Health Industry Advisor, llc

"Strategic Guidance in an Era of Unprecedented Change"

COVID-19 Dashboard

Issue # 48

Saturday, May 9, 2020

Day's Highlights

"Strategic Guidance in an Era of Unprecedented Change"

Measure	Desired Change	Yesterday in the U.S.
Number of Tests	Increase	~300,000 tests on Friday
Test-Positivity Rate	Decline	9.2% on Friday; cumulative down to 15.2%
Number of Cases	Plateau	Active Cases up 2.1% on Friday
Deaths % of Total Cases	Decline	Down slightly to 5.9%%
Number of Deaths / 1M Population	Plateau	Up to 237.5
Recoveries : Death	Increase	2.84

- The U.S. reported ~300,000 new tests on Friday; the test-positive rate was 9.2%. For the week, tests averaged 265,000 per day, with a 9.7% test-positive rate. Note: the World Health Organization suggests a 10% rate or lower as a guide to assess whether testing is sufficient to identify true infection rates. On the other hand, Harvard researchers suggest a minimum of 152 daily tests per 100,000 population; the U.S rate last week was only 80.4. Only 3 states – Massachusetts, North Dakota and Rhode Island are testing at or above the 152 rate.
- Recoveries seem to be significantly underreported (we typically observe states reporting recoveries only periodically). As a result, this also overstates active cases and masks when states have "flattened the curve". We estimate the recoveries are undercounted by ~ 180,000 - 230,000. See our analysis on pages 29-30.
- Despite the presumed lag in reporting recoveries (and, thereby, overstating active cases), 17 states appear to have moved past a peak in active cases; thirty-nine states appear to have moved past a peak in new daily infection rates
- Hawaii has joined Montana is falling below the threshold of 1 new daily infection per 1 million in population. This is the standard recommended by the Institute for Health Metrics an Evaluation (IHME) for determine when to relax restrictions. Only South Koreas and China have done this internationally.
- Twenty-two states reported 50 or fewer new infections per day during the past week (see chart on page 27); thirty states are at 100 or fewer; 6 states, however, reported ~200 or more.
- As new infections decline in Austria, Israel, Japan and South Korea, these countries are falling out of the top 30 in total cases. Bangladesh, Belarus, Indonesia, Poland, Qatar, Romania and Ukraine are moving ahead of some or all of these countries

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COUNTRY-BY-COUNTRY INFORMATION

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Country-by-Country

Comparative Statistics

"Strategic Guidance in an Era of Unprecedented Change"

As of May 8

Country	Total Cases	Rank	Cases per 1M Population	Rank	Deaths	Rank	Death Rate	Rank	Deaths per 1 Million Population	Rank	5-day Moving Average Case Growth Rate	Rank	Tests per 1M Population	Rank	New Daily Infections Per 1M Population (5-Day M.A.)	Rank
USA	1,321,785	(1)	3,993	(4)	78,615	(1)	5.9%	(14)	237.5	(9)	2.2%	(13)	26,092	(13)	82.3	(3)
Austria	15,774	(28)	1,751	(17)	614	(23)	3.9%	(19)	67.6	(16)	0.2%	(27)	33,761	(9)	3.9	(26)
Belgium	52,011	(15)	4,488	(3)	8,521	(7)	16.4%	(1)	735.2	(1)	0.8%	(21)	44,456	(3)	36.7	(12)
Brazil	145,892	(8)	686	(24)	9,992	(6)	6.8%	(10)	43.2	(19)	7.6%	(1)	1,597	(25)	36.1	(13)
Canada	66,434	(12)	1,760	(16)	4,569	(12)	6.9%	(9)	121.1	(11)	2.2%	(12)	27,346	(12)	43.0	(11)
Chile	25,972	(23)	1,359	(20)	294	(26)	1.1%	(27)	14.9	(22)	5.7%	(6)	13,390	(20)	67.0	(6)
China	82,886	(11)	58	(29)	4,633	(11)	5.6%	(16)	3.2	(28)	0.0%	(29)	0	(30)	0.0	(30)
Ecuador	28,818	(20)	1,633	(18)	1,704	(20)	5.9%	(15)	93.7	(13)	-0.5%	(30)	4,665	(24)	20.1	(17)
France	176,079	(6)	2,698	(9)	26,230	(5)	14.9%	(2)	401.8	(5)	0.9%	(20)	21,213	(15)	19.1	(19)
Germany	170,588	(7)	2,036	(13)	7,510	(8)	4.4%	(17)	88.2	(14)	0.6%	(24)	32,891	(10)	11.1	(22)
India	59,695	(14)	43	(30)	1,985	(16)	3.3%	(21)	1.4	(30)	7.0%	(2)	1,042	(28)	2.3	(27)
Iran	104,691	(10)	1,246	(22)	6,541	(9)	6.2%	(12)	77.2	(15)	1.4%	(16)	6,654	(23)	15.4	(20)
Ireland	22,541	(25)	4,565	(2)	1,429	(21)	6.3%	(11)	289.4	(8)	0.9%	(18)	43,493	(4)	48.0	(9)
Israel	16,436	(27)	1,899	(14)	245	(28)	1.5%	(26)	27.7	(20)	0.3%	(26)	51,172	(1)	5.5	(24)
Italy	217,185	(3)	3,592	(6)	30,201	(3)	13.9%	(4)	499.5	(3)	0.6%	(23)	40,440	(6)	23.1	(15)
Japan	15,575	(29)	123	(27)	590	(25)	3.8%	(20)	4.6	(26)	0.9%	(19)	1,597	(25)	1.4	(28)
Mexico	29,616	(19)	230	(25)	2,961	(15)	10.0%	(8)	23.0	(21)	6.0%	(5)	860	(29)	11.5	(21)
Netherlands	42,093	(16)	2,457	(12)	5,359	(10)	12.7%	(5)	308.6	(7)	0.7%	(22)	14,570	(18)	19.2	(18)
Pakistan	26,435	(22)	120	(28)	599	(24)	2.3%	(25)	2.7	(29)	5.6%	(7)	1,165	(27)	5.4	(25)
Peru	61,847	(13)	1,876	(15)	1,714	(19)	2.8%	(22)	49.3	(17)	6.1%	(4)	14,351	(19)	92.7	(2)
Portugal	27,268	(21)	2,674	(10)	1,114	(22)	4.1%	(18)	109.2	(12)	1.5%	(14)	49,204	(2)	32.0	(14)
Russia	187,859	(5)	1,253	(21)	1,723	(18)	0.9%	(28)	10.8	(23)	6.9%	(3)	34,125	(8)	70.0	(5)
Saudi Arabia	35,432	(17)	1,018	(23)	229	(29)	0.6%	(29)	6.6	(24)	5.6%	(8)	12,773	(21)	46.5	(10)
Singapore	21,707	(26)	3,711	(5)	20	(30)	0.1%	(30)	3.4	(27)	3.6%	(9)	12,027	(22)	97.8	(1)
South Korea	10,822	(30)	211	(26)	256	(27)	2.4%	(24)	5.0	(25)	0.1%	(28)	30,016	(11)	0.1	(29)
Spain	260,117	(2)	5,563	(1)	26,299	(4)	10.1%	(7)	557.6	(2)	1.0%	(17)	41,332	(5)	52.3	(8)
Sweden	25,265	(24)	2,502	(11)	3,175	(14)	12.6%	(6)	314.4	(6)	2.5%	(11)	14,704	(17)	53.0	(7)
Switzerland	30,207	(18)	3,527	(7)	1,823	(17)	6.0%	(13)	211.3	(10)	0.4%	(25)	34,857	(7)	8.4	(23)
Turkey	135,569	(9)	1,607	(19)	3,689	(13)	2.7%	(23)	43.7	(18)	1.5%	(15)	15,400	(16)	22.3	(16)
UK	211,364	(4)	3,114	(8)	31,241	(2)	14.8%	(3)	451.0	(4)	2.5%	(10)	24,034	(14)	71.4	(4)

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Country-by-Country

Virus Progression

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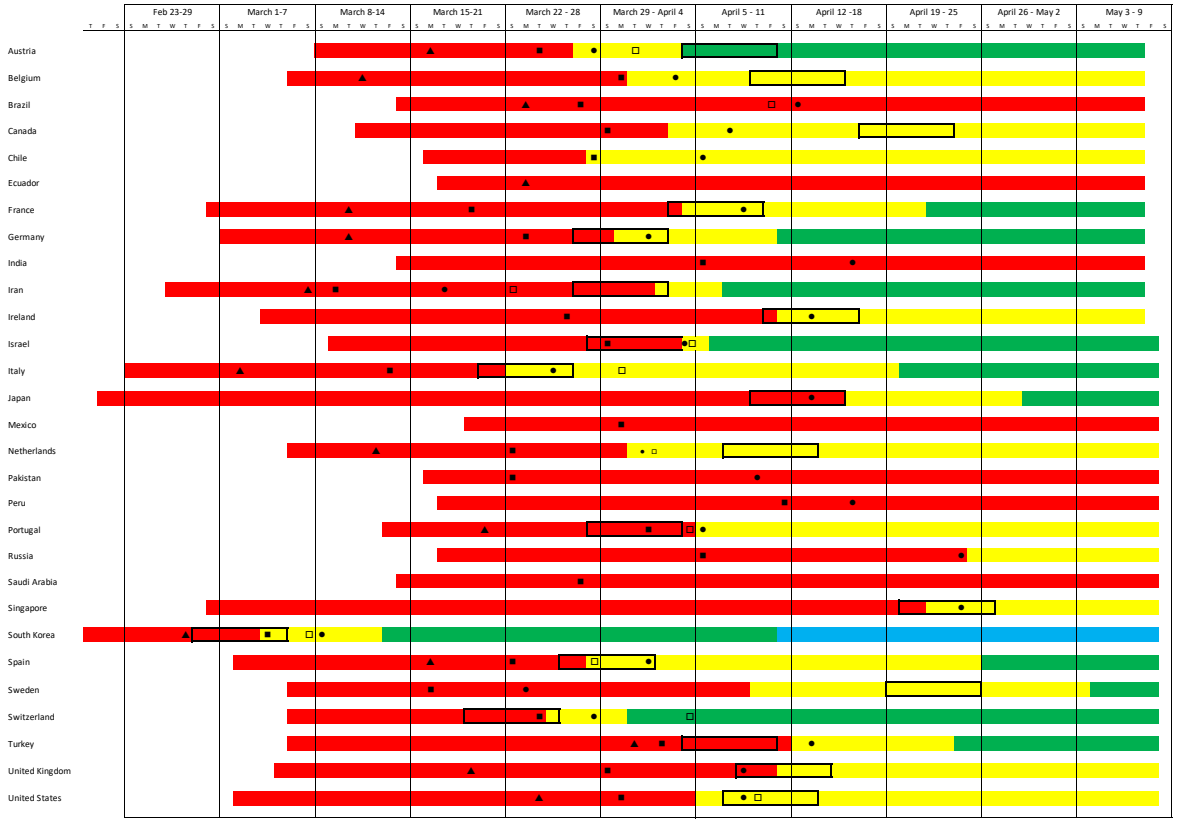
This graphic illustrates when the country first recorded 100 total cases (start of the "contagion" phase); when growth stopped following an exponential pattern (start of the "containment" phase); and, when peak total cases were recorded (start of the "recovery" phase). It uses symbols to indicate when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



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
Listing of Countries By Total Cases

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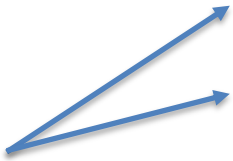
	Total Cases				
	8-May		24-Apr		10-Apr
1	USA	1,321,785	USA	925,232	USA	509,604
2	Spain	260,117	Spain	219,764	Spain	158,273
3	Italy	217,185	Italy	192,994	Italy	147,577
4	UK	211,364	France	159,828	Germany	122,171
5	Russia	187,859	Germany	154,999	France	113,927
6	France	176,079	UK	143,464	China	81,953
7	Germany	170,588	Turkey	104,912	UK	73,758
8	Brazil	145,892	Iran	88,194	Iran	68,192
9	Turkey	135,569	China	82,804	Turkey	47,029
10	Iran	104,691	Russia	68,622	Belgium	26,667
11	China	82,886	Brazil	52,995	Switzerland	24,551
12	Canada	66,434	Belgium	44,293	Netherlands	23,097
13	Peru	61,847	Canada	43,888	Canada	22,148
14	India	59,695	Netherlands	36,535	Brazil	19,789
15	Belgium	52,011	Switzerland	28,677	Portugal	15,472
16	Netherlands	42,093	India	24,447	Austria	13,560
17	Saudi Arabia	35,432	Portugal	22,797	Russia	11,917
18	Switzerland	30,207	Ecuador	22,719	South Korea	10,450
19	Mexico	29,616	Peru	21,648	Israel	10,408
20	Ecuador	28,818	Ireland	18,184	Sweden	9,685
21	Portugal	27,268	Sweden	17,567	Ireland	8,089
22	Pakistan	26,435	Saudi Arabia	15,102	India	7,600
23	Chile	25,972	Austria	15,071	Ecuador	7,161
24	Sweden	25,265	Israel	15,058	Chile	6,501
25	Ireland	22,541	Japan	12,712	Japan	6,005
26	Singapore	21,707	Chile	12,306	Peru	5,897
30	Israel	16,436	Singapore	12,075	Pakistan	4,695
31	Austria	15,774	Pakistan	11,940	Saudi Arabia	3,651
32	Japan	15,575	Mexico	11,633	Mexico	3,441
38	South Korea	10,822	South Korea	10,708	Singapore	2,108



Note: several countries have moved into the "top 30" in recent days. They are not included in this listing.

Cases & Cases Per Capita

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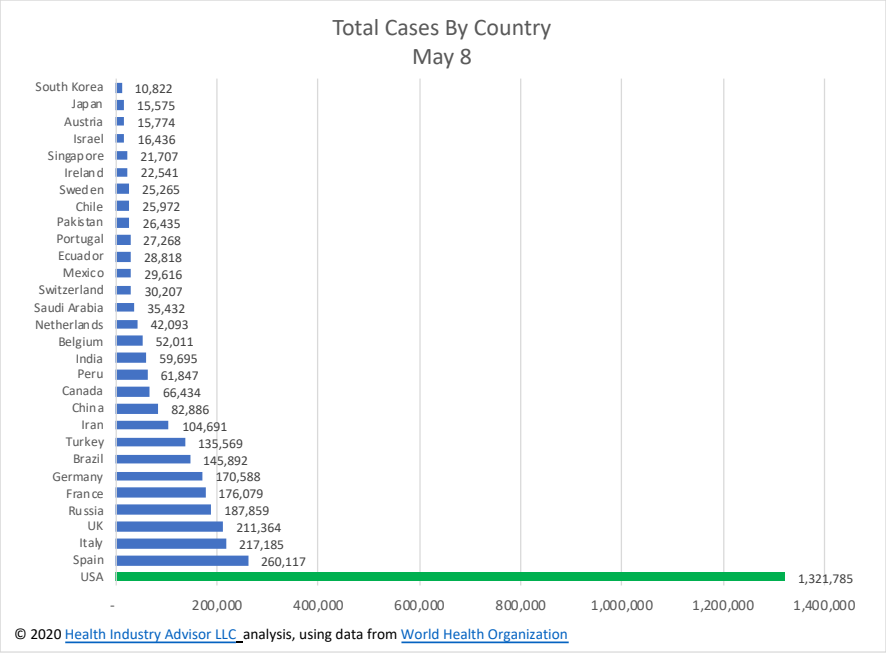

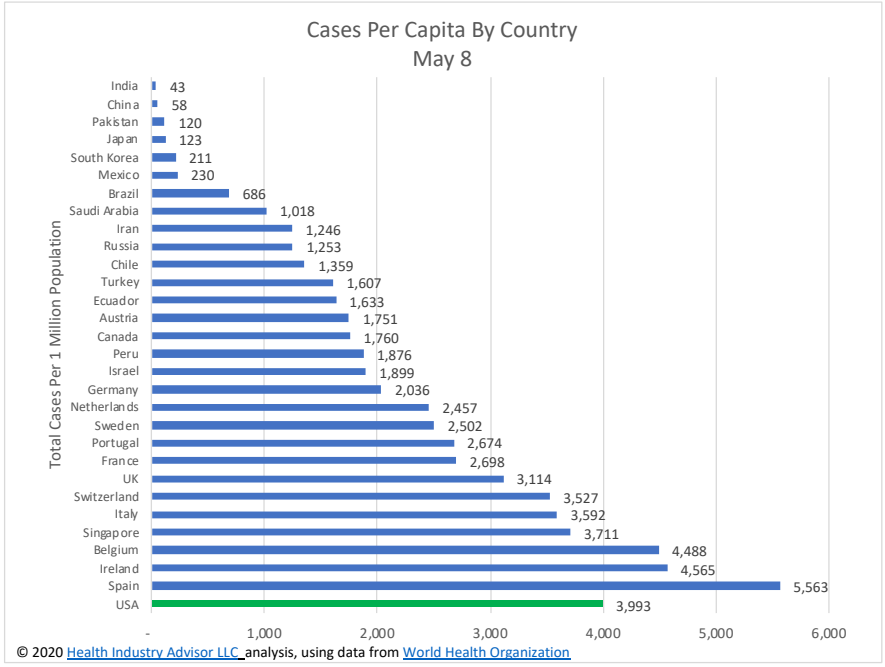

Country-by-Country

Deaths Per Cases & Per Capita

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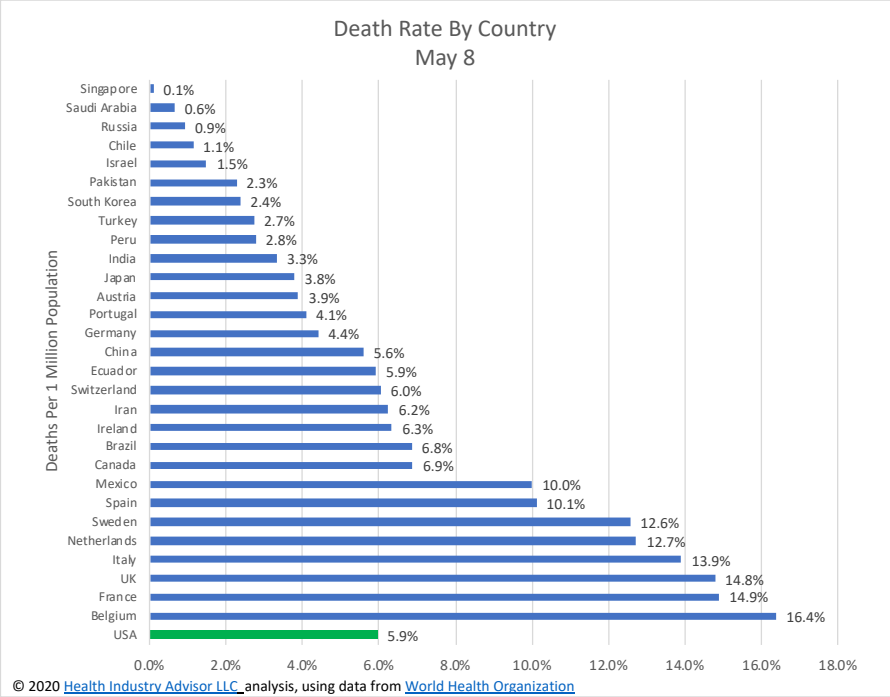

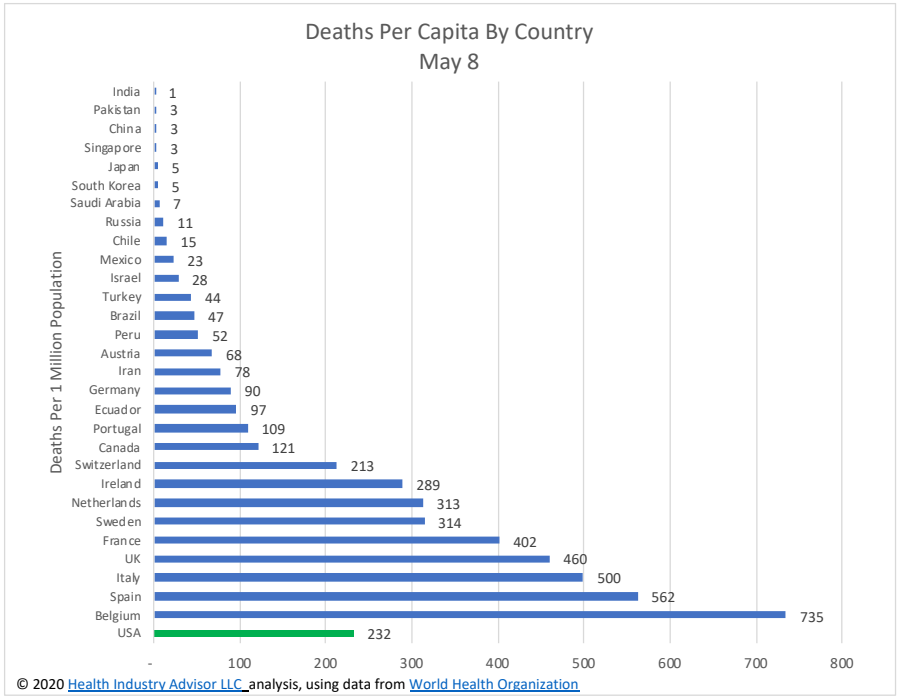

Country-by-Country

Tests Per Capita & Case Growth Rate

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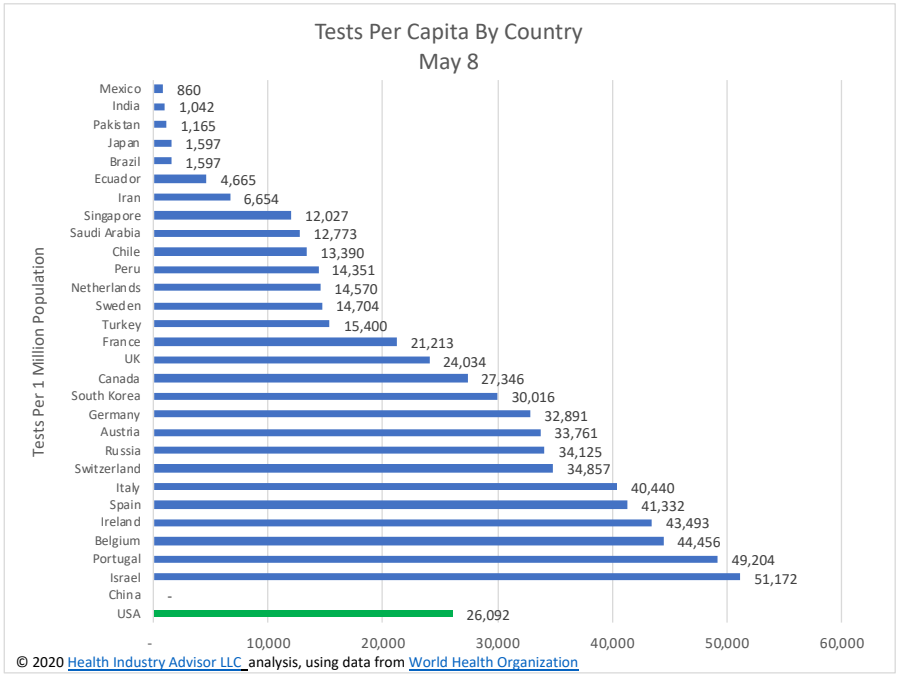

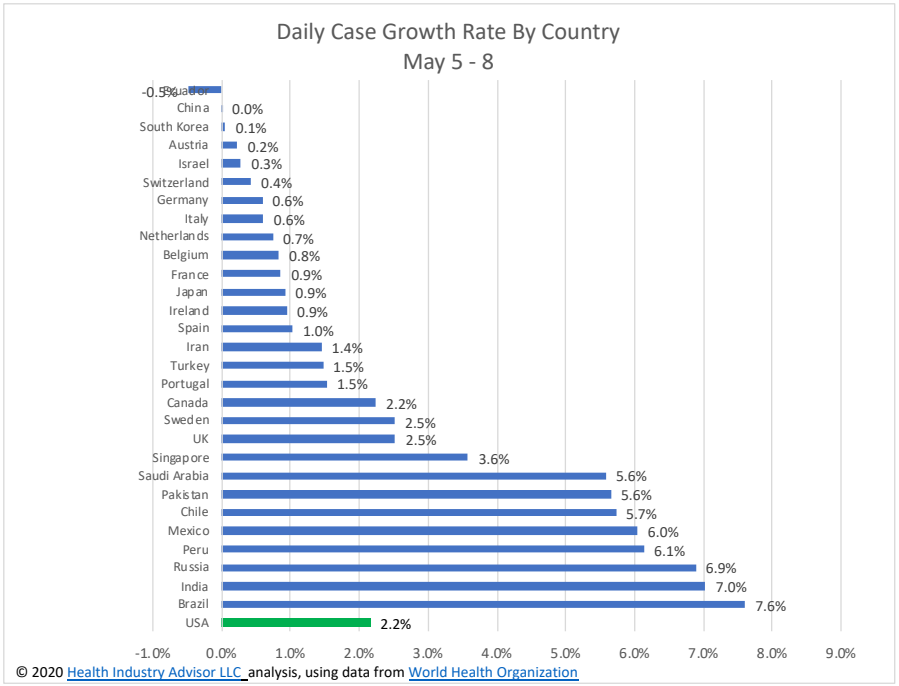

Country-by-Country

New Daily Infection Rate

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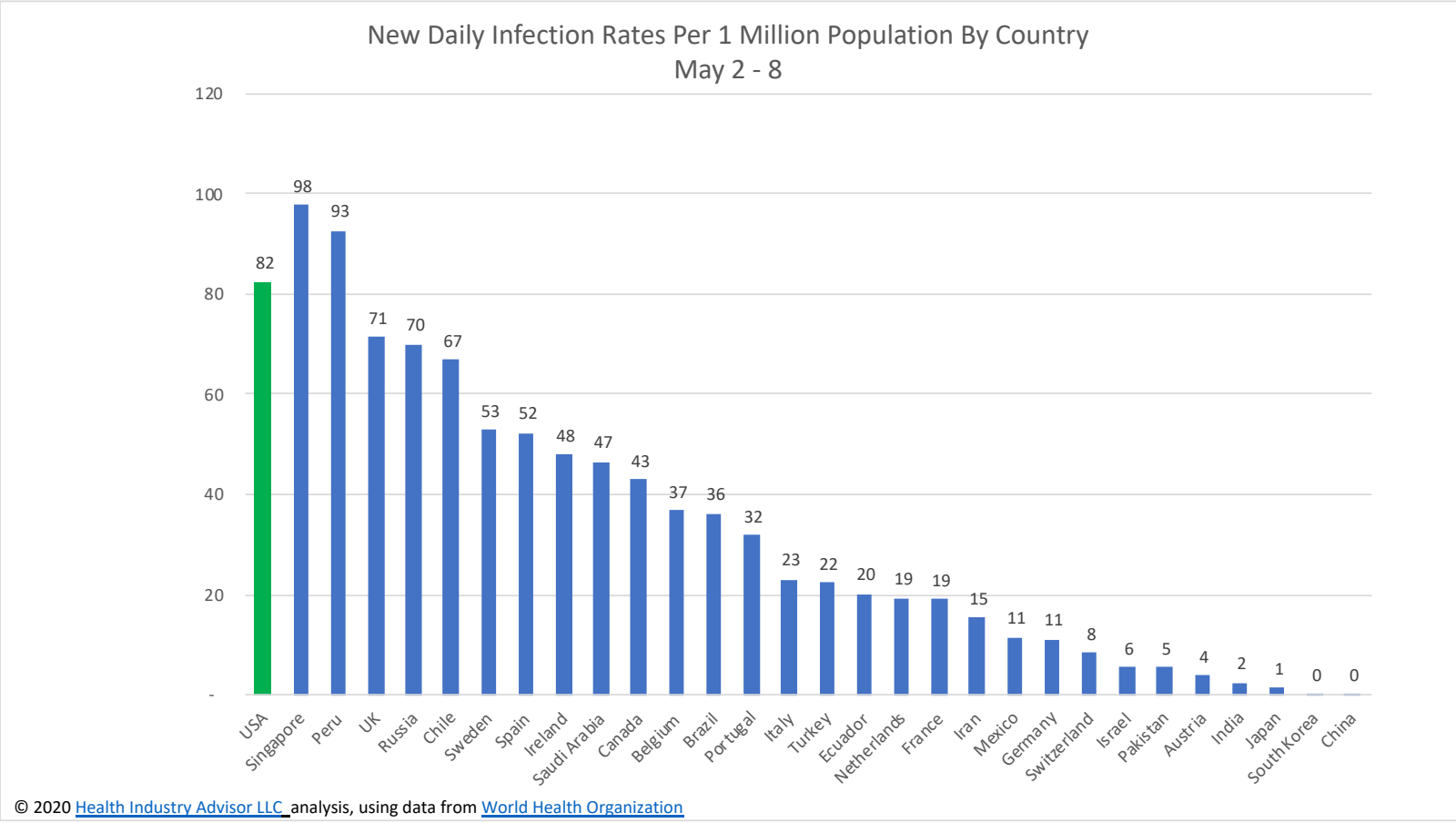
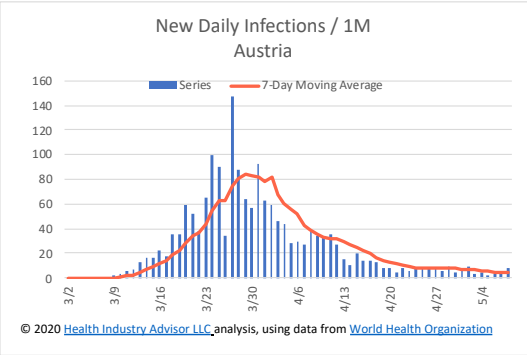
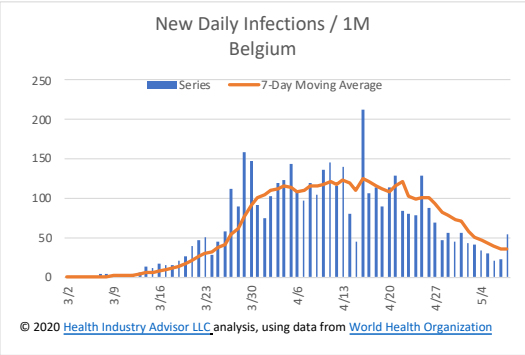
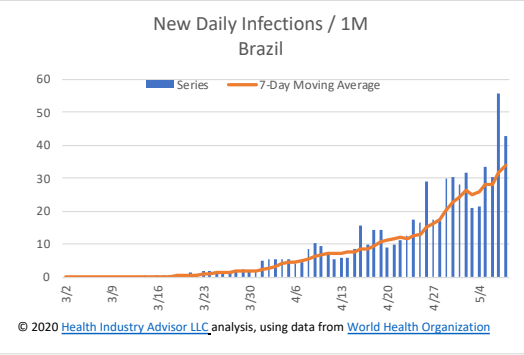
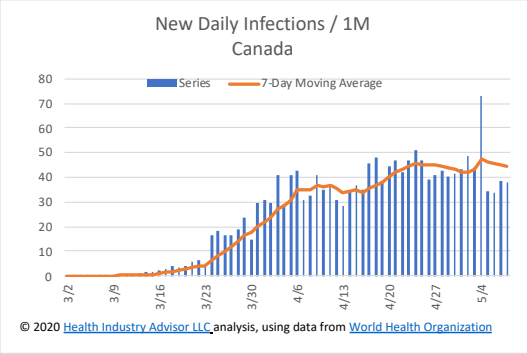


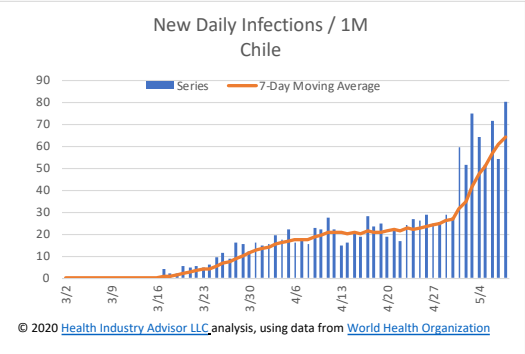
New Daily Infection Rate Time Series

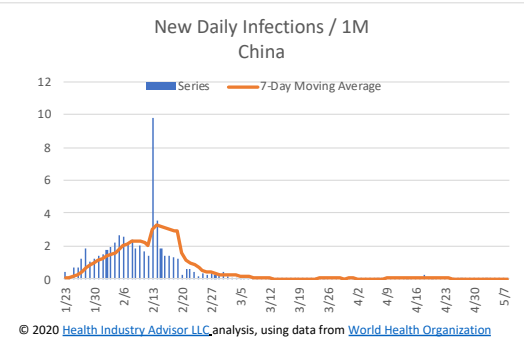












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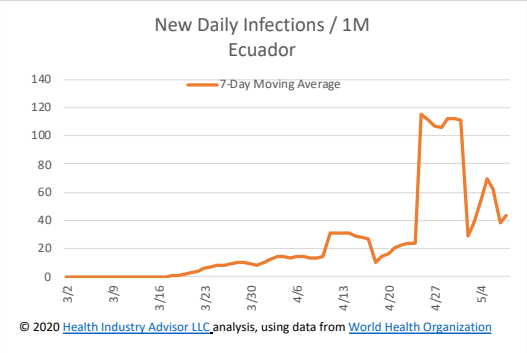
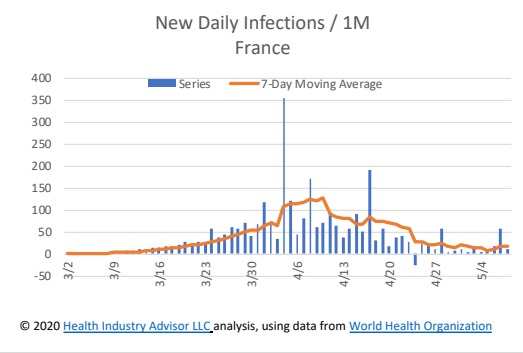
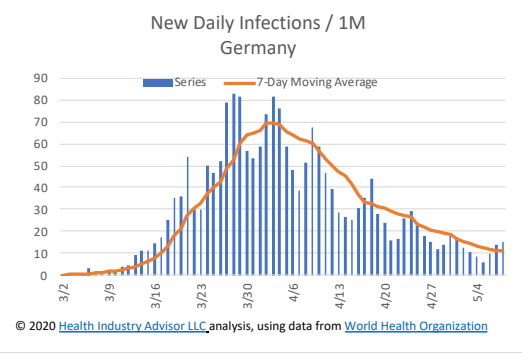
Country-by-Country

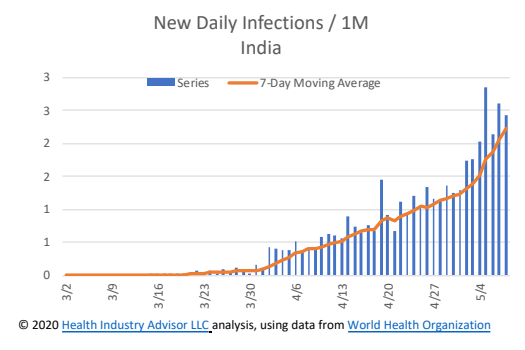
New Daily Infection Rate Time Series

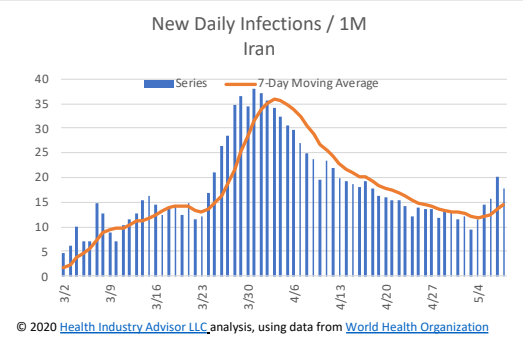
"Strategic Guidance in an Era of Unprecedented Change"

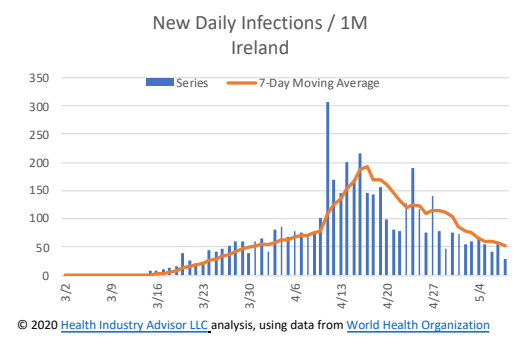








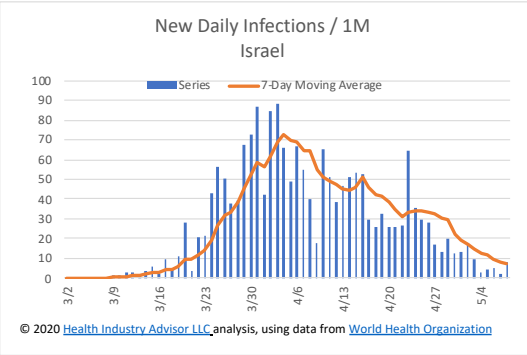


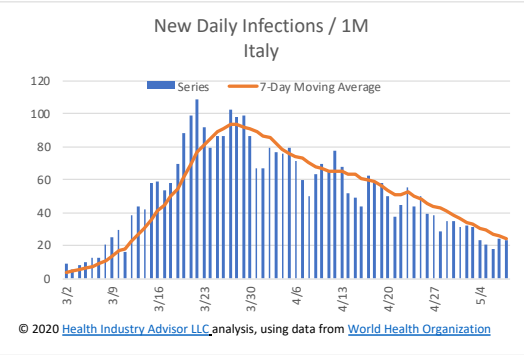


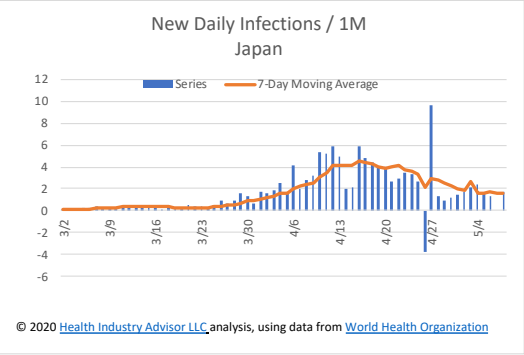
Country-by-Country

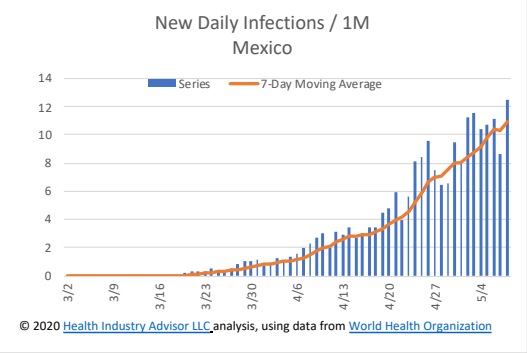
New Daily Infection Rate Time Series

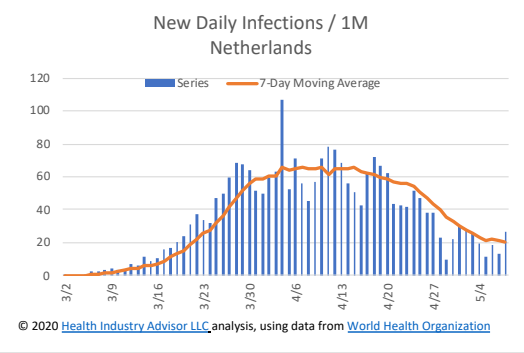
"Strategic Guidance in an Era of Unprecedented Change"

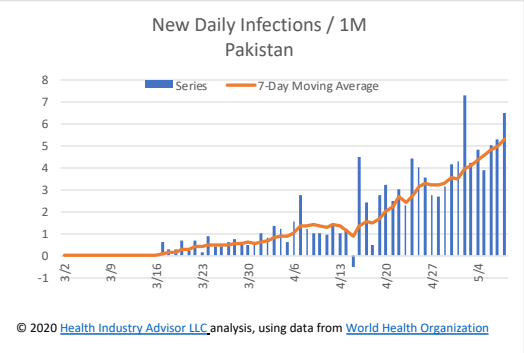








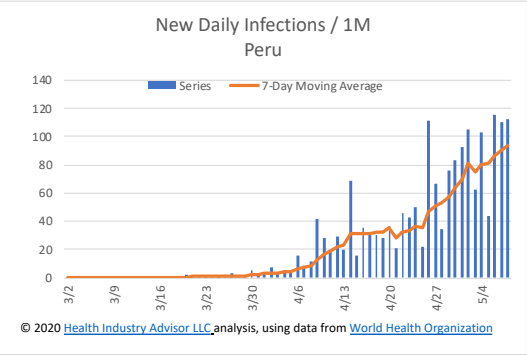


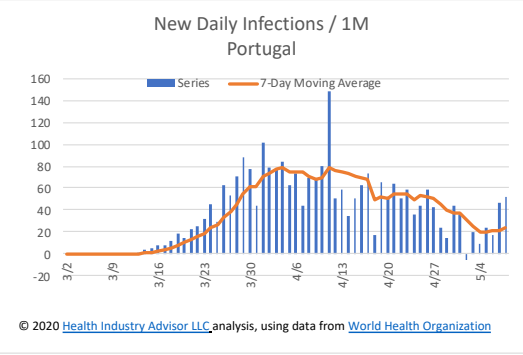


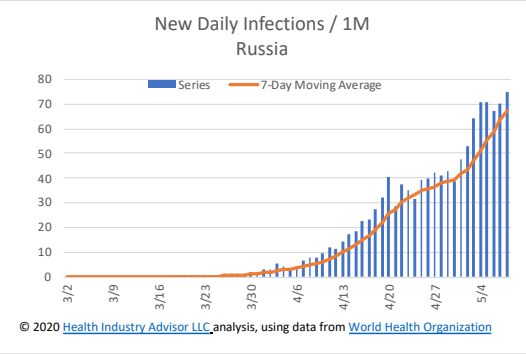
Country-by-Country

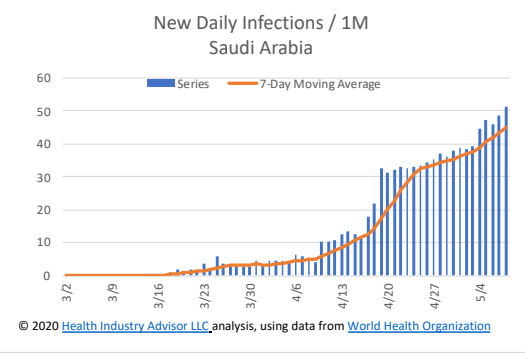
New Daily Infection Rate Time Series

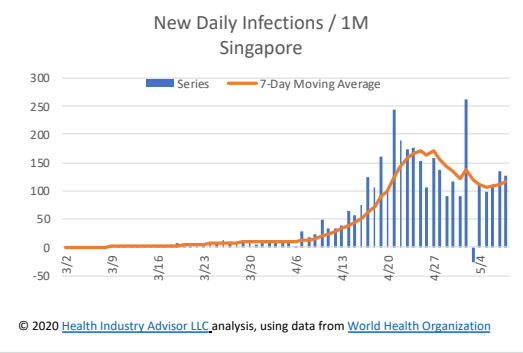
"Strategic Guidance in an Era of Unprecedented Change"

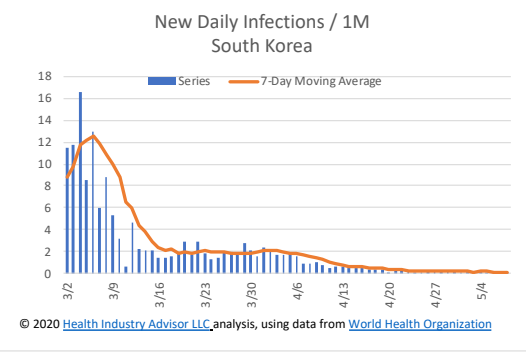








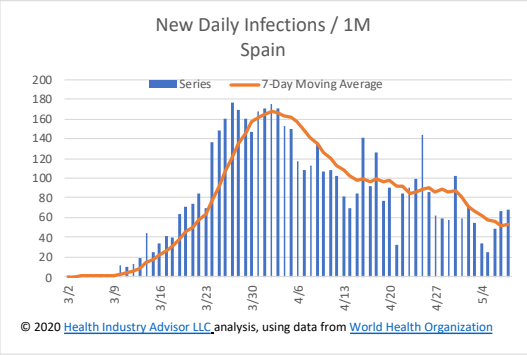


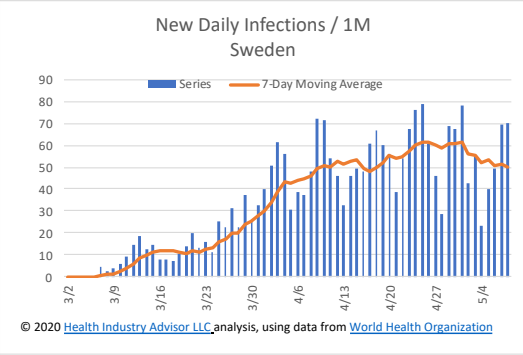


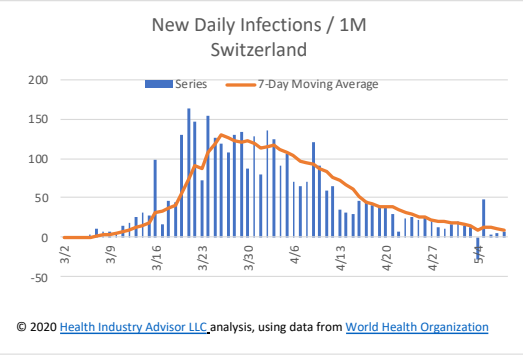
Country-by-Country

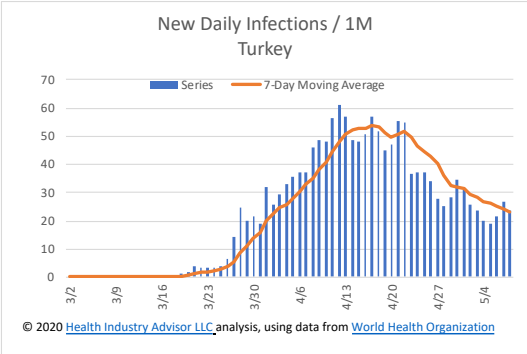
New Daily Infection Rate Time Series

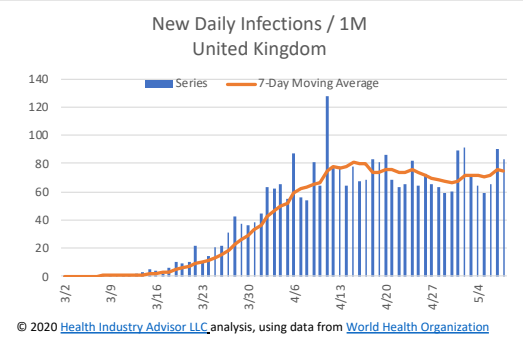
"Strategic Guidance in an Era of Unprecedented Change"

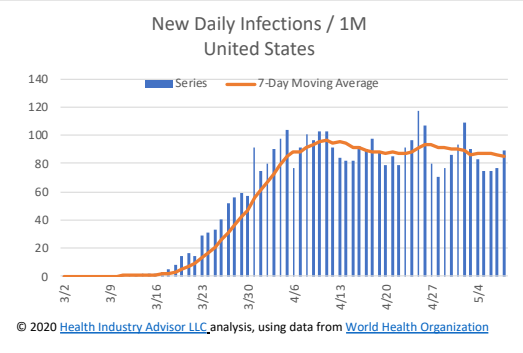




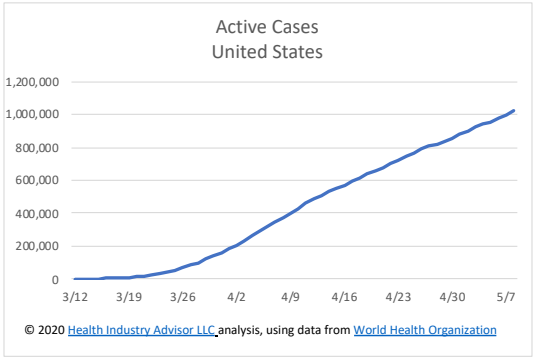


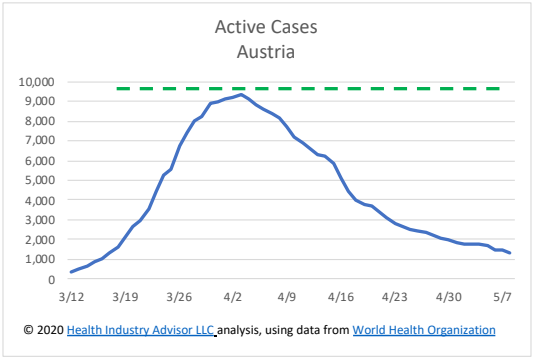


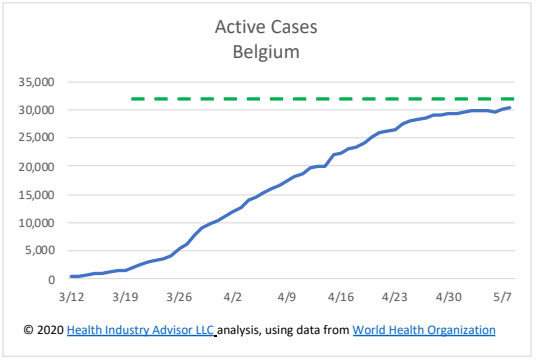


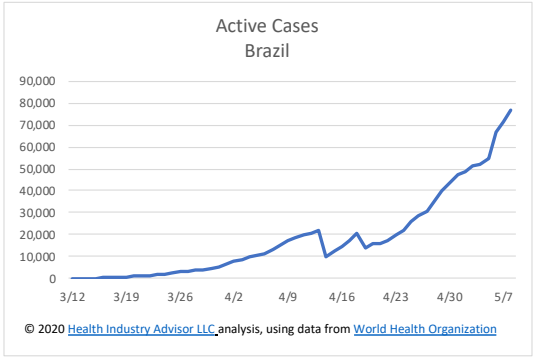


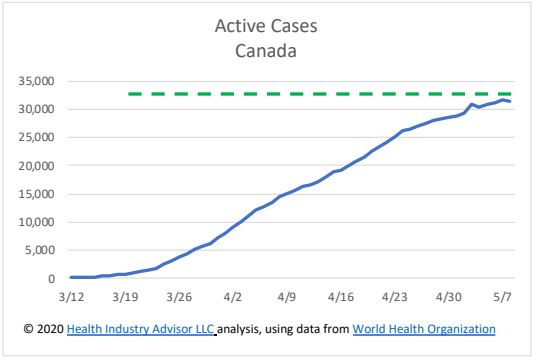
Active Case Trends

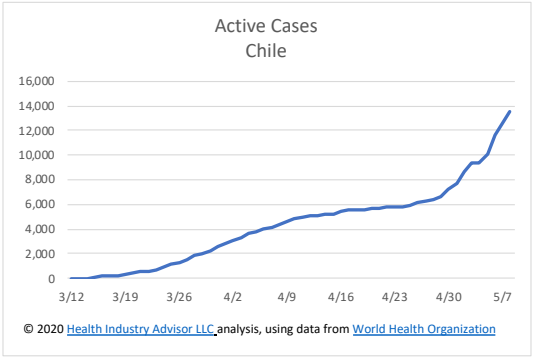








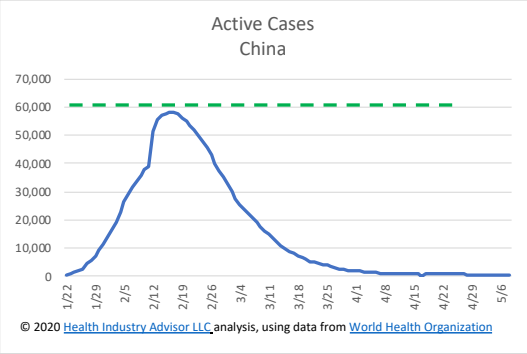


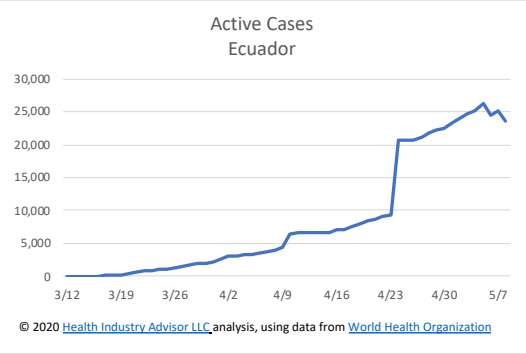


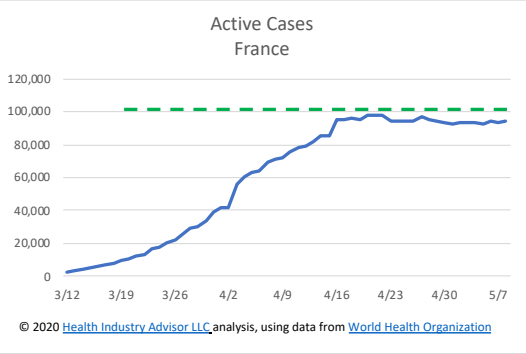
Country-by-Country

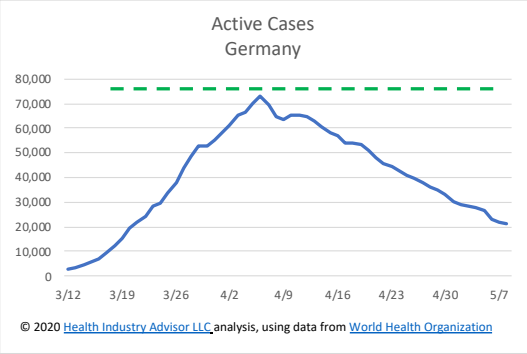
Active Case Trends

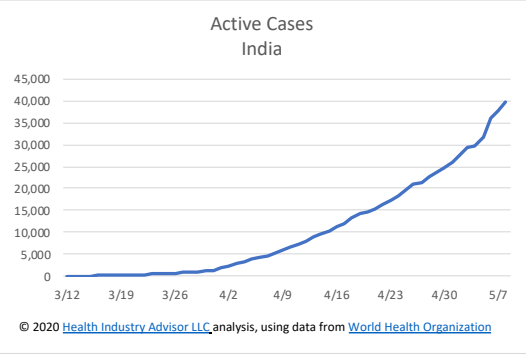
"Strategic Guidance in an Era of Unprecedented Change"

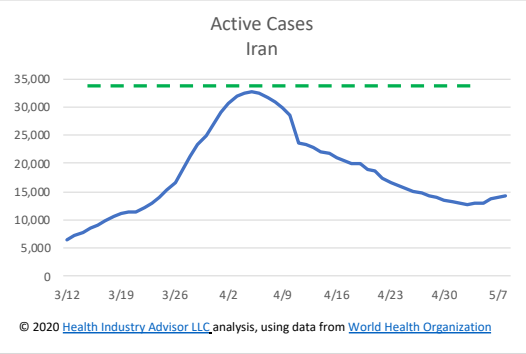








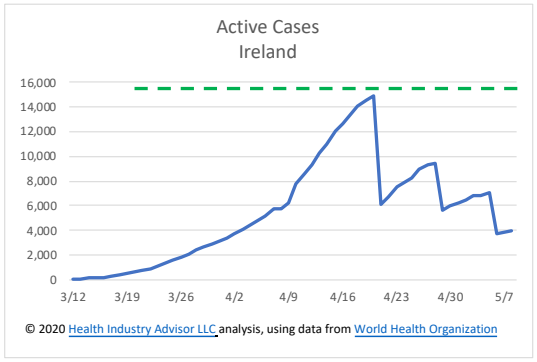


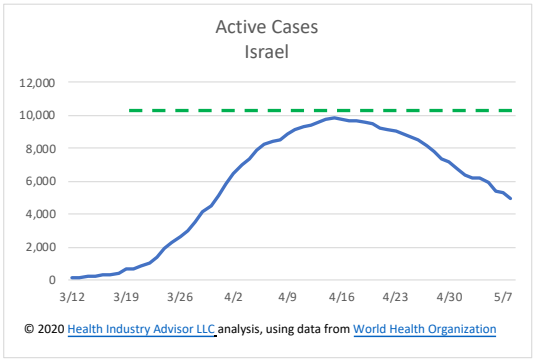


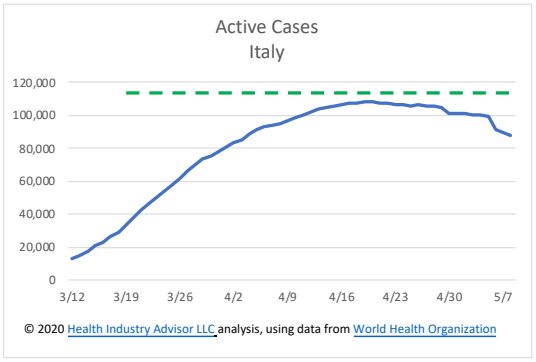
Country-by-Country

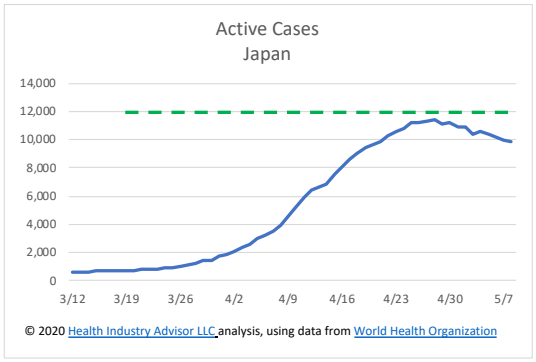
Active Case Trends

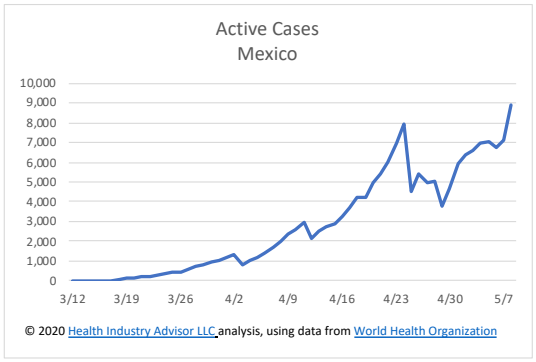
"Strategic Guidance in an Era of Unprecedented Change"

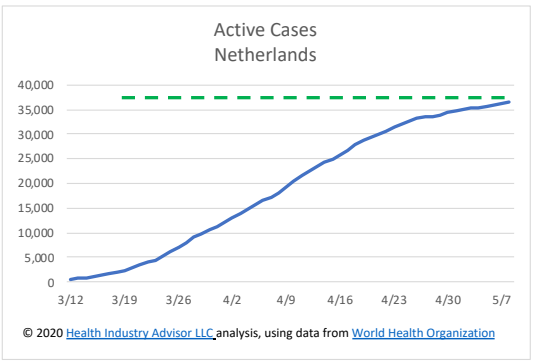




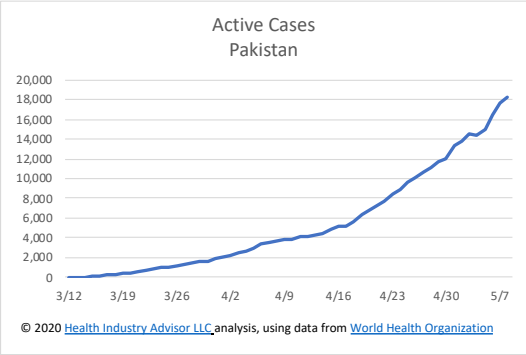


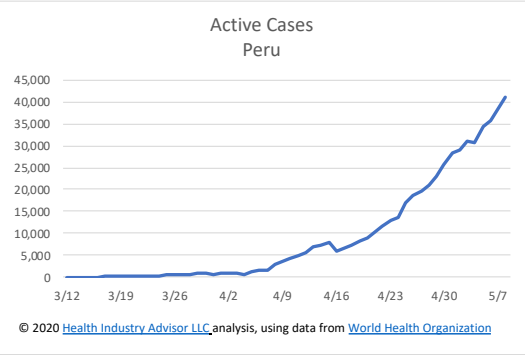


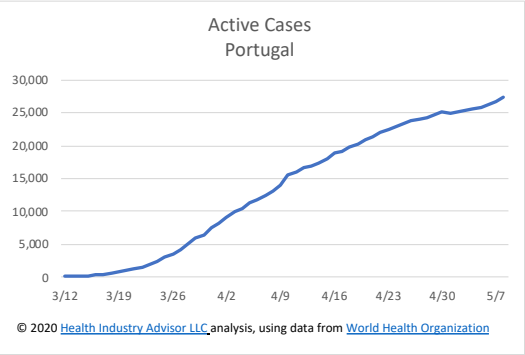


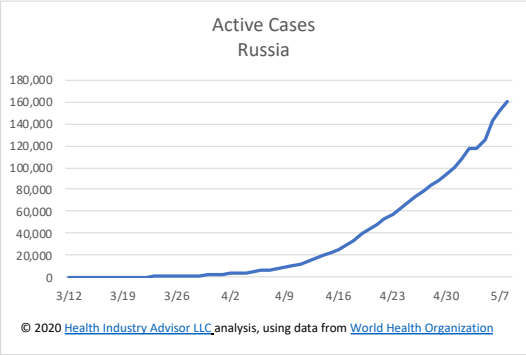


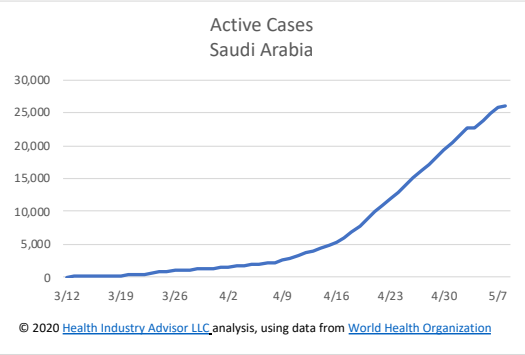
Active Case Trends







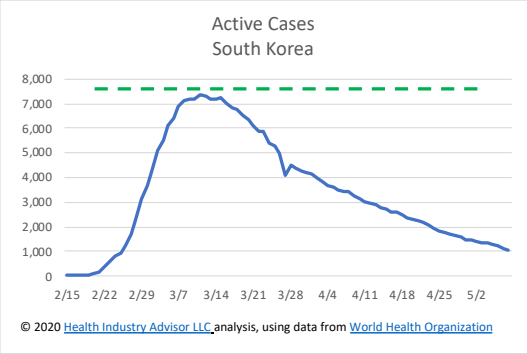


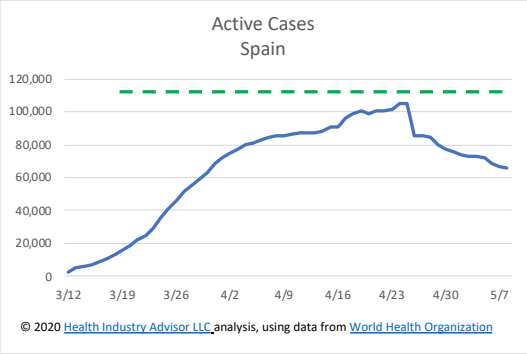


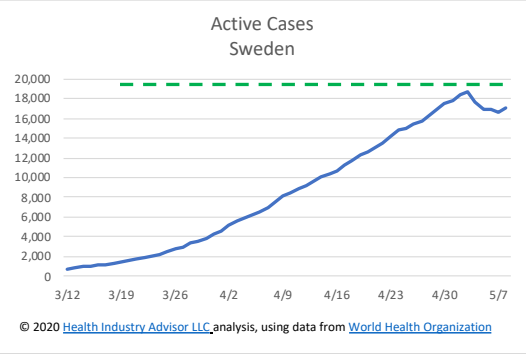
Country-by-Country

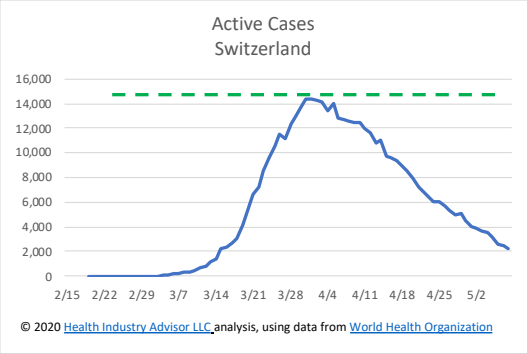
Active Case Trends

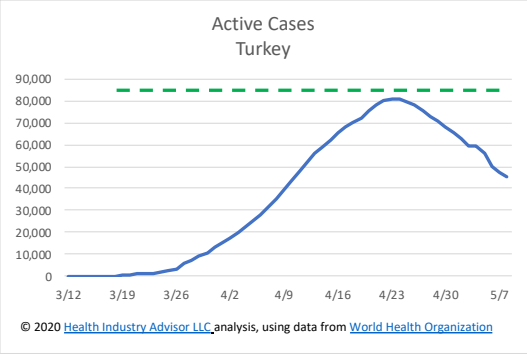
"Strategic Guidance in an Era of Unprecedented Change"

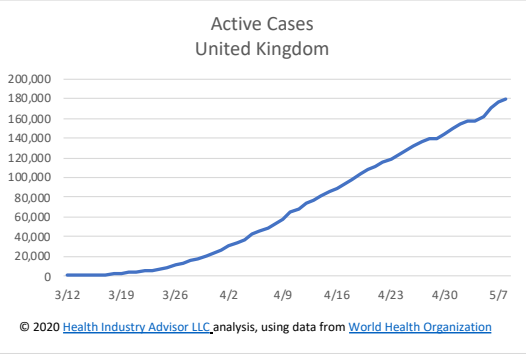








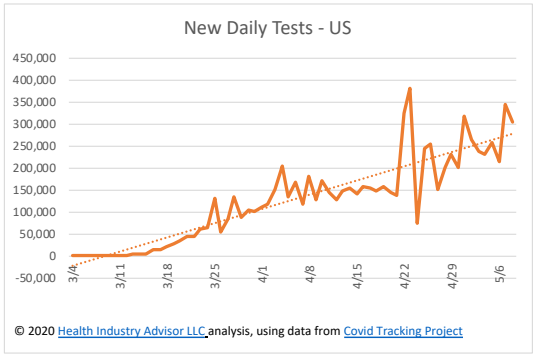


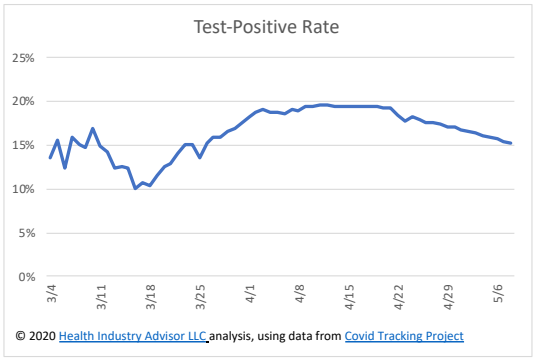


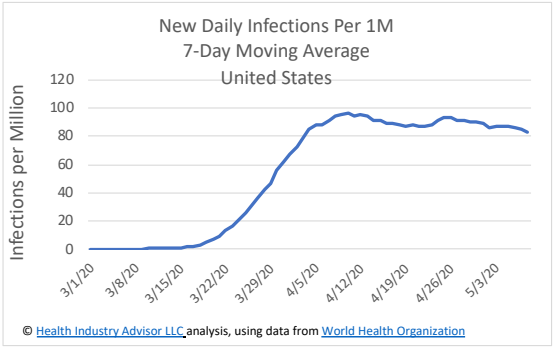
UNITED STATES & STATE-BY-STATE INFORMATION

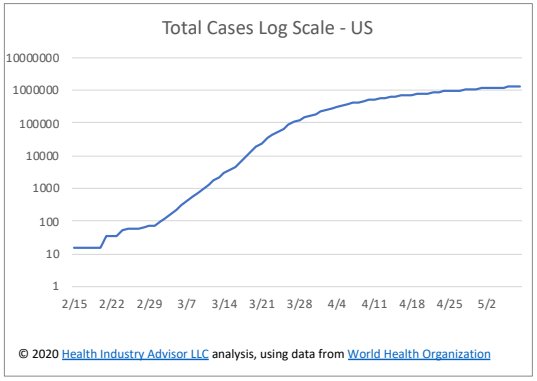
Overall Statistics

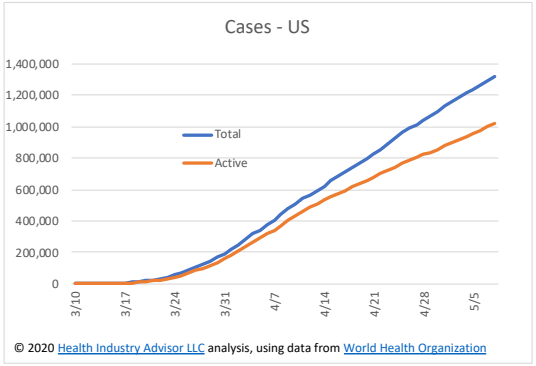
"Strategic Guidance in an Era of Unprecedented Change"

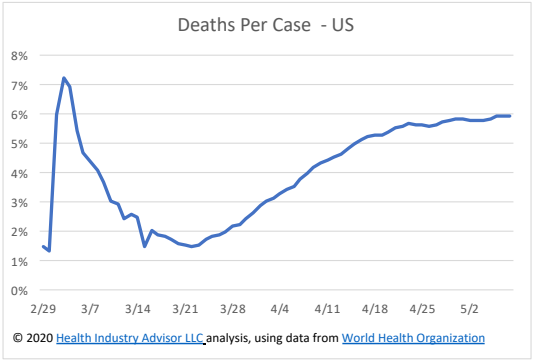








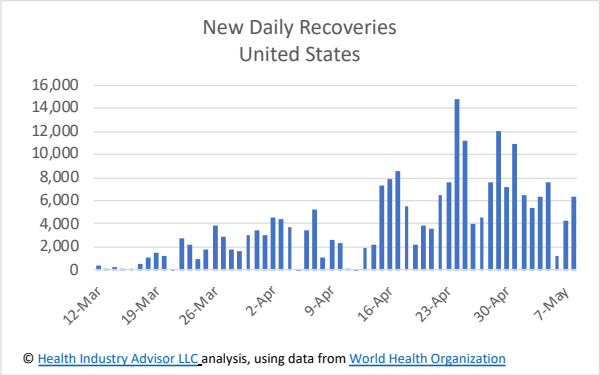


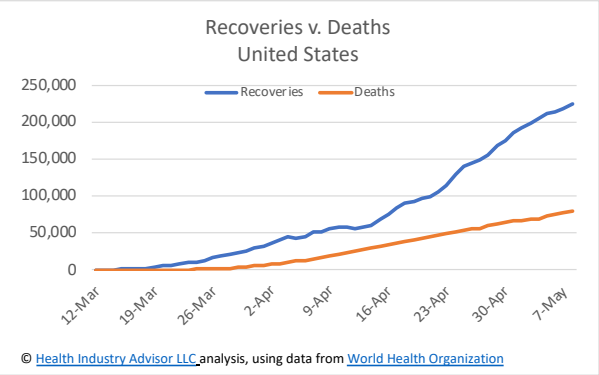


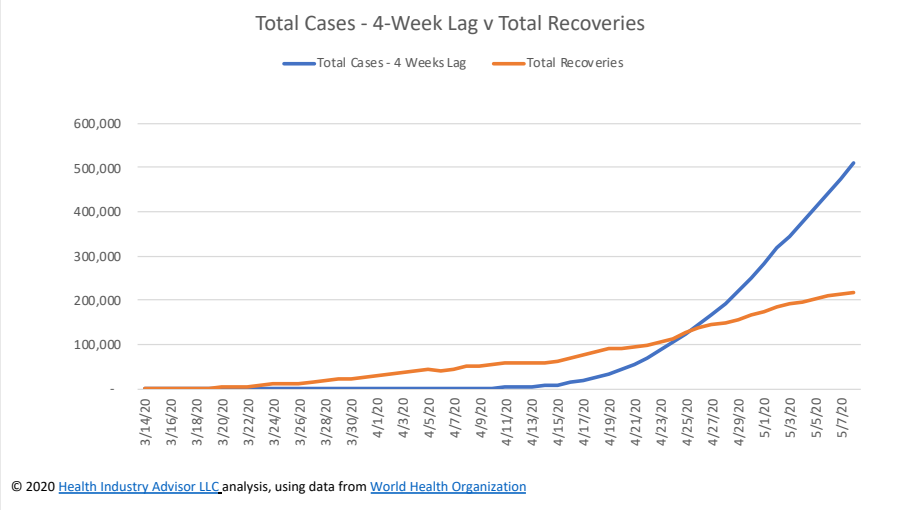
United States

Recoveries

"Strategic Guidance in an Era of Unprecedented Change"







Health Industry Advisor, llc

State-by-State

Comparative Statistics

"Strategic Guidance in an Era of Unprecedented Change"

State	Total Cases	Rank	Cases per 1M Population	Rank	Deaths	Rank	Death Rate	Rank	Deaths per 1 Million Population	Rank	5-day Moving Average Case Growth Rate	Rank	Tests per 1M Population Past 7 days	Rank	New Daily Cases Per 1M Population (5-Day M.A.)	Rank
Alabama	9,375	(27)	1,912.0	(27)	383	(26)	4.1%	(29)	78.1	(25)	3.5%	(16)	821	(21)	60.6	(24)
Alaska	377	(51)	515.3	(49)	10	(50)	2.7%	(42)	13.7	(49)	0.5%	(49)	1,005	(13)	2.5	(49)
Arizona	10,526	(23)	1,446.1	(37)	517	(21)	4.9%	(19)	71.0	(29)	4.0%	(6)	884	(19)	50.3	(30)
Arkansas	3,747	(39)	1,241.6	(42)	88	(40)	2.3%	(44)	29.2	(45)	1.8%	(39)	678	(31)	20.2	(43)
California	64,107	(5)	1,622.5	(34)	2,627	(8)	4.1%	(28)	66.5	(32)	3.2%	(21)	796	(24)	44.6	(33)
Colorado	18,827	(17)	3,269.3	(17)	960	(16)	5.1%	(17)	166.7	(14)	2.5%	(29)	549	(42)	75.9	(20)
Connecticut	32,411	(10)	9,090.7	(5)	2,874	(7)	8.9%	(2)	806.1	(3)	2.0%	(34)	813	(22)	146.1	(11)
Delaware	6,111	(33)	6,275.6	(8)	213	(34)	3.5%	(38)	218.7	(12)	3.2%	(19)	833	(20)	175.0	(8)
District Of Columbia	5,899	(35)	8,358.5	(6)	304	(28)	5.2%	(14)	430.7	(7)	3.3%	(18)	1,210	(7)	251.2	(2)
Florida	39,199	(8)	1,825.1	(31)	1,669	(10)	4.3%	(26)	77.7	(27)	1.7%	(41)	736	(27)	29.7	(40)
Georgia	32,178	(11)	3,030.7	(19)	1,399	(13)	4.3%	(24)	131.8	(16)	2.3%	(30)	797	(23)	63.0	(23)
Hawaii	629	(49)	444.2	(50)	17	(48)	2.7%	(41)	12.0	(51)	0.3%	(50)	557	(41)	1.0	(50)
Idaho	2,205	(43)	1,230.4	(43)	67	(41)	3.0%	(39)	37.4	(40)	1.4%	(44)	163	(51)	13.6	(47)
Illinois	73,760	(4)	5,820.8	(9)	3,241	(6)	4.4%	(23)	255.8	(11)	3.7%	(10)	1,297	(6)	199.6	(6)
Indiana	23,146	(14)	3,438.1	(16)	1,447	(12)	6.3%	(7)	214.9	(13)	3.0%	(22)	647	(34)	95.8	(15)
Iowa	11,457	(21)	3,631.3	(14)	243	(32)	2.1%	(46)	77.0	(28)	4.6%	(4)	1,117	(10)	161.8	(10)
Kansas	6,667	(31)	2,288.5	(21)	168	(36)	2.5%	(43)	57.7	(35)	6.4%	(3)	720	(28)	104.5	(13)
Kentucky	6,288	(32)	1,407.4	(39)	298	(30)	4.7%	(20)	66.7	(31)	4.2%	(5)	793	(25)	45.1	(32)
Louisiana	30,855	(12)	6,637.2	(7)	2,227	(9)	7.2%	(4)	479.0	(5)	1.0%	(47)	1,050	(11)	65.9	(22)
Maine	1,374	(45)	1,022.2	(46)	63	(42)	4.6%	(21)	46.9	(38)	3.0%	(23)	297	(50)	26.7	(41)
Maryland	30,485	(13)	5,042.4	(10)	1,560	(11)	5.1%	(15)	258.0	(10)	3.7%	(11)	737	(26)	165.7	(9)
Massachusetts	75,333	(3)	10,840.1	(3)	4,702	(3)	6.2%	(8)	676.6	(4)	2.0%	(35)	1,570	(3)	226.6	(4)
Michigan	46,326	(7)	4,638.7	(11)	4,393	(4)	9.5%	(1)	439.9	(6)	1.1%	(45)	998	(14)	56.8	(26)
Minnesota	10,088	(24)	1,788.8	(32)	534	(19)	5.3%	(13)	94.7	(21)	8.6%	(1)	670	(32)	110.4	(12)
Mississippi	9,090	(28)	3,054.3	(18)	409	(23)	4.5%	(22)	137.4	(15)	3.8%	(9)	463	(46)	90.1	(17)
Missouri	9,692	(25)	1,579.2	(35)	479	(22)	4.9%	(18)	78.0	(26)	2.8%	(25)	612	(38)	39.0	(35)
Montana	458	(50)	428.5	(51)	16	(49)	3.5%	(37)	15.0	(48)	0.1%	(51)	901	(18)	0.7	(51)
Nebraska	7,831	(29)	4,048.3	(13)	92	(39)	1.2%	(48)	47.6	(37)	6.7%	(2)	962	(15)	221.0	(5)
Nevada	5,884	(36)	1,910.3	(28)	301	(29)	5.1%	(16)	97.7	(19)	1.6%	(42)	452	(47)	30.5	(39)
New Hampshire	2,947	(42)	2,167.4	(24)	121	(38)	4.1%	(27)	89.0	(22)	3.2%	(20)	906	(17)	66.9	(21)
New Jersey	137,212	(2)	15,448.0	(2)	8,986	(2)	6.5%	(5)	1,011.7	(2)	1.5%	(43)	679	(30)	257.7	(1)
New Mexico	4,673	(37)	2,228.6	(23)	181	(35)	3.9%	(33)	86.3	(23)	4.0%	(7)	1,442	(4)	79.0	(19)
New York	340,705	(1)	17,513.8	(1)	26,585	(1)	7.8%	(3)	1,366.6	(1)	1.0%	(46)	1,425	(5)	187.1	(7)
North Carolina	14,007	(20)	1,335.5	(40)	530	(20)	3.8%	(34)	50.5	(36)	3.6%	(15)	610	(39)	40.0	(34)
North Dakota	1,425	(44)	1,869.9	(29)	33	(46)	2.3%	(45)	43.3	(39)	3.7%	(13)	2,432	(2)	59.6	(25)
Ohio	23,016	(15)	1,969.0	(26)	1,306	(14)	5.7%	(11)	111.7	(18)	2.9%	(24)	535	(43)	52.2	(29)
Oklahoma	4,424	(38)	1,118.0	(44)	266	(31)	6.0%	(9)	67.2	(30)	2.2%	(31)	950	(16)	24.4	(42)
Oregon	3,068	(41)	727.4	(48)	124	(37)	4.0%	(30)	29.4	(44)	2.7%	(26)	492	(44)	16.6	(45)
Pennsylvania	57,471	(6)	4,489.2	(12)	3,717	(5)	6.5%	(6)	290.3	(9)	2.0%	(36)	481	(45)	87.4	(18)
Rhode Island	10,779	(22)	10,175.0	(4)	399	(24)	3.7%	(35)	376.6	(8)	2.6%	(28)	2,511	(1)	245.0	(3)
South Carolina	7,367	(30)	1,430.8	(38)	320	(27)	4.3%	(25)	62.2	(34)	2.1%	(32)	390	(49)	30.8	(38)
South Dakota	3,144	(40)	3,553.9	(15)	31	(47)	1.0%	(51)	35.0	(43)	3.6%	(14)	635	(36)	100.0	(14)
Tennessee	14,441	(19)	2,113.4	(25)	241	(33)	1.7%	(47)	35.3	(42)	1.8%	(38)	1,201	(8)	53.3	(28)
Texas	37,727	(9)	1,301.1	(41)	1,079	(15)	2.9%	(40)	37.2	(41)	3.4%	(17)	618	(37)	38.6	(36)
Utah	5,919	(34)	1,846.3	(30)	61	(43)	1.0%	(50)	19.0	(47)	2.7%	(27)	1,164	(9)	48.6	(31)
Vermont	919	(47)	1,472.8	(36)	53	(44)	5.8%	(10)	84.9	(24)	0.5%	(48)	635	(35)	9.2	(48)
Virginia	22,342	(16)	2,617.5	(20)	812	(18)	3.6%	(36)	95.1	(20)	3.7%	(12)	407	(48)	91.1	(16)
Washington	17,196	(18)	2,258.2	(22)	914	(17)	5.3%	(12)	120.0	(17)	1.7%	(40)	688	(29)	38.2	(37)
West Virginia	1,323	(46)	740.3	(47)	52	(45)	3.9%	(32)	29.1	(46)	2.1%	(33)	1,007	(12)	13.7	(46)
Wisconsin	9,590	(26)	1,647.1	(33)	384	(25)	4.0%	(31)	66.0	(33)	3.8%	(8)	662	(33)	55.8	(27)
Wyoming	644	(48)	1,112.7	(45)	7	(51)	1.1%	(49)	12.1	(50)	1.9%	(37)	578	(40)	19.3	(44)
United States	1,321,785		3,993.3		78,615		5.9%		237.5		2.2%		804		82.3	

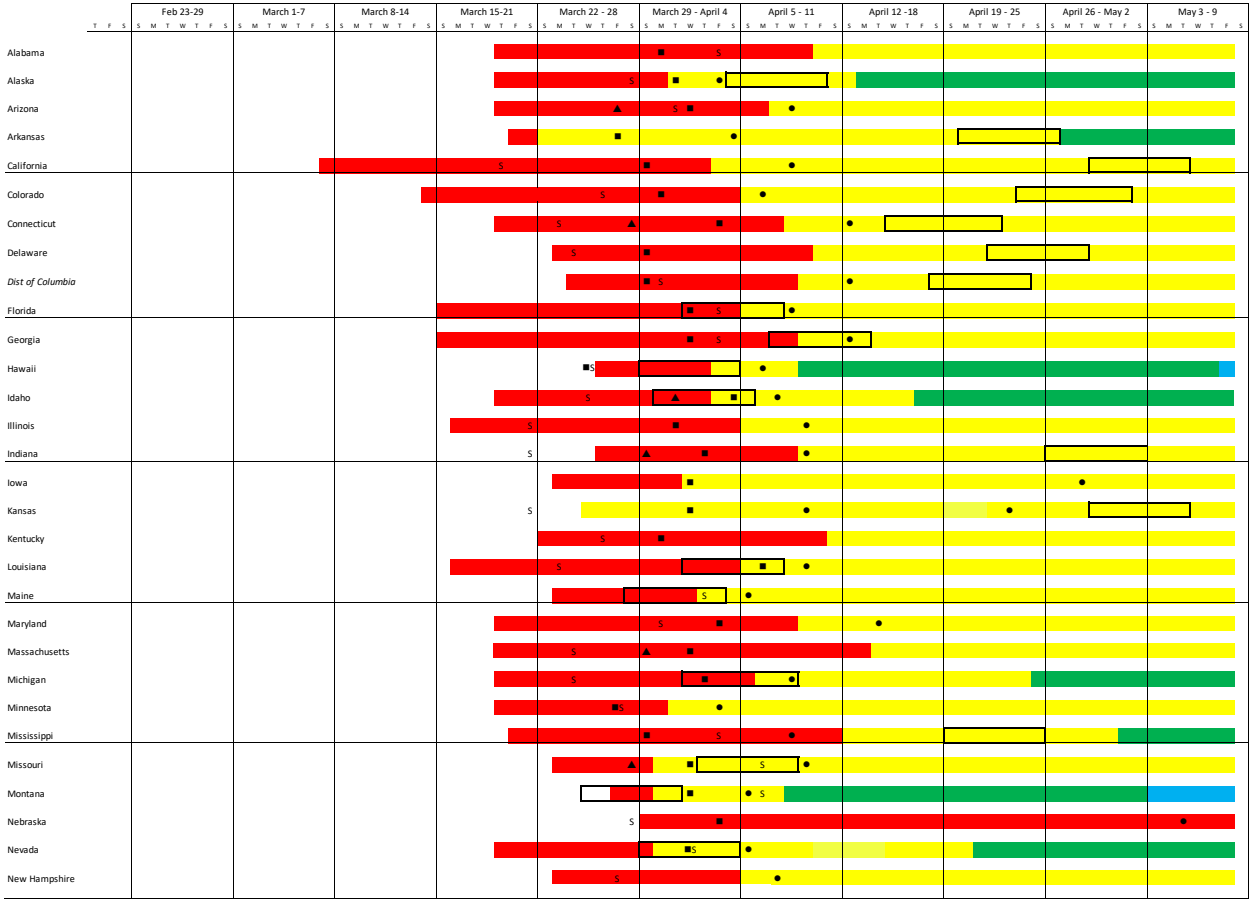
State-by-State

Virus Progression – *1 of 2*

"Strategic Guidance in an Era of Unprecedented Change"

This graphic 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.

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

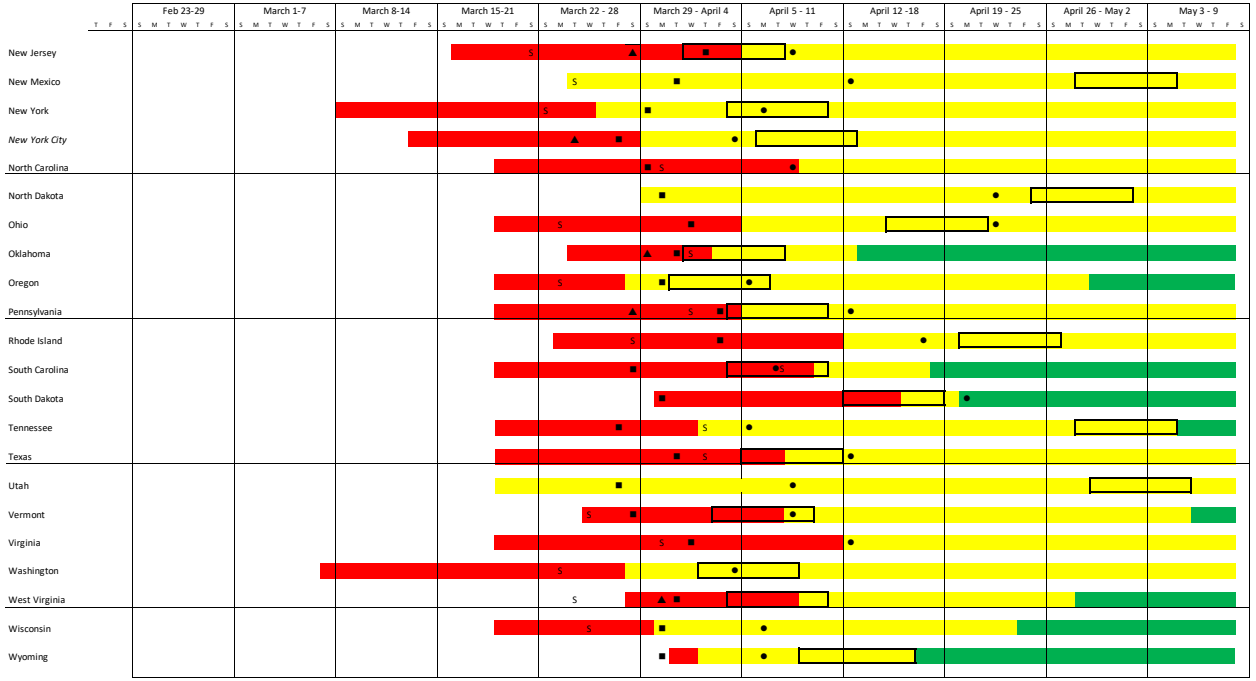


Legend on following page

Virus Progression – *2 of 2*

This graphic 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.

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



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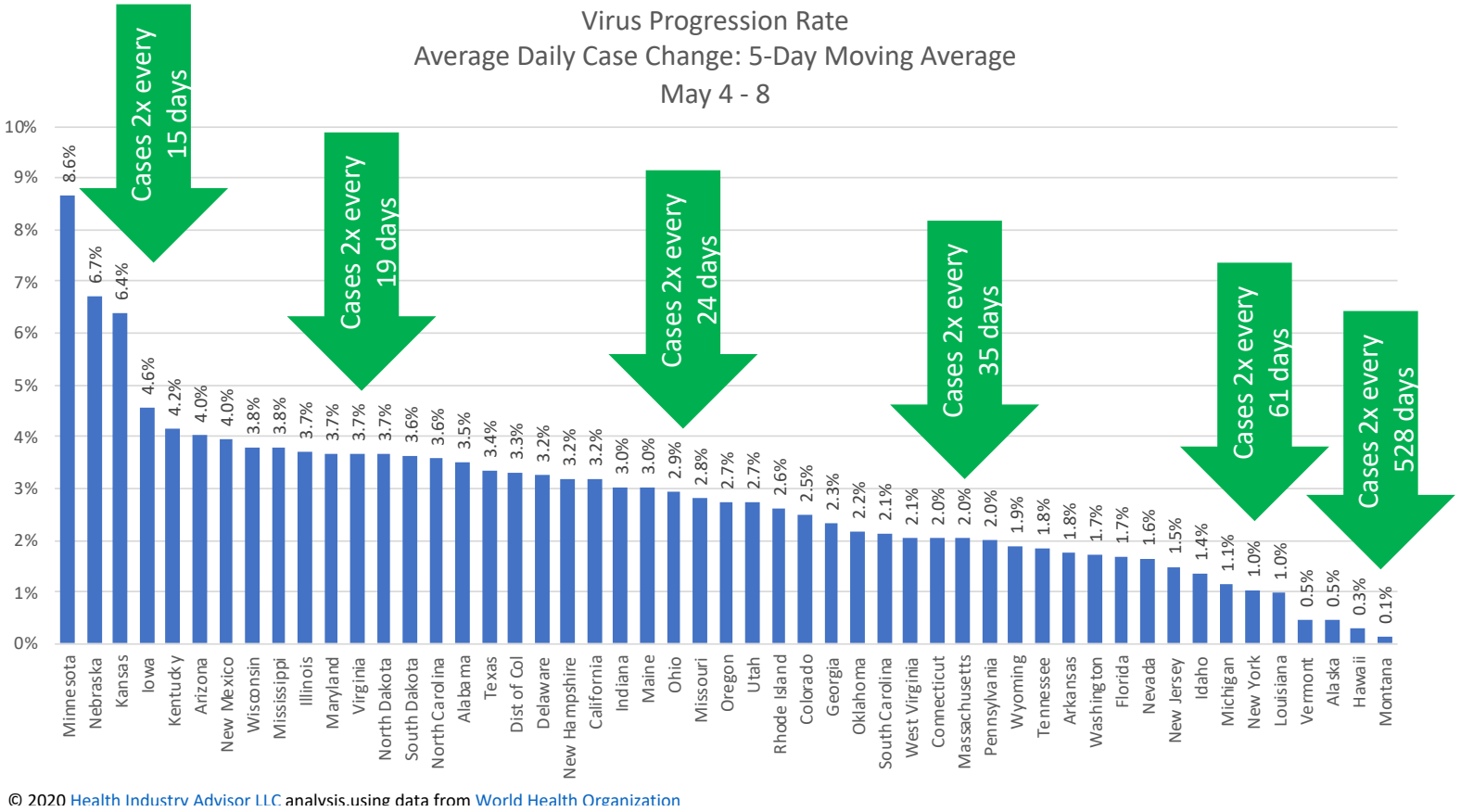
State-by-State

Average Daily Case Growth

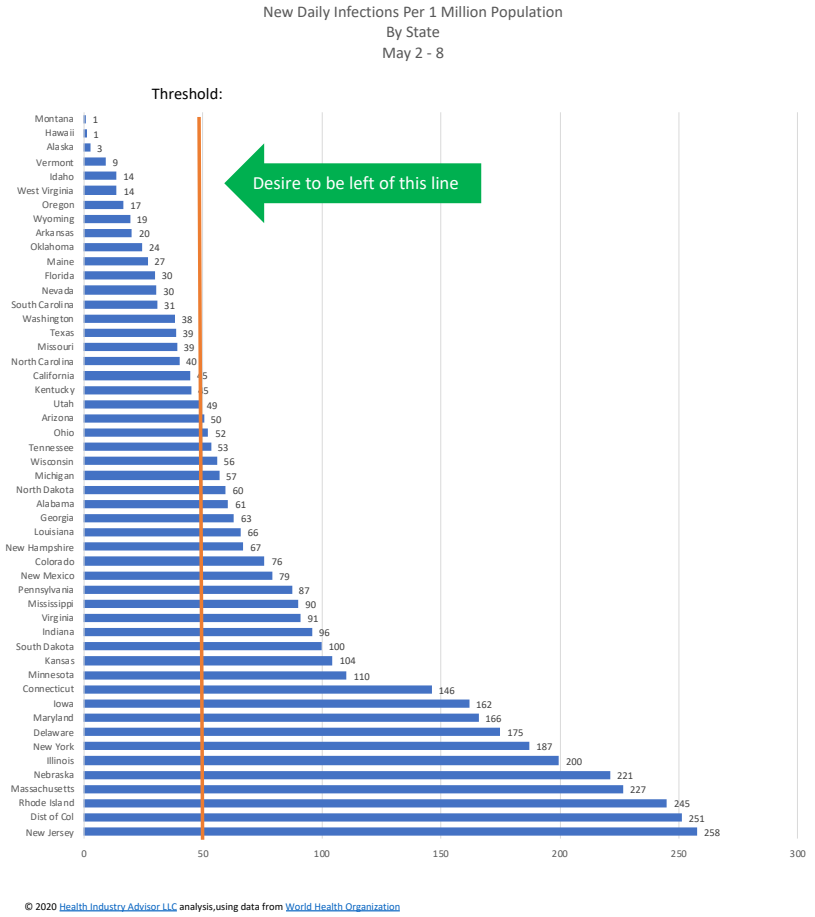
"Strategic Guidance in an Era of Unprecedented Change"

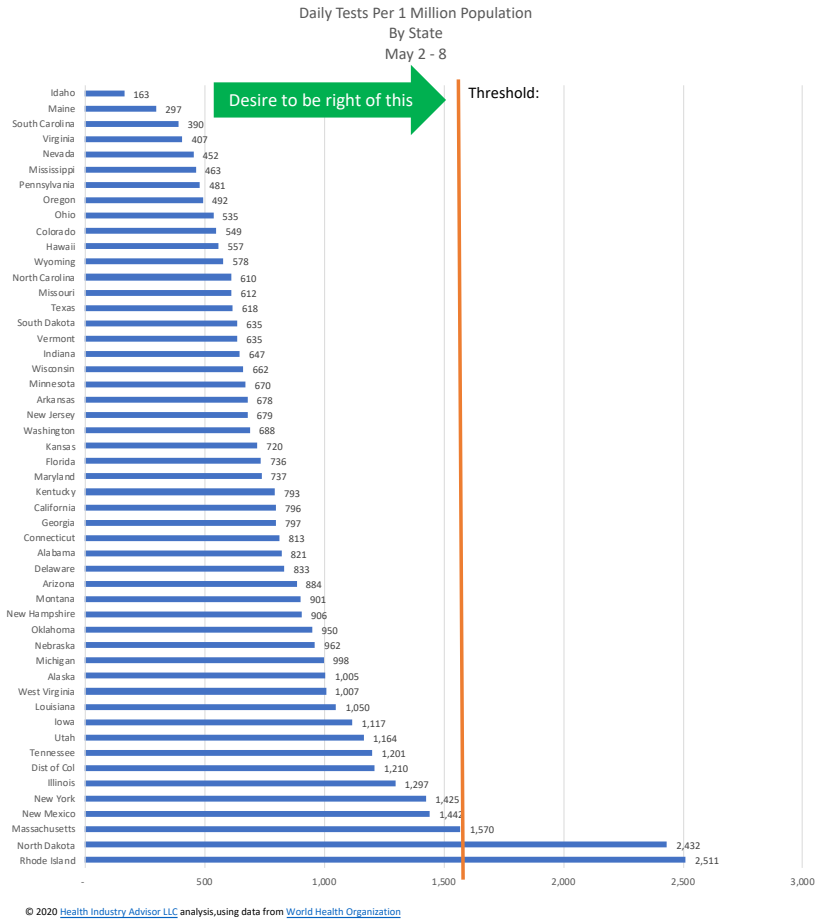


State-by-State

New Daily Infections & Tests Per Capita

"Strategic Guidance in an Era of Unprecedented Change"



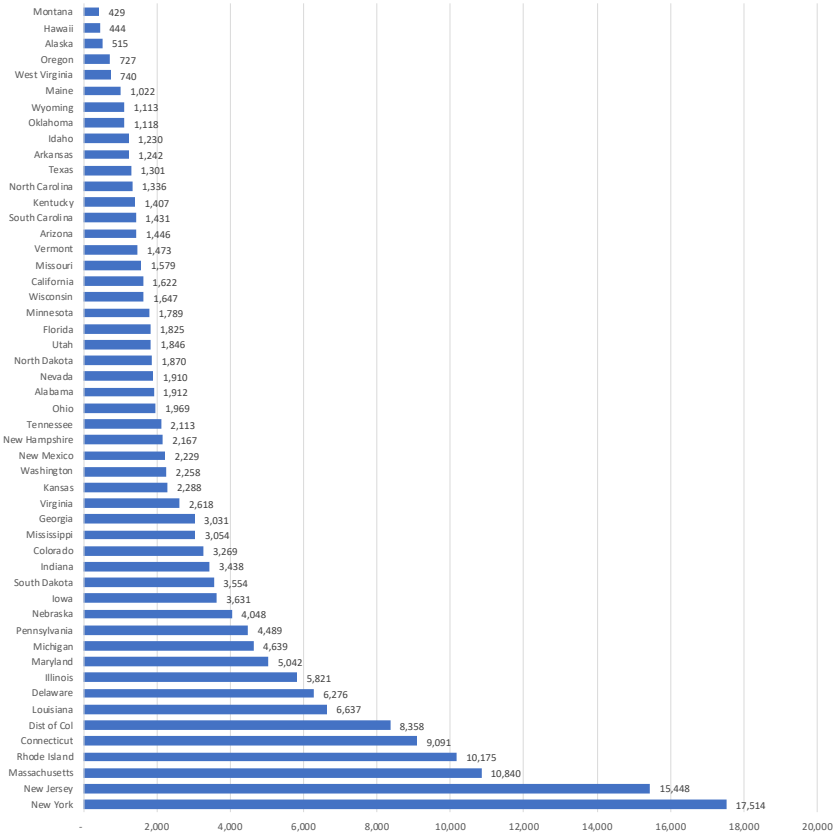


State-by-State

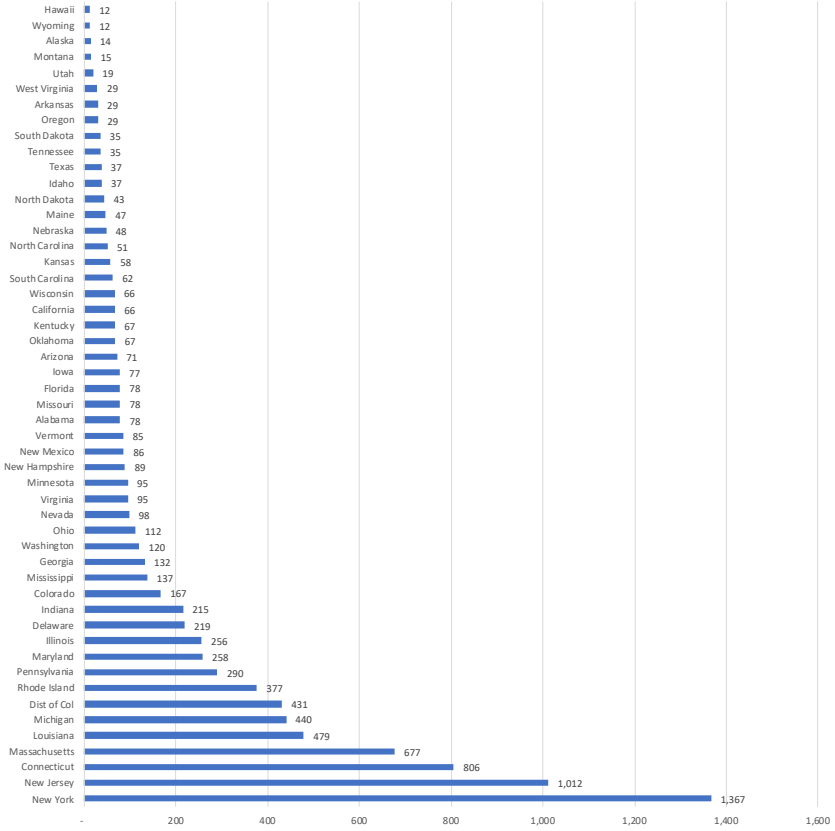
Cases & Deaths Per Capita

"Strategic Guidance in an Era of Unprecedented Change"

Total Cases Per 1 Million Population
By State
As of May 8



Deaths Per 1 Million Population
By State
As of May 8



UNDER-REPORTED RECOVERIES? POSSIBLE LAG IN STATE REPORTING

Reporting of Recoveries Seems to Be Lagging

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Which states seem to be lagging in reporting?

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

Comparing the reported recoveries to Total Cases 4 weeks ago[1], this shortfall is ~180-230k

State	Recoveries	Expected Recoveries Low	Expected Recoveries High
Alabama	20	2,406	2,707
Alaska	305	197	221
Arizona	70	2,490	2,801
Arkansas	2,968	962	1,082
California	9,988	16,858	18,966
Colorado	559	5,208	5,859
Connecticut	65	8,430	9,484
Delaware	2,228	1,061	1,193
District Of Columbia	825	1,328	1,494
Florida	686	14,374	16,171
Georgia	340	9,487	10,673
Hawaii	565	372	419
Idaho	1,379	1,117	1,256
Illinois	645	14,310	16,098
Indiana	1,559	5,526	6,216
Iowa	4,685	1,110	1,249
Kansas	1,675	933	1,049
Kentucky	2,266	1,354	1,524
Louisiana	20,316	15,402	17,328
Maine	836	469	527
Maryland	2,041	5,574	6,271
Massachusetts	8,118	16,779	18,877
Michigan	15,674	18,226	20,505
Minnesota	5,697	1,069	1,202
Mississippi	4,421	1,975	2,222
Missouri	2,063	3,039	3,419
Montana	420	292	329
Nebraska	22	518	583
Nevada	4,197	2,067	2,326
New Hampshire	1,210	708	797
New Jersey	1,468	43,670	49,129
New Mexico	1,125	873	982
New York	56,412	137,886	155,122
North Carolina	1,808	3,270	3,679
North Dakota	714	222	250
Ohio	448	4,702	5,290
Oklahoma	3,064	1,435	1,615
Oregon	1,125	1,097	1,234
Pennsylvania	1,080	16,272	18,306
Rhode Island	730	1,612	1,814
South Carolina	4,881	2,452	2,759
South Dakota	2,069	429	482
Tennessee	7,011	3,890	4,376
Texas	19,604	9,749	10,967
Utah	2,185	1,682	1,892
Vermont	737	543	611
Virginia	2,997	3,607	4,058
Washington	2,747	8,156	9,176
West Virginia	738	459	517
Wisconsin	4,348	2,454	2,761
Wyoming	428	202	228
	-	-	-
United States	223,603	402,301	452,588

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

1 – 4 weeks is the presumed time from infection-onset to recovery referenced by many states

IMPACT OF EXPANDED TESTING:

MEASURING INCREASED INFECTIONS . . . OR, PICKING UP PREVIOUSLY UNDER-REPORTED ASYMPTOMATIC CASES?

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Impact of Increased Testing Rates

Are Reported Case Increases Due to Increased Infections or Increased Testing?

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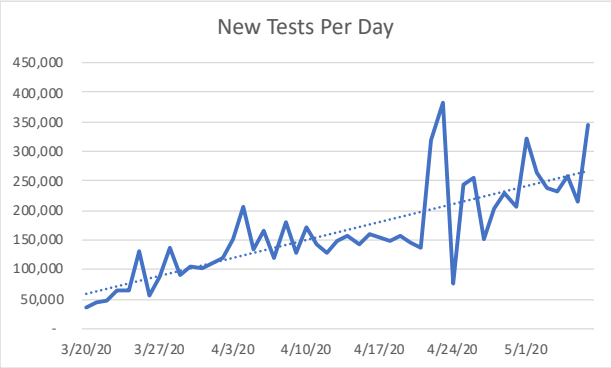
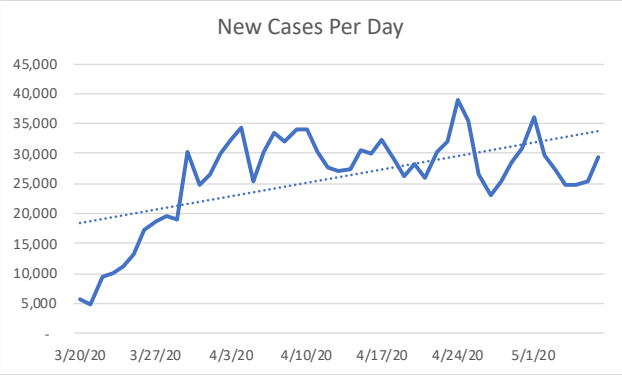
Testing volumes have increased notably over the past 2 months:



Resulting in an increase in new daily cases during this same period:



How much of this increase in cases due to higher infection rates?

And, how much is a function of expanded testing (i.e., identifying more asymptomatic cases and getting closer to identifying the true prevalence of the virus spread)?

(continued next page)

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Impact of Increased Testing Rates

Are Reported Case Increases Due to Increased Infections or Increased Testing?

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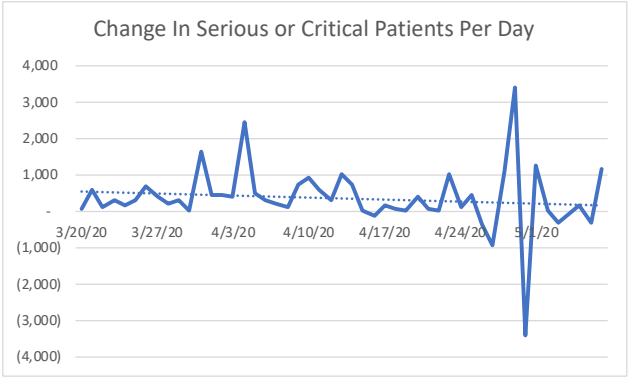
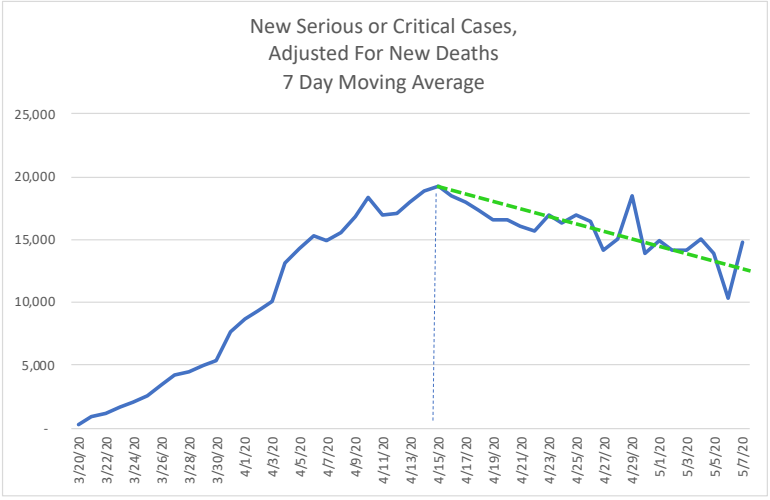
Assuming the severity of new cases should resemble the severity of previous cases, true increases in infection rates should be reflected in increased numbers of serious or critical patients . . .

That is not apparent in the data!





Now, what if we assumed that the deaths on any day would serve to lower the number of existing serious or critical patients?

Then, any increase in serious or critical cases, net of new deaths, could be considered as a reflection of the trend in true infection rates.

From the chart on the left, we may reasonably conclude that true infection rates have been declining since April 15 (thus, any reported increase in cases are a function of expanded testing . . . ***not increased infection rates)***

For this discussion, we are assuming that more people will move from non-serious/critical to serious/critical than the reverse during a growing infection stage; Not an unreasonable assumption.

WHAT FACTORS "EXPLAIN" STATE-BY-STATE DIFFERENCES IN INFECTION AND DEATH RATES?

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"Strategic Guidance in an Era of Unprecedented Change"

State-By-State Modeling Results

Can We "Explain" Different Infection & Death Rates?

Infection and death rates vary widely between the states, and are most pronounced in the Northeast U.S.

	Total Cases		Cases / 1M Pop.		Deaths/ 1M Pop.	
High	New York	340,705	New York	1,367	New York	17,514
	New Jersey	137,212	New Jersey	1,012	New Jersey	15,448
	Massachusetts	75,333	Connecticut	806	Massachusetts	10,840
	Illinois	73,760	Massachusetts	677	Rhode Island	10,175
	California	64,107	Louisiana	479	Connecticut	9,091
Low	Vermont	919	Utah	19	West Virginia	740
	Wyoming	644	Montana	15	Oregon	727
	Hawaii	629	Alaska	14	Alaska	515
	Montana	458	Wyoming	12	Hawaii	444
	Alaska	377	Hawaii	12	Montana	429

All data as of May 8

State-By-State Modeling Results

Can We "Explain" Different Infection & Death Rates?

- We tested various models in attempt to "explain" state-to-state differences in the following (dependent variables):
  - Peak new daily infection rates
  - Deaths (as of May 5)
  - Deaths per capita (as of May 5)
  - Deaths per case (as of May 5)
- Additionally, we tested the impact of stay home orders:
  - Based on date of order
  - Comparing rate of new infections on March 27 to May 5

- The following (independent variables) were tested for their usefulness in "explaining" the differences in infections and deaths:
  - Population
  - Population density
  - % of population under 100% of federal poverty level
  - % of population 65 years old or older
  - % of commuters using shared transportation
  - Hispanic % of the population
  - African American % of the population
  - Timing and magnitude of peak flu season
  - State Stay-Home order issued (Y or N)?
    - If yes, when executed
    - If yes, daily new infections at date of order (-4 to +2 days)

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State-By-State Modeling Results

Can We ”Explain” Different Infection & Death Rates?

“Strategic Guidance in an Era of Unprecedented Change”

- Population and population density have statistically significant impacts ($p<0.05$ that coefficients are nonzero) on:
  - Peak daily infection rates
  - Deaths
- Further, population density has a significant impact on:
  - Deaths per capita
- % of commuters using shared transportation (buses, trains, subways) has a significant impact on:
  - Peak daily infection rates
  - Deaths
  - Deaths per capita
- % Non-Hispanic population and % of population living below 100% of the federal poverty level each have a significant impact on:
  - Peak daily infection rates
- Stay-Home Orders and the Date of Issue had a significant impact on:
  - Deaths per capita
  - The state’s infection rate at the time of the order has had a far more meaningful impact than has the timing of the order (issuing the order when infection rates were low > issuing it at an early date)
  - *However, we could not establish a statistically-valid impact on infection rates!*
- *Further, we could not find a model using these variables to explain differences in death per case rates*
- *Nor could we establish any effect of age, % African American population or the the timing of the peak flu season on: peak infection rates, deaths, deaths per capita or deaths per case*

Special note: with each of these analyses, they are subject to change as additional experience is gained with the virus and more data becomes available

Peak New Daily Infection Rates

"Strategic Guidance in an Era of Unprecedented Change"

Factors influencing peak new infection rates:

- % of commuters using shared transportation
- % of population below 100% of federal poverty level
- Non-Hispanic % of population

P-value indicates the probability that the factor's impact on infection rates is zero. P-values <0.05 are considered statistically significant (i.e., factor's impact is non-zero).

R-square shows how much of the variability in infection rates is explained by these variables

Infection Rate Model 1

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.9329
R Square	0.8703
Adjusted R Square	0.8619
Standard Error	568.8082
Observations	50

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	99891897.73	33297299.24	102.914691	2.027E-20
Residual	46	14882965.14	323542.7204		
Total	49	114774862.9			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	(222.81)	129.67	(1.72)		(483.82)	38.21	(483.82)	38.21
Commute Mode Share - Transit: Raw Value	30,401.46	1,971.87	15.42	0.00	26,432.28	34,370.63	26,432.28	34,370.63
Population Under 100% of Federal Poverty Level (100,000s)	40.23	10.08	3.99	0.00	19.93	60.53	19.93	60.53
Hispanic % of Population	(1,892.61)	917.63	(2.06)	0.04	(3,739.70)	(45.51)	(3,739.70)	(45.51)

Peak New Daily Infection Rates

"Strategic Guidance in an Era of Unprecedented Change"

Factors influencing peak new infection rates:
- Population
- Population density

P-value indicates the probability that the factor's impact on a state's peak new infection rate is zero. P-values <0.05 are considered statistically significant (i.e., factor's impact is non-zero).

R-square shows how much of the variability in the state peak new infection rates is explained by these variables

Although this model overall is not as strong as the one on the prior page, it nonetheless establishes a statistically significant relationship between peak infection rates and both population and population density

Infection Rate Model 2

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.594
R Square	0.352
Adjusted R Square	0.325
Standard Error	1257.565
Observations	50.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	40445741.24	20222870.62	12.7873826	3.6799E-05
Residual	47	74329121.63	1581470.673		
Total	49	114774862.9			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	(165.51)	262.92	(0.63)	0.53	(694.45)	363.42	(694.45)	363.42
Population (1,000,000s)	89.26	25.23	3.54	0.00	38.51	140.02	38.51	140.02
Population Density	2.04	0.69	2.95	0.00	0.65	3.42	0.65	3.42

Deaths Per 1 Million Population (as of May 5)

"Strategic Guidance in an Era of Unprecedented Change"

Factors influencing deaths per capita:

- Population density
- Stay home order issued?
- If yes, when? Number of Days Prior to May 1
- New infection rate around the time of the order (order worked best if set early during virus spread)

P-value indicates the probability that the factor's impact on deaths per capita is zero. P-values <0.05 are considered statistically significant (i.e., factor's impact is non-zero).

R-square shows how much of the variability in deaths per capita is explained by these variables

Deaths Per Capita
Model 1

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.919
R Square	0.845
Adjusted R Square	0.832
Standard Error	94.970
Observations	50

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	2220491.148	555122.787	61.54860527	1.1342E-17
Residual	45	405866.6367	9019.258594		
Total	49	2626357.785			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	22.480	38.823	0.579	0.565	(55.714)	100.673	(55.714)	100.673
Population Density	0.235	0.061	3.845	0.000	0.112	0.358	0.112	0.358
State Issued Stay-Home Order?	(835.542)	122.247	(6.835)	0.000	(1,081.759)	(589.325)	(1,081.759)	(589.325)
Days Before May 1 That Order Was Issued	20.563	3.266	6.296	0.000	13.984	27.142	13.984	27.142
Daily New Inf/Capita - 4 days prior - 2 days after	7.275	0.715	10.169	0.000	5.834	8.716	5.834	8.716

Deaths Per 1 Million Population (as of May 5)

"Strategic Guidance in an Era of Unprecedented Change"

Factors influencing deaths per capita:

- Population density
- Stay home order issued? If yes, when?
- New infection rate around the time of the order (order worked best if set early during virus spread)
- % of commuters using shared transportation

P-value indicates the probability that the factor's impact on deaths per capita is zero. P-values <0.05 are considered statistically significant (i.e., factor's impact is non-zero).

R-square shows how much of the variability in deaths per capita is explained by these variables

Deaths Per Capita Model 2

Adding the % of commuters using shared transportation added to the value of the model shown on the previous page. However, there is a 1-in-9 chance that this factor has a zero-impact on deaths per capita

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.924
R Square	0.854
Adjusted R Square	0.837
Standard Error	93.331
Observations	50

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	5	2243089.91	448617.9819	51.50233682	2.74962E-17
Residual	44	383267.8753	8710.633529		
Total	49	2626357.785			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	14.601	38.465	0.380	0.706	(62.920)	92.123	(62.920)	92.123
Population Density	0.224	0.060	3.698	0.001	0.102	0.346	0.102	0.346
State Issued Stay Home Order?	(691.355)	149.821	(4.615)	0.000	(993.299)	(389.410)	(993.299)	(389.410)
Days Before May 1 That Order Was Issued	16.870	3.945	4.277	0.000	8.921	24.820	8.921	24.820
Daily New Inf/Capita - 4 days prior - 2 days after	6.032	1.044	5.779	0.000	3.929	8.136	3.929	8.136
Commute Mode Share - Transit: Raw Value	888.977	551.916	1.611	0.114	(223.337)	2,001.292	(223.337)	2,001.292

Deaths (as of May 5)

"Strategic Guidance in an Era of Unprecedented Change"

Factors influencing deaths as of May 5:

- Population
- Population density
- New infection rate as of March 27
- % of commuters using shared transportation

P-value indicates the probability that the factor's impact on deaths per capita is zero. P-values <0.05 are considered statistically significant (i.e., factor's impact is non-zero).

R-square shows how much of the variability in deaths per capita is explained by these variables

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.984
R Square	0.969
Adjusted R Square	0.964
Standard Error	729.630
Observations	50

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	6	706769021.2	117794836.9	221.2688808	1.17946E-30
Residual	43	22891506.33	532360.6123		
Total	49	729660527.5			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	(1,652.57)	588.90	(2.81)	0.01	(2,840.20)	(464.95)	(2,840.20)	(464.95)
Population (1,000,000s)	74.71	18.07	4.13	0.00	38.27	111.16	38.27	111.16
Population Density	(0.81)	0.46	(1.74)	0.09	(1.74)	0.13	(1.74)	0.13
New Inf rate on 3/27	70.39	5.83	12.07	0.00	58.63	82.14	58.63	82.14
% of Population Under 100% of PL	4,865.52	4,512.93	1.08	0.29	(4,235.67)	13,966.71	(4,235.67)	13,966.71
Commute Mode Share - Transit: Raw Value	24,539.45	5,880.64	4.17	0.00	12,680.01	36,398.88	12,680.01	36,398.88
Hispanic % of Population	(2,097.09)	1,211.07	(1.73)	0.09	(4,539.44)	345.26	(4,539.44)	345.26

Additional variables that strengthen the model yet, cannot be established statistically as having a non-zero impact are:

- % of Population Under 100% of the Federal poverty level and
- Non-Hispanic % of population