Health Industry Advisor, llc

"Strategic Guidance in an Era of Unprecedented Change"

COVID-19 Dashboard

Issue # 54

Tuesday, May 19, 2020

Day's Highlights

"Strategic Guidance in an Era of Unprecedented Change"

Measure	Desired Change	Yesterday in the U.S.
Number of Tests	Increase	335,000 tests on Monday; average of 366,000 for past 7 days
Test-Positivity Rate	Decline	5.9% for the day; 6.5% for past 7 days
Number of Cases	Plateau	New Cases up slightly day-over-day, however, down 4.9% week-over-week
Deaths % of Total Cases	Decline	Down slightly to 5.9% (v.6.0%)
Number of Deaths / 1M Population	Plateau	277.9
Recoveries : Death	Increase	3.87 (increasing daily)

- While U.S. testing is reaching minimum levels considered necessary to provide a reasonable view of the virus prevalence, several states are behind - both on tests per capita and test-positive rates: Arizona, Delaware, Maryland, Massachusetts, Minnesota, Pennsylvania and Virginia
- Nine of the most-populous counties in the U.S. again reported their highest new daily infection rates (trailing 7-day moving average) on Monday: Orange and Ventura, CA, New Haven, CT, DuPage, IL, Hennepin, MN, Monroe, NY, Mecklenburg, NC, Cuyahoga, OH and El Paso, TX. Milwaukee, WI is only one day removed from its highest rate; Fresno, CA, Orange and Palm Beach, FL, Salt Lake, UT are only 2 days removed from their peak
- Death rates have seemingly stabilized in the U.S. Recoveries, despite likely to be undercounted by nearly 2x, are nearly 4x the number of deaths
- 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 last Wednesday evening.) While both states showed slightly higher new infection rates over past few days, both still report relatively low test-positive and new infection rates.
- Several countries moving up the rankings of most cases worldwide: Brazil, Chile, India, Mexico, Pakistan, Peru, Russia and Saudi Arabia. Of these, only Pakistan and Russia have experienced declining new daily infection rates. So, we may anticipate these other countries to continue their upward movement up these rankings

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 89.3% 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

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As of May 18

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	1,550,294	(1)	4,684	(5)	91,981	(1)	5.9%	(14)	277.9	(9)	1.6%	(13)	37,188	(12)	71.0	(4)
Austria	16,269	(29)	1,806	(20)	629	(25)	3.9%	(20)	69.8	(18)	0.3%	(24)	39,710	(8)	6.1	(23)
Belgium	55,559	(16)	4,794	(4)	9,080	(7)	16.3%	(1)	783.4	(1)	0.6%	(19)	57,302	(4)	26.0	(14)
Brazil	255,368	(4)	1,201	(24)	16,853	(6)	6.6%	(11)	79.3	(17)	6.2%	(1)	3,462	(25)	58.0	(7)
Canada	78,072	(14)	2,069	(16)	5,842	(10)	7.5%	(10)	154.8	(12)	1.6%	(14)	33,567	(14)	30.6	(13)
Chile	46,059	(18)	2,409	(14)	478	(26)	1.0%	(27)	25.0	(22)	6.0%	(2)	18,346	(18)	119.5	(1)
China	82,954	(13)	58	(30)	4,634	(13)	5.6%	(16)	3.2	(29)	0.0%	(30)	N/A	N/A	0.0	(30)
Ecuador	33,582	(21)	1,903	(19)	2,799	(17)	8.3%	(9)	158.6	(11)	2.0%	(10)	5,301	(24)	33.0	(10)
France	179,927	(7)	2,757	(12)	28,239	(4)	15.7%	(2)	432.6	(5)	0.2%	(26)	21,218	(15)	5.5	(24)
Germany	177,289	(8)	2,116	(15)	8,123	(8)	4.6%	(18)	97.0	(14)	0.4%	(22)	37,585	(11)	8.0	(21)
India	100,328	(11)	73	(29)	3,156	(16)	3.1%	(21)	2.3	(30)	5.1%	(3)	1,548	(28)	3.1	(26)
Iran	122,492	(10)	1,458	(23)	7,057	(9)	5.8%	(15)	84.0	(16)	1.7%	(12)	8,022	(23)	22.5	(15)
Ireland	24,200	(26)	4,901	(2)	1,547	(21)	6.4%	(12)	313.3	(8)	0.7%	(18)	52,488	(5)	30.8	(11)
Israel	16,643	(27)	1,923	(18)	276	(28)	1.7%	(26)	31.9	(21)	0.1%	(29)	57,733	(3)	2.3	(27)
Italy	225,886	(6)	3,736	(6)	32,007	(3)	14.2%	(3)	529.4	(3)	0.3%	(23)	48,698	(6)	14.3	(19)
Japan	16,305	(28)	129	(28)	749	(24)	4.6%	(17)	5.9	(25)	0.3%	(25)	1,900	(26)	0.5	(28)
Mexico	49,219	(17)	382	(25)	5,177	(12)	10.5%	(7)	40.2	(20)	5.1%	(4)	1,271	(29)	15.7	(18)
Netherlands	44,141	(19)	2,576	(13)	5,694	(11)	12.9%	(5)	332.3	(7)	0.4%	(21)	16,809	(20)	11.3	(20)
Pakistan	42,125	(20)	191	(27)	903	(23)	2.1%	(25)	4.1	(27)	3.6%	(8)	1,631	(27)	7.2	(22)
Peru	94,933	(12)	2,879	(10)	2,789	(18)	2.9%	(22)	84.6	(15)	4.5%	(6)	19,156	(16)	113.1	(2)
Portugal	29,209	(24)	2,864	(11)	1,231	(22)	4.2%	(19)	120.7	(13)	0.8%	(17)	58,828	(2)	21.4	(16)
Russia	290,678	(2)	1,939	(17)	2,722	(19)	0.9%	(28)	18.2	(23)	3.7%	(7)	45,614	(7)	66.1	(6)
Saudi Arabia	57,345	(15)	1,647	(22)	320	(27)	0.6%	(29)	9.2	(24)	5.0%	(5)	14,457	(22)	67.0	(5)
Singapore	28,343	(25)	4,845	(3)	22	(30)	0.1%	(30)	3.8	(28)	2.3%	(9)	15,773	(21)	110.4	(3)
South Korea	11,065	(30)	216	(26)	263	(29)	2.4%	(24)	5.1	(26)	0.2%	(27)	38,371	(10)	0.4	(29)
Spain	278,188	(3)	5,950	(1)	27,709	(5)	10.0%	(8)	592.6	(2)	0.5%	(20)	64,977	(1)	30.7	(12)
Sweden	30,377	(23)	3,008	(9)	3,698	(15)	12.2%	(6)	366.2	(6)	1.7%	(11)	17,589	(19)	52.4	(8)
Switzerland	30,597	(22)	3,573	(8)	1,886	(20)	6.2%	(13)	220.2	(10)	0.1%	(28)	39,247	(9)	4.2	(25)
Turkey	150,593	(9)	1,786	(21)	4,171	(14)	2.8%	(23)	49.5	(19)	1.0%	(16)	18,874	(17)	18.3	(17)
UK	246,406	(5)	3,630	(7)	34,796	(2)	14.1%	(4)	512.6	(4)	1.4%	(15)	36,696	(13)	49.1	(9)

Note: China does not report test volumes

Country-by-Country

Virus Progression

"Strategic Guidance in an Era of Unprecedented Change"

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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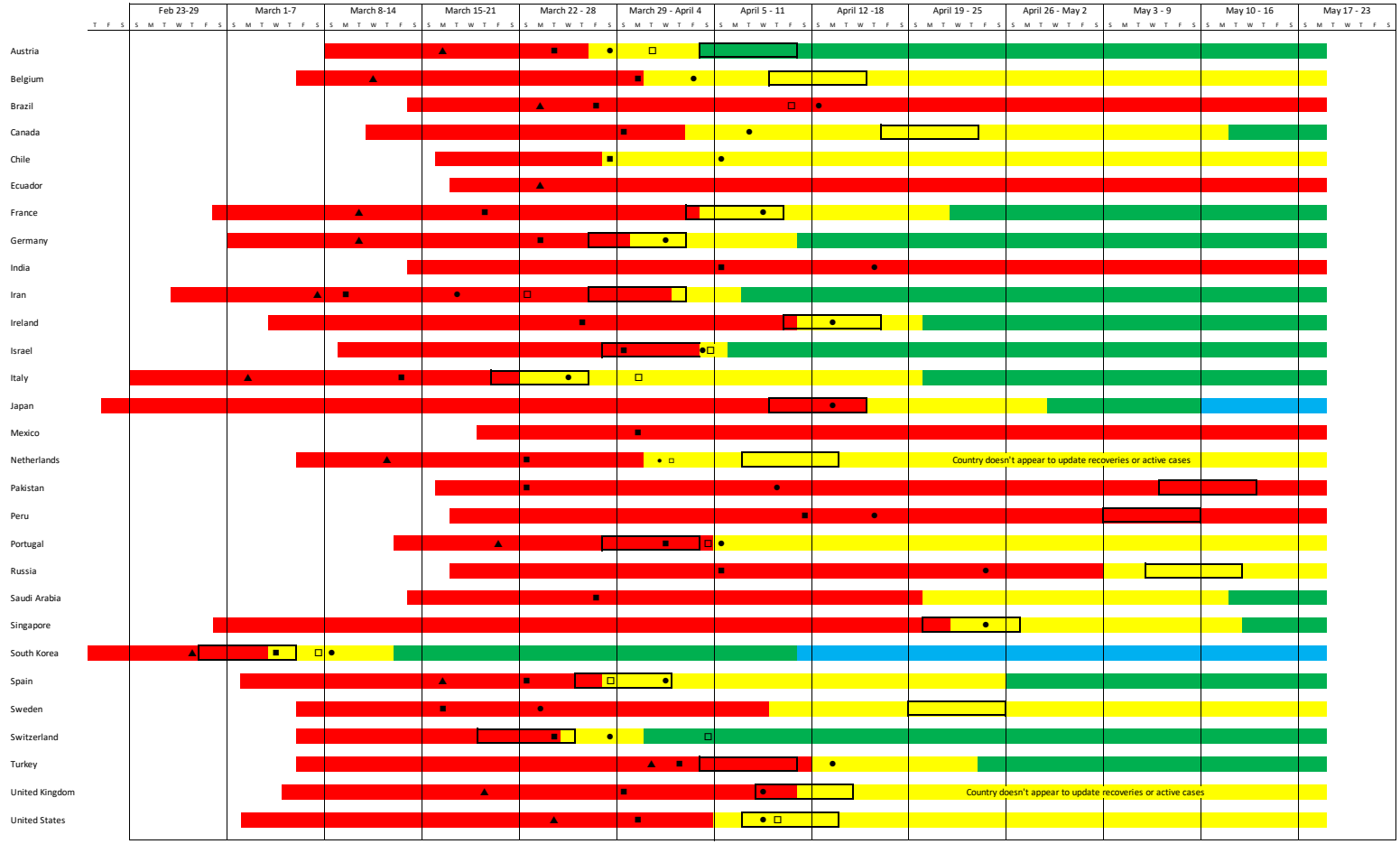

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Country-By-Country
Listing of Countries By Total Cases

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 movements are highlighted

	Total Cases						
Rank	Country	15-May	Rank	Country	6-May	Rank	Country	27-Apr
1	USA	1,550,294	1	USA	1,263,092	1	USA	1,010,356
2	Russia	290,678	2	Spain	253,682	2	Spain	229,422
3	Spain	278,188	3	Italy	214,457	3	Italy	199,414
4	Brazil	255,368	4	UK	201,101	4	France	165,842
5	UK	246,406	5	France	174,191	5	Germany	158,758
6	Italy	225,886	6	Germany	168,162	6	UK	157,149
7	France	179,927	7	Russia	165,929	7	Turkey	112,261
8	Germany	177,289	8	Turkey	131,744	8	Iran	91,472
9	Turkey	150,593	9	Brazil	126,611	9	Russia	87,147
10	Iran	122,492	10	Iran	101,650	10	China	82,830
11	India	100,328	11	China	82,883	11	Brazil	66,501
12	Peru	94,933	12	Canada	63,496	12	Canada	48,500
13	China	82,954	13	Peru	54,817	13	Belgium	46,687
14	Canada	78,072	14	India	52,987	14	Netherlands	38,245
15	Saudi Arabia	57,345	15	Belgium	50,781	15	India	29,451
16	Belgium	55,559	16	Netherlands	41,319	16	Switzerland	29,164
17	Mexico	49,219	17	Saudi Arabia	31,938	17	Peru	28,669
18	Chile	46,059	18	Switzerland	30,060	18	Portugal	24,070
19	Netherlands	44,141	19	Ecuador	29,420	19	Ecuador	23,240
20	Pakistan	42,125	20	Portugal	26,182	20	Ireland	19,648
22	Ecuador	33,582	21	Mexico	26,025	21	Sweden	18,926
23	Switzerland	30,597	22	Sweden	23,918	22	Saudi Arabia	18,811
25	Sweden	30,377	23	Pakistan	23,214	23	Israel	15,555
26	Portugal	29,209	24	Chile	23,048	24	Austria	15,274
27	Singapore	28,343	25	Ireland	22,248	25	Mexico	14,677
28	Ireland	24,200	26	Singapore	20,198	26	Singapore	14,423
35	Israel	16,643	29	Israel	16,310	27	Pakistan	13,915
37	Japan	16,305	31	Austria	15,684	28	Chile	13,813
39	Austria	16,269	32	Japan	15,253	29	Japan	13,614
44	S. Korea	11,065	38	S. Korea	10,806	35	South Korea	10,738
	Others	523,678		Others	356,176		Others	263,943
	World	4,888,124			3,817,382		World	3,062,515
	30 countries' share	89.3%			90.7%			91.4%

Country-By-Country

Countries Yet To Slow Case Growth

- The chart on the previous page illustrates the large upward movement in cases for:
  - Brazil
  - Chile
  - India
  - Mexico
  - Pakistan
  - Peru
  - Russia
  - Saudi Arabia
- Of these countries, only Pakistan and Russia have yet to find a peak in new daily infection rates – therefore, continued upward movement in cases may be anticipated for Brazil, Chile, India, Mexico, Peru and Saudi Arabia
- On the following three pages, we provide charts for these countries for
  - exponential case growth
  - active cases
  - new daily infection rates

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Country-By-Country

Exponential Case Growth Trends

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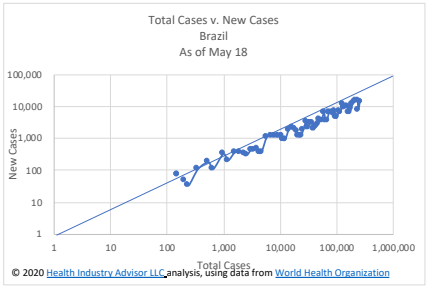

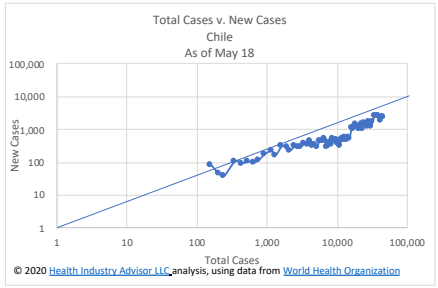

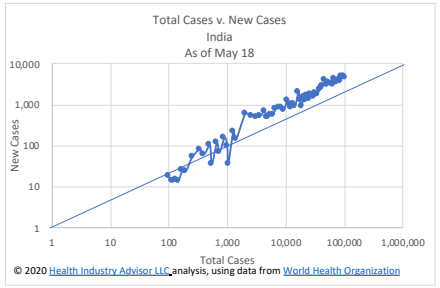

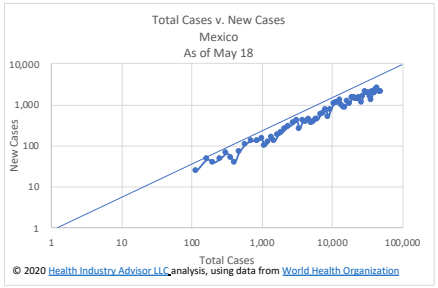

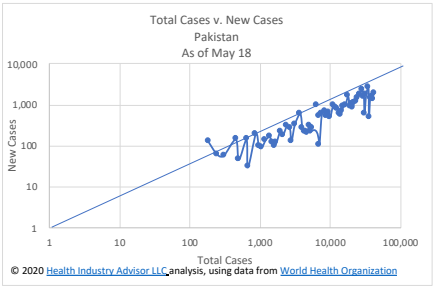

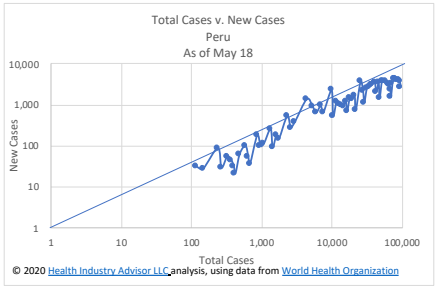

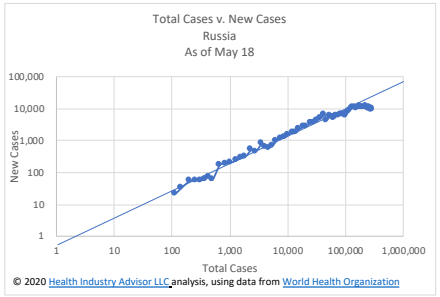

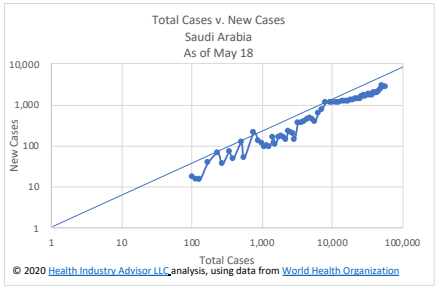

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Country-By-Country

Active Case Trends

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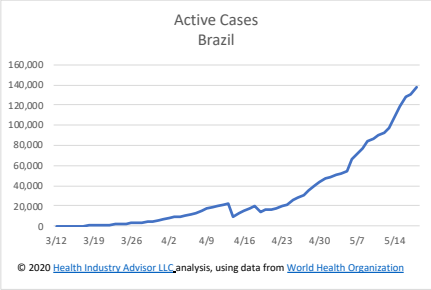

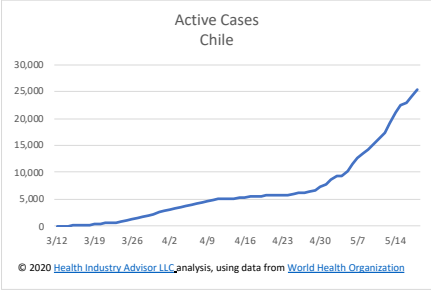

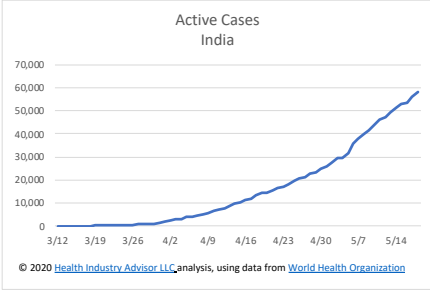

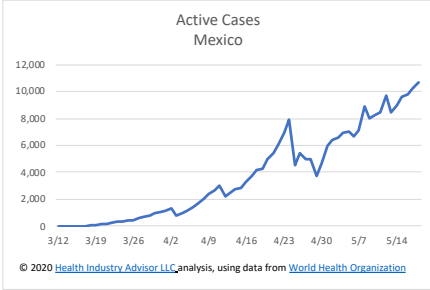

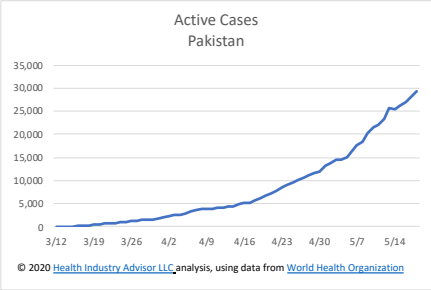

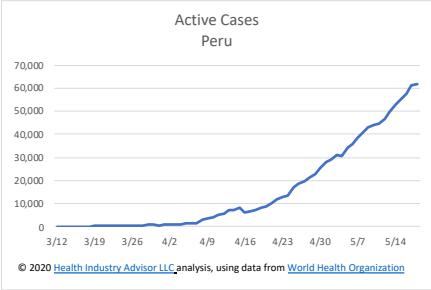

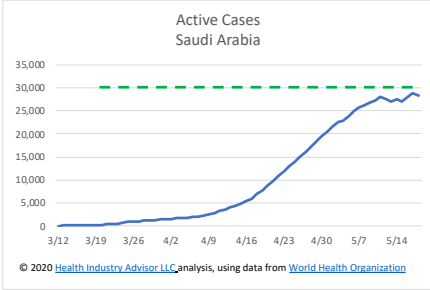

Country-By-Country

New Daily Infection Trends

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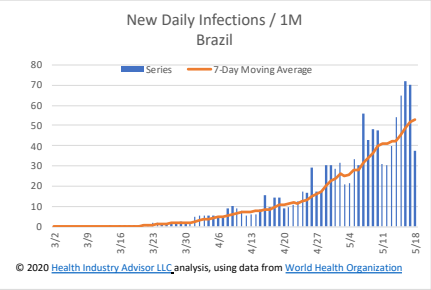

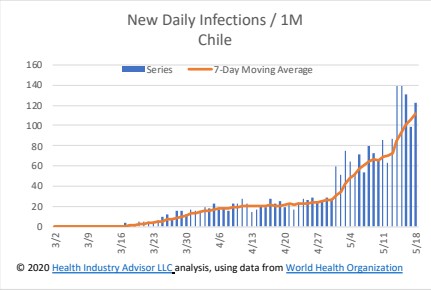

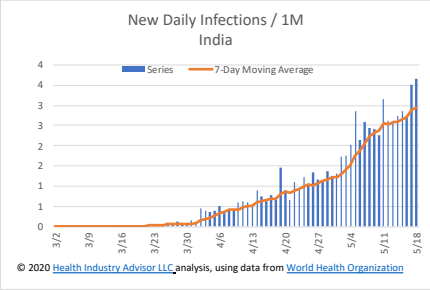

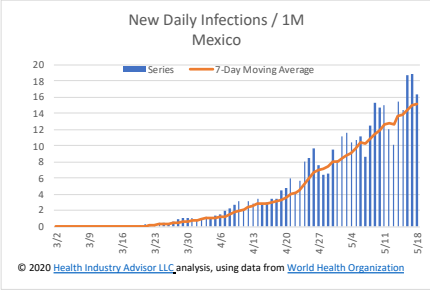

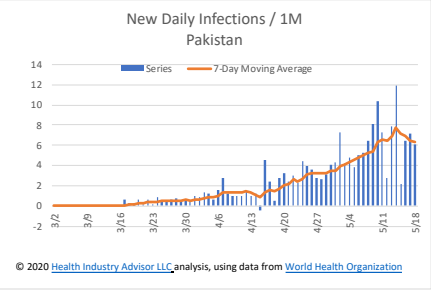

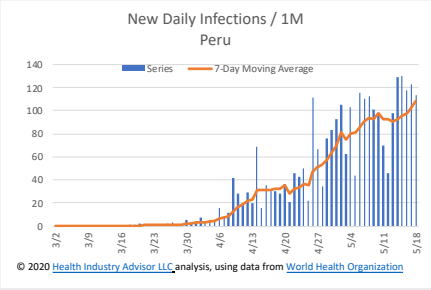

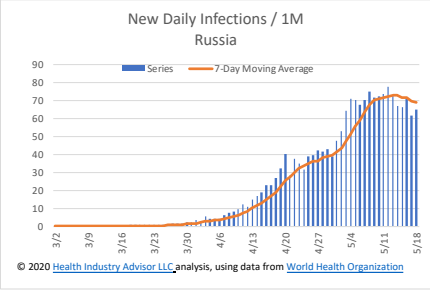

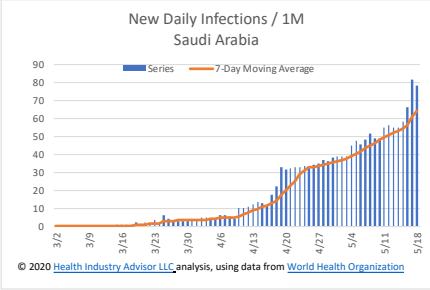

Country-by-Country

Cases & Cases Per Capita

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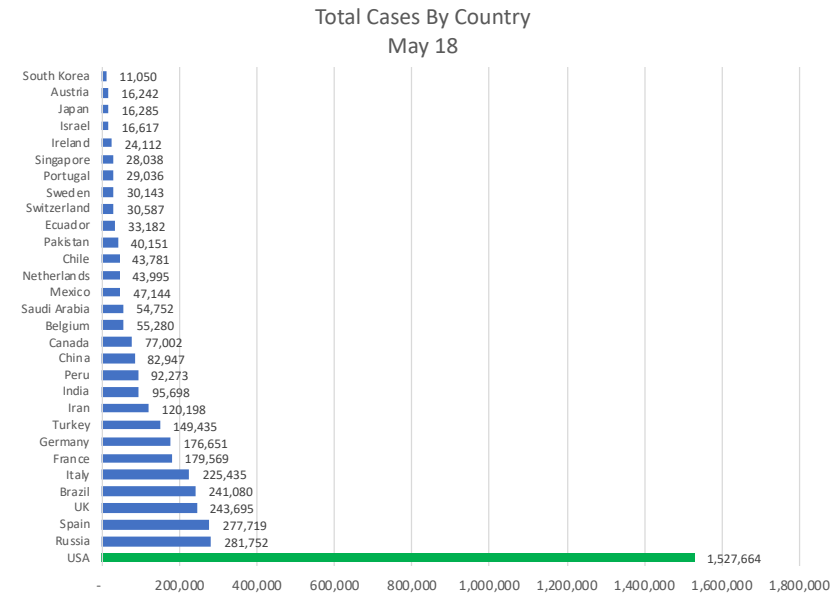
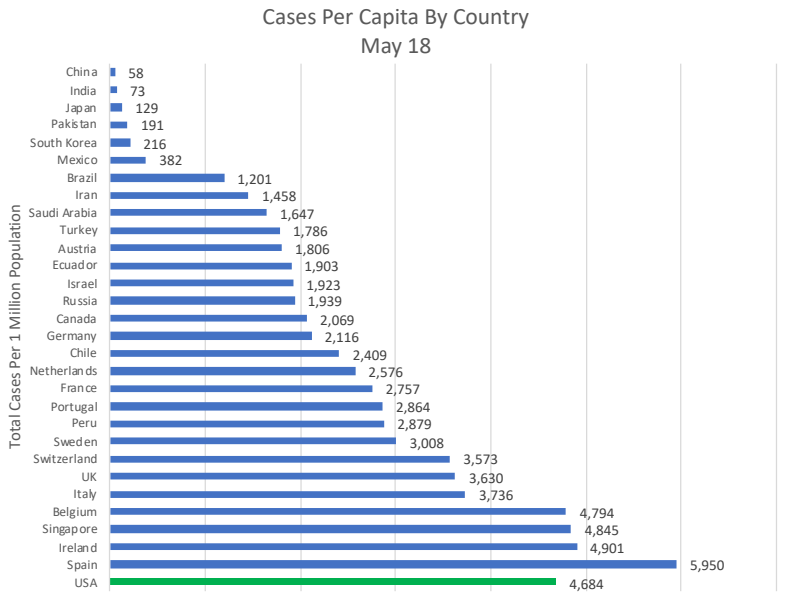
Brazil, Chile, India, Mexico, Pakistan, Peru, Russia and Saudi Arabia are moving up in the ranks of most cases; Austria, Israel, Japan and South Korea are dropping

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





Country-by-Country

Deaths Per Cases & Per Capita

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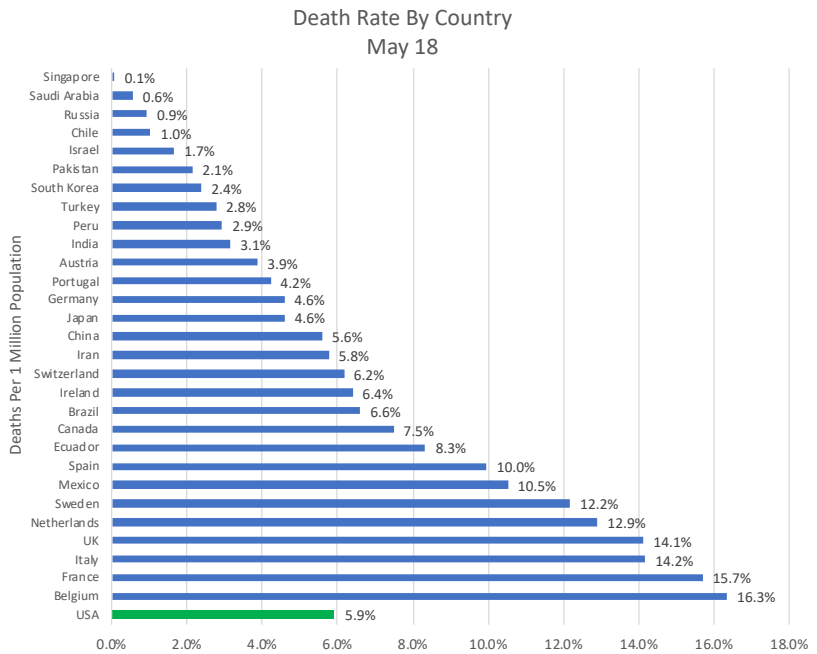
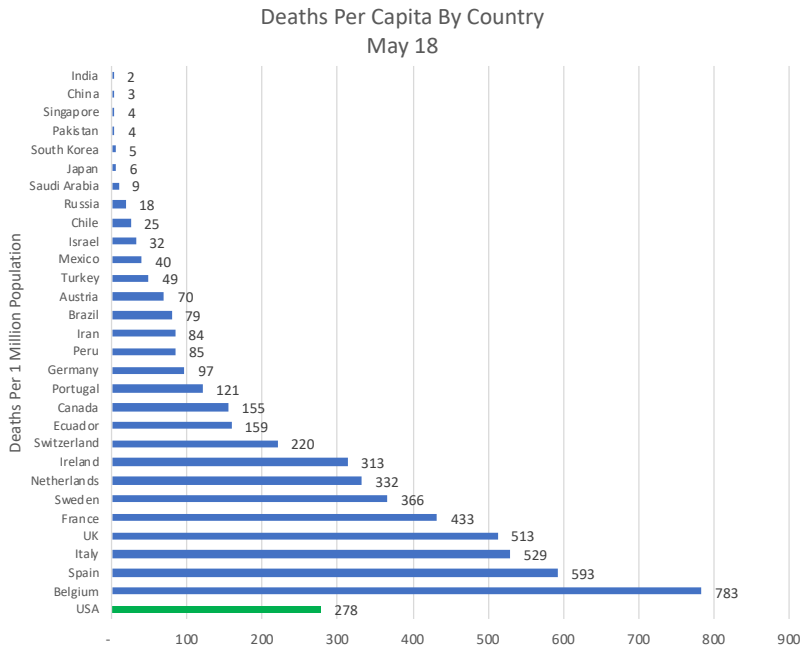
Death rates per case and per capita are the highest in Belgium, France, Italy and the UK. Rates in the US are in the middle of this group of countries





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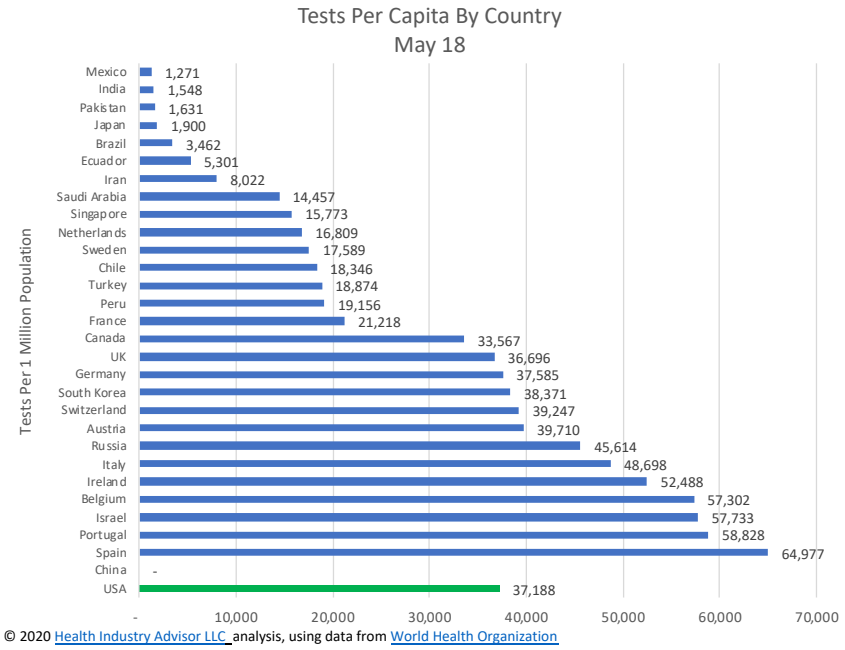
Country-by-Country

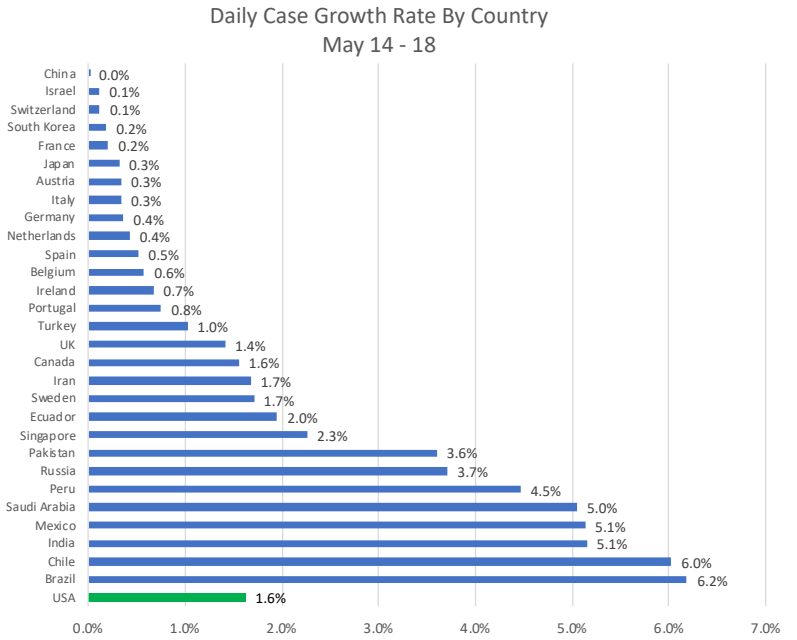
Tests Per Capita & Case Growth Rate

"Strategic Guidance in an Era of Unprecedented Change"

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.



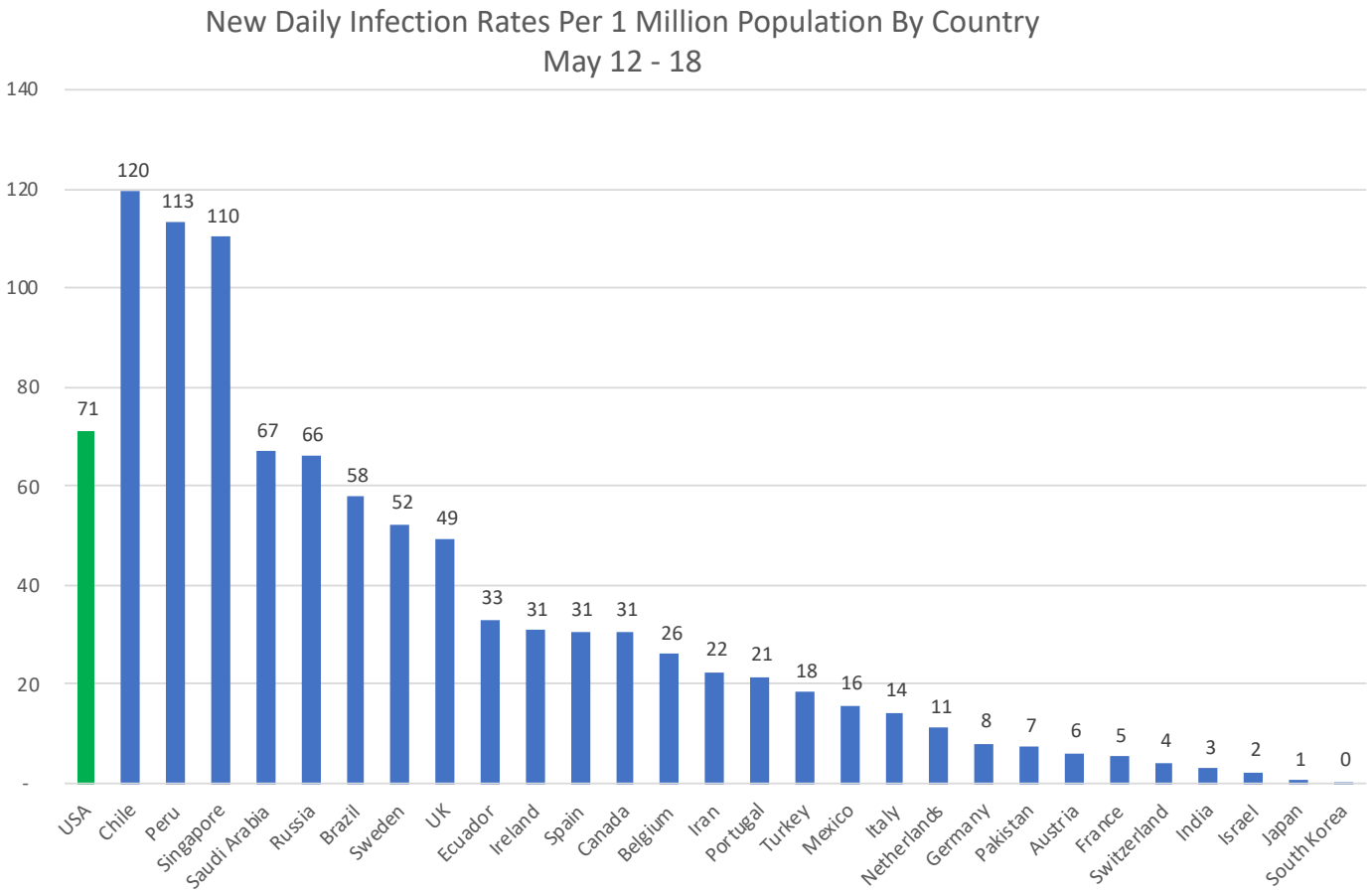
Case growth among the hardest-hit countries has fallen sharply over the past month



New Daily Infection Rate

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

Health Industry Advisor, llc

State-by-State

Comparative Statistics

"Strategic Guidance in an Era of Unprecedented Change"

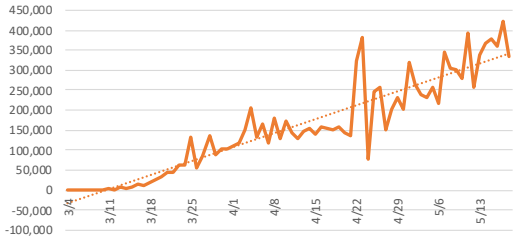
As of May 18

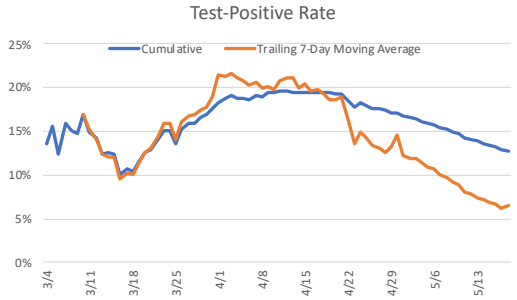
State	Total Cases	Rank	Cases per 1M Population	Rank2	Deaths	Rank3	Death Rate	Rank4	Deaths per 1 Million Population	Rank5	5-day Moving Average Case Growth Rate	Rank6	Tests per 1M Population Past 7 days	Rank7	New Daily Cases Per 1M Population (5-Day M.A.)	Rank8
Alabama	12,086	(26)	2,464.9	(28)	489	(25)	4.0%	(31)	99.7	(25)	2.5%	(17)	806	(34)	56.0	(25)
Alaska	399	(51)	545.4	(49)	10	(51)	2.5%	(42)	13.7	(50)	0.8%	(47)	1,353	(15)	3.5	(48)
Arizona	14,170	(23)	1,946.8	(35)	686	(21)	4.8%	(18)	94.2	(27)	3.1%	(6)	122	(50)	54.8	(27)
Arkansas	4,813	(39)	1,594.9	(41)	100	(40)	2.1%	(46)	33.1	(45)	2.6%	(12)	767	(36)	36.5	(36)
California	81,711	(5)	2,068.0	(34)	3,321	(8)	4.1%	(30)	84.0	(30)	2.3%	(18)	1,087	(21)	45.2	(32)
Colorado	22,202	(17)	3,855.4	(17)	1,224	(16)	5.5%	(11)	212.5	(14)	1.6%	(32)	489	(47)	57.6	(23)
Connecticut	38,116	(12)	10,690.9	(5)	3,449	(7)	9.0%	(2)	967.4	(3)	1.8%	(31)	1,810	(4)	174.3	(6)
Delaware	7,869	(33)	8,081.0	(7)	297	(33)	3.8%	(33)	305.0	(12)	2.5%	(15)	1,545	(9)	191.3	(2)
District Of Columbia	7,270	(35)	10,301.1	(6)	392	(27)	5.4%	(13)	555.4	(5)	2.0%	(28)	1,531	(10)	178.3	(4)
Florida	46,442	(9)	2,162.3	(33)	1,997	(11)	4.3%	(28)	93.0	(28)	1.8%	(30)	767	(37)	36.3	(37)
Georgia	38,283	(11)	3,605.7	(20)	1,649	(14)	4.3%	(27)	155.3	(16)	1.6%	(36)	1,520	(11)	57.6	(24)
Hawaii	640	(49)	452.0	(50)	17	(48)	2.7%	(41)	12.0	(51)	0.1%	(51)	440	(48)	0.6	(51)
Idaho	2,455	(43)	1,369.9	(43)	74	(42)	3.0%	(39)	41.3	(43)	1.1%	(45)	361	(49)	15.5	(45)
Illinois	96,485	(3)	7,614.1	(8)	4,234	(6)	4.4%	(24)	334.1	(11)	2.6%	(10)	1,813	(3)	197.0	(1)
Indiana	28,255	(16)	4,197.0	(16)	1,765	(12)	6.2%	(8)	262.2	(13)	2.1%	(25)	790	(35)	77.0	(18)
Iowa	15,083	(22)	4,780.6	(14)	364	(29)	2.4%	(43)	115.4	(24)	2.6%	(13)	1,148	(20)	122.7	(10)
Kansas	8,340	(31)	2,862.7	(23)	198	(36)	2.4%	(44)	68.0	(35)	2.1%	(24)	632	(45)	58.7	(22)
Kentucky	7,935	(32)	1,776.1	(38)	346	(31)	4.4%	(26)	77.4	(32)	2.3%	(19)	1,367	(13)	40.2	(35)
Louisiana	34,709	(13)	7,466.2	(9)	2,563	(9)	7.4%	(4)	551.3	(6)	1.2%	(44)	1,503	(12)	88.9	(14)
Maine	1,713	(45)	1,274.4	(46)	71	(43)	4.1%	(29)	52.8	(39)	2.5%	(16)	27	(51)	26.7	(42)
Maryland	39,762	(10)	6,576.9	(10)	2,023	(10)	5.1%	(17)	334.6	(10)	2.7%	(8)	868	(31)	151.0	(8)
Massachusetts	87,052	(4)	12,526.4	(3)	5,862	(3)	6.7%	(7)	843.5	(4)	1.6%	(34)	1,359	(14)	176.6	(5)
Michigan	51,915	(7)	5,198.3	(13)	4,915	(4)	9.5%	(1)	492.1	(7)	1.4%	(40)	1,591	(7)	62.4	(21)
Minnesota	16,372	(21)	2,903.0	(22)	740	(19)	4.5%	(22)	131.2	(19)	4.9%	(1)	1,034	(24)	115.8	(11)
Mississippi	11,432	(27)	3,841.2	(18)	528	(23)	4.6%	(20)	177.4	(15)	2.5%	(14)	954	(29)	84.4	(15)
Missouri	11,203	(28)	1,825.4	(37)	612	(22)	5.5%	(12)	99.7	(26)	1.6%	(33)	831	(32)	24.5	(43)
Montana	470	(50)	439.8	(51)	16	(49)	3.4%	(37)	15.0	(49)	0.3%	(49)	748	(40)	1.5	(50)
Nebraska	10,625	(29)	5,492.6	(11)	125	(39)	1.2%	(49)	64.6	(37)	3.2%	(4)	1,570	(8)	151.6	(7)
Nevada	6,906	(36)	2,242.1	(31)	358	(30)	5.2%	(16)	116.2	(23)	1.6%	(37)	1,009	(25)	35.0	(38)
New Hampshire	3,652	(42)	2,685.9	(24)	172	(37)	4.7%	(19)	126.5	(21)	2.1%	(27)	1,050	(22)	51.7	(29)
New Jersey	150,087	(2)	16,897.5	(2)	10,448	(2)	7.0%	(6)	1,176.3	(2)	1.0%	(46)	1,281	(18)	143.9	(9)
New Mexico	6,096	(37)	2,907.2	(21)	270	(35)	4.4%	(23)	128.8	(20)	2.6%	(11)	2,095	(2)	70.0	(19)
New York	361,266	(1)	18,570.7	(1)	28,480	(1)	7.9%	(3)	1,464.0	(1)	0.6%	(48)	1,725	(6)	103.7	(12)
North Carolina	19,208	(19)	1,831.4	(36)	693	(20)	3.6%	(36)	66.1	(36)	3.3%	(2)	816	(33)	53.6	(28)
North Dakota	1,931	(44)	2,533.9	(27)	44	(47)	2.3%	(45)	57.7	(38)	3.2%	(3)	1,790	(5)	77.4	(17)
Ohio	28,485	(15)	2,436.9	(29)	1,660	(13)	5.8%	(9)	142.0	(17)	2.1%	(26)	749	(39)	45.2	(33)
Oklahoma	5,398	(38)	1,364.2	(44)	288	(34)	5.3%	(14)	72.8	(34)	2.2%	(23)	995	(27)	28.3	(41)
Oregon	3,687	(41)	874.2	(47)	138	(38)	3.7%	(34)	32.7	(46)	1.5%	(38)	668	(44)	13.6	(46)
Pennsylvania	66,674	(6)	5,208.1	(12)	4,668	(5)	7.0%	(5)	364.6	(9)	1.4%	(41)	577	(46)	68.0	(20)
Rhode Island	12,795	(24)	12,078.0	(4)	506	(24)	4.0%	(32)	477.6	(8)	1.6%	(35)	2,974	(1)	181.4	(3)
South Carolina	8,942	(30)	1,736.7	(39)	391	(28)	4.4%	(25)	75.9	(33)	2.2%	(21)	1,307	(17)	31.9	(39)
South Dakota	4,027	(40)	4,552.0	(15)	44	(47)	1.1%	(50)	49.7	(40)	1.5%	(39)	721	(41)	82.4	(16)
Tennessee	18,011	(20)	2,635.8	(25)	301	(32)	1.7%	(47)	44.0	(42)	1.9%	(29)	1,341	(16)	51.6	(30)
Texas	49,684	(8)	1,713.5	(40)	1,369	(15)	2.8%	(40)	47.2	(41)	2.7%	(9)	972	(28)	43.5	(34)
Utah	7,384	(34)	2,303.2	(30)	80	(41)	1.1%	(51)	25.0	(47)	2.2%	(20)	1,044	(23)	45.5	(31)
Vermont	940	(47)	1,506.4	(42)	54	(45)	5.7%	(10)	86.5	(29)	0.2%	(50)	676	(43)	3.0	(49)
Virginia	31,140	(14)	3,648.3	(19)	1,014	(18)	3.3%	(38)	118.8	(22)	3.1%	(5)	763	(38)	101.6	(13)
Washington	19,510	(18)	2,562.1	(26)	1,019	(17)	5.2%	(15)	133.8	(18)	1.3%	(43)	682	(42)	30.4	(40)
West Virginia	1,502	(46)	840.4	(48)	68	(44)	4.5%	(21)	38.0	(44)	1.4%	(42)	1,004	(26)	10.6	(47)
Wisconsin	12,687	(25)	2,179.0	(32)	459	(26)	3.6%	(35)	78.8	(31)	3.1%	(7)	950	(30)	55.7	(26)
Wyoming	766	(48)	1,323.5	(45)	10	(51)	1.3%	(48)	17.3	(48)	2.2%	(22)	1,239	(19)	23.9	(44)
United States	1,550,294		4,683.6		91,981		5.9%		277.9		1.6%		1,057		71.0	

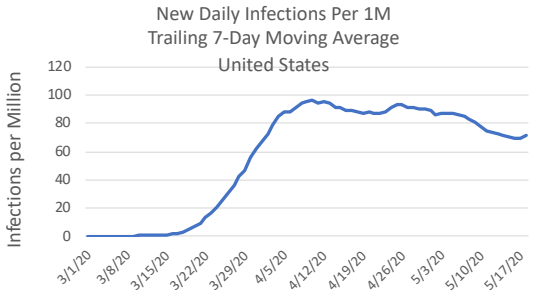
Overall Statistics

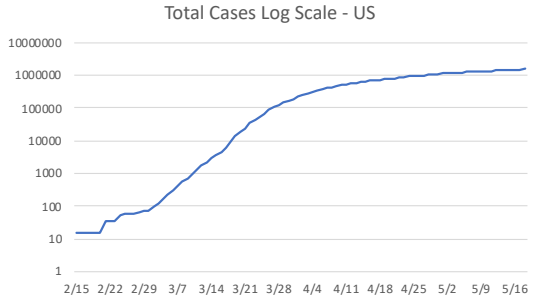
"Strategic Guidance in an Era of Unprecedented Change"

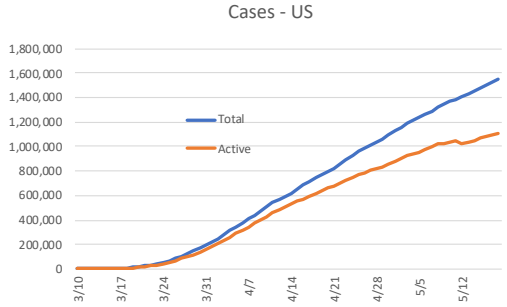
With significantly increased testing, the US is now meeting the WHO standard of <10% test-positives. This suggests that asymptomatic cases are being captured and that we have a better view of true infection rates.
Further, new daily infections continue to decline; the death rate seems to have stabilized.

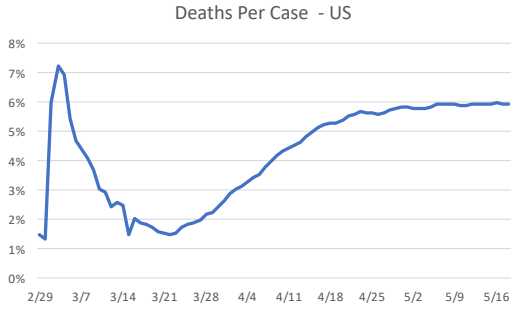












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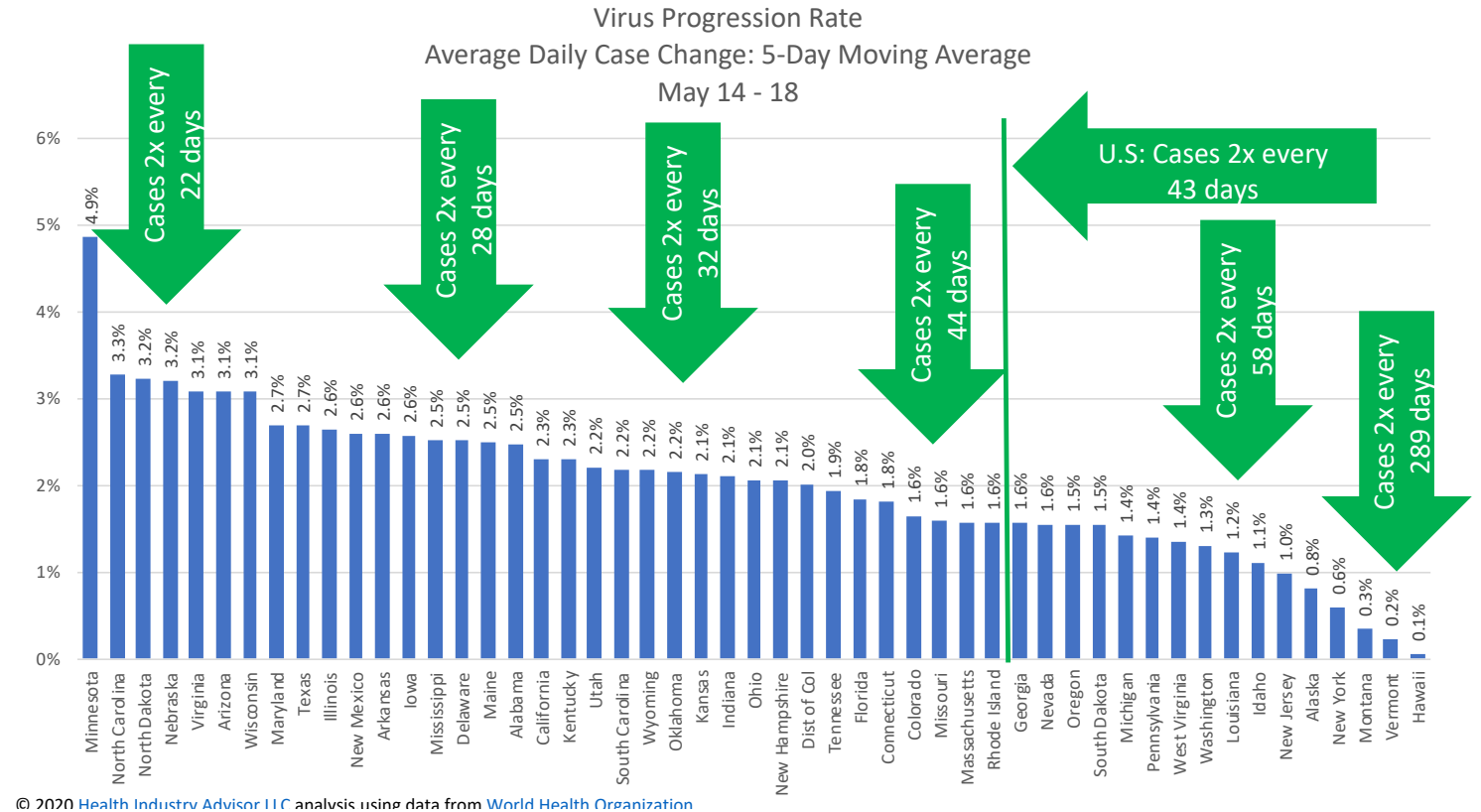
State-by-State

Average Daily Case Growth

"Strategic Guidance in an Era of Unprecedented Change"

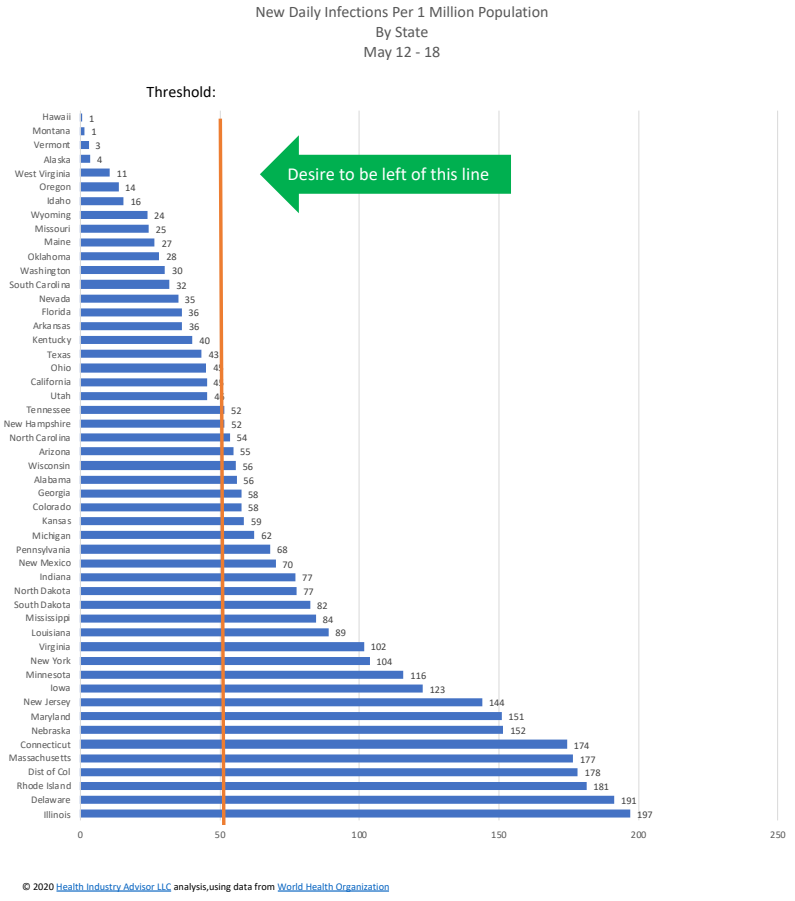
Just 1 month ago, cases in every state were doubling every 1 – 3 weeks.
Now, they would take 2 weeks to more than 1 year to double

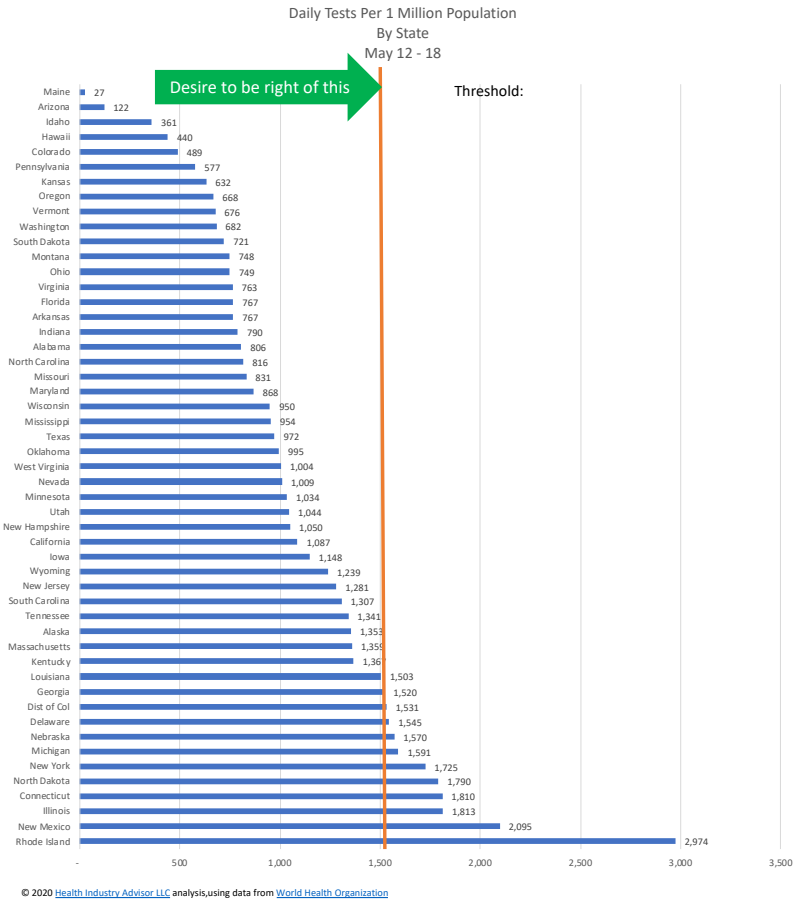


State-by-State

New Daily Infections & Tests Per Capita

"Strategic Guidance in an Era of Unprecedented Change"



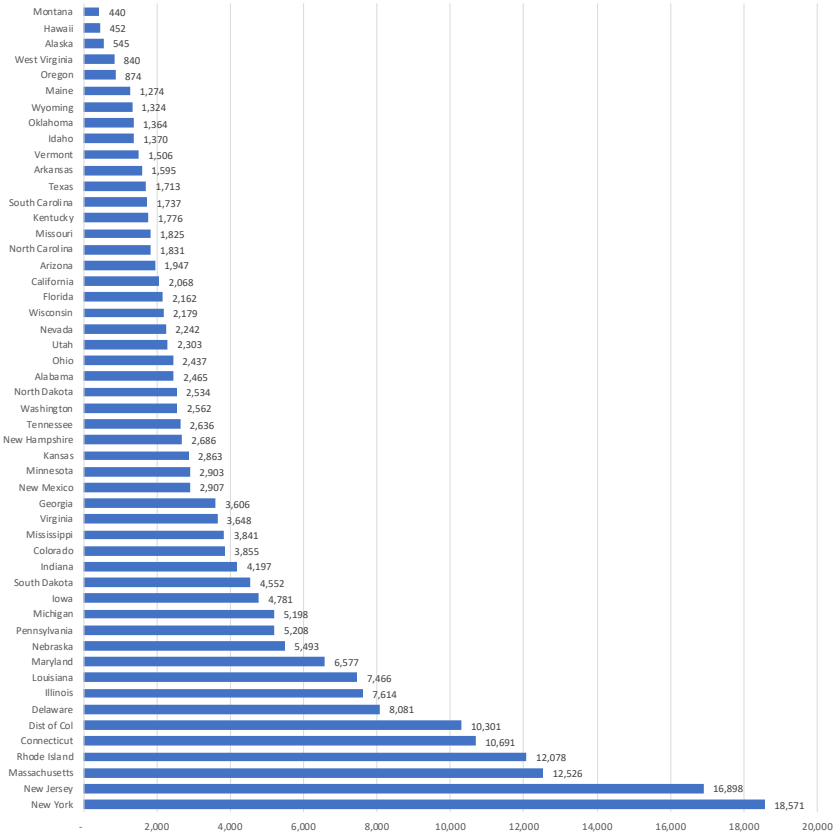


State-by-State

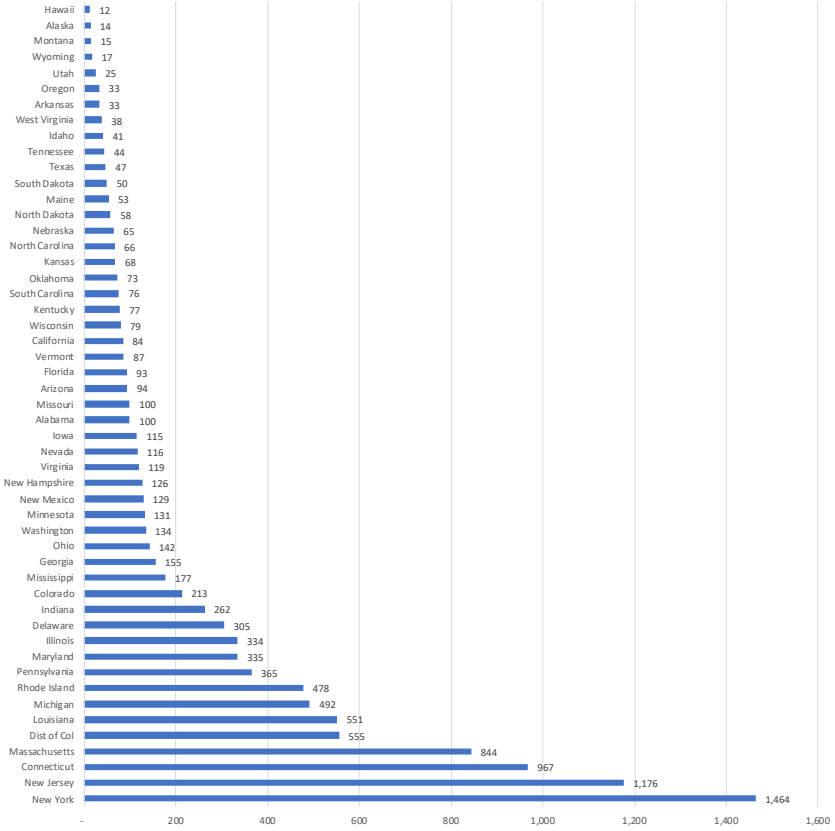
Cases & Deaths Per Capita

"Strategic Guidance in an Era of Unprecedented Change"

Total Cases Per 1 Million Population
By State
As of May 18



Deaths Per 1 Million Population
By State
As of May 18

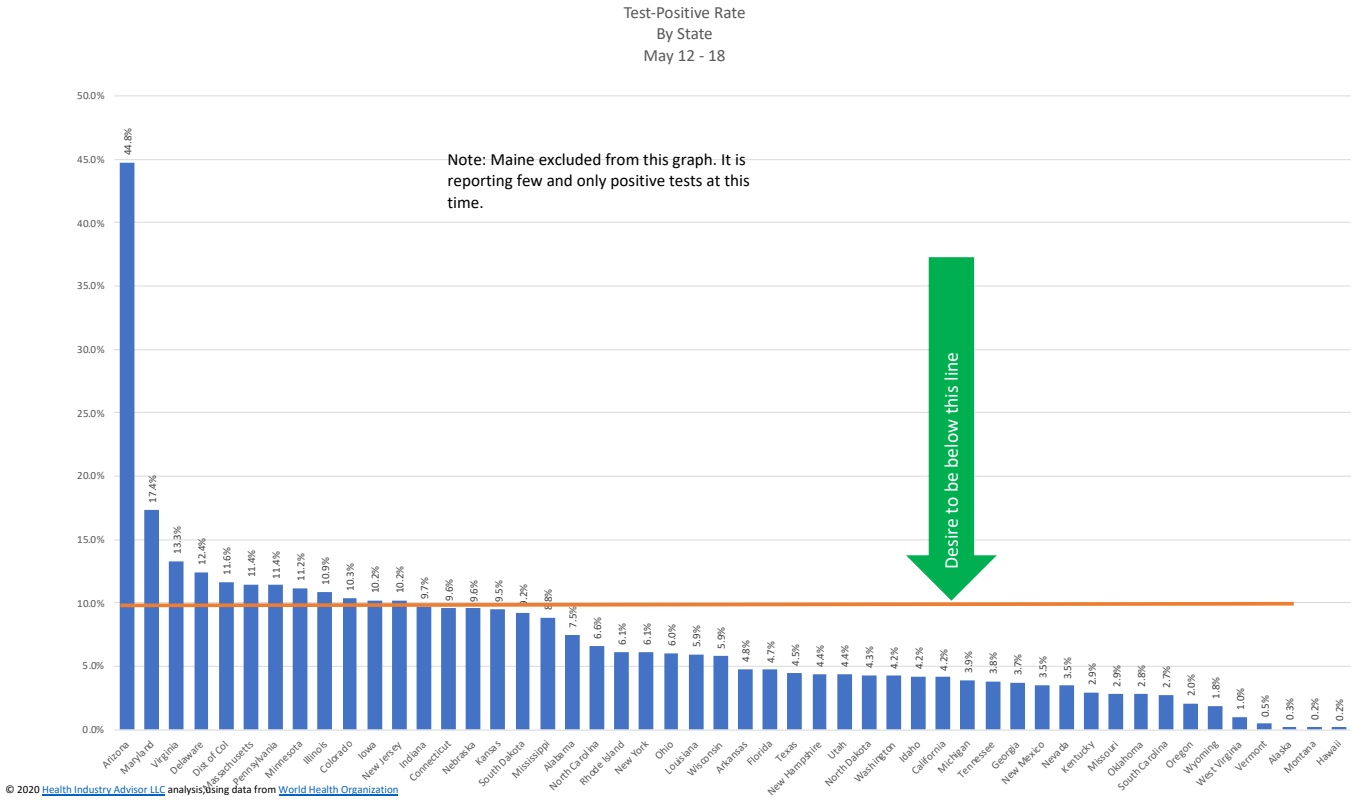


State-by-State

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.



VIRUS PROGRESSION: ROADMAP TO RECOVERY

Virus Progression

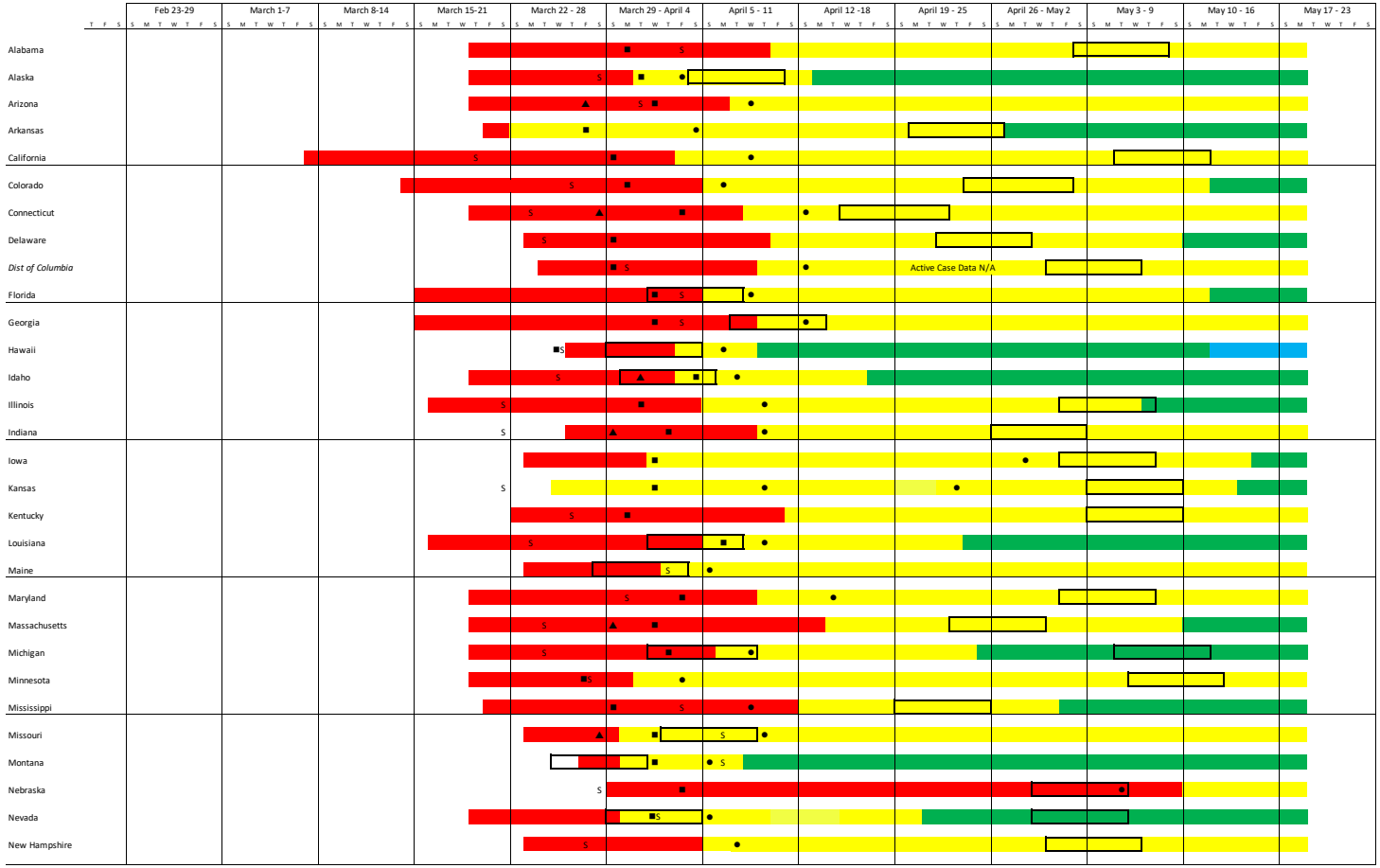
The graphic on the following two pages illustrates when the state first recorded 100 total cases (start of the "contagion" phase); when growth stopped following an exponential pattern (start of the "containment" phase); and, when peak total cases were recorded (start of the "recovery" phase). It uses 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

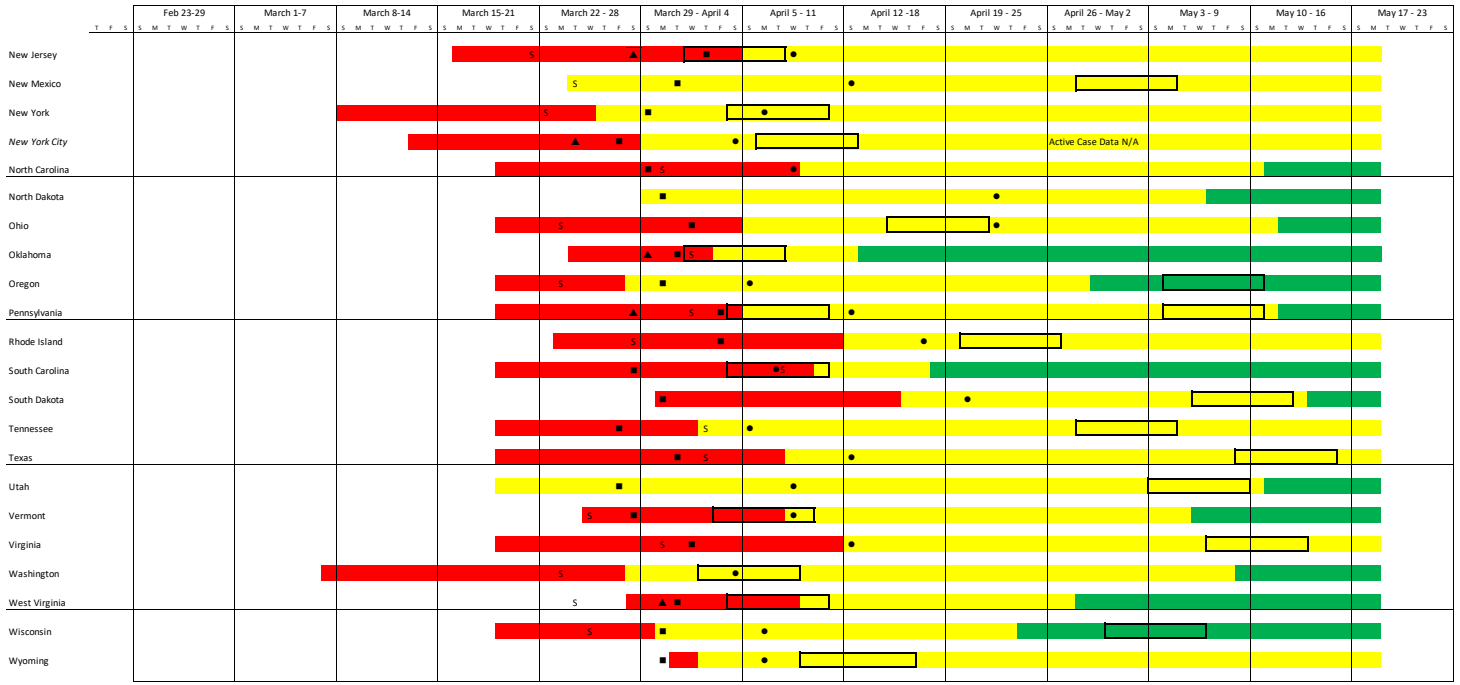
Virus Progression – *1 of 2*

"Strategic Guidance in an Era of Unprecedented Change"



Legend on following page

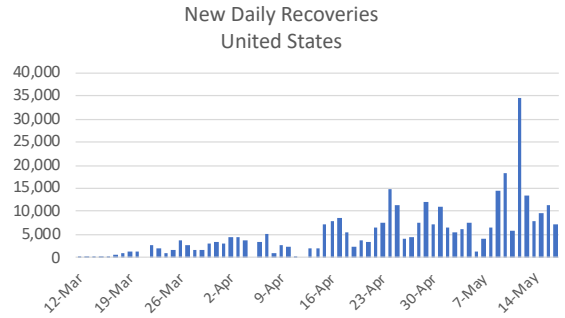
Virus Progression – *2 of 2*

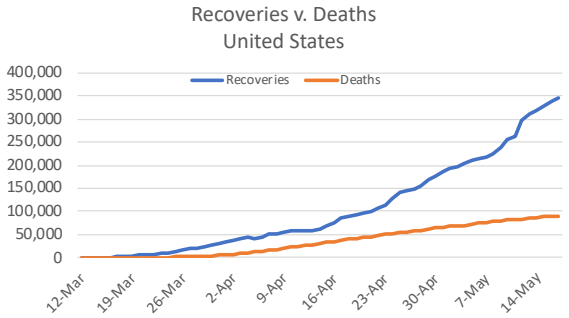


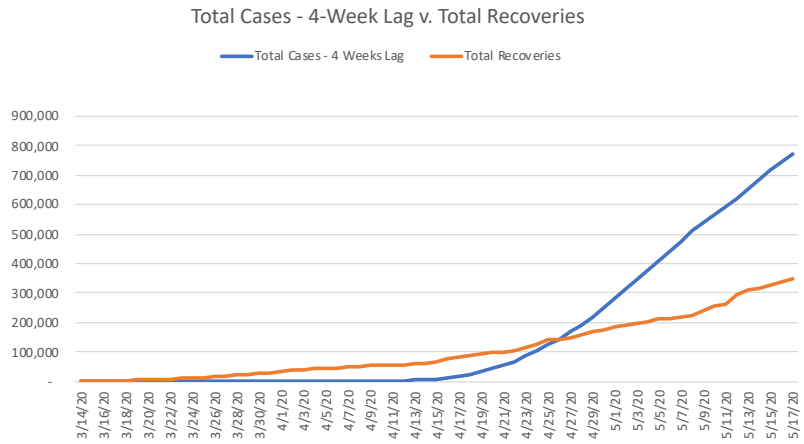
UNDER-REPORTED RECOVERIES? POSSIBLE LAG IN STATE REPORTING

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 ~275-360k

* - 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	4,062	4,570
Alaska	345	257	289
Arizona	70	4,051	4,558
Arkansas	3,645	1,577	1,774
California	14,747	26,949	30,317
Colorado	1,491	8,085	9,095
Connecticut	6,264	15,852	17,834
Delaware	3,545	2,196	2,471
District Of Columbia	1,028	2,342	2,634
Florida	7,638	21,646	24,352
Georgia	340	15,519	17,459
Hawaii	574	467	526
Idaho	1,379	1,389	1,562
Illinois	2,168	25,206	28,357
Indiana	1,869	9,349	10,517
Iowa	7,797	2,527	2,843
Kansas	2,604	1,589	1,787
Kentucky	2,785	2,440	2,745
Louisiana	26,249	19,618	22,071
Maine	1,053	700	788
Maryland	2,806	10,947	12,316
Massachusetts	27,812	31,714	35,679
Michigan	28,234	25,600	28,800
Minnesota	10,897	1,976	2,223
Mississippi	6,268	3,610	4,061
Missouri	2,807	4,665	5,248
Montana	434	346	390
Nebraska	349	1,318	1,483
Nevada	5,039	3,064	3,447
New Hampshire	1,269	1,158	1,302
New Jersey	6,861	71,045	79,925
New Mexico	1,739	1,577	1,774
New York	62,191	201,675	226,885
North Carolina	9,115	5,494	6,180
North Dakota	1,219	502	564
Ohio	4,868	10,335	11,627
Oklahoma	3,945	2,144	2,412
Oregon	1,406	1,565	1,760
Pennsylvania	6,749	27,131	30,523
Rhode Island	886	4,072	4,581
South Carolina	6,043	3,551	3,995
South Dakota	2,784	1,348	1,517
Tennessee	9,886	5,790	6,514
Texas	28,008	15,858	17,840
Utah	4,183	2,570	2,892
Vermont	815	653	734
Virginia	4,107	7,192	8,091
Washington	5,008	9,668	10,877
West Virginia	919	722	812
Wisconsin	6,773	3,599	4,049
Wyoming	504	342	385
	-	-	-
United States	356,383	634,207	713,483

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

MONITORING THE IMPACT OF RELAXING RESTRICTIONS

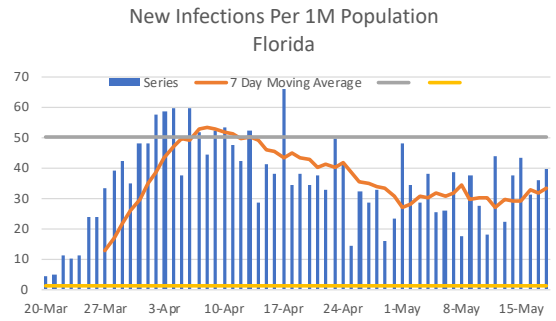
State-By-State

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 last Wednesday).

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



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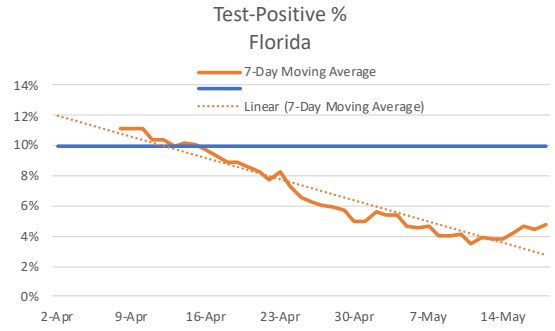

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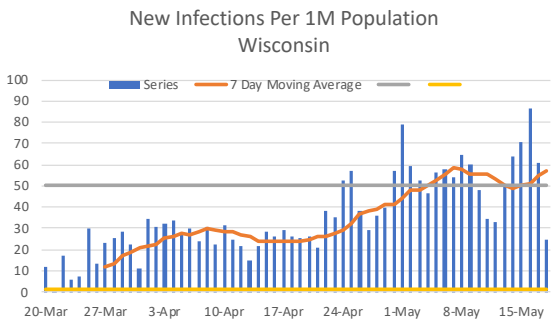

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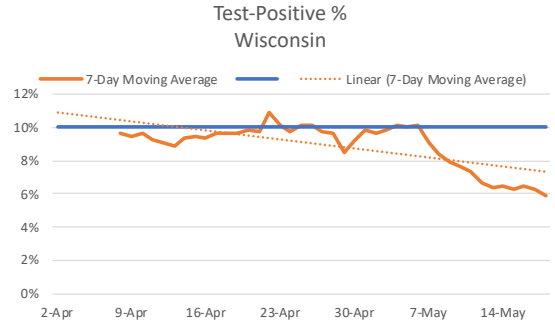

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U.S. COUNTY-BY-COUNTY INFORMATION

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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County-By-County

Cases, Deaths and Daily Infection Rates

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"Strategic Guidance in an Era of Unprecedented Change"

As of May 17

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	15-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	40.0	17-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	12-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	22.6	17-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	15-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

1. Data from The New York Times, based on reports from state and local health agencies. Accessed May 10-19, 2020
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County-By-County

Cases, Deaths and Daily Infection Rates

Listed in Alpha Order By State (Page 2 of 3)

"Strategic Guidance in an Era of Unprecedented Change"

As of May 17

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	15-Apr
Gwinnett, GA	Georgia	Lawrenceville	0.936	2,597	102	2,774	109	3.9%	29.6	78.1	4-May
Honolulu HI	Hawaii	Honolulu	0.975	415	11	426	11	2.7%	1.2	23.7	5-Apr
Cook, IL	Illinois	Chicago	5.150	61,212	2,814	11,885	546	4.6%	264.6	328.1	7-May
DuPage, IL	Illinois	Wheaton	0.923	5,780	293	6,263	317	5.1%	199.2	201.4	17-May
Lake, IL	Illinois	Waukegan	0.697	6,382	209	9,162	300	3.3%	242.6	265.0	12-May
Will, IL	Illinois	Joliet	0.691	4,312	240	6,243	347	5.6%	139.8	199.2	6-May
Marion, IN	Indiana	Indianapolis	0.965	8,240	509	8,543	528	6.2%	137.1	213.9	6-May
Jefferson, KY	Kentucky	Louisville	0.767	1,922	127	2,507	166	6.6%	52.2	97.1	25-Apr
Baltimore, MD	Maryland	Towson	0.827	4,566	240	5,519	290	5.3%	140.4	156.1	24-Apr
Montgomery, MD	Maryland	Rockville	1.051	8,026	461	7,639	439	5.7%	195.5	236.0	4-May
Prince George's, MD	Maryland	Upper Marlboro	0.909	11,052	420	12,154	462	3.8%	287.7	389.1	7-May
Essex, MA	Massachusetts	Salem and Lawrence	0.789	12,314	766	15,606	971	6.2%	199.7	470.2	29-Apr
Middlesex, MA	Massachusetts	Lowell and Cambridge	1.612	18,883	1,370	11,716	850	7.3%	139.7	350.7	25-Apr
Norfolk, MA	Massachusetts	Dedham	0.707	7,412	719	10,487	1,017	9.7%	106.1	305.8	25-Apr
Suffolk, MA	Massachusetts	Boston	0.804	16,346	778	20,333	968	4.8%	218.0	634.2	27-Apr
Worcester, MA	Massachusetts	Worcester	0.831	9,067	554	10,916	667	6.1%	250.4	317.1	29-Apr
Macomb, MI	Michigan	Mount Clemens	0.874	6,304	739	7,213	846	11.7%	46.6	255.2	7-Apr
Oakland, MI	Michigan	Pontiac	1.258	8,023	910	6,380	724	11.3%	37.6	240.4	7-Apr
Washtenaw, MI	Michigan	Ann Arbor	0.368	1,241	88	3,376	239	7.1%	25.3	134.5	2-Apr
Wayne, MI	Michigan	Detroit	1.749	19,016	2,212	10,870	1,264	11.6%	86.2	433.6	7-Apr
Hennepin, MN	Minnesota	Minneapolis	1.266	4,930	454	3,895	359	9.2%	175.0	180.6	17-May
Jackson, MO	Missouri	Independence and Kansas City	0.703	432	16	614	23	3.7%	8.5	18.9	6-Apr
St Louis, MO	Missouri	Warren	0.994	4,106	329	4,130	331	8.0%	54.5	116.4	8-Apr
St. Louis, MO	Missouri	Clayton	0.303	1,631	96	5,386	317	5.9%	69.3	176.0	7-May
Clark, NV	Nevada	Las Vegas	2.267	5,298	293	2,337	129	5.5%	37.4	62.5	5-Apr
Bergen, NJ	New Jersey	Hackensack	0.932	17,246	1,450	18,500	1,555	8.4%	67.7	708.6	7-Apr
Essex, NJ	New Jersey	Newark	0.799	16,032	1,522	20,066	1,905	9.5%	119.3	628.1	10-Apr
Hudson, NJ	New Jersey	Jersey City	0.672	17,326	1,045	25,768	1,554	6.0%	138.3	766.8	9-Apr
Middlesex, NJ	New Jersey	New Brunswick	0.825	14,514	872	17,591	1,057	6.0%	130.7	508.2	10-Apr
Bernalillo, NM	New Mexico	Albuquerque	0.679	1,194	56	1,758	82	4.7%	30.3	52.6	4-May
Erie, NY	New York	Buffalo	0.919	4,867	428	5,298	466	8.8%	82.4	149.7	29-Apr
Monroe, NY	New York	Rochester	0.742	2,193	165	2,956	222	7.5%	80.3	84.2	17-May

1. Data from The New York Times, based on reports from state and local health agencies. Accessed May 10-19, 2020
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County-By-County

Cases, Deaths and Daily Infection Rates

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"Strategic Guidance in an Era of Unprecedented Change"

As of May 17

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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	9-Apr
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	15-Apr
Suffolk, MY	New York	Riverhead	1.48	37,942	1,783	25,695	1,208	4.7%	143.3	856.0	7-Apr
Westchester, NY	New York	White Plains	0.97	32,096	1,398	33,174	1,445	4.4%	149.1	981.3	14-May
Mecklenburg, NC	North Carolina	Charlotte	1.11	2,504	63	2,255	57	2.5%	59.3	66.5	17-May
Wake, NC	North Carolina	Raleigh	1.11	1,176	28	1,058	25	2.4%	20.9	28.9	2-May
Cuyahoga, OH	Ohio	Cleveland	1.24	3,223	163	2,610	132	5.1%	54.1	60.8	17-May
Franklin, OH	Ohio	Columbus	1.32	4,420	169	3,357	128	3.8%	77.0	111.3	8-May
Hamilton, OH	Ohio	Cincinnati	0.82	2,007	111	2,455	136	5.5%	48.2	68.0	6-May
Oklahoma, OK	Oklahoma	Oklahoma City	0.80	1,070	46	1,342	58	4.3%	25.6	31.5	10-Apr
Multnomah, OR	Oregon	Portland	0.81	979	55	1,204	68	5.6%	20.4	28.5	14-Apr
Allegheny, PA	Pennsylvania	Pittsburgh	1.22	1,595	143	1,312	118	9.0%	12.8	42.8	8-Apr
Montgomery, PA	Pennsylvania	Norristown	0.83	5,797	614	6,977	739	10.6%	117.1	184.1	11-Apr
Philadelphia, PA	Pennsylvania	Philadelphia	1.58	19,606	1,031	12,377	651	5.3%	155.6	308.2	28-Apr
Davidson, TN	Tennessee	Nashville	0.69	4,049	43	5,833	62	1.1%	95.3	157.0	7-May
Shelby, TN	Tennessee	Memphis	0.94	3,681	85	3,928	91	2.3%	75.0	91.3	17-Apr
Bexar, TX	Texas	San Antonio	2.00	2,120	62	1,058	31	2.9%	16.6	31.0	6-May
Collin, TX	Texas	McKinney	1.03	1,018	31	984	30	3.0%	15.9	27.5	9-Apr
Dallas, TX	Texas	Dallas	2.64	7,250	170	2,751	65	2.3%	88.4	95.0	11-May
Denton, TX	Texas	Denton	0.89	1,051	28	1,185	32	2.7%	22.1	28.7	12-Apr
El Paso, TX	Texas	El Paso	0.84	1,726	46	2,057	55	2.7%	68.8	73.5	17-May
Fort Bend, TX	Texas	Richmond	0.81	1,558	40	1,919	49	2.6%	33.1	49.3	7-May
Harris, TX	Texas	Houston	4.71	9,126	204	1,936	43	2.2%	40.1	69.0	11-Apr
Hidalgo, TX	Texas	Edinburg	0.87	425	10	489	12	2.4%	6.2	16.8	11-Apr
Tarrant, TX	Texas	Fort Worth	2.10	4,350	121	2,069	58	2.8%	77.5	85.8	13-May
Travis, TX	Texas	Austin	1.27	2,425	77	1,904	60	3.2%	37.0	48.4	17-Apr
Salt Lake, UT	Utah	Salt Lake City	1.16	3,785	55	3,262	47	1.5%	71.3	75.5	15-May
Fairfax, VA	Virginia	Fairfax	1.15	7,386	278	6,436	242	3.8%	221.1	237.3	14-May
King, WA	Washington	Seattle	2.25	7,759	528	3,444	234	6.8%	27.9	86.5	11-Apr
Pierce, WA	Washington	Tacoma	0.90	1,793	68	1,981	75	3.8%	18.8	65.4	7-Apr
Snohomish, WA	Washington	Everett	0.82	3,071	125	3,736	152	4.1%	26.8	116.6	1-Apr
Dane, WI	Wisconsin	Madison	0.55	523	25	957	46	4.8%	15.2	33.2	1-Apr
Milwaukee, WI	Wisconsin	Milwaukee	0.95	4,936	252	5,219	266	5.1%	163.4	163.4	16-May

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