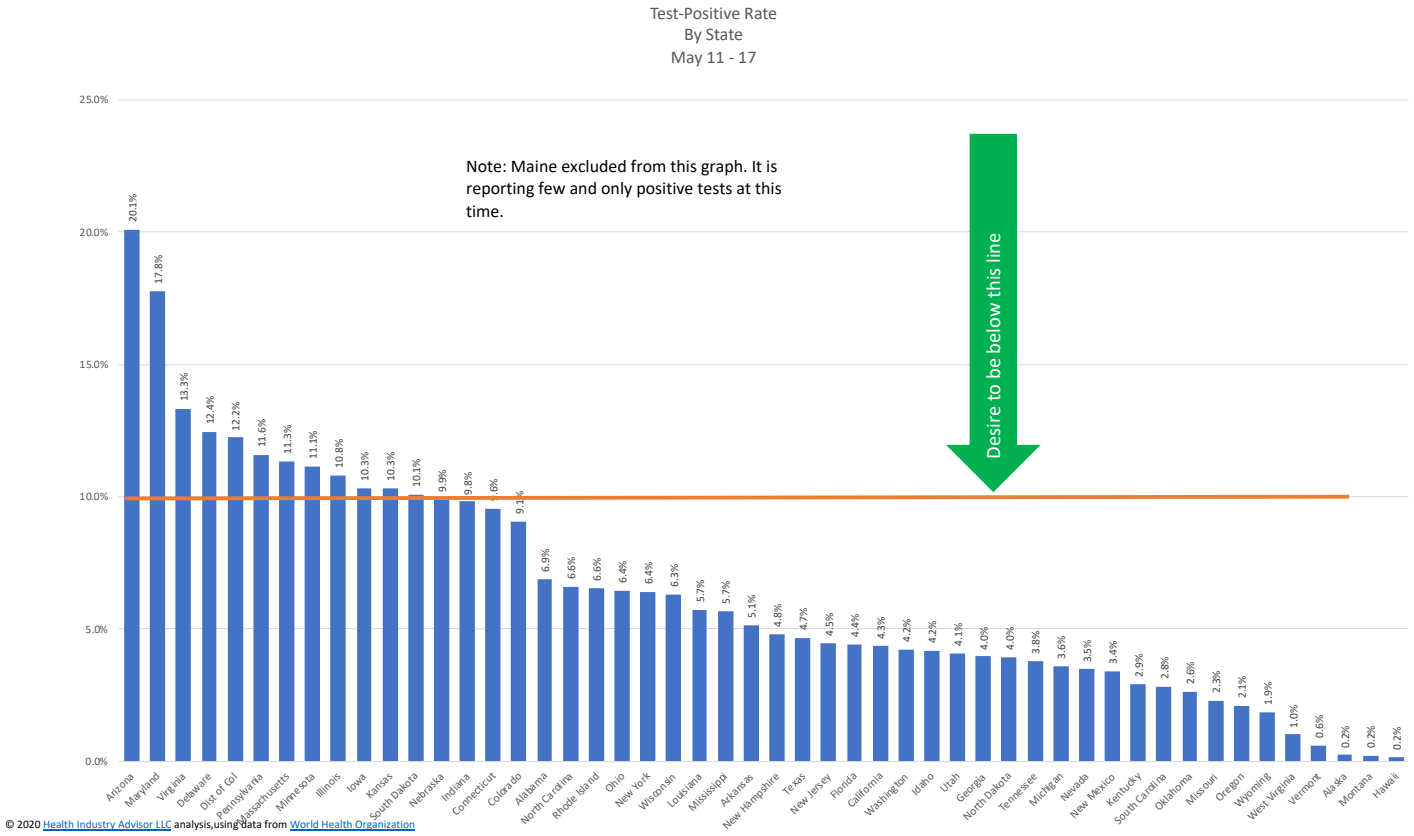


State-by-State

Which States Are Performing Sufficient Tests?

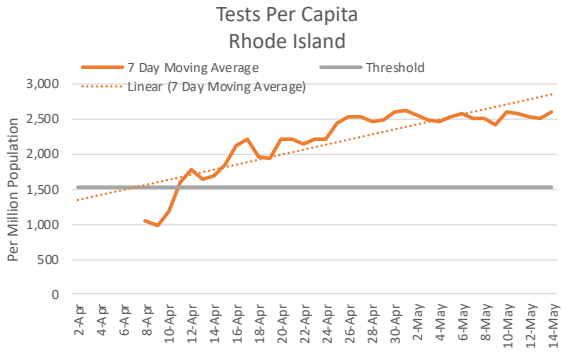
"Strategic Guidance in an Era of Unprecedented Change"

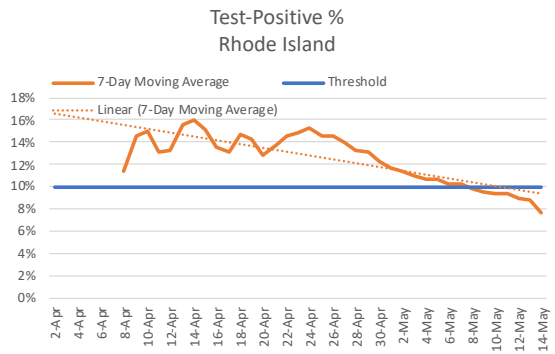
The World Health Organization suggested that the test-positive rate should be 10% or lower, for testing to be sufficient to assess the true prevalence of the virus. All except 11 states and the District of Columbia effectively met this guideline for the past week.



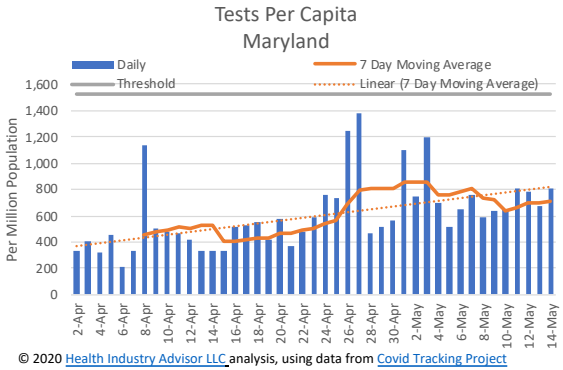
Which States Are Performing Sufficient Tests?

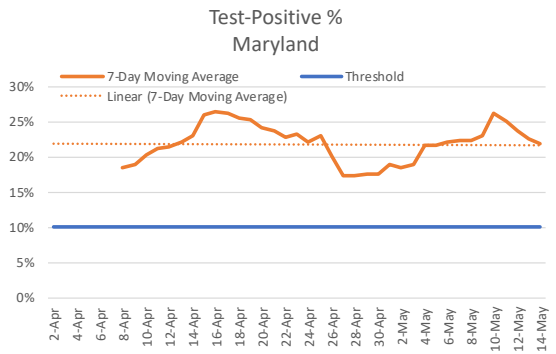
What sufficient testing looks like: high volume of tests, with low test-positive rates . . .





What insufficient testing looks like: low volume of tests, with high test-positive rates . . .





STATE-BY-STATE READINESS FOR RELAXING RESTRICTIONS

Readiness For Relaxing Restrictions

We recently modified the tests/capita metric in two ways: first, we changed to tests/capita past 2 weeks (v. cumulative); second, we adopted the Harvard based study of susceptible-infected-recovered model (SEIR) identification of a goal of 2.7% of population tested per week; and, a minimum of 1520 tests per 1 million population. This will serve as a more challenging standard.

- We recently introduced a scorecard to provide a snapshot of each state's readiness for relaxing restrictions on businesses and individuals.
- To portray readiness we have incorporated the following measures into to the scorecard, (along with the rationale for the scoring within each measure):
  - Tests/Capita – last 14 days; indicates testing robustness; grading quintiles based on Harvard study using susceptible-infected-recovered model (SEIR) 2.7% of population tested per week, 1%, 0.7%, 0.35%, all others
    - Direction – whether test volume increased/stayed level, or decreased the past 2 weeks v. prior two weeks
  - Test-Positive Rate – indicates whether testing is identifying sufficient numbers of non-infected persons; grading based on comparison to best reported in the world (South Korea, Australia, New Zealand), next group of countries (Canada, Germany, Denmark), then, next 3 levels set to differentiate among states
    - Direction – whether test positive rate increased/stayed level, or past 2 weeks v. prior two weeks
  - New Infections / 1 Million – indicates how quickly the virus is spreading; grading based on: rate proposed by IHME for ending social distancing, top ten, top 20, top 25 among the countries we track, then all others
    - Direction – whether new infection per capita rate increased/stayed level, or past 2 weeks v. prior two weeks
  - Influenza-Like Illness – Using CDC-reported data, indicates whether the state's visits for influenza the past week were above or below CDC baseline for the state's region
    - Direction – whether the % visits for influenza the last 3 weeks increased or decreased the past 3 weeks v. the prior 3 weeks
  - Hospital Resources – using IHME projections, whether the state is pre- or post- peak projected hospital resource needs due to the virus; and the 5 of peak resources projected to be needed today. Grading based on current need at <45% of peak, 45-60%, 60-75%, 75-85%, and all others.
- On the following pages, we portray state-by-state readiness on various dates.
- **These scorecards are for informational purposes only. The measures and grading used are not based on any scientific standard and should not be considered a substitute for public health considerations or other clinical or economic judgement. States may elect to move faster or slower than the scorecard might otherwise indicate.**

Readiness For Relaxing Restrictions

Highlights:

- Progress has been made in several states, on both testing volumes and test-positive rates
  - Most states are still testing far below the minimum 152 daily tests per 1 million population cited in a recent NY Times article; and the higher standard of 2.7% of the population tested weekly (386 daily per 1 million, as suggested by a recent Kaiser Family Foundation article. Both articles referenced Harvard researchers as the source of these metrics
  - Test-positive rates in many states, however, are below or close to the 10% threshold suggested by Dr. Maria Van Kerkhove of the World Health Organization, as indicative of sufficient testing to have reasonable visibility to true infection rates
- As we have progressed past the peak flu season in many states, that "constraint" on re-opening is diminishing
- With the relaxing of restrictions in many states, the Institute for Health Metrics and Evaluation's (IHME) projections of these states' hospital resources needs have increased significantly in the past week. Note: these metrics consider hospital resource needs, however, they do not consider capacity

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State-By-State

Relative "Readiness" For Relaxing Restrictions

"Strategic Guidance in an Era of Unprecedented Change"

Change over past 10 days

May 17

State	Tests / Capita		Test-Positive Rate		New Infections / 1 Million		Influenza-Like Illness		Hospital Resources
	#	Direction	#	Direction	#	Direction	Baseline	Direction	
Alabama		✓		✓		✗	✓	✓	
Alaska		✓		✓		✓	✓	✓	
Arizona		✓		✓		✗	✓	✓	
Arkansas		✓		✓		✓	✓	✓	
California		✓		✓		✗	✓	✓	
Colorado		✓		✓		✓	✓	✓	
Connecticut		✓		✓		✓	✗	✓	
Delaware		✓		✗		✓	✓	✗	
District Of Columbia		✓		✓		✓	✓	✓	
Florida		✓		✓		✓	✗	!	
Georgia		✓		✓		✓	✓	✓	
Hawaii		✓		✓		✓	✓	✓	
Idaho		✓		✓		✓	✓	✓	
Illinois		✓		✓		✗	✓	✓	
Indiana		✓		✓		✓	✓	✓	
Iowa		✓		✗		✓	✓	✗	
Kansas		✓		✗		✓	✓	✓	
Kentucky		✓		✓		✗	✗	✗	
Louisiana		✓		✓		✓	✗	✓	
Maine		✓		✗		✗	✓	✓	
Maryland		✓		✗		✗	✓	✓	
Massachusetts		✓		✓		✓	✓	✓	
Michigan		✓		✓		✓	✓	✓	
Minnesota		✓		✗		✗	✓	✗	
Mississippi		✓		✗		✓	✓	✓	
Missouri		✓		✓		✓	✓	✓	
Montana		✓		✓		✓	✓	✓	
Nebraska		✓		✗		✗	✓	✓	
Nevada		✓		✓		✓	✓	✓	
New Hampshire		✓		✓		✓	✓	✓	
New Jersey		✓		✓		✓	✓	✓	
New Mexico		✓		✓		✗	✓	✓	
New York		✓		✓		✓	✓	✓	
North Carolina		✓		✓		✗	✓	✓	
North Dakota		✓		✓		✗	✓	✓	
Ohio		✓		✓		✓	✓	✗	
Oklahoma		✓		✓		✓	✓	✓	
Oregon		✓		✓		✗	✓	✓	
Pennsylvania		✓		✓		✓	✓	✓	
Rhode Island		✓		✓		✗	✓	✗	
South Carolina		✓		✓		✓	✓	✓	
South Dakota		✓		✗		✗	✓	✓	
Tennessee		✓		✓		✓	✓	✓	
Texas		✓		✓		✗	✓	✓	
Utah		✓		✓		✓	✓	✓	
Vermont		✓		✓		✓	✓	✓	
Virginia		✓		✗		✗	✗	✓	
Washington		✓		✓		✓	✓	✓	
West Virginia		✓		✓		✓	✗	✗	
Wisconsin		✓		✓		✗	✗	✓	
Wyoming		✓		✗		✗	✗	✗	

May 7

State	Tests / Capita		Test-Positive Rate		New Infections / 1 Million		Influenza-Like Illness		Hospital Resources
	#	Direction	#	Direction	#	Direction	Baseline	Direction	
Alabama		✓		✓		✗	✓	✓	
Alaska		✓		✓		✓	✓	✓	
Arizona		✓		✓		✗	✓	✓	
Arkansas		✓		✓		✓	✓	✓	
California		✓		✓		✗	✓	✓	
Colorado		✓		✓		✗	✓	✓	
Connecticut		✓		✓		✓	✗	✓	
Delaware		✓		✓		✗	✓	✓	
District Of Columbia		✓		✓		✗	✗	✓	
Florida		✓		✓		✓	!	!	
Georgia		✓		✓		✓	✓	✓	
Hawaii		✓		✓		✓	✓	✓	
Idaho		✓		✓		✓	✗	✗	
Illinois		✓		✓		✗	✗	✓	
Indiana		✓		✓		✗	✓	✓	
Iowa		✓		✓		✗	✓	✓	
Kansas		✓		✓		✗	✗	✓	
Kentucky		✓		✓		✗	✓	✓	
Louisiana		✓		✓		✓	✗	✓	
Maine		✓		✓		✗	✓	✓	
Maryland		✓		✗		✗	✗	✓	
Massachusetts		✓		✓		✗	✗	✓	
Michigan		✓		✓		✓	✓	✓	
Minnesota		✓		✓		✗	✗	✓	
Mississippi		✓		✓		✗	✓	✓	
Missouri		✓		✓		✗	✓	✓	
Montana		✓		✓		✓	✓	✓	
Nebraska		✓		✗		✗	✓	✓	
Nevada		✓		✓		✓	✓	✓	
New Hampshire		✓		✓		✗	✓	✓	
New Jersey		✓		✗		✗	✗	✓	
New Mexico		✓		✓		✗	✓	✓	
New York		✓		✓		✗	✓	✓	
North Carolina		✓		✓		✗	✓	✓	
North Dakota		✓		✓		✗	✓	✓	
Ohio		✓		✓		✓	✓	✓	
Oklahoma		✓		✓		✓	✓	✓	
Oregon		✓		✓		✗	✗	✓	
Pennsylvania		✓		✗		✓	✗	✓	
Rhode Island		✓		✓		✗	✓	✗	
South Carolina		✓		✓		✓	✗	✓	
South Dakota		✓		✗		✓	✓	✓	
Tennessee		✓		✓		✓	✗	✓	
Texas		✓		✓		✓	✗	✓	
Utah		✓		✓		✓	✗	✓	
Vermont		✓		✓		✓	✓	✓	
Virginia		✓		✗		✓	✗	✓	
Washington		✓		✓		✓	✗	✓	
West Virginia		✓		✓		✓	✓	✓	
Wisconsin		✓		✗		✗	✗	✓	
Wyoming		✓		✗		✓	✗	✓	

Legend and sources provided on 2nd following page

Change in "Hospital Resources" due to IHME raising projections, in response to relaxed social distancing

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State-By-State

Relative "Readiness" For Relaxing Restrictions

"Strategic Guidance in an Era of Unprecedented Change"

Progress over past month

May 17

State	Tests / Capita		Test-Positive Rate		New Infections / 1 Million		Influenza-Like Illness		Hospital Resources
	#	Direction	#	Direction	#	Direction	Baseline	Direction	
Alabama		✓		✓		✗	✓	✓	
Alaska		✓		✓		✓	✓	✓	
Arizona		✓		✓		✗	✓	✓	
Arkansas		✓		✓		✓	✓	✓	
California		✓		✓		✗	✓	✓	
Colorado		✓		✓		✓	✓	✓	
Connecticut		✓		✓		✗	✗	✓	
Delaware		✓		✗		✓	✓	✗	
District Of Columbia		✓		✓		✓	✓	✓	
Florida		✓		✓		✓	✗	!	
Georgia		✓		✓		✓	✓	✓	
Hawaii		✓		✓		✓	✓	✓	
Idaho		✓		✓		✓	✓	✓	
Illinois		✓		✓		✗	✓	✓	
Indiana		✓		✓		✓	✓	✓	
Iowa		✓		✗		✓	✓	✗	
Kansas		✓		✗		✓	✓	✓	
Kentucky		✓		✓		✗	✗	✗	
Louisiana		✓		✓		✓	✗	✓	
Maine		✓		✗		✗	✓	✓	
Maryland		✓		✗		✗	✓	✓	
Massachusetts		✓		✓		✓	✓	✓	
Michigan		✓		✓		✓	✓	✓	
Minnesota		✓		✗		✗	✓	✗	
Mississippi		✓		✗		✓	✓	✓	
Missouri		✓		✓		✓	✓	✓	
Montana		✓		✓		✓	✓	✓	
Nebraska		✓		✗		✗	✓	✓	
Nevada		✓		✓		✓	✓	✓	
New Hampshire		✓		✓		✓	✓	✓	
New Jersey		✓		✓		✓	✓	✓	
New Mexico		✓		✓		✗	✓	✓	
New York		✓		✓		✓	✓	✓	
North Carolina		✓		✓		✗	✓	✓	
North Dakota		✓		✓		✗	✓	✓	
Ohio		✓		✓		✓	✓	✗	
Oklahoma		✓		✓		✓	✓	✓	
Oregon		✓		✓		✗	✓	✓	
Pennsylvania		✓		✓		✓	✓	✓	
Rhode Island		✓		✓		✗	✓	✗	
South Carolina		✓		✓		✓	✓	✓	
South Dakota		✓		✗		✗	✓	✓	
Tennessee		✓		✓		✓	✓	✓	
Texas		✓		✓		✗	✓	✓	
Utah		✓		✓		✓	✓	✓	
Vermont		✓		✓		✓	✓	✓	
Virginia		✓		✗		✗	✗	✓	
Washington		✓		✓		✓	✓	✓	
West Virginia		✓		✓		✓	✗	✗	
Wisconsin		✓		✓		✗	✗	✓	
Wyoming		✓		✗		✗	✗	✗	

April 15

State	Tests / Capita		Test-Positive Rate		New Infections / 1 Million		Influenza-Like Illness		Hospital Resources
	#	Direction	#	Direction	#	Direction	Baseline	Direction	
Alabama		✓		✓		✗	✗	✓	
Alaska		✓		✓		✓	✓	✓	
Arizona		✓		✓		✗	✗	✓	
Arkansas		✓		✓		✗	✓	✓	
California		✓		✓		✓	✗	✓	
Colorado		✓		✗		✓	✗	✓	
Connecticut		✓		✗		✗	✗	✓	
Delaware		✓		✓		✗	✓	✓	
District Of Columbia		✓		✓		✗	✗	✓	
Florida		✓		✗		✓	✓	✓	
Georgia		✓		✗		✗	✗	✓	
Hawaii		✓		✗		✓	✓	✓	
Idaho		✓		✗		✓	✗	✓	
Illinois		✓		✗		✗	✗	✓	
Indiana		✓		✗		✓	✗	✓	
Iowa		✓		✓		✗	✓	✓	
Kansas		✓		✗		✗	✗	✓	
Kentucky		✓		✓		✓	✓	✓	
Louisiana		✓		✗		✗	✓	✓	
Maine		✓		✗		✓	✗	✓	
Maryland		✓		✓		✗	✗	✓	
Massachusetts		✓		✓		✗	✗	✓	
Michigan		✓		✓		✗	✓	✓	
Minnesota		✓		✓		✗	✓	✓	
Mississippi		✓		✓		✓	✗	✓	
Missouri		✓		✓		✓	✓	✓	
Montana		✓		✗		✓	✓	✓	
Nebraska		✓		✓		✗	✗	✓	
Nevada		✓		✗		✓	✓	✓	
New Hampshire		✓		✗		✗	✓	✓	
New Jersey		✓		✓		✓	✗	✓	
New Mexico		✓		✓		✗	✓	✓	
New York		✓		✗		✓	✗	✓	
North Carolina		✓		✗		✗	✓	✓	
North Dakota		✓		✓		✗	✗	✓	
Ohio		✓		✓		✗	✓	✓	
Oklahoma		✓		✗		✓	✗	✓	
Oregon		✓		✓		✓	✗	✓	
Pennsylvania		✓		✓		✗	✗	✓	
Rhode Island		✓		✓		✓	✗	✓	
South Carolina		✓		✓		✓	✗	✓	
South Dakota		✓		✓		✗	✗	✓	
Tennessee		✓		✓		✓	✗	✓	
Texas		✓		✓		✓	✗	✓	
Utah		✓		✓		✓	✗	✓	
Vermont		✓		✓		✓	✗	✓	
Virginia		✓		✓		✓	✗	✓	
Washington		✓		✓		✗	✗	✓	
West Virginia		✓		✓		✓	✗	✓	
Wisconsin		✓		✓		✗	✗	✓	
Wyoming		✓		✓		✗	✗	✓	

Legend and sources provided on following page

State-By-State

Relative "Readiness" For Relaxing Restrictions

"Strategic Guidance in an Era of Unprecedented Change"

Legend:

	Tests per Capita	Direction	Test-Positive Rate	Direction	New Daliy Infection Rate	Direction	Baseline	Direction	Hospital Resources
Time period	per 1M Average last 2 weeks	last 14 days v prior 2 weeks	last 7 days	last 14 days v prior 2 weeks	per 1M last 7 days	last 14 days v prior 2 weeks	CDC Baseline by region	last 14 days v prior 2 weeks	As of 4/26
	>3,850		<=2%		<10				<45% of Peak
	1520 - 3,850		2-10%		10-50				45-60% of Peak
	1,501 - 3,850		10-14%		50-100				60-75% of Peak
	501 - 1,500		14-18%		100-150				75-85% of peak
	<750		>18%		>150				>85% of Peak or Pre-Peak
✓		Up		Down		Down by 40%	Below Baseline	Down	
!						Down by 10%		N/A	
✗		Down		Up		Down <10% or Up	Above Baseline	Up	

Sources:

Influenza guidelines and data from Centers fo Disease Control (https://gis.cdc.gov/grasp/fluview/fluportaldashboard.html), accessed April 30, 2020

Test data from Covid Tracking Project (https://covidtracking.com/), accessed March 21-May 2, 2020

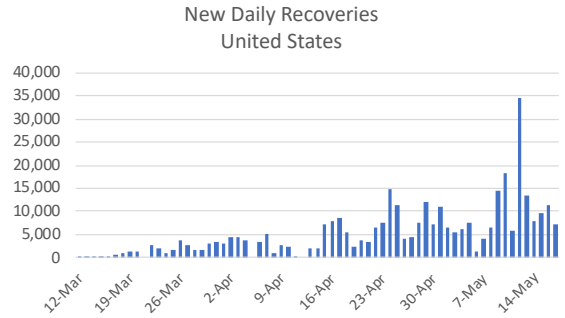
Hospital resource Need projections from Institure for Health Metrics and Evaluation (), accessed April 30, 2020

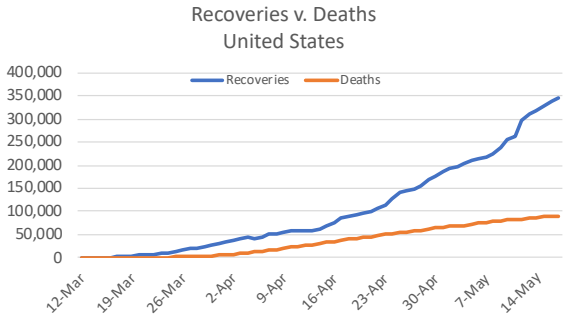
Infection rate data from World Health Organization (worldometer.info), accessed March 21-May 2, 2020

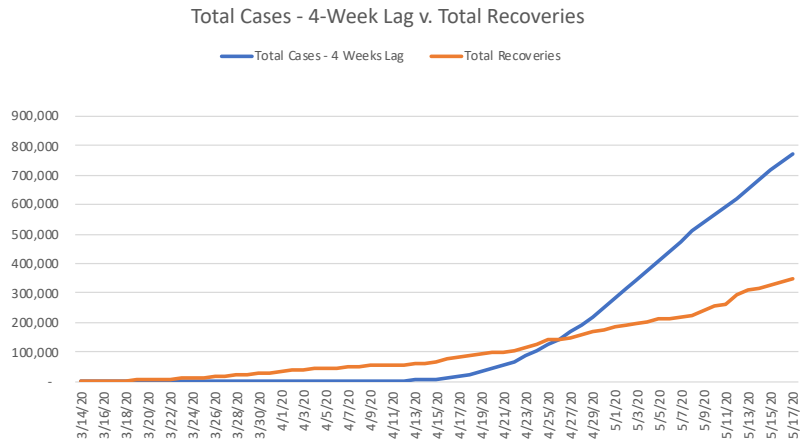
UNDER-REPORTED RECOVERIES? POSSIBLE LAG IN STATE REPORTING

Recoveries

"Strategic Guidance in an Era of Unprecedented Change"







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Recoveries

Reporting of Recoveries Seems to Be Lagging

"Strategic Guidance in an Era of Unprecedented Change"

At this point, we should be expecting far more recoveries in the U.S.

Comparing the reported recoveries to Total Cases 4 weeks ago*, this shortfall is ~250-325k

* - 4 weeks is the presumed time from infection-onset to recovery referenced by many states

Which states seem to be lagging in reporting?

State	Recoveries	Expected Recoveries Low	Expected Recoveries High
Alabama	20	3,922	4,413
Alaska	344	255	287
Arizona	70	3,943	4,436
Arkansas	3,590	1,425	1,603
California	13,106	25,144	28,287
Colorado	1,491	7,784	8,757
Connecticut	6,264	14,370	16,166
Delaware	3,478	2,030	2,284
District Of Columbia	1,023	2,234	2,514
Florida	7,638	21,051	23,683
Georgia	340	14,526	16,341
Hawaii	573	464	522
Idaho	1,379	1,338	1,505
Illinois	2,168	24,286	27,321
Indiana	1,869	8,968	10,089
Iowa	7,154	2,322	2,612
Kansas	2,477	1,479	1,664
Kentucky	2,768	2,368	2,664
Louisiana	22,608	19,142	21,535
Maine	1,028	694	780
Maryland	2,806	10,264	11,547
Massachusetts	27,812	30,462	34,269
Michigan	28,234	25,139	28,282
Minnesota	10,897	1,885	2,120
Mississippi	6,268	3,419	3,847
Missouri	2,807	4,558	5,128
Montana	431	346	390
Nebraska	22	1,030	1,158
Nevada	5,039	2,901	3,263
New Hampshire	1,258	1,074	1,208
New Jersey	3,357	65,136	73,278
New Mexico	1,739	1,438	1,618
New York	61,397	192,833	216,937
North Carolina	9,115	5,093	5,729
North Dakota	1,111	422	475
Ohio	4,168	8,178	9,200
Oklahoma	3,945	2,056	2,313
Oregon	1,406	1,475	1,660
Pennsylvania	6,549	25,385	28,558
Rhode Island	886	3,593	4,042
South Carolina	6,043	3,397	3,821
South Dakota	2,673	1,234	1,388
Tennessee	9,529	5,410	6,086
Texas	26,870	14,943	16,811
Utah	3,718	2,345	2,638
Vermont	804	642	723
Virginia	3,678	6,442	7,248
Washington	4,770	9,442	10,622
West Virginia	889	660	743
Wisconsin	6,193	3,359	3,779
Wyoming	498	338	380
United States	339,232	591,034	664,913

Low = 80% of Total Cases 4 week ago
High = 90% of Total Cases 4 week ago

- States seemingly up-to-date with reporting recoveries
- States only reporting~ 1/2 expected recoveries
- States well-behind in reporting recoveries

VIRUS PROGRESSION: ROADMAP TO RECOVERY

Virus Progression

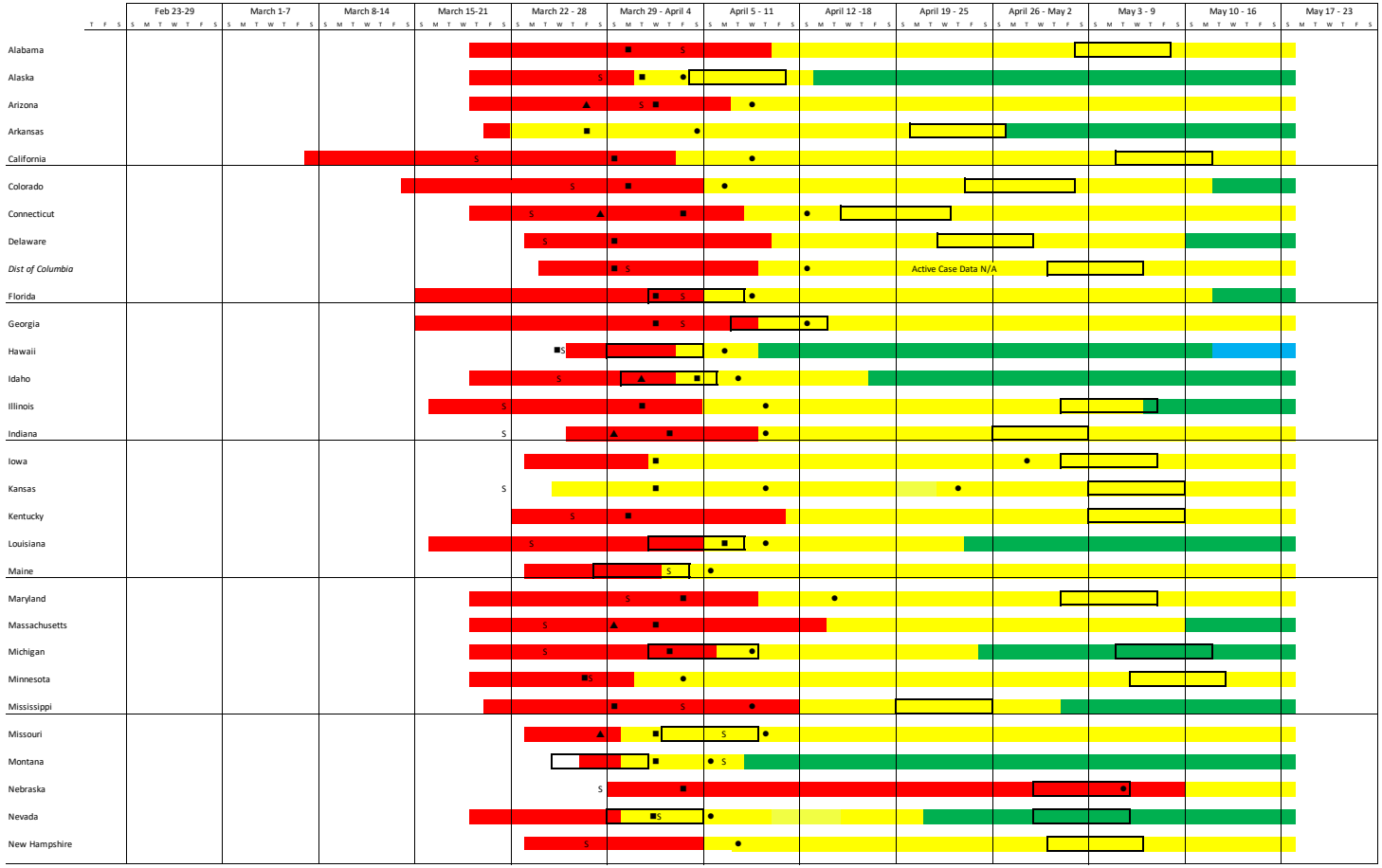
The graphic on the following two pages illustrates when the state first recorded 100 total cases (start of the "contagion" phase); when growth stopped following an exponential pattern (start of the "containment" phase); and, when peak total cases were recorded (start of the "recovery" phase). It uses symbols to indicate when average daily case growth rates fell (and were sustained) below certain benchmarks, as well as when deaths stopped growing exponentially.

A state is not shaded green until active cases appear to have peaked.

State-by-State

Virus Progression – *1 of 2*

"Strategic Guidance in an Era of Unprecedented Change"



Legend on following page

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State-by-State

Virus Progression – *2 of 2*

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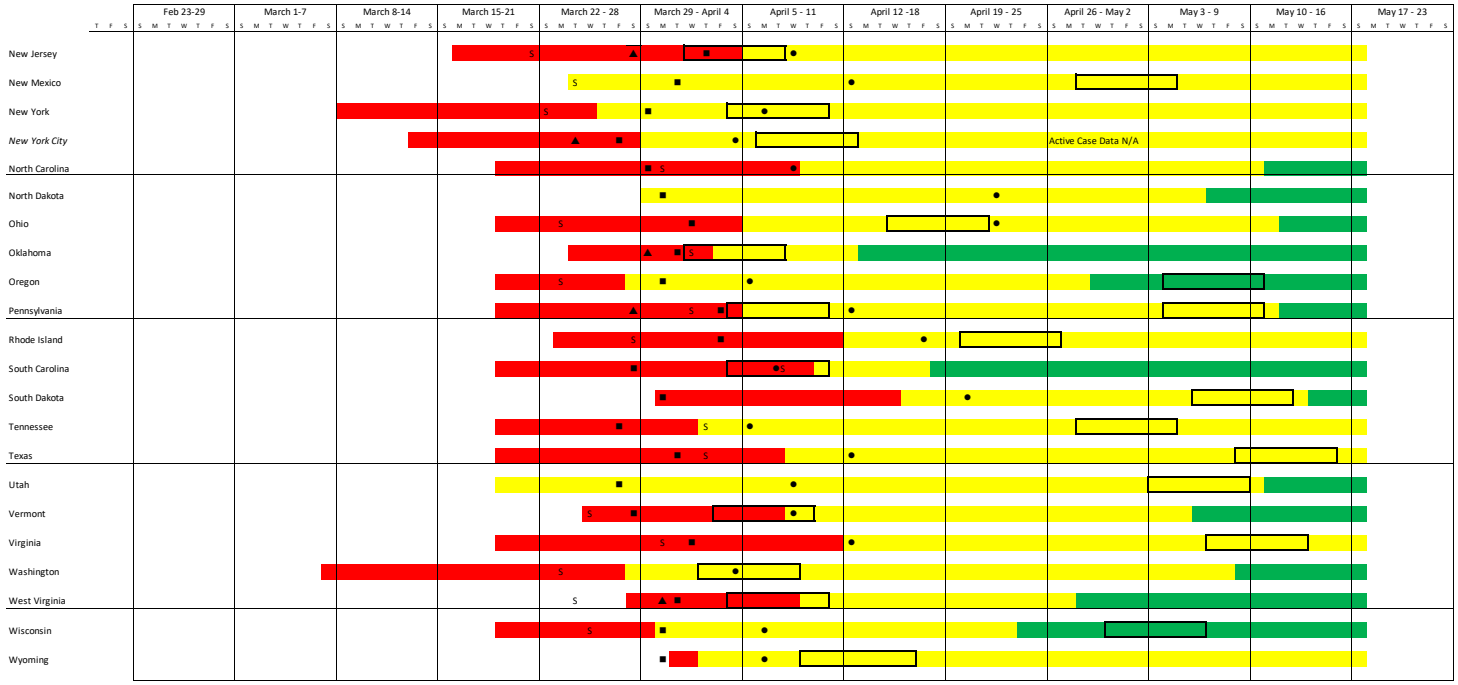


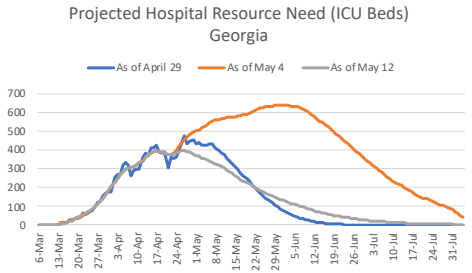
MONITORING THE IMPACT OF RELAXING RESTRICTIONS

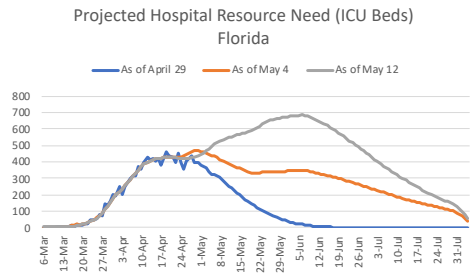
Impact of Relaxing Social Distancing

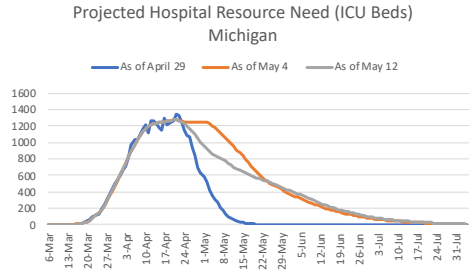
IHME's Hospital Resource Need Projections Are Sensitive to Relaxing Restrictions

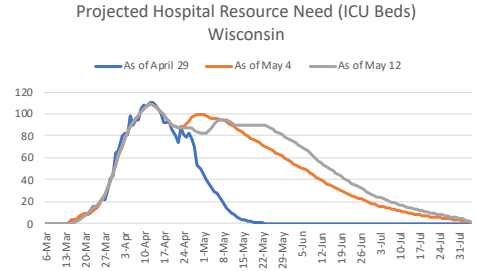
"Strategic Guidance in an Era of Unprecedented Change"

The Institute for Health Metrics and Evaluation (IHME) regularly updates projections of hospital resource needs. Comparing their projections from April 29. May 2 and May 12 indicates how much relaxing restrictions factors into these projections. Consider how much the projections changed for Florida and Wisconsin:









Note: ICU beds were selected as representative of the three metrics that IHME uses: total beds, ICU beds and ventilators. HIA does not vouch for the accuracy of these projections; in our limited experience, they seem to over-state actual needs.

State-By-State

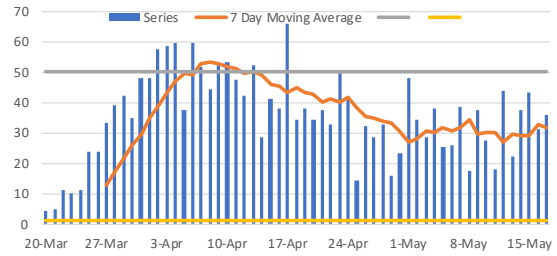
Impact of Relaxing Restrictions

"Strategic Guidance in an Era of Unprecedented Change"

With several states re-opening, we are monitoring testing and infection rates to determine if, when and how much impact relaxation has on renewed spread of the virus. Here, we focus on Florida and Wisconsin (its state Supreme Court last week invalidates governor's stay-home order; its bars re-opened on Wednesday).

Florida and Wisconsin's infections rates have increased slightly the past few days. However, these rates in both states are relatively low.

New Infections Per 1M Population
Florida



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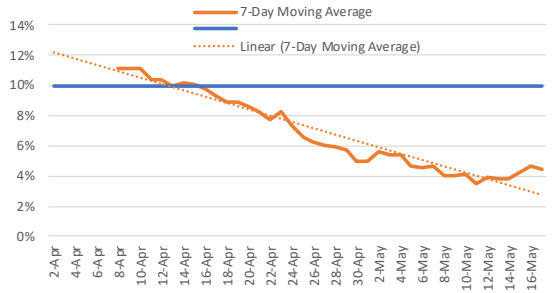
Test-Positive %
Florida



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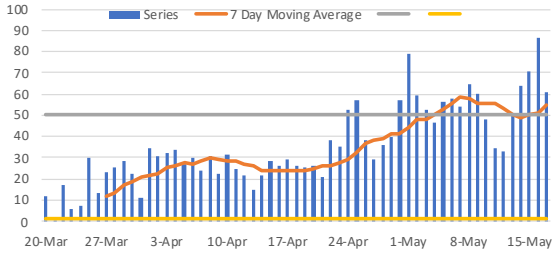
New Infections Per 1M Population
Wisconsin



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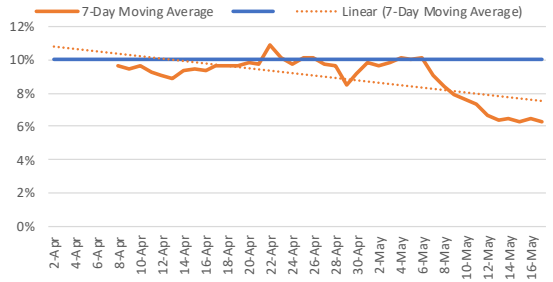
Test-Positive %
Wisconsin



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STATE TEST, INFECTION AND CASE TRENDS

Test, New Daily Infection and Active Case Trends

On Mondays, Wednesday and Fridays we provide graphics relevant to judging how far a state (or the District of Columbia) has progressed against the virus. Seventeen states (or, sixteen and D.C.) are presented at a time. Today, we provide:

- Alabama
- Alaska
- Arizona
- Arkansas
- California
- Colorado
- Connecticut
- Delaware
- District of Columbia
- Florida
- Georgia
- Hawaii
- Idaho
- Illinois
- Indiana
- Iowa
- Kansas

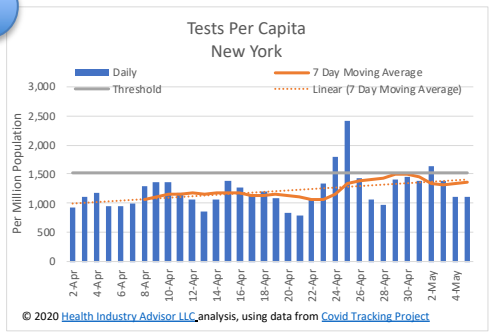
Mark.VanSumeren@HealthIndustryAdvisor.com

Test, New Daily Infection and Active Case Trends

How to "read" these charts:

- Chart 1 – Desire to see tests per capita:
  - Above the threshold
  - Increasing or stable
- Chart 2 - Desire to see Test-Positive %:
  - Below the threshold
  - Declining or stable
- Chart 3 - Desire to see New Infections Per Capita:
  - Below the threshold
  - Declining or stable
- Chart 4 - Desire to see Active Cases:
  - Declining

1



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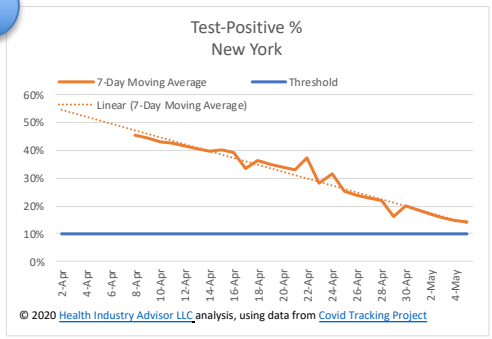

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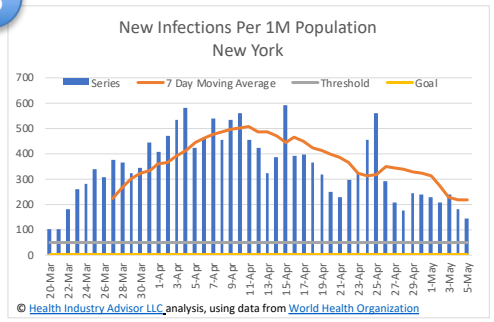

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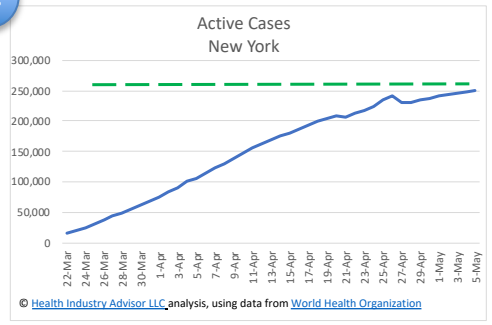
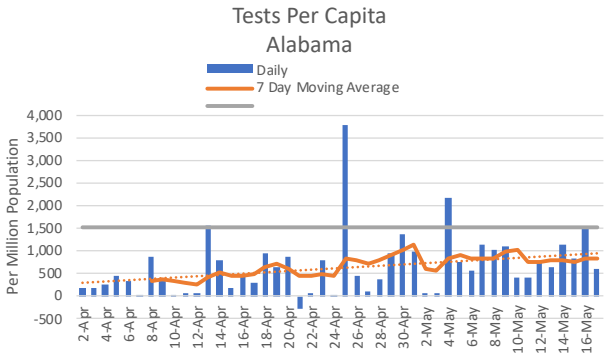
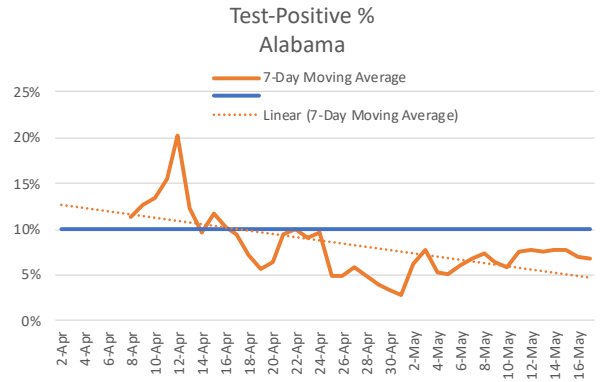


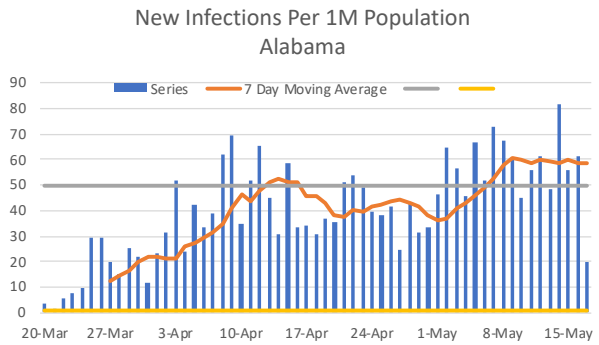
State-by-State

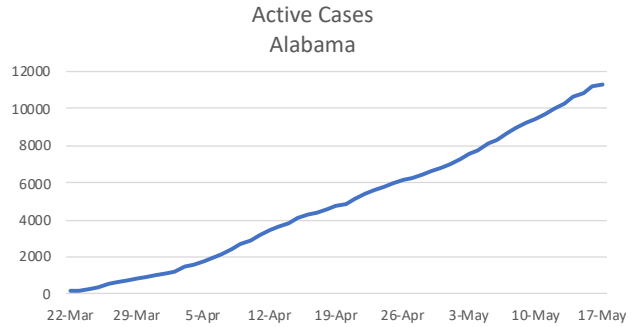
Test, New Daily Infection and Active Case Trends

"Strategic Guidance in an Era of Unprecedented Change"





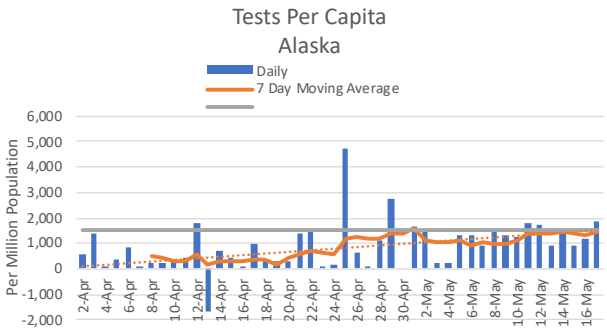




State-by-State

Test, New Daily Infection and Active Case Trends

"Strategic Guidance in an Era of Unprecedented Change"



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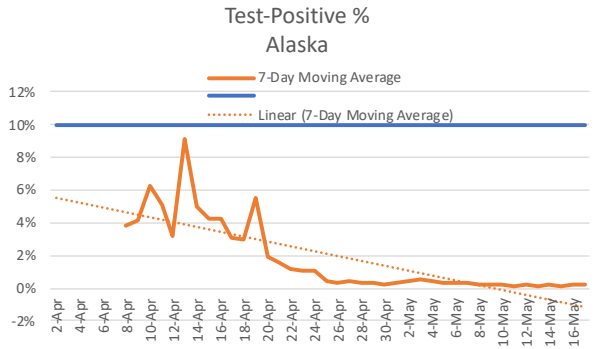

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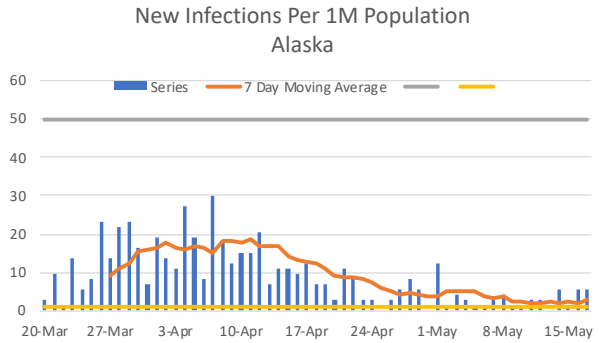

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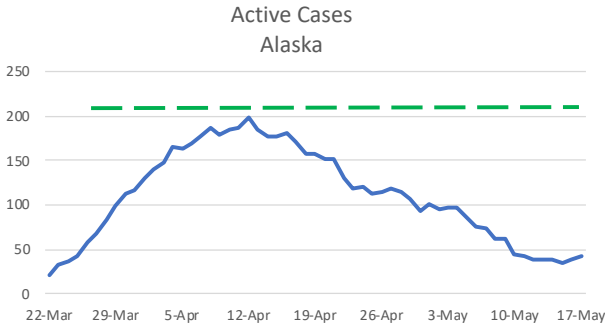

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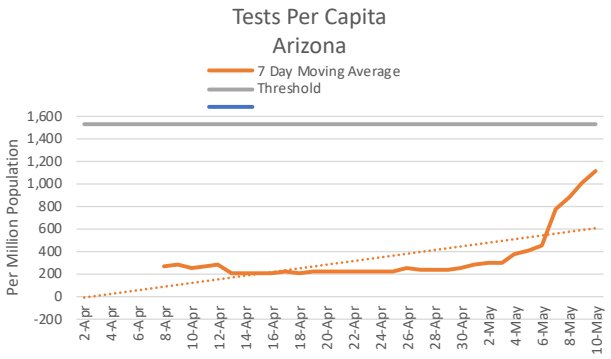
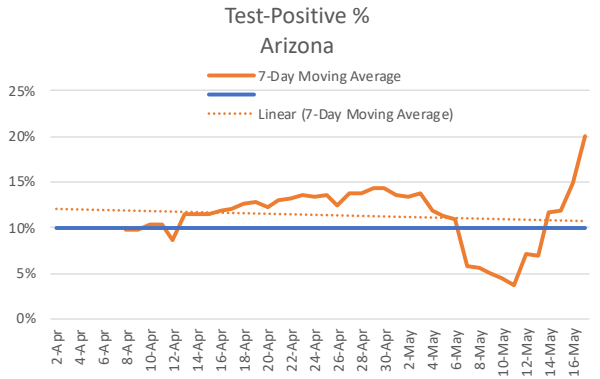
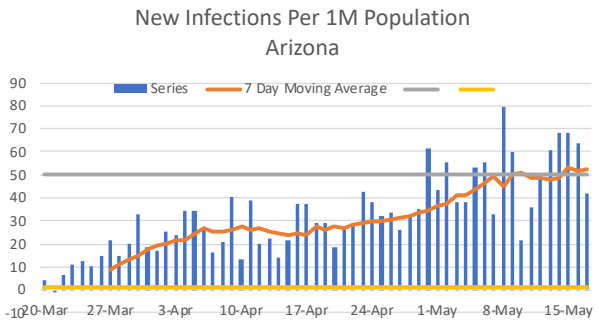
State-by-State

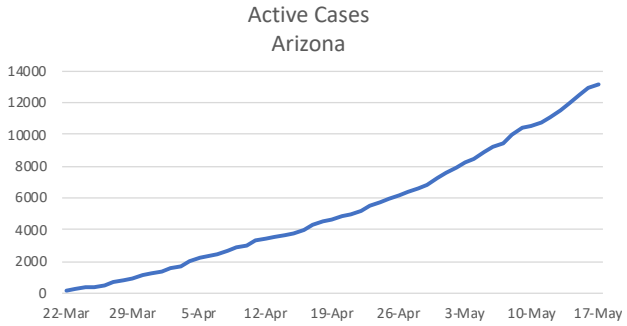
Test, New Daily Infection and Active Case Trends

"Strategic Guidance in an Era of Unprecedented Change"









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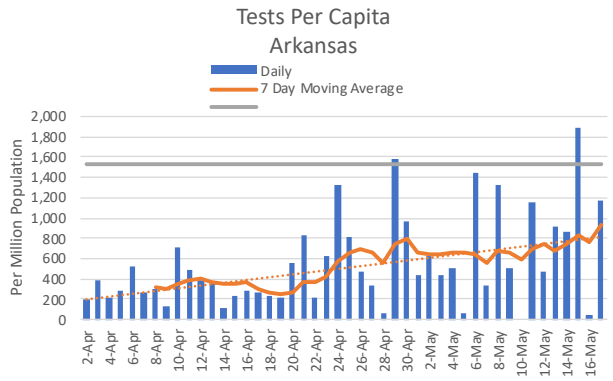

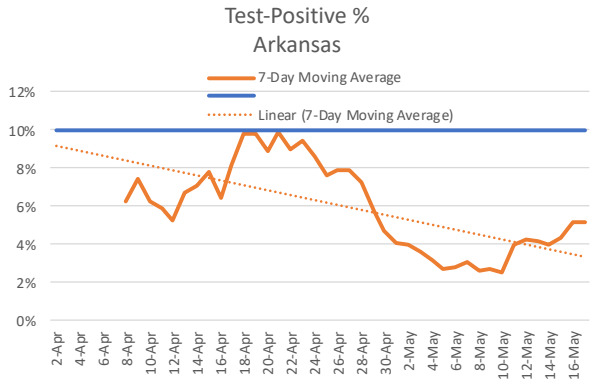

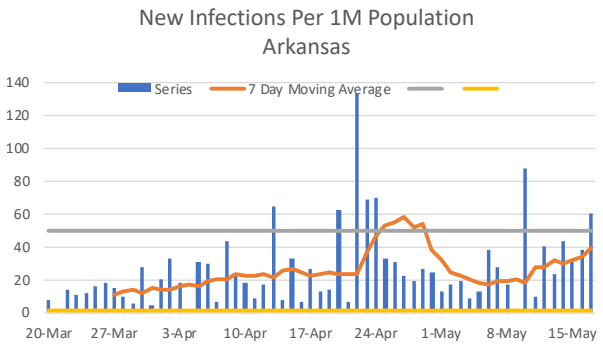

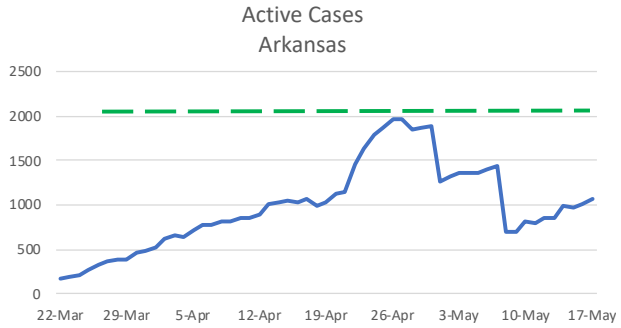

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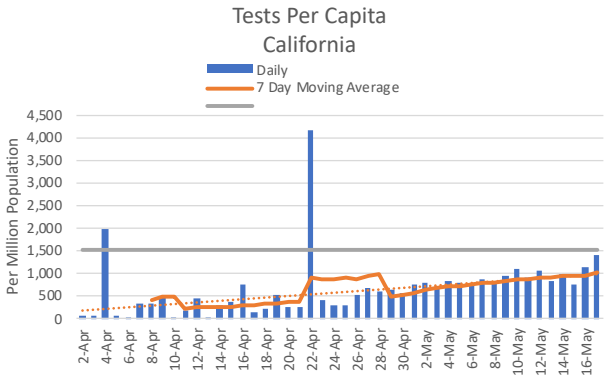

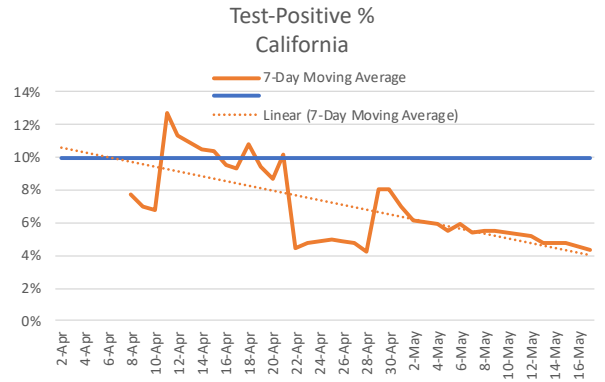

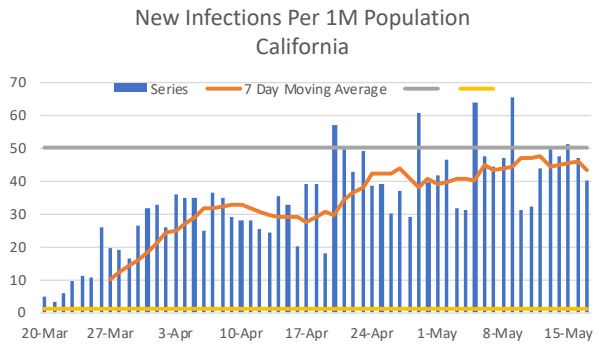

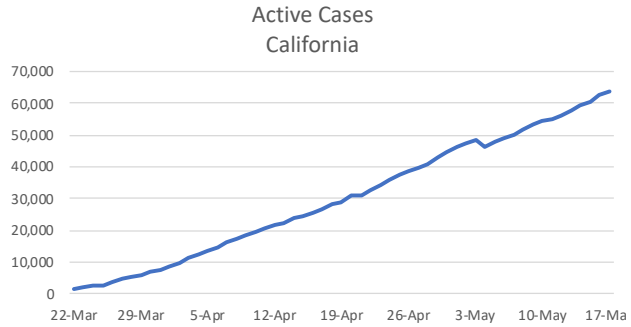

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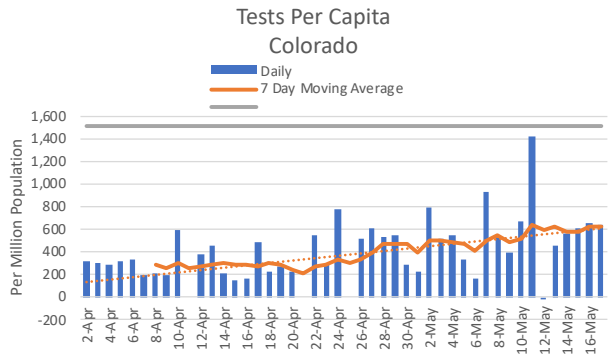

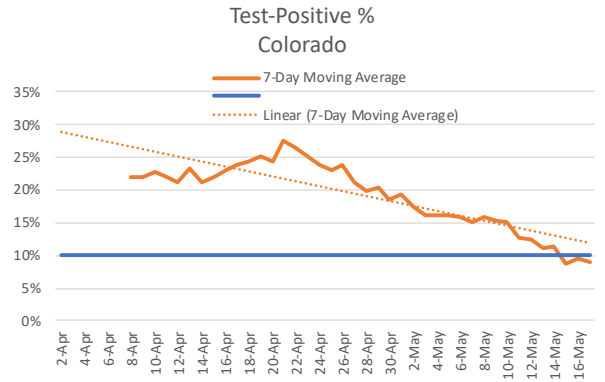

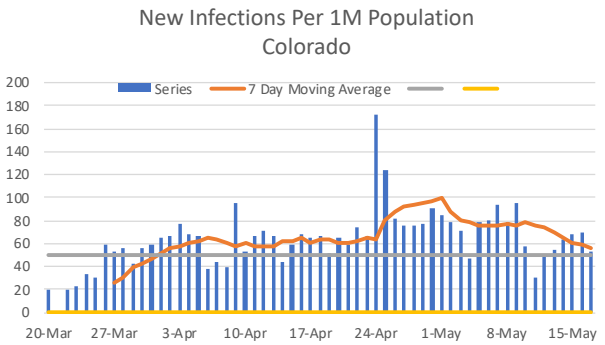

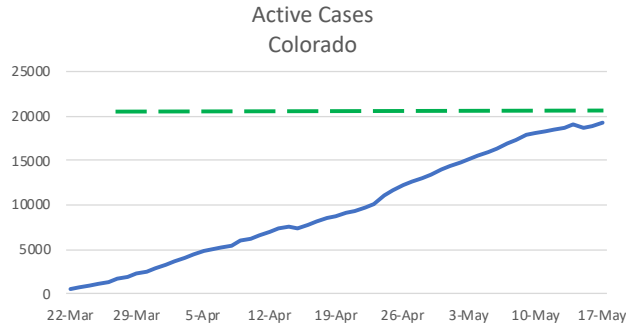

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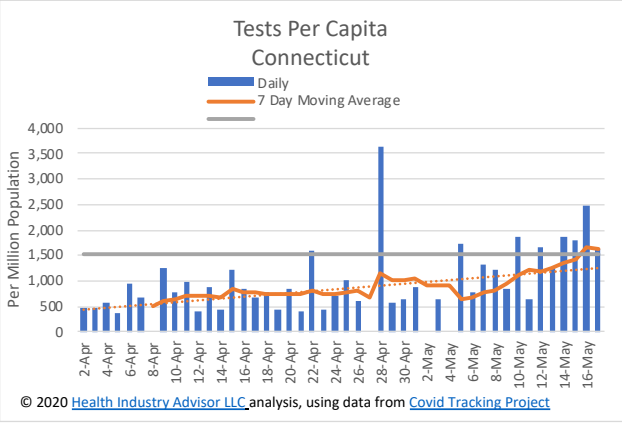

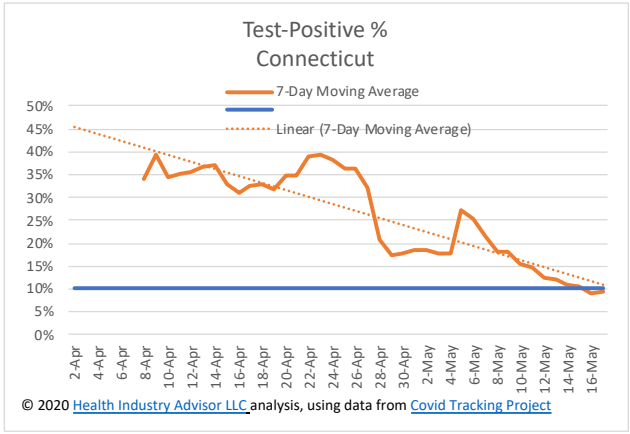

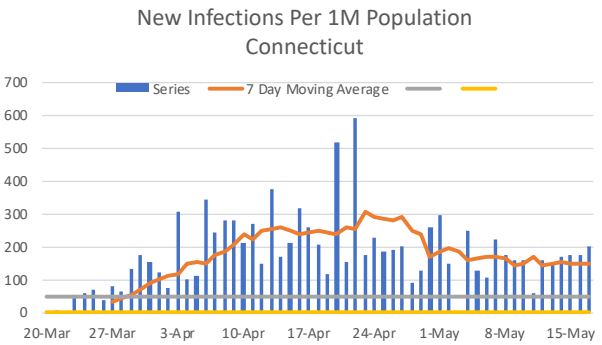

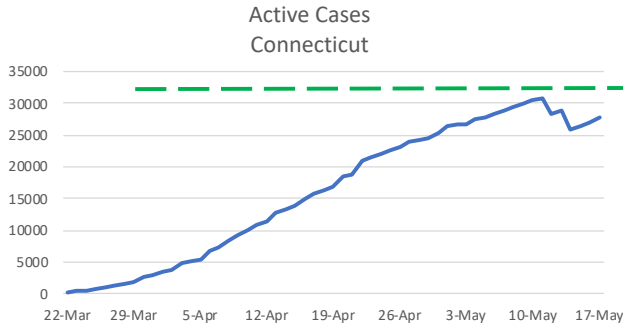

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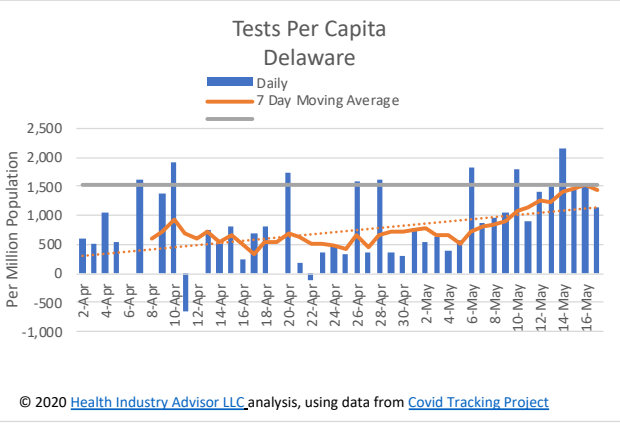

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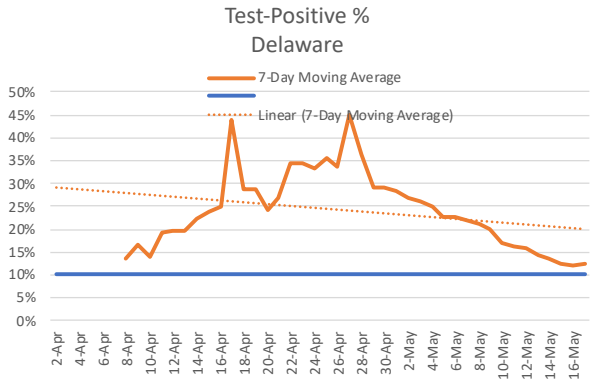

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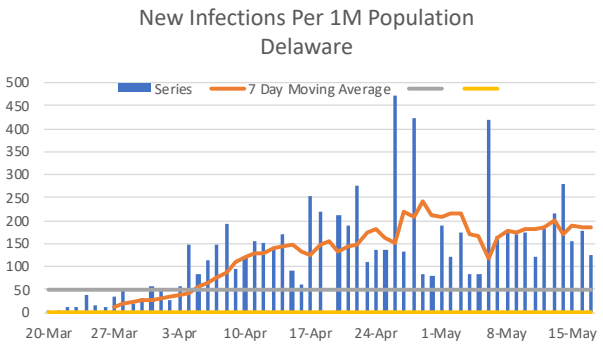

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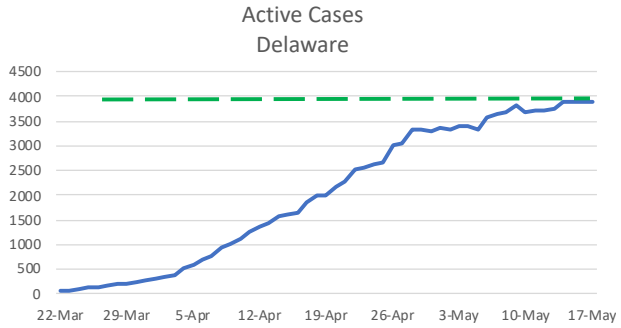

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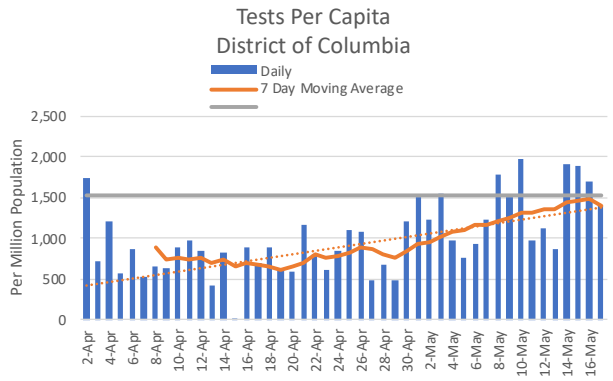

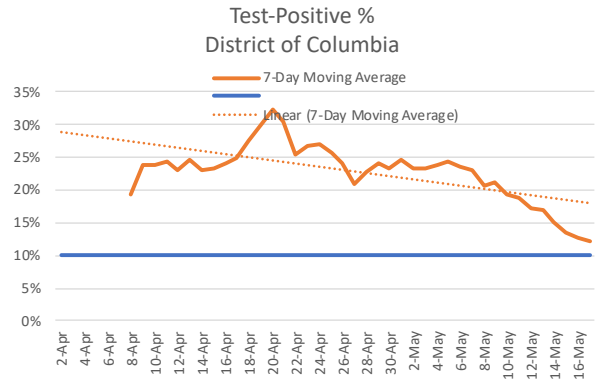

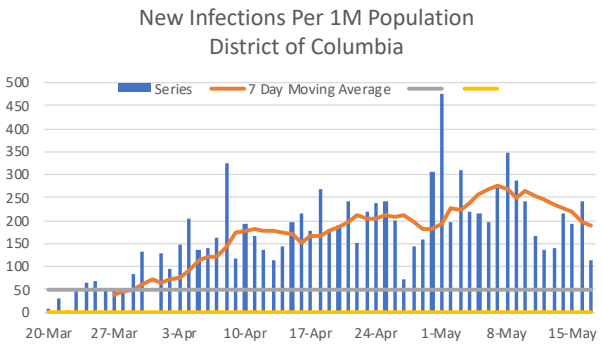

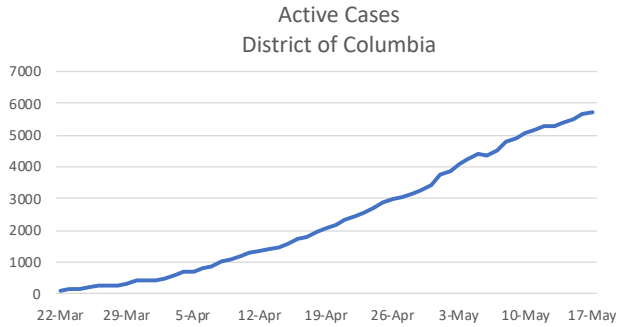

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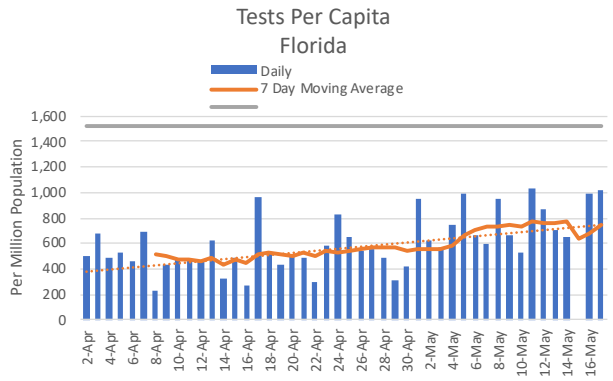

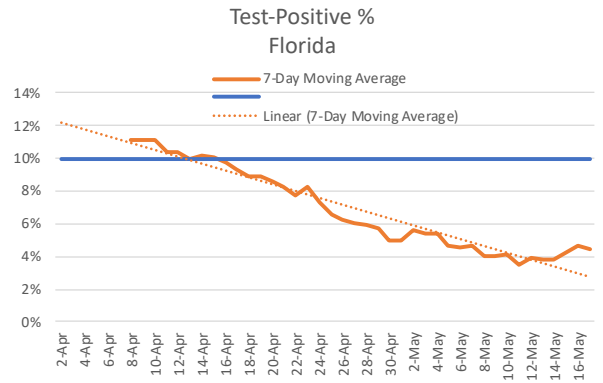

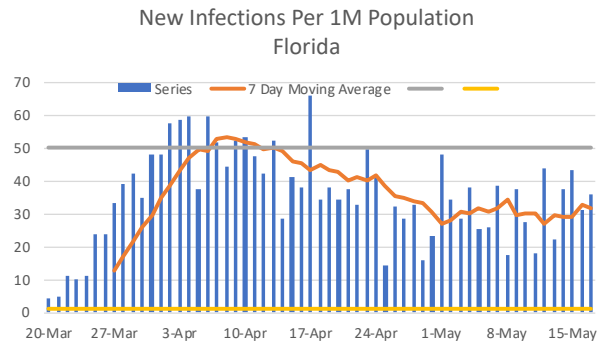

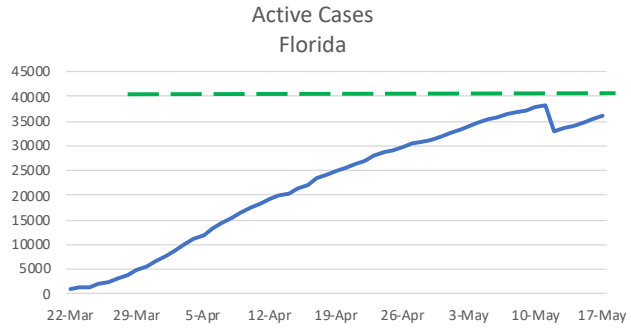

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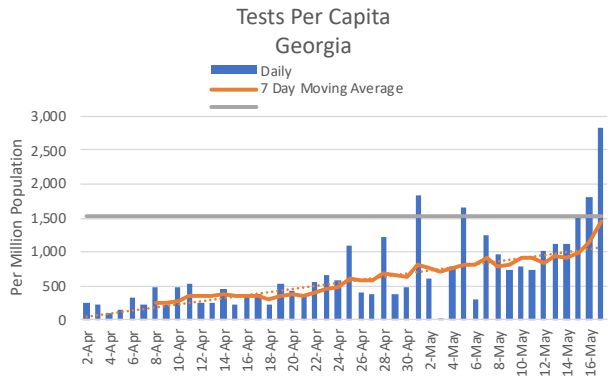

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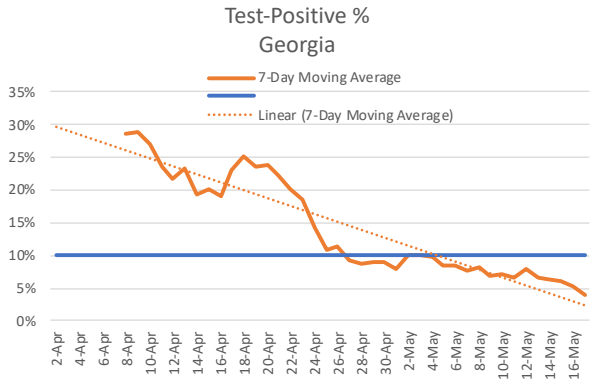

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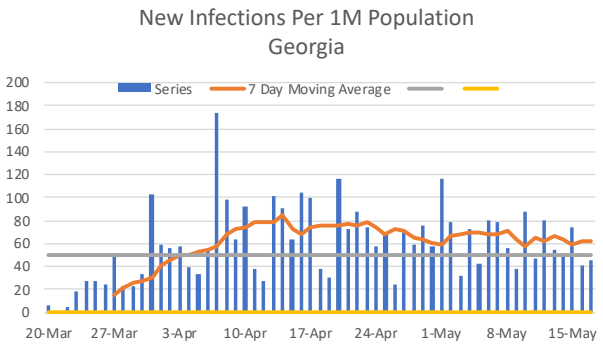

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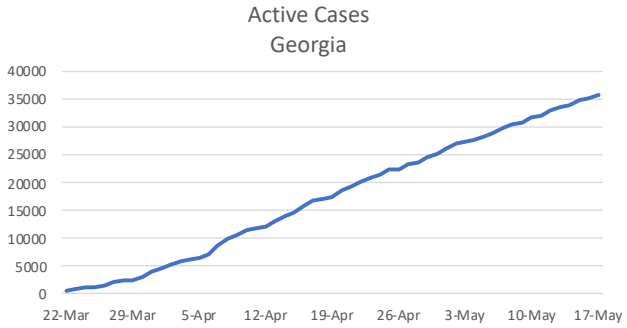

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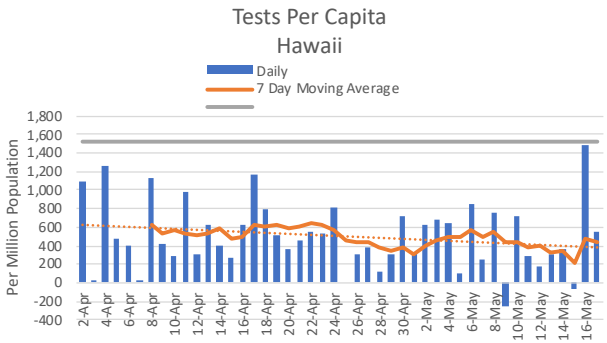

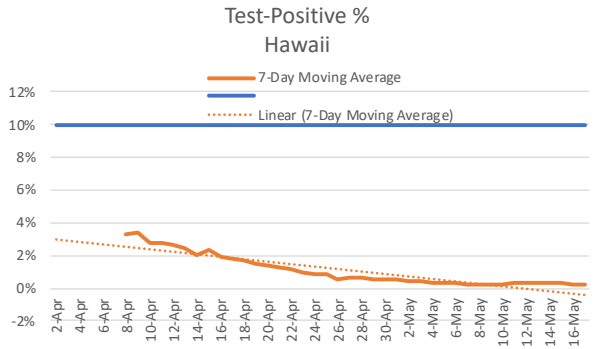

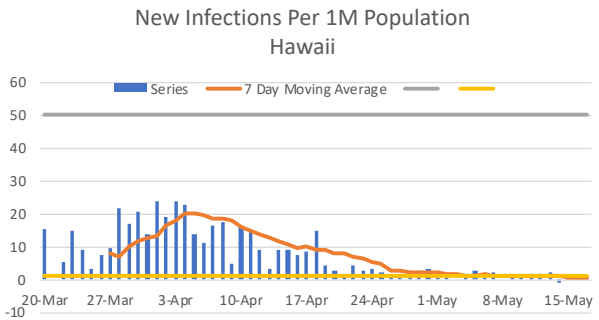

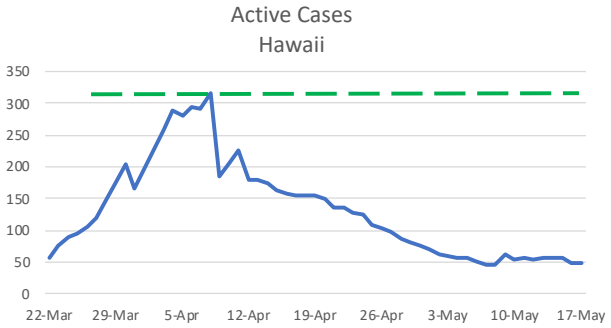

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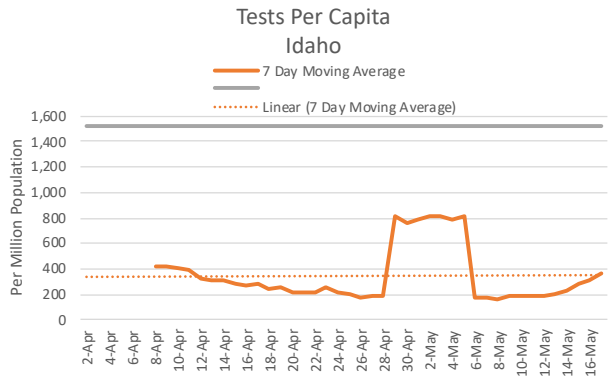

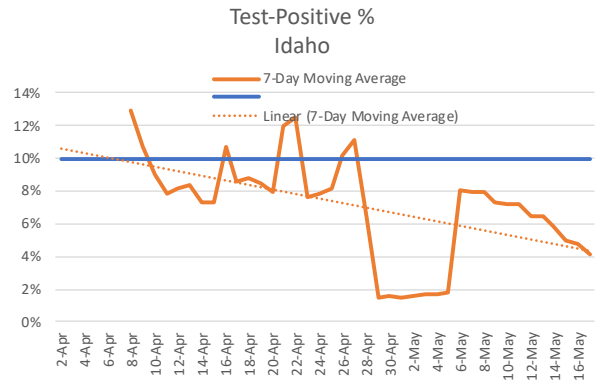

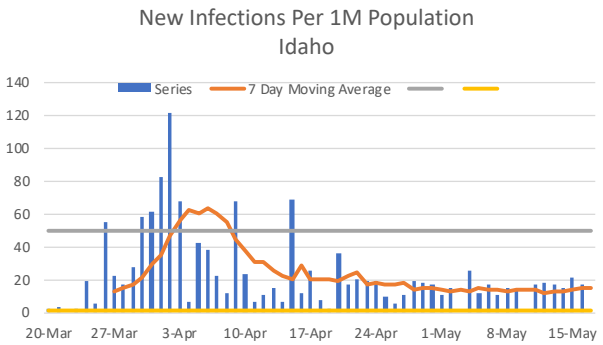

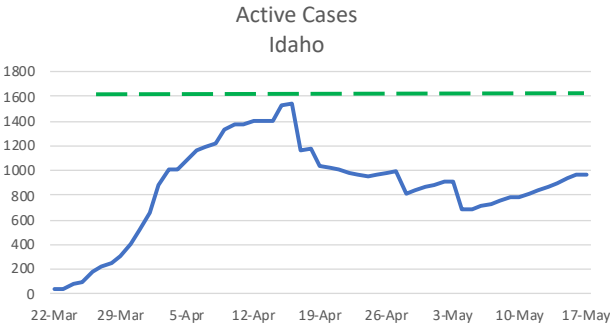

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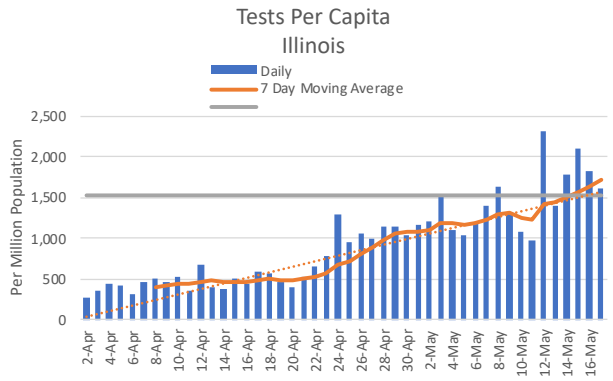

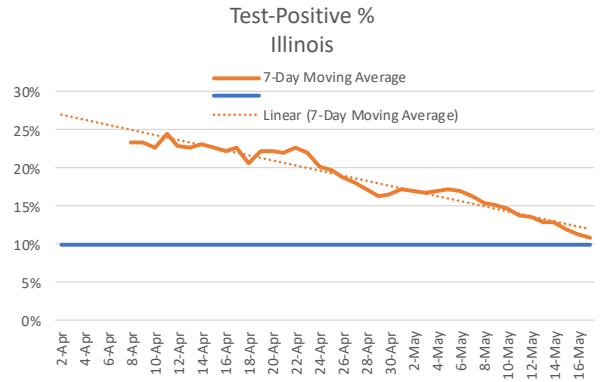

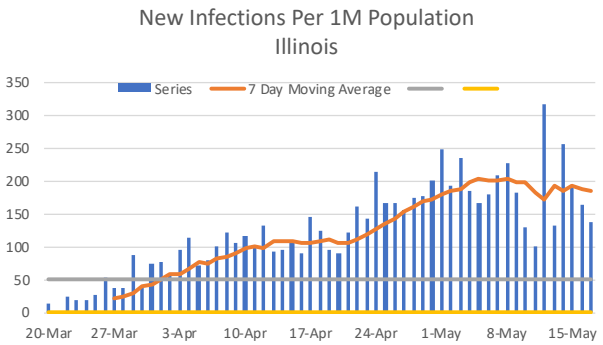

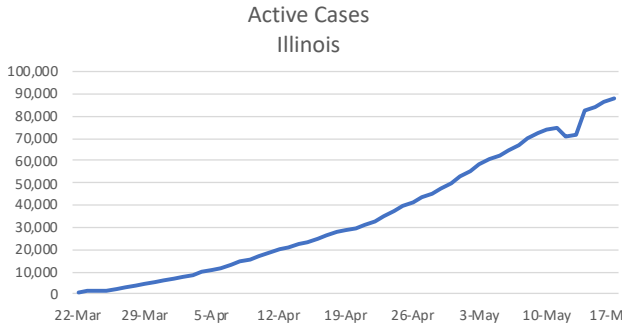

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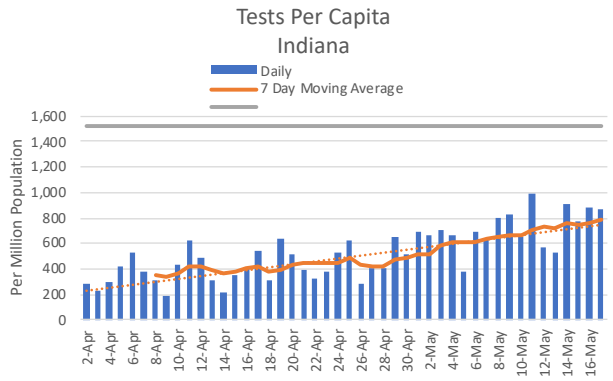

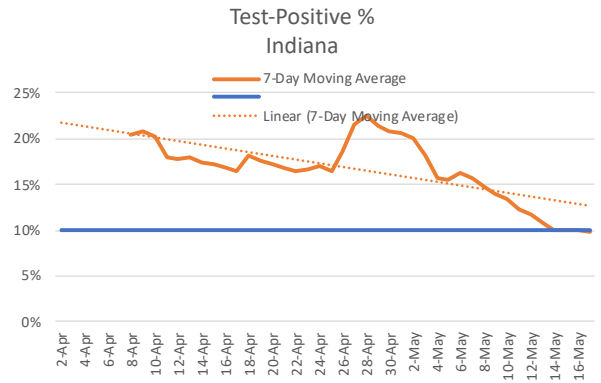

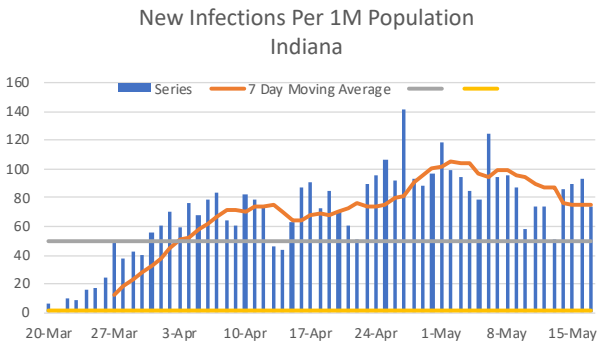

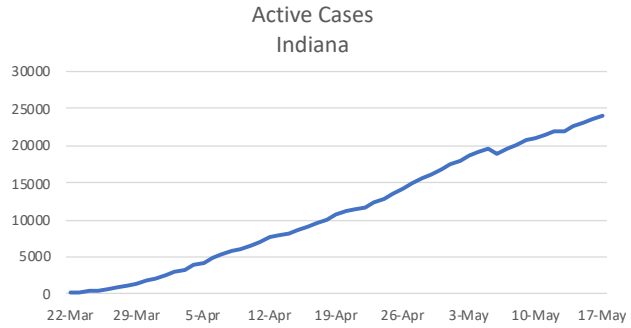

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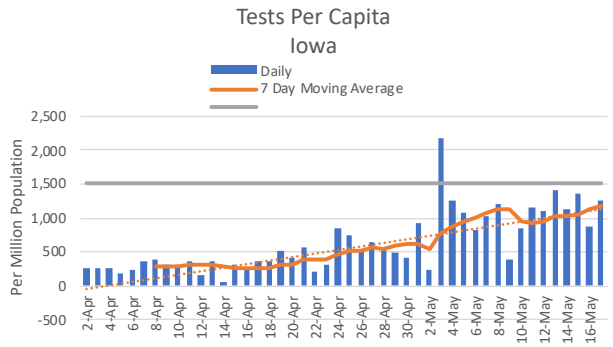

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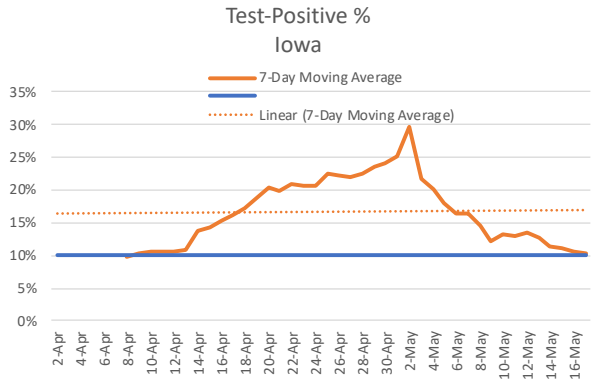

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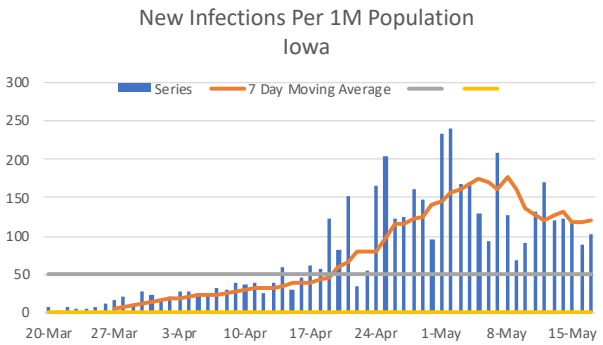

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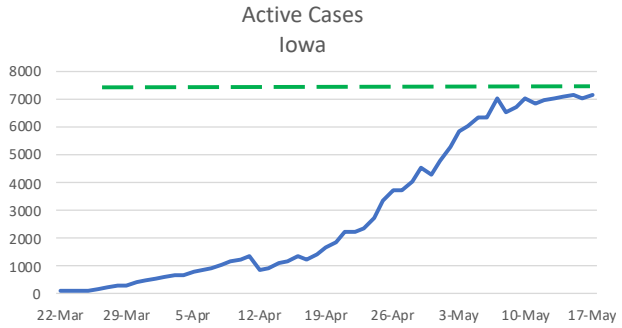

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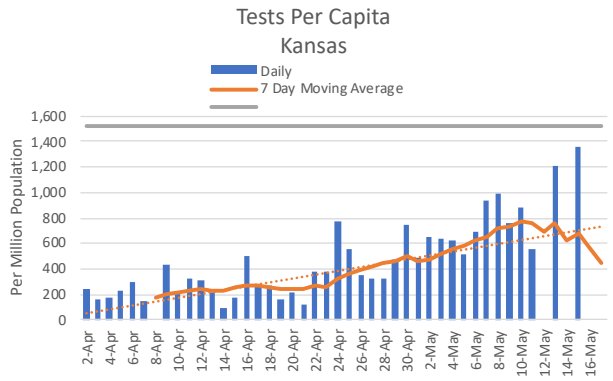

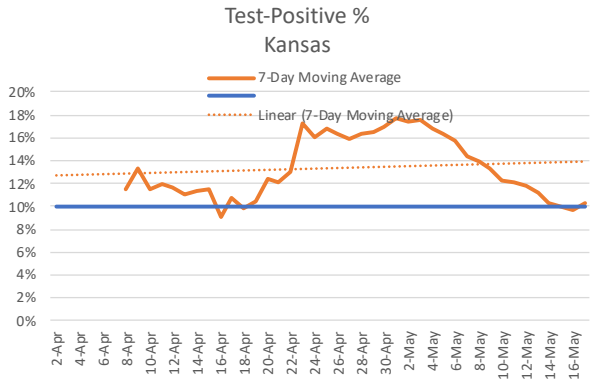

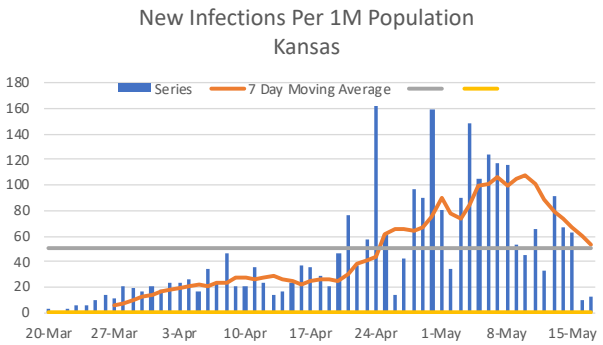

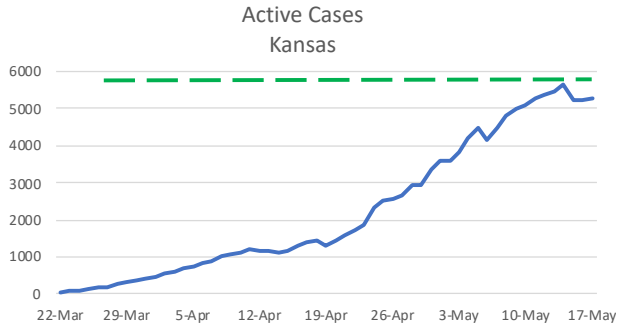

U.S. COUNTY-BY-COUNTY INFORMATION

Health Industry Advisor, llc

"Strategic Guidance in an Era of Unprecedented Change"

U.S. County-By-County

Case and Death Information For 100 Most Populous Counties

- On the following pages, case and death information[1] is presented for the 100 most populous counties in the United States
  - New York case and death information are reported on a combined basis for Bronx, Kings, New York, Queens and Richmond counties
  - St. Louis City is reported as a distinct entity from St. Louis County
  - Dane County (Madison), Wisconsin and Washtenaw County (Ann Arbor), Michigan are included for professional-interest reasons
- Population information is the 2019 official estimate from the US Census Bureau[2]

1. Data from The New York Times, based on reports from state and local health agencies. Accessed May 10-19, 2020
2. "Annual Estimates of the Resident Population for Counties in the United States: April 1, 2010 to July 1, 2019 (CO-EST2019-ANNRES)",Source: U.S. Census Bureau, Population Division, Release Date: March 2020. Accessed May 12, 2020

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Cases, Deaths and Daily Infection Rates

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County	State	County seat	2019 Est. Population - Millions	Total Cases	Total Deaths	Cases Per 1M	Deaths Per 1M	Deaths Per Case	New Daily Infections Last 7 Days	Peak New Daily Infections Traling 7-Day M.A	Date of Peak New Daily Infections
Maricopa, AZ	Arizona	Phoenix	4.49	7,096	319	1,582	71	4.5%	41.9	45.1	6-May
Pima, AZ	Arizona	Tucson	1.05	1,781	157	1,701	150	8.8%	31.0	39.7	19-Apr
Alameda, CA	California	Oakland	1.67	2,372	85	1,419	51	3.6%	28.0	31.0	11-Apr
Contra Costa, CA	California	Martinez	1.15	1,121	33	972	29	2.9%	10.5	28.5	6-Apr
Fresno, CA	California	Fresno	1.00	1,192	16	1,193	16	1.3%	43.9	45.0	14-May
Kern, CA	California	Bakersfield	0.90	1,483	25	1,647	28	1.7%	38.9	45.1	12-Apr
Los Angeles, CA	California	Los Angeles	10.04	37,303	1,793	3,716	179	4.8%	86.9	102.3	26-Apr
Orange, CA	California	Santa Ana	3.18	4,281	86	1,348	27	2.0%	39.9	39.9	15-May
Riverside, CA	California	Riverside	2.47	5,618	255	2,274	103	4.5%	36.2	67.7	18-Apr
Sacramento, CA	California	Sacramento	1.55	1,221	55	787	35	4.5%	5.2	27.6	7-Apr
San Bernardino, CA	California	San Bernardino	2.18	3,463	155	1,588	71	4.5%	36.8	54.6	16-May
San Diego, CA	California	San Diego	3.34	5,725	235	1,715	70	4.1%	37.9	44.7	11-May
San Francisco, CA	California	San Francisco	0.88	2,065	36	2,342	41	1.7%	27.7	60.6	13-Apr
San Joaquin, CA	California	Stockton	0.76	670	31	879	41	4.6%	12.2	28.1	18-Apr
San Mateo, CA	California	Redwood City	0.77	1,612	67	2,103	87	4.2%	34.8	52.2	7-Apr
Santa Clara, CA	California	San Jose	1.93	2,418	137	1,254	71	5.7%	8.2	41.6	5-Apr
Ventura, CA	California	Ventura	0.85	789	25	933	30	3.2%	20.8	20.8	16-May
Denver, CO	Colorado	Denver	0.73	4,548	261	6,254	359	5.7%	107.5	162.9	30-Apr
El Paso, CO	Colorado	Colorado Springs	0.72	1,291	83	1,792	115	6.4%	36.1	44.0	4-Apr
Fairfield, CT	Connecticut	Bridgeport	0.94	14,140	1,125	14,989	1,193	8.0%	168.1	515.3	22-Apr
Hartford, CT	Connecticut	Hartford	0.89	8,299	1,044	9,307	1,171	12.6%	191.3	262.4	26-Apr
New Haven, CT	Connecticut	New Haven	0.85	10,075	800	11,787	936	7.9%	164.5	357.2	17-Apr
Broward, FL	Florida	Fort Lauderdale	1.95	6,201	278	3,175	142	4.5%	30.8	80.6	13-Apr
Duval, FL	Florida	Jacksonville	0.96	1,259	34	1,315	35	2.7%	18.6	47.4	8-Apr
Hillsborough, FL	Florida	Tampa	1.47	1,585	51	1,077	35	3.2%	18.0	30.2	5-Apr
Lee, FL	Florida	Fort Myers	0.77	1,400	79	1,817	103	5.6%	28.2	49.7	10-Apr
Miami-Dade, FL	Florida	Miami	2.72	15,365	559	5,655	206	3.6%	80.2	160.1	8-Apr
Orange, FL	Florida	Orlando	1.39	1,628	37	1,168	27	2.3%	12.7	46.5	15-May
Palm Beach, FL	Florida	West Palm Beach	1.50	4,438	275	2,965	184	6.2%	61.3	74.1	10-May
Pinellas, FL	Florida	Clearwater	0.97	1,008	67	1,034	69	6.6%	23.4	35.6	5-Apr
Polk, FL	Florida	Bartow	0.72	722	41	996	57	5.7%	19.5	25.8	9-Apr
Cobb, GA	Georgia	Marietta	0.76	2,407	132	3,167	174	5.5%	52.4	78.9	19-Apr
DeKalb, GA	Georgia	Decatur	0.76	2,800	81	3,688	107	2.9%	58.5	109.1	19-Apr

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County	State	County seat	2019 Est. Population - Millions	Total Cases	Total Deaths	Cases Per 1M	Deaths Per 1M	Deaths Per Case	New Daily Infections Last 7 Days	Peak New Daily Infections Traling 7-Day M.A	Date of Peak New Daily Infections
Fulton, GA	Georgia	Atlanta	1.064	3,749	165	3,524	155	4.4%	48.9	86.1	4/15/20
Gwinnett, GA	Georgia	Lawrenceville	0.936	2,597	102	2,774	109	3.9%	29.6	78.1	5/4/20
Honolulu HI	Hawaii	Honolulu	0.975	415	11	426	11	2.7%	1.2	23.7	4/5/20
Cook, IL	Illinois	Chicago	5.150	61,212	2,814	11,885	546	4.6%	264.6	328.1	5/7/20
DuPage, IL	Illinois	Wheaton	0.923	5,780	293	6,263	317	5.1%	199.2	199.2	5/16/20
Lake, IL	Illinois	Waukegan	0.697	6,382	209	9,162	300	3.3%	242.6	265.0	5/12/20
Will, IL	Illinois	Joliet	0.691	4,312	240	6,243	347	5.6%	139.8	199.2	5/6/20
Marion, IN	Indiana	Indianapolis	0.965	8,240	509	8,543	528	6.2%	137.1	213.9	5/6/20
Jefferson, KY	Kentucky	Louisville	0.767	1,922	127	2,507	166	6.6%	52.2	97.1	4/25/20
Baltimore, MD	Maryland	Towson	0.827	4,566	240	5,519	290	5.3%	140.4	156.1	4/24/20
Montgomery, MD	Maryland	Rockville	1.051	8,026	461	7,639	439	5.7%	195.5	236.0	5/4/20
Prince George's, MD	Maryland	Upper Marlboro	0.909	11,052	420	12,154	462	3.8%	287.7	389.1	5/7/20
Essex, MA	Massachusetts	Salem and Lawrence	0.789	12,314	766	15,606	971	6.2%	199.7	470.2	4/29/20
Middlesex, MA	Massachusetts	Lowell and Cambridge	1.612	18,883	1,370	11,716	850	7.3%	139.7	350.7	4/25/20
Norfolk, MA	Massachusetts	Dedham	0.707	7,412	719	10,487	1,017	9.7%	106.1	305.8	4/25/20
Suffolk, MA	Massachusetts	Boston	0.804	16,346	778	20,333	968	4.8%	218.0	634.2	4/27/20
Worcester, MA	Massachusetts	Worcester	0.831	9,067	554	10,916	667	6.1%	250.4	317.1	4/29/20
Macomb, MI	Michigan	Mount Clemens	0.874	6,304	739	7,213	846	11.7%	46.6	255.2	4/7/20
Oakland, MI	Michigan	Pontiac	1.258	8,023	910	6,380	724	11.3%	37.6	240.4	4/7/20
Washtenaw, MI	Michigan	Ann Arbor	0.368	1,241	88	3,376	239	7.1%	25.3	134.5	4/2/20
Wayne, MI	Michigan	Detroit	1.749	19,016	2,212	10,870	1,264	11.6%	86.2	433.6	4/7/20
Hennepin, MN	Minnesota	Minneapolis	1.266	4,930	454	3,895	359	9.2%	175.0	175.0	5/16/20
Jackson, MO	Missouri	Independence and Kansas City	0.703	432	16	614	23	3.7%	8.5	18.9	4/6/20
St Louis, MO	Missouri	Warren	0.994	4,106	329	4,130	331	8.0%	54.5	116.4	4/8/20
St. Louis, MO	Missouri	Clayton	0.303	1,631	96	5,386	317	5.9%	69.3	176.0	5/7/20
Clark, NV	Nevada	Las Vegas	2.267	5,298	293	2,337	129	5.5%	37.4	62.5	4/5/20
Bergen, NJ	New Jersey	Hackensack	0.932	17,246	1,450	18,500	1,555	8.4%	67.7	708.6	4/7/20
Essex, NJ	New Jersey	Newark	0.799	16,032	1,522	20,066	1,905	9.5%	119.3	628.1	4/10/20
Hudson, NJ	New Jersey	Jersey City	0.672	17,326	1,045	25,768	1,554	6.0%	138.3	766.8	4/9/20
Middlesex, NJ	New Jersey	New Brunswick	0.825	14,514	872	17,591	1,057	6.0%	130.7	508.2	4/10/20
Bernalillo, NM	New Mexico	Albuquerque	0.679	1,194	56	1,758	82	4.7%	30.3	52.6	5/4/20
Erie, NY	New York	Buffalo	0.919	4,867	428	5,298	466	8.8%	82.4	149.7	4/29/20
Monroe, NY	New York	Rochester	0.742	2,193	165	2,956	222	7.5%	80.3	80.3	5/16/20

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Nassau, NY	New York	Mineola	1.36	39,033	2,507	28,766	1,848	6.4%	105.8	1005.7	4/9/20
New York, NY	New York	Includes: Bronx, Kings, New York and	8.34	196,481	20,071	23,568	2,408	10.2%	134.0	650.8	4/15/20
Suffolk, MY	New York	Riverhead	1.48	37,942	1,783	25,695	1,208	4.7%	143.3	856.0	4/7/20
Westchester, NY	New York	White Plains	0.97	32,096	1,398	33,174	1,445	4.4%	149.1	981.3	5/14/20
Mecklenburg, NC	North Carolina	Charlotte	1.11	2,504	63	2,255	57	2.5%	59.3	59.3	5/11/20
Wake, NC	North Carolina	Raleigh	1.11	1,176	28	1,058	25	2.4%	20.9	28.9	5/16/20
Cuyahoga, OH	Ohio	Cleveland	1.24	3,223	163	2,610	132	5.1%	54.1	59.2	5/6/20
Franklin, OH	Ohio	Columbus	1.32	4,420	169	3,357	128	3.8%	77.0	111.3	5/8/20
Hamilton, OH	Ohio	Cincinnati	0.82	2,007	111	2,455	136	5.5%	48.2	68.0	5/6/20
Oklahoma, OK	Oklahoma	Oklahoma City	0.80	1,070	46	1,342	58	4.3%	25.6	31.5	4/10/20
Multnomah, OR	Oregon	Portland	0.81	979	55	1,204	68	5.6%	20.4	28.5	4/14/20
Allegheny, PA	Pennsylvania	Pittsburgh	1.22	1,595	143	1,312	118	9.0%	12.8	42.8	4/8/20
Montgomery, PA	Pennsylvania	Norristown	0.83	5,797	614	6,977	739	10.6%	117.1	184.1	4/11/20
Philadelphia, PA	Pennsylvania	Philadelphia	1.58	19,606	1,031	12,377	651	5.3%	155.6	308.2	4/28/20
Davidson, TN	Tennessee	Nashville	0.69	4,049	43	5,833	62	1.1%	95.3	157.0	5/7/20
Shelby, TN	Tennessee	Memphis	0.94	3,681	85	3,928	91	2.3%	75.0	91.3	4/17/20
Bexar, TX	Texas	San Antonio	2.00	2,120	62	1,058	31	2.9%	16.6	31.0	5/6/20
Collin, TX	Texas	McKinney	1.03	1,018	31	984	30	3.0%	15.9	27.5	4/9/20
Dallas, TX	Texas	Dallas	2.64	7,250	170	2,751	65	2.3%	88.4	95.0	5/11/20
Denton, TX	Texas	Denton	0.89	1,051	28	1,185	32	2.7%	22.1	28.7	4/12/20
El Paso, TX	Texas	El Paso	0.84	1,726	46	2,057	55	2.7%	68.8	71.0	5/14/20
Fort Bend, TX	Texas	Richmond	0.81	1,558	40	1,919	49	2.6%	33.1	49.3	5/7/20
Harris, TX	Texas	Houston	4.71	9,126	204	1,936	43	2.2%	40.1	69.0	4/11/20
Hidalgo, TX	Texas	Edinburg	0.87	425	10	489	12	2.4%	6.2	16.8	4/11/20
Tarrant, TX	Texas	Fort Worth	2.10	4,350	121	2,069	58	2.8%	77.5	85.8	5/13/20
Travis, TX	Texas	Austin	1.27	2,425	77	1,904	60	3.2%	37.0	48.4	4/17/20
Salt Lake, UT	Utah	Salt Lake City	1.16	3,785	55	3,262	47	1.5%	71.3	75.5	5/19/20
Fairfax, VA	Virginia	Fairfax	1.15	7,386	278	6,436	242	3.8%	221.1	237.3	5/14/20
King, WA	Washington	Seattle	2.25	7,759	528	3,444	234	6.8%	27.9	86.5	4/11/20
Pierce, WA	Washington	Tacoma	0.90	1,793	68	1,981	75	3.8%	18.8	65.4	4/7/20
Snohomish, WA	Washington	Everett	0.82	3,071	125	3,736	152	4.1%	26.8	116.6	4/1/20
Dane, WI	Wisconsin	Madison	0.55	523	25	957	46	4.8%	15.2	33.2	4/1/20
Milwaukee, WI	Wisconsin	Milwaukee	0.95	4,936	252	5,219	266	5.1%	163.4	163.4	5/16/20

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