

# COVID19 Time Series Analysis, Worldwide and U.S.

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## Contents

<b>Worldwide</b>	<b>1</b>
Worldwide Summary . . . . .	1
Ln (Seven-Day-Moving-Average New Cases) Impact on Ln (New Cases) . . . . .	3
Forecast New Cases by Country . . . . .	6
Forecast New Cases WW Total . . . . .	7
Sparklines . . . . .	9
<b>U.S. Analysis</b>	<b>12</b>
State Summary . . . . .	12
Ln (Seven-Day-Moving-Average New Cases) Impact on Ln (New Cases) . . . . .	13
Forecast New Cases by State . . . . .	15
Forecast New Cases U.S. Total . . . . .	18
Sparklines . . . . .	20
Zero at Fifty Cases . . . . .	26
<b>Testing Data</b>	<b>26</b>
State-by-State Testing Summary . . . . .	26
Hospitalization Summary . . . . .	28
Selected States Drill-Down . . . . .	29

Source data: 2019 Novel Coronavirus COVID-19 (2019-nCoV) Data Repository by Johns Hopkins CSSE;  
<https://github.com/CSSEGISandData/COVID-19>

Source code: <https://github.com/opencedar/covid19>

The visualizations in this document are heavily indebted to Edward Tufte and his use of sparklines—small, clutter-free time series lines—to show how many different panels or categories of data are changing through time; check out [https://www.edwardtufte.com/bboard/q-and-a-fetch-msg?msg\\_id=0001OR](https://www.edwardtufte.com/bboard/q-and-a-fetch-msg?msg_id=0001OR).

## Worldwide

### Worldwide Summary

Sorted by total number of cases. Percent growth in total cases in the past seven days is last column.

Table 1: Worldwide Summary

Country_Region	days_100	conf	deaths	new_conf	conf_lag7	l7_rate
US	34	308850	8407	33264	121478	156%
Spain	34	126168	11947	6969	73235	72%
Italy	42	124632	15362	4805	92472	36%
Germany	35	96092	1444	4933	57695	68%
France	36	90848	7574	25646	38105	140%
China	74	82543	3330	32	81999	0%
Iran	39	55743	3452	2560	35408	56%
United Kingdom	25	42477	4320	3788	17312	144%

Country_Region	days_100	conf	deaths	new_conf	conf_lag7	l7_rate
Turkey	17	23934	501	3013	7402	224%
Switzerland	31	20505	666	899	14076	44%
Belgium	30	18431	1283	1661	9134	100%
Netherlands	30	16727	1656	906	9819	72%
Canada	25	12978	218	541	5576	132%
Austria	28	11781	186	257	8271	44%
Portugal	23	10524	266	638	5170	104%
Brazil	23	10360	445	1304	3904	164%
Korea, South	45	10156	177	94	9478	8%
Israel	25	7851	44	423	3619	116%
Sweden	30	6443	373	312	3447	88%
Australia	26	5550	30	220	3640	52%
Norway	30	5550	62	180	4015	40%
Russia	19	4731	43	582	1264	276%
Ireland	22	4604	137	331	2415	92%
Czechia	23	4472	59	381	2631	68%
Denmark	26	4269	161	323	2366	80%
Chile	20	4161	27	424	1909	116%
Poland	22	3627	79	244	1638	120%
Romania	22	3613	146	430	1452	148%
Malaysia	27	3483	57	150	2320	52%
Ecuador	18	3465	172	97	1823	92%
Japan	44	3139	77	522	1693	84%
Philippines	22	3094	144	76	1075	188%
India	22	3082	86	515	987	212%
Pakistan	20	2818	41	132	1495	88%
Luxembourg	19	2729	31	117	1831	48%
Saudi Arabia	22	2179	29	140	1203	80%
Indonesia	21	2092	191	106	1155	80%
Thailand	21	2067	20	89	1245	68%
Finland	23	1882	25	267	1167	60%
Peru	19	1746	73	151	671	160%
Mexico	17	1688	60	178	717	136%
Greece	23	1673	68	60	1061	56%
Panama	17	1673	41	198	786	112%
Serbia	17	1624	44	148	659	148%
South Africa	18	1585	9	80	1187	32%
United Arab Emirates	18	1505	10	241	468	220%
Dominican Republic	15	1488	68	0	719	108%
Argentina	16	1451	43	186	690	112%
Iceland	24	1417	4	53	963	48%
Colombia	17	1406	32	139	608	132%
Qatar	25	1325	3	250	590	124%
Algeria	15	1251	130	80	454	176%
Ukraine	11	1225	32	153	356	244%
Singapore	36	1189	6	75	802	48%
Croatia	17	1126	12	47	657	72%
Egypt	22	1070	71	85	576	84%
Estonia	22	1039	13	78	645	60%
World	25	1173131	63987	99573	647533	80%

## Ln (Seven-Day-Moving-Average New Cases) Impact on Ln (New Cases)

In other words, elasticity. How does this elasticity change through time, from days since the 100th case?

An elasticity under 1 indicates that over a seven-day period, new cases are decreasing.

The black line shows the best curve fit for elasticity changing over time. All countries generally are moving to cap the rate of exponential growth. Countries above the line are doing worse than average, and those below the line are doing better than average. A rate below 1 indicates that new cases are declining over an average 7-day period.

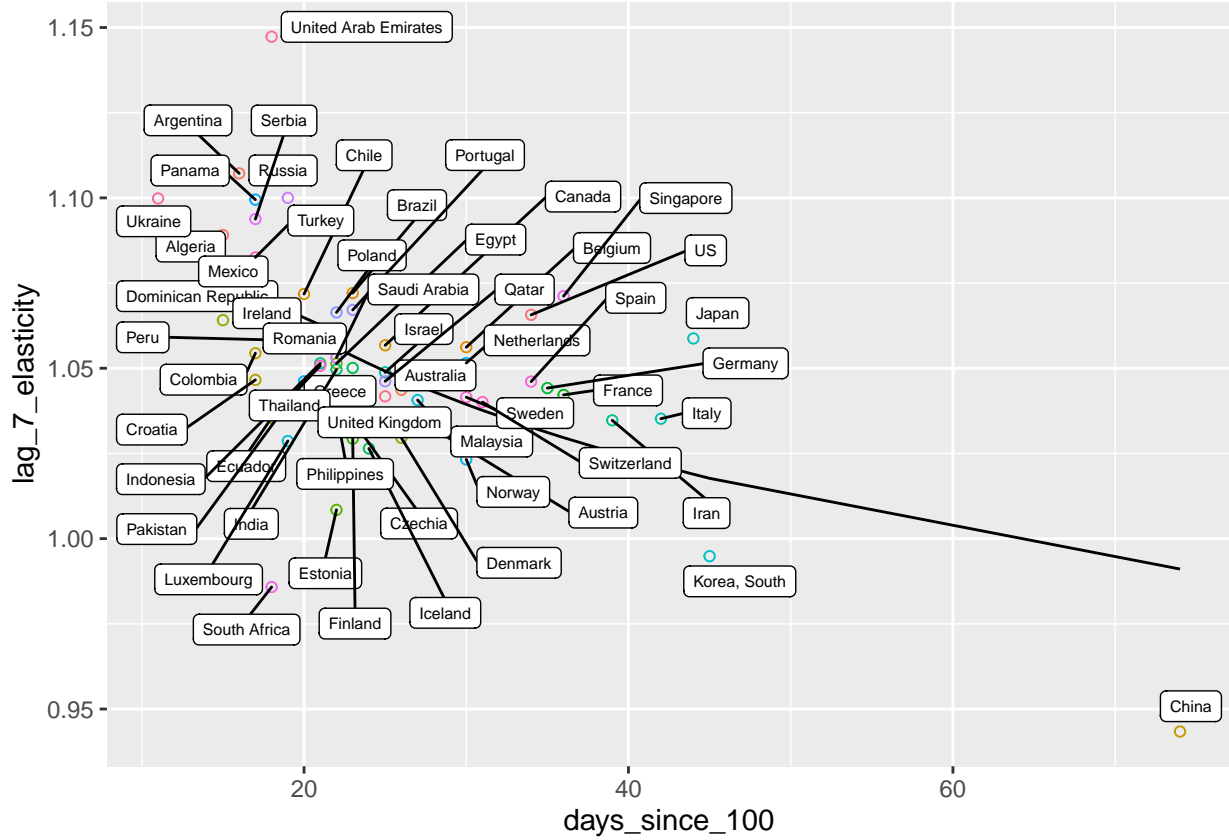


Table 2: Countries by Predicted vs. Actual Lag 7 New Case Elasticity on Today's Cases

country	days_since_100	lag_7_elasticity	prediction	residual
Ukraine	11	1.10	1.09	0.01
Dominican Republic	15	1.06	1.08	-0.01
Algeria	15	1.09	1.08	0.01
Argentina	16	1.11	1.07	0.03
Croatia	17	1.05	1.07	-0.02
Colombia	17	1.05	1.07	-0.02
Mexico	17	1.07	1.07	0.00
Turkey	17	1.08	1.07	0.01
Serbia	17	1.09	1.07	0.02
Panama	17	1.10	1.07	0.03
South Africa	18	0.99	1.07	-0.08
Ecuador	18	1.04	1.07	-0.03
United Arab Emirates	18	1.15	1.07	0.08

country	days_since_100	lag_7_elasticity	prediction	residual
Luxembourg	19	1.03	1.06	-0.04
Peru	19	1.06	1.06	-0.01
Russia	19	1.10	1.06	0.04
Pakistan	20	1.05	1.06	-0.01
Chile	20	1.07	1.06	0.01
Thailand	21	1.05	1.06	-0.01
Indonesia	21	1.05	1.06	-0.01
Estonia	22	1.01	1.06	-0.05
Philippines	22	1.04	1.06	-0.02
India	22	1.05	1.06	-0.01
Egypt	22	1.05	1.06	0.00
Saudi Arabia	22	1.05	1.06	0.00
Romania	22	1.06	1.06	0.00
Ireland	22	1.06	1.06	0.00
Poland	22	1.07	1.06	0.01
Finland	23	1.03	1.05	-0.02
Czechia	23	1.03	1.05	-0.02
Greece	23	1.05	1.05	0.00
Portugal	23	1.07	1.05	0.01
Brazil	23	1.07	1.05	0.02
Iceland	24	1.03	1.05	-0.02
United Kingdom	25	1.04	1.05	-0.01
Qatar	25	1.05	1.05	0.00
Israel	25	1.05	1.05	0.00
Canada	25	1.06	1.05	0.01
Denmark	26	1.03	1.05	-0.02
Australia	26	1.04	1.05	0.00
Malaysia	27	1.04	1.05	0.00
Austria	28	1.03	1.04	-0.01
Norway	30	1.02	1.04	-0.02
Sweden	30	1.04	1.04	0.00
Netherlands	30	1.05	1.04	0.01
Belgium	30	1.06	1.04	0.02
Switzerland	31	1.04	1.04	0.00
Spain	34	1.05	1.03	0.01
US	34	1.07	1.03	0.03
Germany	35	1.04	1.03	0.01
France	36	1.04	1.03	0.01
Singapore	36	1.07	1.03	0.04
Iran	39	1.03	1.03	0.01
Italy	42	1.04	1.02	0.01
Japan	44	1.06	1.02	0.04
Korea, South	45	0.99	1.02	-0.02
China	74	0.94	0.99	-0.05

### Comparisons with averages

Table 3: Countries by Predicted vs. Actual Lag 7 New Case Elasticity on Today's Cases

country	days_since_100	lag_7_elasticity	prediction	ww_residual
Ukraine	11	1.10	1.09	0.01
Dominican Republic	15	1.06	1.08	-0.01
Algeria	15	1.09	1.08	0.01
Argentina	16	1.11	1.07	0.03
Croatia	17	1.05	1.07	-0.02
Colombia	17	1.05	1.07	-0.02
Mexico	17	1.07	1.07	0.00
Turkey	17	1.08	1.07	0.01
Serbia	17	1.09	1.07	0.02
Panama	17	1.10	1.07	0.03
South Africa	18	0.99	1.07	-0.08
Ecuador	18	1.04	1.07	-0.03
United Arab Emirates	18	1.15	1.07	0.08
Luxembourg	19	1.03	1.06	-0.04
Peru	19	1.06	1.06	-0.01
Russia	19	1.10	1.06	0.04
Pakistan	20	1.05	1.06	-0.01
Chile	20	1.07	1.06	0.01
Thailand	21	1.05	1.06	-0.01
Indonesia	21	1.05	1.06	-0.01
Estonia	22	1.01	1.06	-0.05
Philippines	22	1.04	1.06	-0.02
India	22	1.05	1.06	-0.01
Egypt	22	1.05	1.06	0.00
Saudi Arabia	22	1.05	1.06	0.00
Romania	22	1.06	1.06	0.00
Ireland	22	1.06	1.06	0.00
Poland	22	1.07	1.06	0.01
Finland	23	1.03	1.05	-0.02
Czechia	23	1.03	1.05	-0.02
Greece	23	1.05	1.05	0.00
Portugal	23	1.07	1.05	0.01
Brazil	23	1.07	1.05	0.02
Iceland	24	1.03	1.05	-0.02
United Kingdom	25	1.04	1.05	-0.01
Qatar	25	1.05	1.05	0.00
Israel	25	1.05	1.05	0.00
Canada	25	1.06	1.05	0.01
Denmark	26	1.03	1.05	-0.02
Australia	26	1.04	1.05	0.00
Malaysia	27	1.04	1.05	0.00
Austria	28	1.03	1.04	-0.01
Norway	30	1.02	1.04	-0.02
Sweden	30	1.04	1.04	0.00
Netherlands	30	1.05	1.04	0.01
Belgium	30	1.06	1.04	0.02
Switzerland	31	1.04	1.04	0.00
Spain	34	1.05	1.03	0.01
US	34	1.07	1.03	0.03

country	days_since_100	lag_7_elasticity	prediction	ww_residual
Germany	35	1.04	1.03	0.01
France	36	1.04	1.03	0.01
Singapore	36	1.07	1.03	0.04
Iran	39	1.03	1.03	0.01
Italy	42	1.04	1.02	0.01
Japan	44	1.06	1.02	0.04
Korea, South	45	0.99	1.02	-0.02
China	74	0.94	0.99	-0.05

## Forecast New Cases by Country

We estimate new cases by date, to see when countries will peak, based on the worldwide curve fit.

Table 4: Forecast Peak New Cases by Country

country	total_cases	peak_new_cases	date	population	perc_pop_infected
China	83,014	15,133	2020-02-13	1,378,665,000	0.0%
Italy	259,191	6,557	2020-03-21	60,600,590	0.4%
Thailand	7,656	188	2020-03-22	68,863,514	0.0%
Switzerland	50,982	1,321	2020-03-23	8,372,098	0.6%
Saudi Arabia	10,123	205	2020-03-24	32,275,687	0.0%
Luxembourg	6,092	234	2020-03-25	582,972	1.0%
Spain	397,363	9,630	2020-03-25	46,443,959	0.9%
Austria	24,488	1,321	2020-03-26	8,747,358	0.3%
Estonia	2,727	134	2020-03-26	1,316,481	0.2%
Malaysia	10,764	235	2020-03-26	31,187,265	0.0%
Germany	318,219	6,933	2020-03-27	82,667,685	0.4%
Norway	11,437	386	2020-03-27	5,232,929	0.2%
South Africa	2,712	243	2020-03-27	55,908,865	0.0%
Australia	16,288	497	2020-03-28	24,127,159	0.1%
Belgium	97,128	1,850	2020-03-28	11,348,159	0.9%
Dominican Republic	7,261	208	2020-03-31	10,648,791	0.1%
Philippines	12,023	538	2020-03-31	103,320,222	0.0%
Colombia	7,204	159	2020-04-01	48,653,419	0.0%
Croatia	3,996	96	2020-04-01	4,170,600	0.1%
Ecuador	10,671	508	2020-04-01	16,385,068	0.1%
India	18,799	601	2020-04-01	1,324,171,354	0.0%
Peru	10,576	258	2020-04-01	31,773,839	0.0%
Canada	76,073	1,724	2020-04-02	36,286,425	0.2%
Greece	6,348	129	2020-04-02	10,746,740	0.1%
Iceland	3,467	99	2020-04-02	334,252	1.0%
Israel	33,442	765	2020-04-02	8,547,100	0.4%
Pakistan	11,191	303	2020-04-02	193,203,476	0.0%
Sweden	24,552	621	2020-04-02	9,903,122	0.2%
Denmark	12,601	373	2020-04-03	5,731,118	0.2%
Indonesia	8,997	196	2020-04-03	261,115,456	0.0%
Romania	23,996	445	2020-04-03	19,705,301	0.1%
United Kingdom	158,181	4,516	2020-04-03	65,637,239	0.2%
Finland	5,722	267	2020-04-04	5,495,096	0.1%
France	413,099	25,646	2020-04-04	66,896,109	0.6%
Japan	34,663	522	2020-04-04	126,994,511	0.0%
Qatar	7,554	250	2020-04-04	2,569,804	0.3%

country	total_cases	peak_new_cases	date	population	perc_pop_infected
Netherlands	68,411	1,205	2020-04-14	17,018,408	0.4%
Ireland	25,013	446	2020-04-16	4,773,095	0.5%
Poland	29,480	483	2020-04-21	37,948,016	0.1%
Portugal	72,067	1,296	2020-04-21	10,324,611	0.7%
Mexico	14,705	233	2020-04-23	127,540,423	0.0%
Chile	36,772	614	2020-04-24	17,909,754	0.2%
US	3,882,175	83,303	2020-04-27	323,127,513	1.2%
Turkey	395,219	8,110	2020-04-28	79,512,426	0.5%
Brazil	142,807	2,479	2020-04-29	207,652,865	0.1%
Ukraine	21,927	353	2020-04-30	45,004,645	0.0%
Algeria	19,411	291	2020-05-01	40,606,052	0.0%
Serbia	36,658	549	2020-05-07	7,057,412	0.5%
Singapore	11,897	124	2020-05-09	5,607,283	0.2%
Panama	39,626	589	2020-05-11	4,034,119	1.0%
United Arab Emirates	882,454	31,747	2020-05-15	9,269,612	9.5%
Argentina	63,764	862	2020-05-22	43,847,430	0.1%

## Forecast New Cases WW Total

WW Confirmed COVID19 Case Forecast as of 05 April 2020

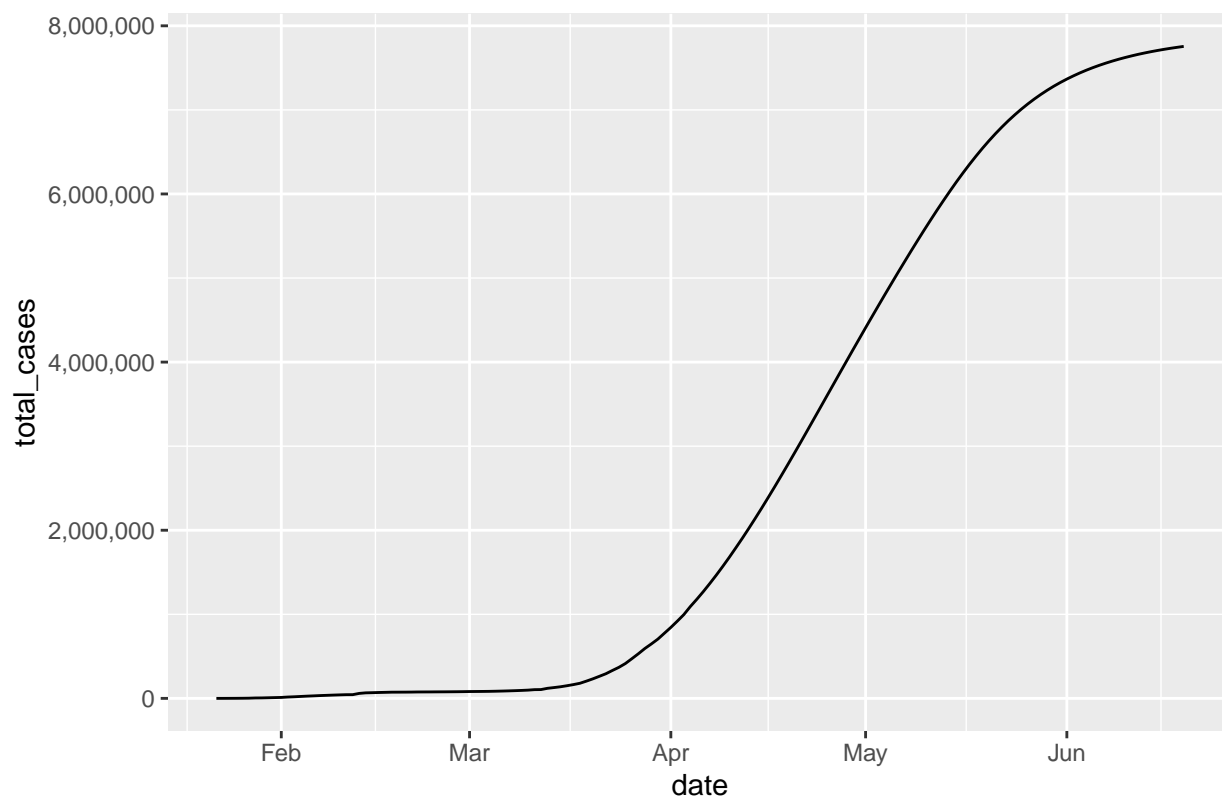
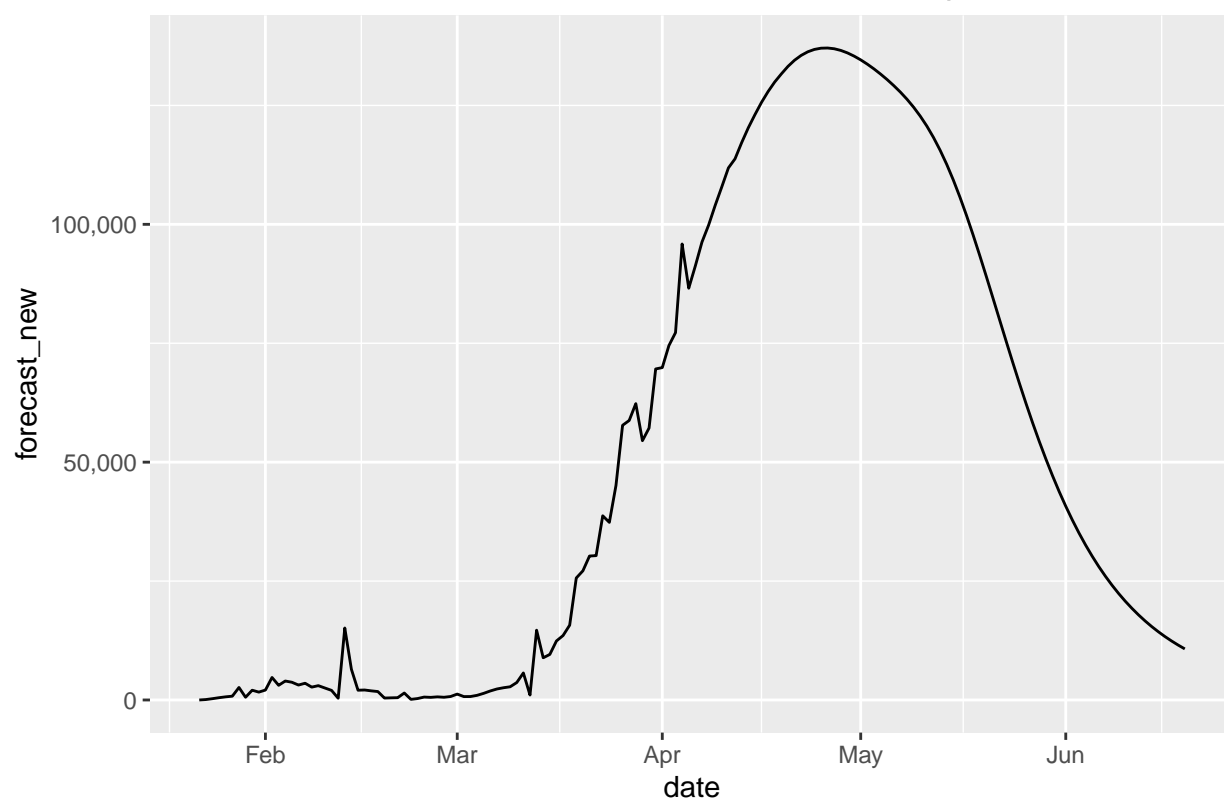


Table 5: Peak Daily New Cases Worldwide and Total on That Day

date	forecast_new	total_cases
2020-04-26	137,074	3,729,423

Worldwide New COVID19 Case Forecast as of 05 April 2020





## Sparklines

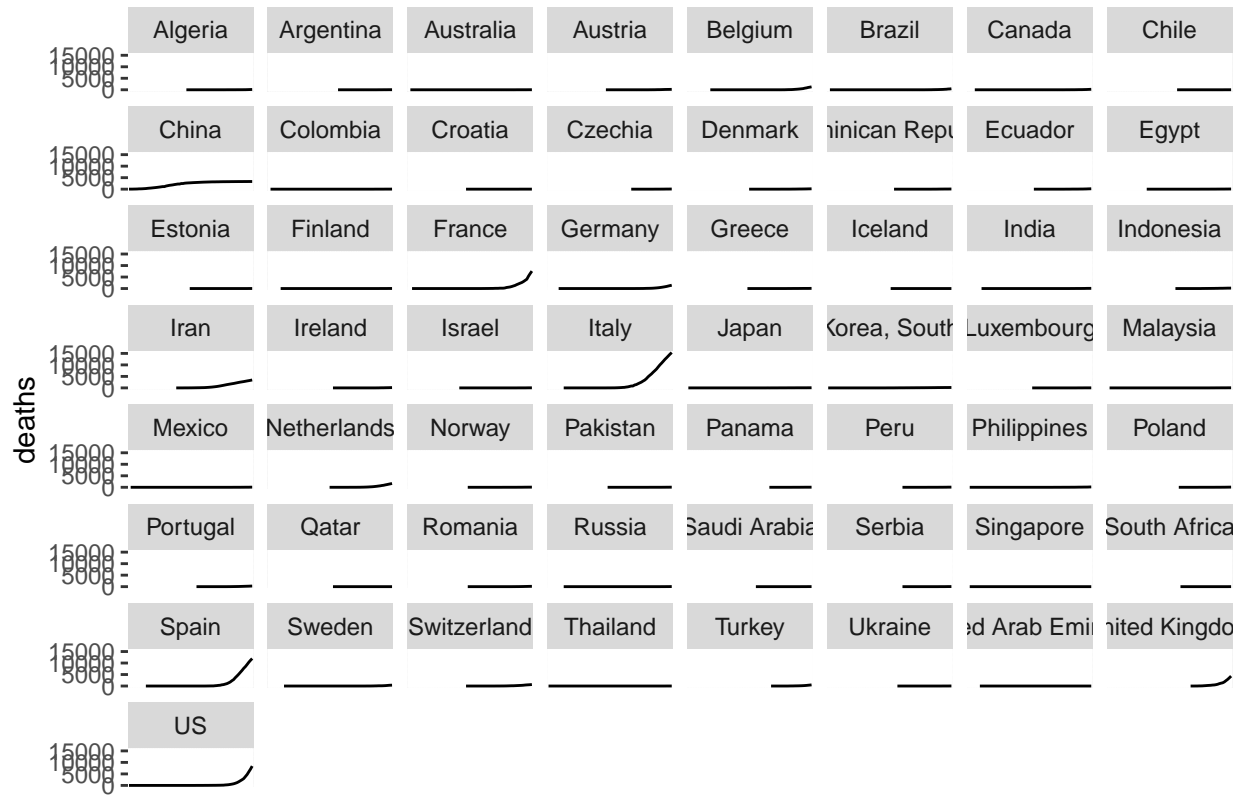
### Confirmed Cases

#### Confirmed COVID19 Cases Through 05 April 2020



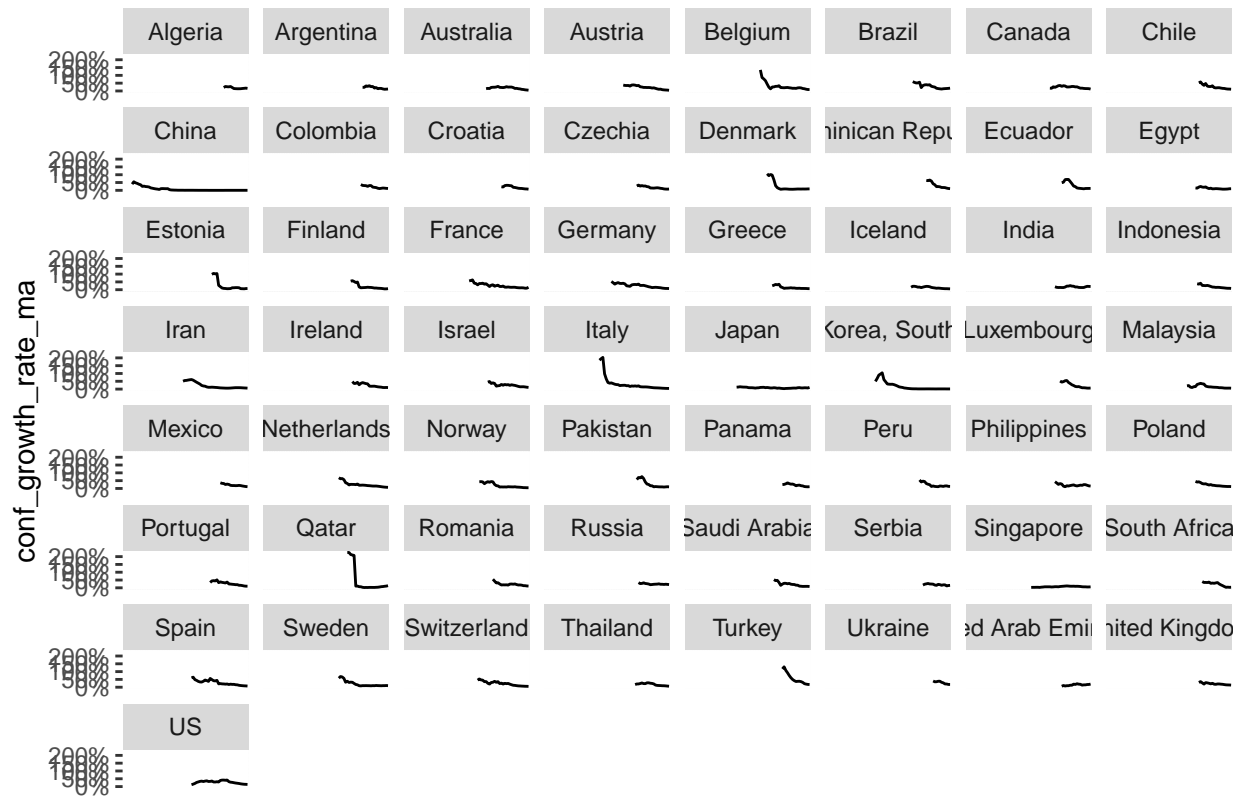
## Deaths

### Cumulative COVID19 Deaths Through 05 April 2020



## Confirmed Growth Rate 5-Day Moving Average

5-Day MA Confirmed Growth Rate Through 05 April 2020



## Death Rate

### Death Rate Through 05 April 2020



## U.S. Analysis

### State Summary

Sorted by total number of cases. Percent growth in total cases in the past seven days is last column.

Table 6: State-by-State Summary

Province_State	days_100	conf	deaths	new_conf	conf_lag7	l7_rate	death_rate
New York	28	113833	3565	10846	52410	117%	3.13%
New Jersey	20	34124	846	4229	11124	207%	2.48%
Michigan	17	14225	540	1481	4650	206%	3.80%
California	27	12837	289	833	5095	152%	2.25%
Louisiana	20	12496	409	2199	3315	277%	3.27%
Massachusetts	24	11736	216	1334	4257	176%	1.84%
Florida	21	11545	195	1277	3763	207%	1.69%
Pennsylvania	19	10444	136	1874	2845	267%	1.30%
Illinois	20	10357	244	1453	3491	197%	2.36%
Washington	29	7247	315	401	4030	80%	4.35%
Texas	19	6556	116	822	2455	167%	1.77%
Georgia	20	6160	201	329	2366	160%	3.26%
Connecticut	17	5276	165	362	1524	246%	3.13%
Colorado	22	4188	111	446	1740	141%	2.65%
Indiana	15	3953	116	516	1233	221%	2.93%

Province_State	days_100	conf	deaths	new_conf	conf_lag7	l7_rate	death_rate
Ohio	17	3739	102	427	1406	166%	2.73%
Tennessee	17	3322	50	255	1511	120%	1.51%
Maryland	17	3125	54	367	995	214%	1.73%
North Carolina	17	2486	34	235	1020	144%	1.37%
Virginia	16	2407	52	395	740	225%	2.16%
Missouri	13	2310	33	446	836	176%	1.43%
Arizona	15	2187	52	250	773	183%	2.38%
Wisconsin	17	2030	54	18	1055	92%	2.66%
South Carolina	16	1917	40	217	660	190%	2.09%
Nevada	16	1742	46	228	626	178%	2.64%
Alabama	15	1614	44	119	694	133%	2.73%
Mississippi	15	1455	35	97	663	119%	2.41%
Utah	15	1435	8	180	602	138%	0.56%
Oklahoma	12	1161	42	171	377	208%	3.62%
Idaho	10	1022	10	131	234	337%	0.98%
Kentucky	14	917	40	147	393	133%	4.36%
District of Columbia	14	902	21	145	304	197%	2.33%
Oregon	16	899	22	0	479	88%	2.45%
Minnesota	16	865	24	77	441	96%	2.77%
Rhode Island	13	806	17	95	239	237%	2.11%
Iowa	13	787	14	88	298	164%	1.78%
Arkansas	15	743	14	39	409	82%	1.88%
Kansas	12	698	21	69	266	162%	3.01%
Delaware	12	593	14	143	214	177%	2.36%
New Hampshire	13	540	7	61	187	189%	1.30%
New Mexico	12	534	10	0	208	157%	1.87%
Vermont	11	461	20	72	211	118%	4.34%
Maine	13	456	10	24	211	116%	2.19%
Puerto Rico	8	452	18	136	100	352%	3.98%
Hawaii	9	351	3	32	149	136%	0.85%
Nebraska	7	321	6	42	96	234%	1.87%
West Virginia	7	282	2	45	96	194%	0.71%
Montana	9	265	6	22	129	105%	2.26%
South Dakota	6	212	2	25	68	212%	0.94%
Wyoming	5	187	0	25	82	128%	0.00%
North Dakota	6	186	3	13	94	98%	1.61%
Alaska	7	171	5	14	85	101%	2.92%
US	15	308557	8399	33252	121249	154%	2.72%

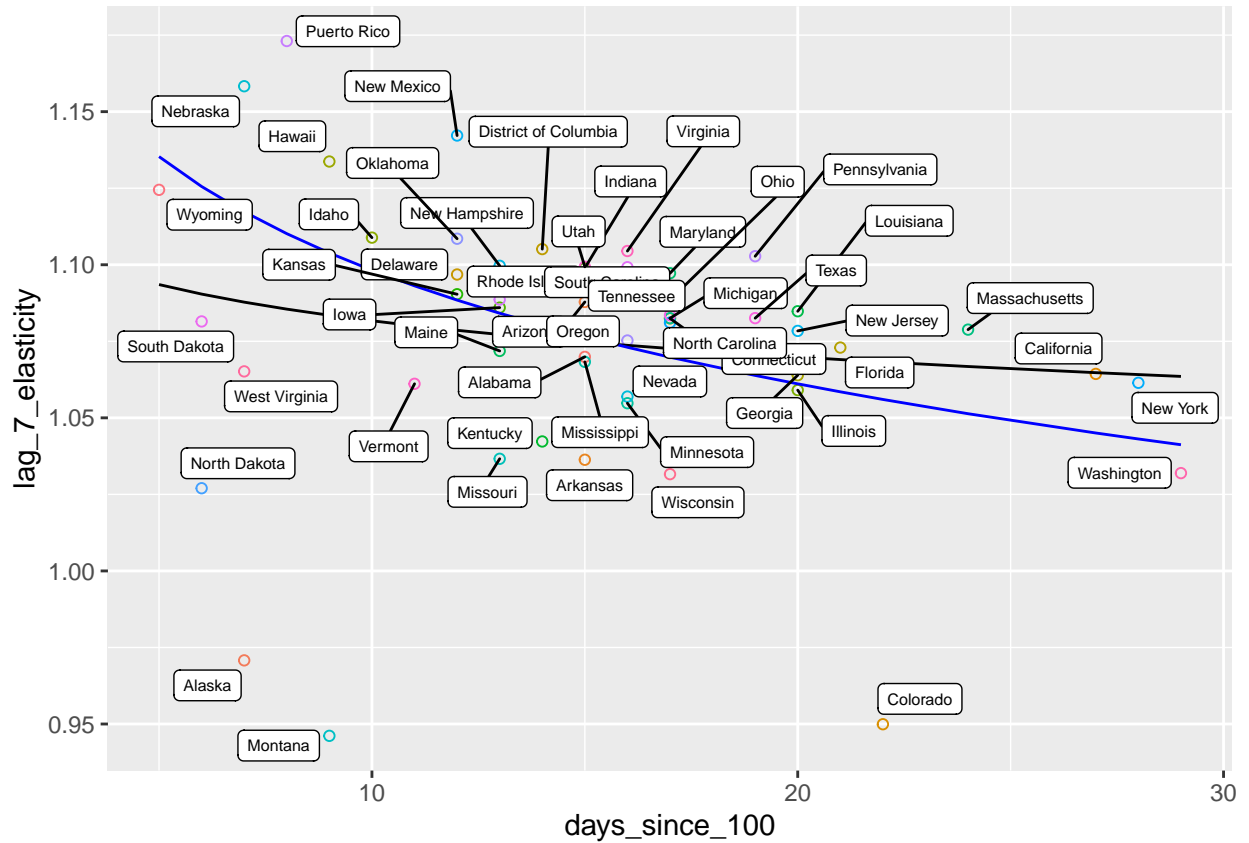
## Ln (Seven-Day-Moving-Average New Cases) Impact on Ln (New Cases)

In other words, elasticity. How does this elasticity change through time, from days since the 50th case?

An elasticity under 1 indicates that over a seven-day period, new cases are decreasing.

The black line is the best fit for elasticity for the states that have had 100 cases as they progress. Above the line: worse than average; below-the-line: better than average.

The blue line is the best fit for elasticity for countries across the world. It's apparent that the U.S. is not doing as well as the rest of the world in containing exponential growth—probably due to initial testing failures.



### Comparisons with U.S. and worldwide averages

Some states are doing better than worldwide averages when taking into account days since 100th case. Most are doing worse.

Table 7: States by Predicted vs. Actual Lag 7 New Case Elasticity on Today's Cases

state	days_since_100	lag_7_elasticity	prediction_us	prediction_ww	us_residual	ww_residual
Wyoming	5	1.12	1.09	1.14	0.03	-0.01
North Dakota	6	1.03	1.09	1.13	-0.06	-0.10
South Dakota	6	1.08	1.09	1.13	-0.01	-0.04
Alaska	7	0.97	1.09	1.12	-0.12	-0.15
West Virginia	7	1.07	1.09	1.12	-0.02	-0.05
Nebraska	7	1.16	1.09	1.12	0.07	0.04
Puerto Rico	8	1.17	1.09	1.11	0.09	0.06
Montana	9	0.95	1.08	1.10	-0.14	-0.16
Hawaii	9	1.13	1.08	1.10	0.05	0.03
Idaho	10	1.11	1.08	1.10	0.03	0.01
Vermont	11	1.06	1.08	1.09	-0.02	-0.03
Kansas	12	1.09	1.08	1.09	0.01	0.00
Delaware	12	1.10	1.08	1.09	0.02	0.01
Oklahoma	12	1.11	1.08	1.09	0.03	0.02
New Mexico	12	1.14	1.08	1.09	0.06	0.05
Missouri	13	1.04	1.08	1.08	-0.04	-0.05
Maine	13	1.07	1.08	1.08	-0.01	-0.01
Iowa	13	1.09	1.08	1.08	0.01	0.00

state	days_since_100	lag_7_elasticity	prediction_us	prediction_ww	us_residual	ww_residual
Rhode Island	13	1.09	1.08	1.08	0.01	0.00
New Hampshire	13	1.10	1.08	1.08	0.02	0.02
Kentucky	14	1.04	1.08	1.08	-0.03	-0.04
District of Columbia	14	1.11	1.08	1.08	0.03	0.02
Arkansas	15	1.04	1.07	1.08	-0.04	-0.04
Mississippi	15	1.07	1.07	1.08	-0.01	-0.01
Alabama	15	1.07	1.07	1.08	0.00	-0.01
Arizona	15	1.09	1.07	1.08	0.01	0.01
Indiana	15	1.10	1.07	1.08	0.02	0.02
Utah	15	1.10	1.07	1.08	0.02	0.02
Minnesota	16	1.05	1.07	1.07	-0.02	-0.02
Nevada	16	1.06	1.07	1.07	-0.02	-0.02
Oregon	16	1.08	1.07	1.07	0.00	0.00
South Carolina	16	1.10	1.07	1.07	0.03	0.03
Virginia	16	1.10	1.07	1.07	0.03	0.03
Wisconsin	17	1.03	1.07	1.07	-0.04	-0.04
North Carolina	17	1.08	1.07	1.07	0.01	0.01
Connecticut	17	1.08	1.07	1.07	0.01	0.01
Michigan	17	1.08	1.07	1.07	0.01	0.01
Tennessee	17	1.08	1.07	1.07	0.01	0.01
Ohio	17	1.09	1.07	1.07	0.02	0.02
Maryland	17	1.10	1.07	1.07	0.02	0.03
Texas	19	1.08	1.07	1.06	0.01	0.02
Pennsylvania	19	1.10	1.07	1.06	0.03	0.04
Illinois	20	1.06	1.07	1.06	-0.01	0.00
Georgia	20	1.06	1.07	1.06	-0.01	0.00
New Jersey	20	1.08	1.07	1.06	0.01	0.02
Louisiana	20	1.08	1.07	1.06	0.01	0.02
Florida	21	1.07	1.07	1.06	0.00	0.01
Colorado	22	0.95	1.07	1.06	-0.12	-0.11
Massachusetts	24	1.08	1.07	1.05	0.01	0.03
California	27	1.06	1.06	1.05	0.00	0.02
New York	28	1.06	1.06	1.04	0.00	0.02
Washington	29	1.03	1.06	1.04	-0.03	-0.01

## Forecast New Cases by State

We estimate new cases by date, to see when states will peak, based on the worldwide curve fit. The reasoning is that testing rates increasing wildly recently in the U.S. have falsely inflated elasticity.

Table 8: Forecast Peak New Cases by State

State	Peak Cases	Peak Deaths	Max Case Date	Max Death Date	Population
Arkansas	61	2	2020-03-25	2020-03-28	2,959,373
Nevada	294	12	2020-03-29	2020-04-01	2,790,136
Colorado	655	26	2020-03-31	2020-04-03	5,268,367
Georgia	1,121	45	2020-03-31	2020-04-03	9,992,167
Kentucky	149	6	2020-03-31	2020-04-03	4,395,295
Maine	73	3	2020-04-02	2020-04-05	1,328,302
Montana	33	1	2020-04-02	2020-04-05	1,015,165
Washington	781	31	2020-04-02	2020-04-05	6,971,406
Alabama	262	10	2020-04-03	2020-04-06	4,833,722

State	Peak Cases	Peak Deaths	Max Case Date	Max Death Date	Population
Wisconsin	264	11	2020-04-03	2020-04-06	5,742,713
Minnesota	77	3	2020-04-04	2020-04-07	5,420,380
Missouri	446	18	2020-04-04	2020-04-07	6,044,171
Vermont	72	3	2020-04-04	2020-04-07	626,630
New York	17,208	688	2020-04-17	2020-04-20	19,651,127
Mississippi	192	8	2020-04-20	2020-04-23	2,991,207
Illinois	1,808	72	2020-04-21	2020-04-24	12,882,135
New Jersey	10,443	418	2020-04-21	2020-04-24	8,899,339
Louisiana	5,881	235	2020-04-25	2020-04-28	4,625,470
Michigan	5,823	233	2020-04-28	2020-05-01	9,895,622
Connecticut	1,777	71	2020-04-29	2020-05-02	3,596,080
Oregon	101	4	2020-04-29	2020-05-02	3,930,065
Iowa	172	7	2020-04-30	2020-05-03	3,090,416
Massachusetts	4,910	196	2020-04-30	2020-05-03	6,692,824
Rhode Island	199	8	2020-05-01	2020-05-04	1,051,511
Florida	4,229	169	2020-05-02	2020-05-05	19,552,860
California	3,362	134	2020-05-03	2020-05-06	38,332,521
Delaware	192	8	2020-05-03	2020-05-06	925,749
Kansas	157	6	2020-05-03	2020-05-06	2,893,957
Idaho	579	23	2020-05-05	2020-05-08	1,612,136
North Carolina	737	29	2020-05-05	2020-05-08	9,848,060
Pennsylvania	19,828	793	2020-05-05	2020-05-08	12,773,801
Arizona	800	32	2020-05-06	2020-05-09	6,626,624
District of Columbia	456	18	2020-05-06	2020-05-09	646,449
Tennessee	902	36	2020-05-06	2020-05-09	6,495,978
Indiana	3,317	133	2020-05-09	2020-05-12	6,570,902
Texas	3,564	143	2020-05-09	2020-05-12	26,448,193
New Hampshire	194	8	2020-05-10	2020-05-13	1,323,459
Ohio	2,003	80	2020-05-10	2020-05-13	11,570,808
Maryland	2,845	114	2020-05-12	2020-05-15	5,928,814
Utah	787	31	2020-05-13	2020-05-16	2,900,872
Oklahoma	944	38	2020-05-14	2020-05-17	3,850,568
South Carolina	1,519	61	2020-05-15	2020-05-18	4,774,839
Virginia	3,796	152	2020-05-17	2020-05-20	8,260,405
Hawaii	363	15	2020-05-26	2020-05-29	1,404,054
New Mexico	2,767	111	2020-05-26	2020-05-29	2,085,287

Table 9: Forecast Total New Cases by State

State	Total Cases	Total Deaths	Population	% Population Infected
Arkansas	2,895	116	2,959,373	0.1%
Nevada	11,061	442	2,790,136	0.4%
Colorado	7,140	285	5,268,367	0.1%
Georgia	60,870	2,434	9,992,167	0.6%
Kentucky	4,373	175	4,395,295	0.1%
Maine	3,708	148	1,328,302	0.3%
Montana	630	25	1,015,165	0.1%
Washington	25,016	1,000	6,971,406	0.4%
Alabama	15,079	603	4,833,722	0.3%
Wisconsin	6,921	277	5,742,713	0.1%
Minnesota	4,738	189	5,420,380	0.1%



State	Total Cases	Total Deaths	Population	% Population Infected
Missouri	9,521	381	6,044,171	0.2%
Vermont	2,870	115	626,630	0.5%
New York	672,263	26,890	19,651,127	3.4%
Mississippi	11,777	471	2,991,207	0.4%
Illinois	89,616	3,584	12,882,135	0.7%
New Jersey	380,960	15,238	8,899,339	4.3%
Louisiana	221,474	8,859	4,625,470	4.8%
Michigan	254,763	10,190	9,895,622	2.6%
Connecticut	86,867	3,474	3,596,080	2.4%
Oregon	7,682	307	3,930,065	0.2%
Iowa	11,717	468	3,090,416	0.4%
Massachusetts	224,710	8,988	6,692,824	3.4%
Rhode Island	12,655	506	1,051,511	1.2%
Florida	222,428	8,897	19,552,860	1.1%
California	201,737	8,068	38,332,521	0.5%
Delaware	12,532	501	925,749	1.4%
Kansas	10,844	433	2,893,957	0.4%
Idaho	32,335	1,293	1,612,136	2.0%
North Carolina	46,962	1,878	9,848,060	0.5%
Pennsylvania	705,862	28,234	12,773,801	5.5%
Arizona	49,272	1,970	6,626,624	0.7%
District of Columbia	24,842	993	646,449	3.8%
Tennessee	56,199	2,247	6,495,978	0.9%
Indiana	165,557	6,622	6,570,902	2.5%
Texas	206,652	8,265	26,448,193	0.8%
New Hampshire	13,911	556	1,323,459	1.1%
Ohio	118,464	4,738	11,570,808	1.0%
Maryland	149,547	5,981	5,928,814	2.5%
Utah	48,995	1,959	2,900,872	1.7%
Oklahoma	57,444	2,297	3,850,568	1.5%
South Carolina	89,539	3,581	4,774,839	1.9%
Virginia	202,608	8,104	8,260,405	2.5%
Hawaii	25,642	1,025	1,404,054	1.8%
New Mexico	124,325	4,973	2,085,287	6.0%

## Forecast New Cases U.S. Total

U.S. Confirmed COVID19 Case Forecast as of 05 April 2020

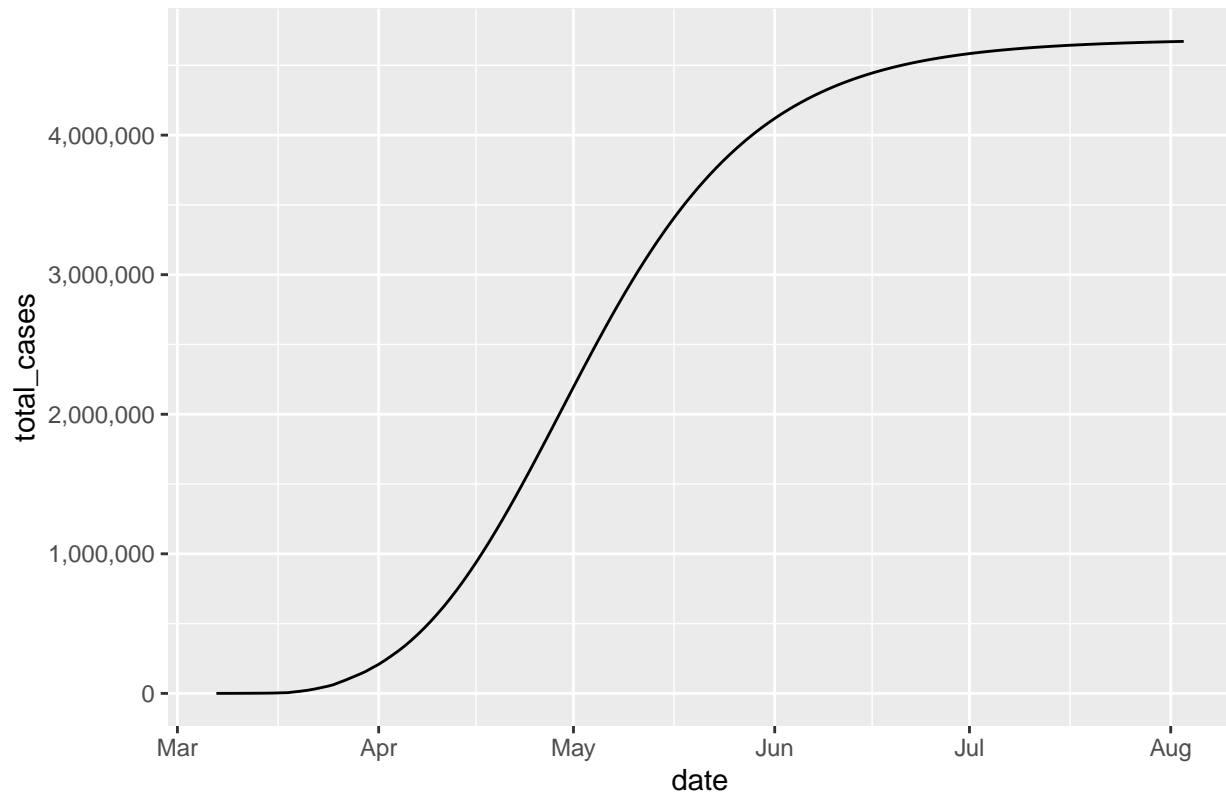


Table 10: Peak Daily New Cases in U.S. and Total on That Day

date	forecast_new	deaths_new	total_cases	total_deaths
2020-04-30	89,517	3548.4	2,105,060	73473.36

### U.S. New COVID19 Case Forecast as of 05 April 2020

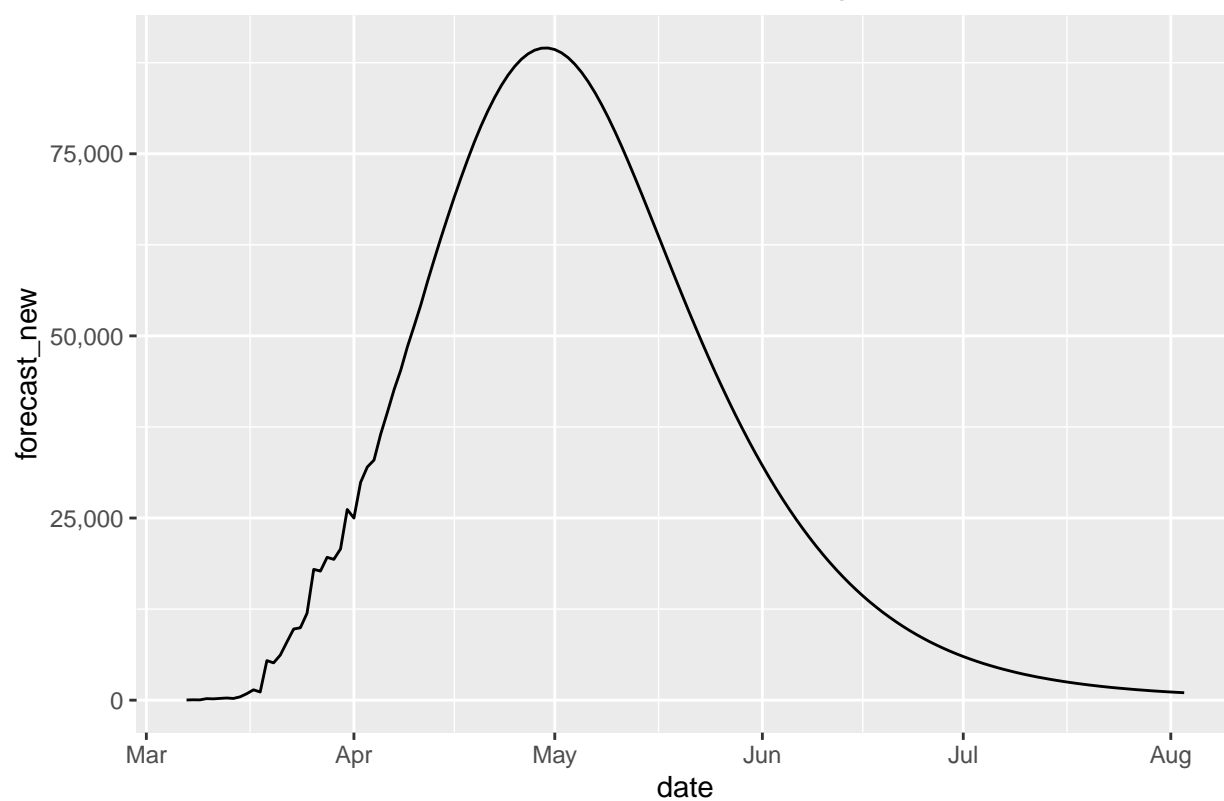
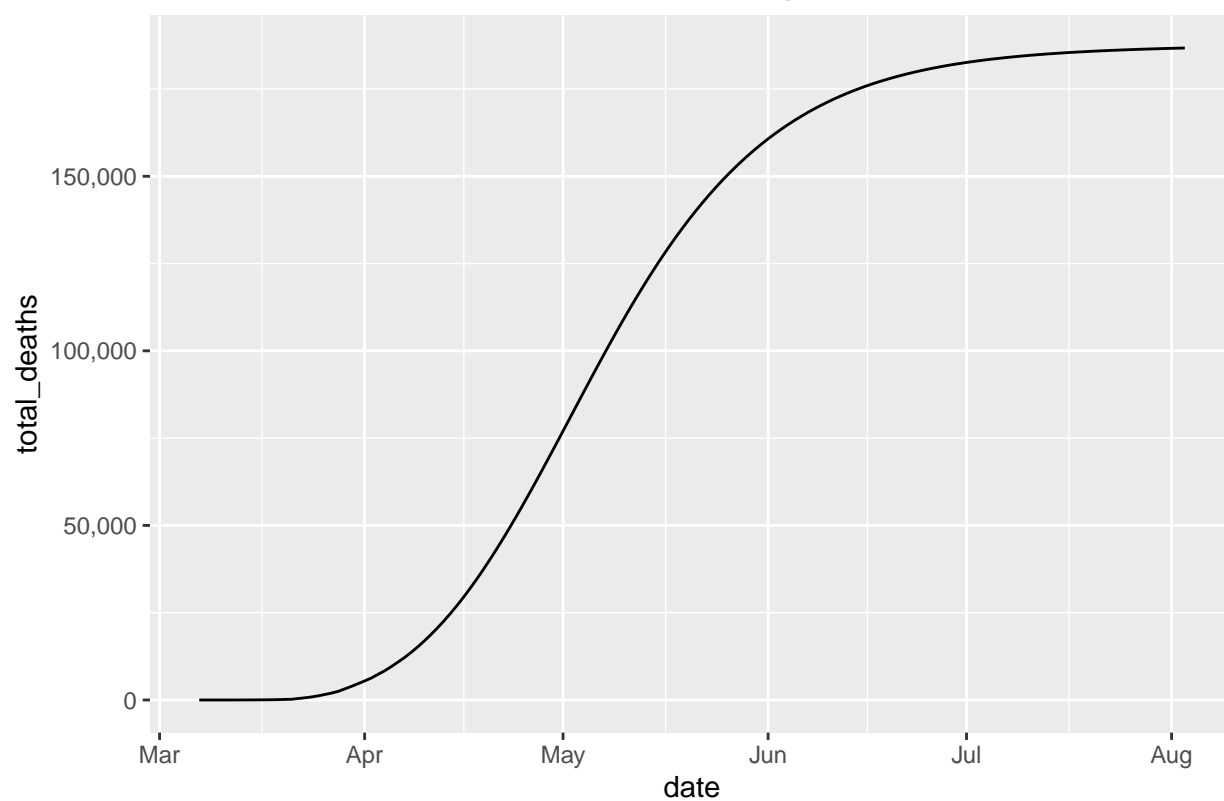


Table 11: Peak Daily Deaths in U.S. and Total on That Day

date	forecast_new	deaths_new	total_cases	total_deaths
2020-05-03	88189	3,581	2,371,420	84202.4

## U.S. COVID19 Death Forecast as of 05 April 2020



## Sparklines

We only look at states with more than one hundred cases today. For moving average growth rates, we only look at states with deaths and recoveries over 25.

## Confirmed Cases

### Confirmed COVID19 Cases Through 05 April 2020



## Deaths

### Cumulative COVID19 Deaths Through 05 April 2020



## Confirmed Growth Rate 5-Day Moving Average

Confirmed Growth Rate Through 05-1 April 2020



## Death Rate 5-Day Moving Average

Only states with >25 deaths are shown

## Death Rate Through 05-1 April 2020

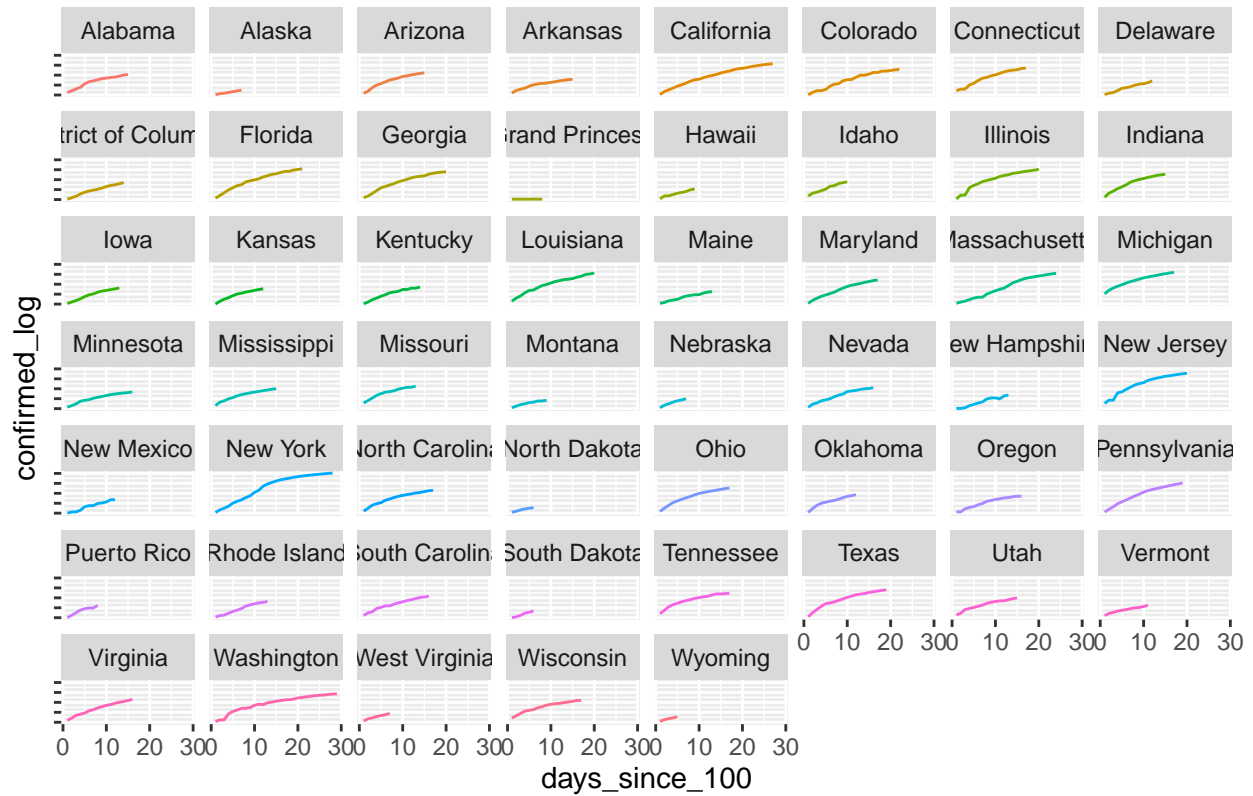




## Log / Time for States After 100th Case

### Log-10 by States: Confirmed Cases by Day After 50th Confirmed Case

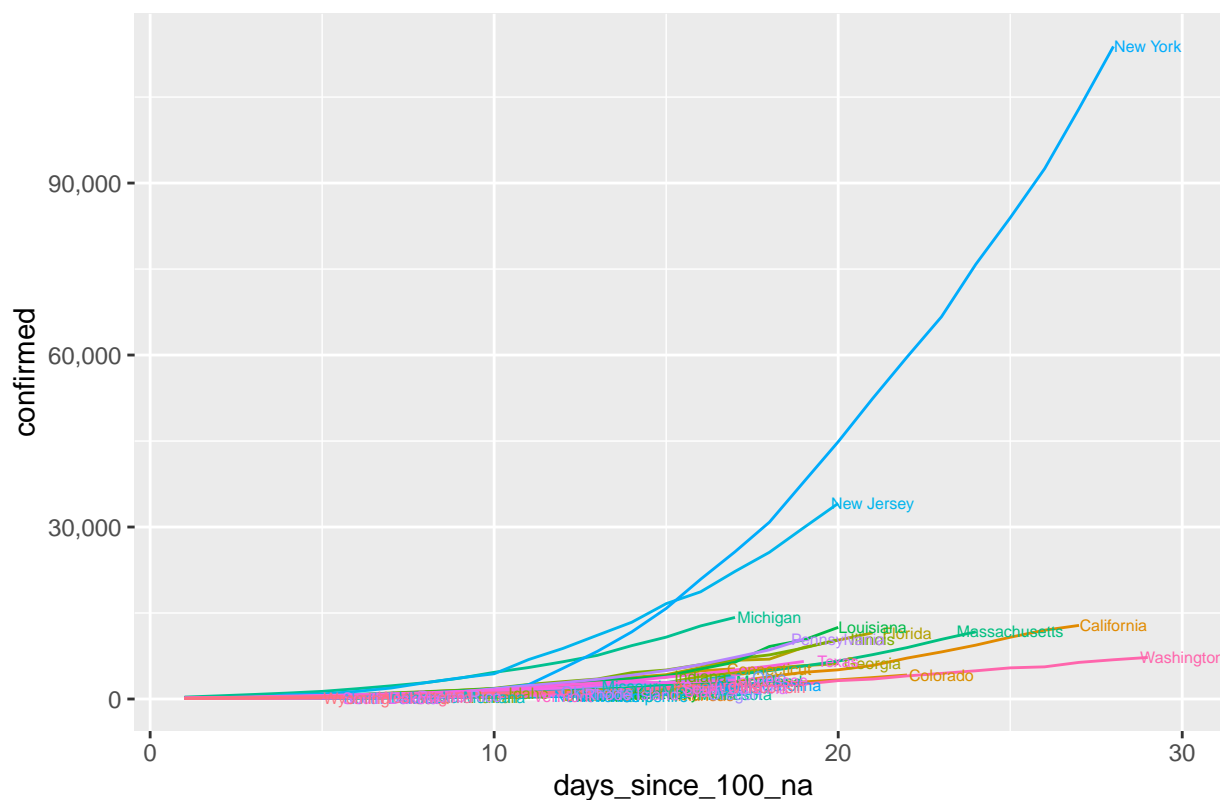
#### Log-10 of Confirmed Cases Since 100th Case by State as of 05 April 2020



## Zero at Fifty Cases

### Confirmed Cases

#### Confirmed COVID19 Cases by State Through 05 April 2020



## Testing Data

### State-by-State Testing Summary

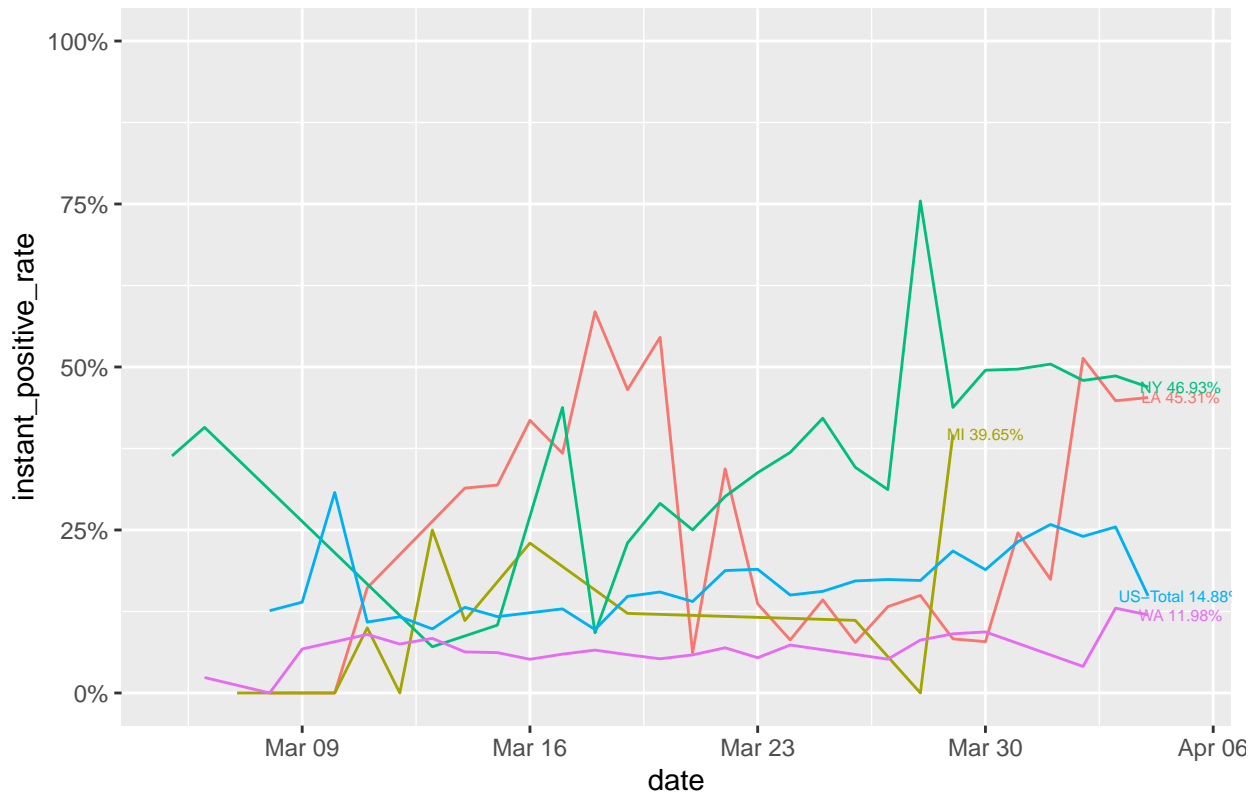
States are sorted descending by total tested. Cum Pos Rate is the cumulative positive rate since the pandemic began; instant positive rate is the current daily testing rate. Instant positive trend is instant positive rate / cumulative positive rate.

Table 12: State-by-State Testing Summary

State	Pos	Cum Tested	Cum Pos Rate	Pos Increase	Tested Increase	Instant Pos Rate	Instant Pos Trend
NY	113,704	283,621	40.1%	10,841	23,101	46.9%	17.1%
CA	12,026	113,700	10.6%	1,325	78,400	1.7%	-84.0%
FL	11,111	102,067	10.9%	1,526	10,345	14.8%	35.5%
WA	6,966	82,599	8.4%	381	3,181	12.0%	42.0%
NJ	34,124	75,356	45.3%	4,229	7,853	53.9%	18.9%
PA	10,017	70,030	14.3%	1,597	7,915	20.2%	41.1%
MA	11,736	68,800	17.1%	1,334	5,838	22.9%	34.0%
TX	6,110	63,751	9.6%	780	7,987	9.8%	1.9%
LA	12,496	58,498	21.4%	2,199	4,853	45.3%	112.1%
IL	10,357	53,581	19.3%	1,453	5,533	26.3%	35.9%
OH	3,739	41,871	8.9%	427	3,496	12.2%	36.8%
TN	3,321	41,391	8.0%	254	3,552	7.2%	-10.9%

State	Pos	Cum Tested	Cum Pos Rate	Pos Increase	Tested Increase	Instant Pos Rate	Instant Pos Trend
NC	2,402	38,773	6.2%	309	7,175	4.3%	-30.5%
UT	1,428	28,043	5.1%	182	3,795	4.8%	-5.8%
AZ	2,019	27,160	7.4%	250	2,487	10.1%	35.2%
GA	6,160	26,294	23.4%	329	1,029	32.0%	36.5%
MI	14,225	26,118	54.5%	1,481	1,481	100.0%	83.6%
WI	2,112	25,971	8.1%	200	1,682	11.9%	46.2%
MD	3,125	25,610	12.2%	367	1,920	19.1%	56.6%
MN	865	25,423	3.4%	76	1,196	6.4%	86.8%
MO	2,291	24,905	9.2%	178	3,435	5.2%	-43.7%
CO	4,173	22,071	18.9%	445	1,660	26.8%	41.8%
CT	5,276	22,029	24.0%	362	2,014	18.0%	-25.0%
VA	2,407	21,552	11.2%	395	2,547	15.5%	38.9%
IN	3,953	19,800	20.0%	516	1,965	26.3%	31.5%
SC	1,917	18,314	10.5%	363	11,319	3.2%	-69.4%
OR	899	17,434	5.2%	0	1,276	0.0%	-100.0%
NV	1,742	16,163	10.8%	228	1,631	14.0%	29.7%
NM	495	15,632	3.2%	92	854	10.8%	240.2%
KY	831	15,572	5.3%	61	2,768	2.2%	-58.7%
HI	319	12,278	2.6%	34	1,787	1.9%	-26.8%
AL	1,580	10,853	14.6%	148	1,234	12.0%	-17.6%
AR	743	10,370	7.2%	39	671	5.8%	-18.9%
IA	786	10,240	7.7%	87	787	11.1%	44.0%
ID	1,013	8,870	11.4%	122	925	13.2%	15.5%
WV	282	7,686	3.7%	45	1,319	3.4%	-7.0%
KS	698	7,578	9.2%	78	504	15.5%	68.0%
NH	540	7,505	7.2%	61	451	13.5%	88.0%
MS	1,455	6,588	22.1%	97	477	20.3%	-7.9%
ME	456	6,544	7.0%	24	24	100.0%	1 335.1%
DE	593	6,467	9.2%	143	1,022	14.0%	52.6%
DC	902	6,438	14.0%	145	854	17.0%	21.2%
RI	806	6,390	12.6%	95	1,267	7.5%	-40.6%
ND	186	6,207	3.0%	13	409	3.2%	6.1%
MT	265	6,177	4.3%	22	601	3.7%	-14.7%
AK	171	6,040	2.8%	14	24	58.3%	1 960.4%
VT	461	5,844	7.9%	72	616	11.7%	48.2%
NE	321	5,379	6.0%	42	613	6.9%	14.8%
SD	212	5,224	4.1%	25	444	5.6%	38.7%
WY	187	3,132	6.0%	25	266	9.4%	57.4%
OK	1,159	2,521	46.0%	171	218	78.4%	70.6%
PR	452	2,517	18.0%	74	90	82.2%	357.9%
GU	93	565	16.5%	9	22	40.9%	148.5%
VI	40	224	17.9%	2	32	6.2%	-65.0%
MP	8	21	38.1%	0	0	NaN%	NaN%
AS	NA	20	NA%	0	0	NaN%	NaN%

## U.S. and Selected State Instant Positive Test Rate as of 05 April 2020



## Hospitalization Summary

State-by-state hospitalization data are still VERY spotty as of April 5th. Most states are not reporting.

Table 13: State-by-State Hospitalization and ICU Data

State	Positive	Hospitalized	In ICU	Recovered	Dead	% Hospitalized	% ICU (of Hospitalized)	% Recovered
NY	113,704	15,905	4,126	10,478	3,565	14.0%	25.9%	9.2%
CA	12,026	2,300	1,008	NA	276	19.1%	43.8%	NA%
LA	12,496	1,726	NA	NA	409	13.8%	NA%	NA%
CT	5,276	1,033	NA	NA	165	19.6%	NA%	NA%
MO	2,291	413	NA	NA	24	18.0%	NA%	NA%
NC	2,402	271	NA	NA	24	11.3%	NA%	NA%
DE	593	95	NA	71	14	16.0%	NA%	12.0%
MN	865	95	42	440	24	11.0%	44.2%	50.9%
RI	806	93	31	35	17	11.5%	33.3%	4.3%
IA	786	85	NA	188	14	10.8%	NA%	23.9%
AR	743	72	NA	80	14	9.7%	NA%	10.8%
NM	543	41	NA	26	11	7.6%	NA%	4.8%
VT	461	29	NA	15	20	6.3%	NA%	3.3%
AK	171	NA	NA	NA	5	NA%	NA%	NA%
AL	1,633	NA	NA	NA	44	NA%	NA%	NA%
AZ	2,019	NA	NA	NA	52	NA%	NA%	NA%
CO	4,565	NA	NA	NA	126	NA%	NA%	NA%
DC	902	NA	NA	235	21	NA%	NA%	26.1%
FL	11,545	NA	NA	NA	195	NA%	NA%	NA%
GA	6,383	NA	NA	NA	208	NA%	NA%	NA%

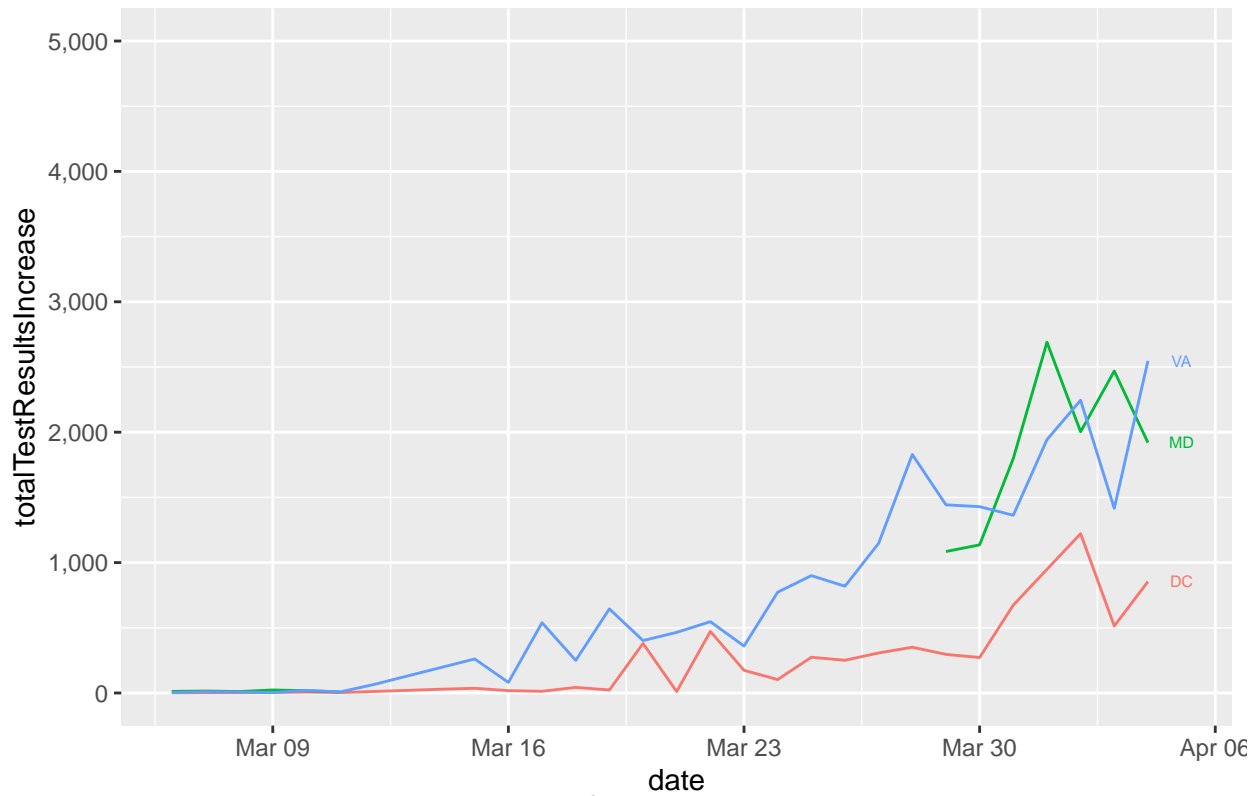
State	Positive	Hospitalized	In ICU	Recovered	Dead	% Hospitalized	% ICU (of Hospitalized)	% Recovered
HI	351	NA	NA	78	4	NA%	NA%	22.2%
ID	1,077	NA	NA	NA	10	NA%	NA%	NA%
IL	10,357	NA	NA	NA	243	NA%	NA%	NA%
IN	3,953	NA	NA	NA	116	NA%	NA%	NA%
KS	698	NA	NA	NA	21	NA%	NA%	NA%
KY	917	NA	NA	NA	40	NA%	NA%	NA%
MA	11,736	NA	NA	NA	216	NA%	NA%	NA%
MD	3,125	NA	NA	159	53	NA%	NA%	5.1%
ME	456	NA	NA	140	10	NA%	NA%	30.7%
MI	14,225	NA	NA	NA	540	NA%	NA%	NA%
MS	1,455	NA	NA	NA	35	NA%	NA%	NA%
MT	281	NA	NA	NA	6	NA%	NA%	NA%
ND	186	NA	NA	63	3	NA%	NA%	33.9%
NE	323	NA	NA	NA	8	NA%	NA%	NA%
NH	621	NA	NA	146	9	NA%	NA%	23.5%
NJ	34,124	NA	NA	NA	846	NA%	NA%	NA%
NV	1,742	NA	NA	NA	46	NA%	NA%	NA%
OH	3,739	NA	NA	NA	102	NA%	NA%	NA%
OK	1,159	NA	NA	NA	42	NA%	NA%	NA%
OR	999	NA	NA	NA	26	NA%	NA%	NA%
PA	10,017	NA	NA	NA	136	NA%	NA%	NA%
SC	1,917	NA	NA	NA	40	NA%	NA%	NA%
SD	212	NA	NA	76	2	NA%	NA%	35.8%
TN	3,321	NA	NA	416	43	NA%	NA%	12.5%
TX	6,110	NA	NA	38	105	NA%	NA%	0.6%
UT	1,428	NA	NA	NA	8	NA%	NA%	NA%
VA	2,407	NA	NA	NA	52	NA%	NA%	NA%
WA	7,591	NA	NA	NA	310	NA%	NA%	NA%
WI	2,112	NA	NA	NA	56	NA%	NA%	NA%
WV	282	NA	NA	NA	2	NA%	NA%	NA%
WY	187	NA	NA	49	0	NA%	NA%	26.2%
PR	452	NA	NA	NA	18	NA%	NA%	NA%
AS	NA	NA	NA	NA	0	NA%	NA%	NA%
GU	93	NA	NA	20	4	NA%	NA%	21.5%
MP	8	NA	NA	NA	1	NA%	NA%	NA%
VI	42	NA	NA	34	NA	NA%	NA%	81.0%

## Selected States Drill-Down

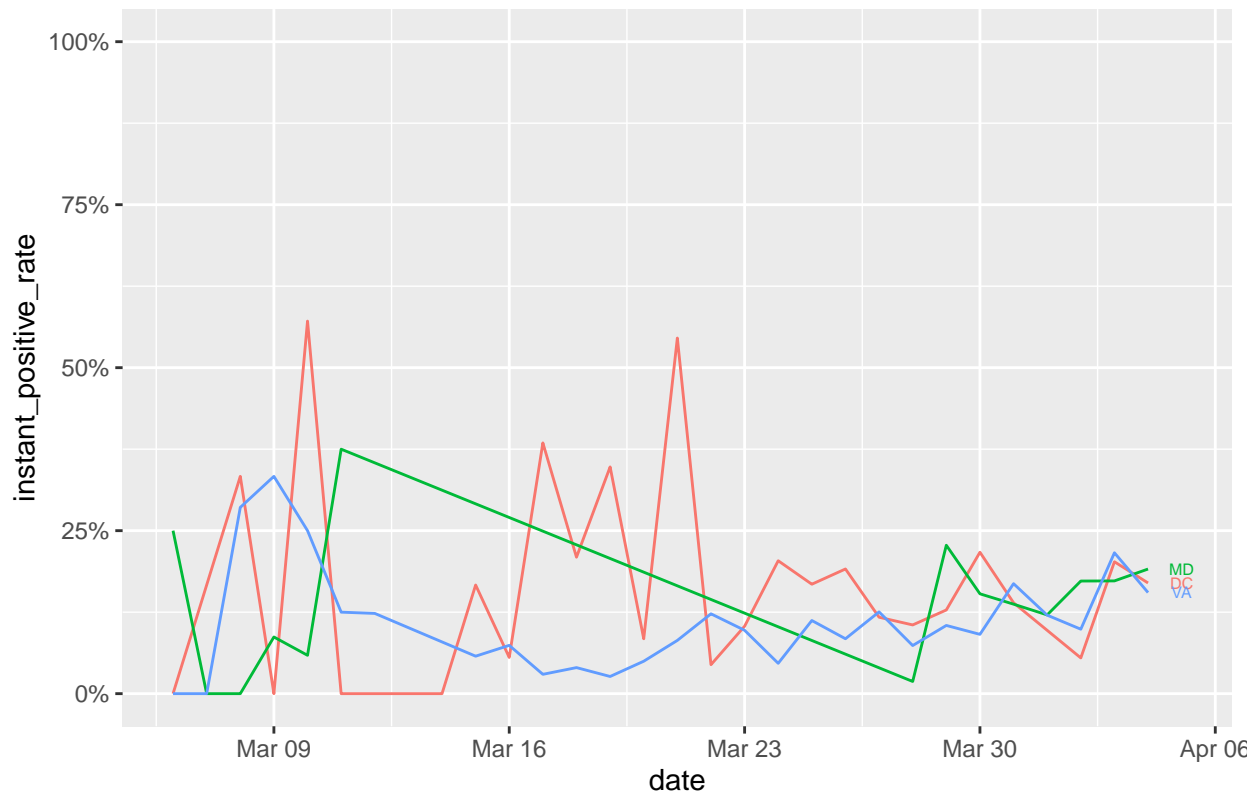
New York State has been the U.S. epicenter so far. New York is also testing much more than most states, but at the same time, its positive rate is very high (around 50% as of early March), indicating that people being tested are high-likelihood cases; as such it should be assumed that there remain a very large population of untested positive patients.

The DMV (D.C., Maryland, Virginia) might be a coming hotspot. Watching instant positive test rates will be a key leading indicator of hospitalizations and ICU beds in the coming week.

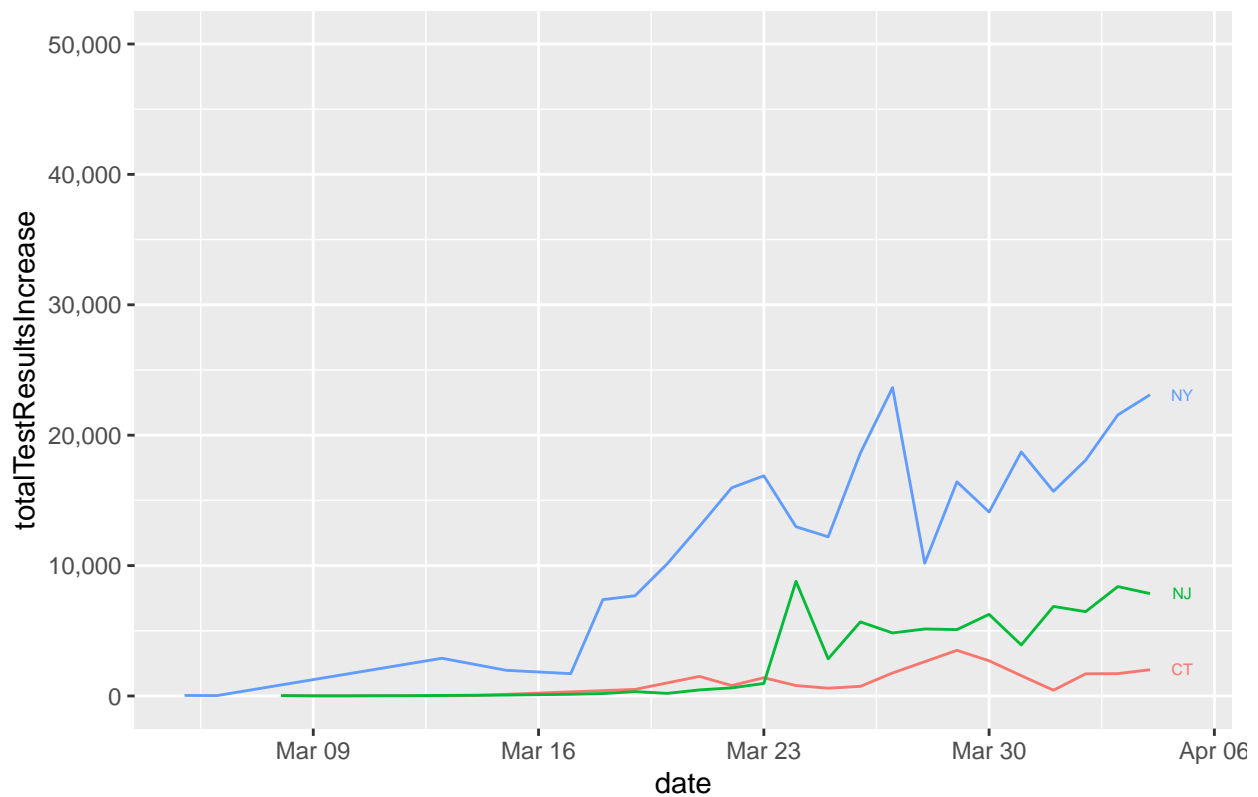
New Tests as of 05 April 2020, DMV Area



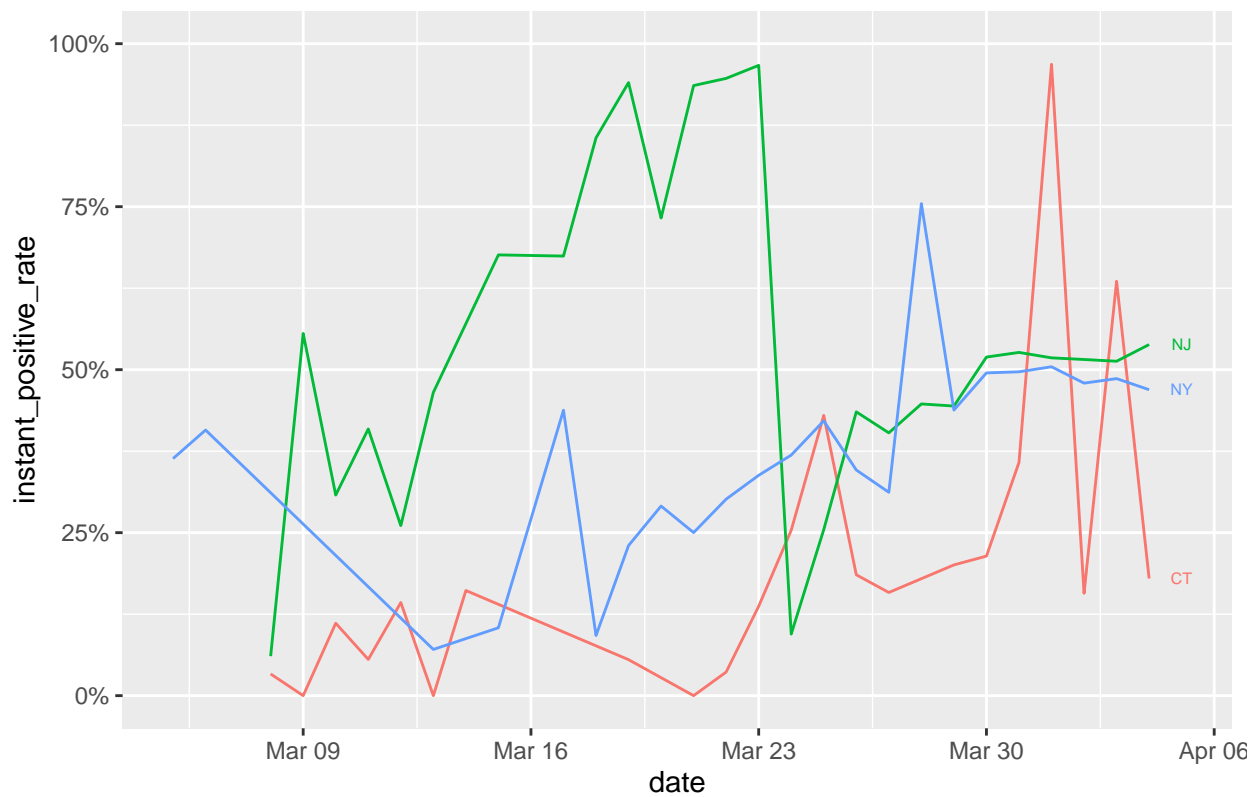
Instant Positive Test Rate as of 05 April 2020, DMV Area



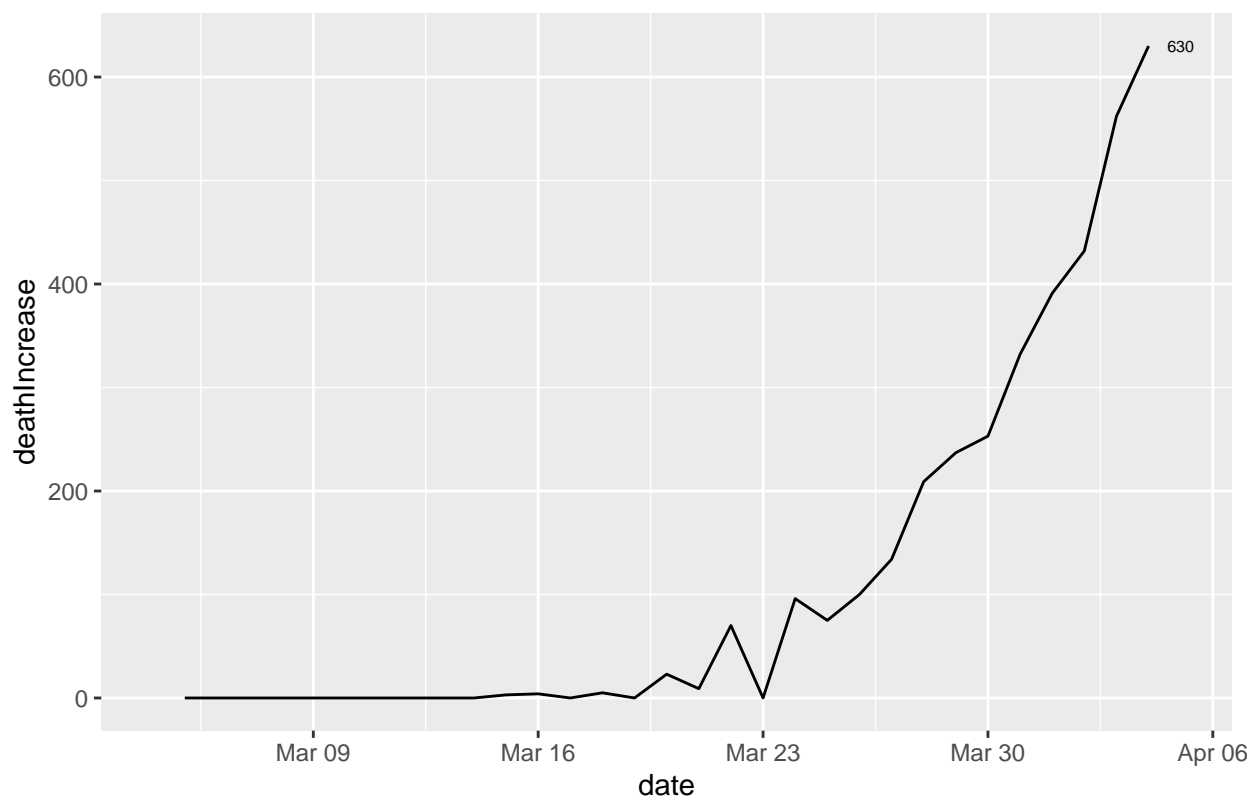
New Tests as of 05 April 2020, NYC Area



Instant Positive Test Rate as of 05 April 2020, NYC Area



New Deaths as of 05 April 2020, NY



In ICU as of 05 April 2020, NY

