

Analysis of the IHME COVID 19 Forecasting Model – June 9th Update

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Outline

- ❖ IHME revisions since June 2nd
- ❖ A look at Kansas and United States mortality statistics
- ❖ Fairly major changes over the last month in predictions
- ❖ Relaxing social distancing by State
- ❖ Distribution of daily deaths compared to the March 26th model
- ❖ Cumulative deaths compared to the March 26th model



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Introduction

- The COVID 19 virus is having a major effect on the economy with an unemployment rate of 13%
- Since the middle of March, more than 40 million U.S. workers filed for unemployment due to the shut down a significant share of the economy
- The Institute for Health Metrics and Evaluation (IHME) at the University of Washington is playing a large role in the formation of policy
 - The data used in this analysis is sourced from <http://www.healthdata.org/covid>
- It is important to document and understand the ex-post performance of the model and the periodic revisions that are made in the predictive model
- This is an update of the June 2nd discussion



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Changes in the May 29th IHME Modeling Approach

- Revised the death model
- Use a spline function to log cumulative deaths versus log cumulative cases
- Death predictions made based on cases over time
- Unsmoothed daily deaths and the predicted daily deaths used to fit a spline
- Sample standard deviation developed using 1,000 drawn from the residuals
- Argued to be more robust for locations with smaller epidemics
- Updated data is the major change in the last week
- Paper is still in the peer review process



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Kansas COVID Deaths by Age Group

Age Group	Number of Deaths	Percent of COVID Deaths	2018 Mortality Rates
25-34	1	0.4%	1.8%
35-44 years	6	2.5%	2.5%
45-54 years	13	5.5%	4.8%
55-64 years	33	14.0%	12.8%
65-74 years	44	18.6%	18.2%
75-84 years	49	20.8%	23.4%
85+ years	90	38.1%	34.2%
Total	236	100%	97.6%

<https://www.coronavirus.kdheks.gov/160/COVID-19-in-Kansas>, June 9, 2020

https://www.kdheks.gov/phi/AS_Tables/AS_2018_Tables_and_Figures/general_mortality/Table_E4.pdf, June 9, 2020



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U.S. COVID Deaths by Age Group

Age Group	Number of Deaths	Percent of COVID Deaths	2017 Mortality Rates
15-24 years	93	0.1%	0.2%
25-34 years	542	0.7%	1.1%
35-44 years	1,403	1.7%	2.1%
45-54 years	3,893	4.8%	6.0%
55-64 years	9,776	12.0%	13.2%
65-74 years	16,981	20.8%	18.9%
75-84 years	21,822	26.8%	23.4%
85+ years	26,843	33.1%	31.2%
Total	81,372	99.98%	98.87%

<https://data.cdc.gov/NCHS/Provisional-COVID-19-Death-Counts-by-Sex-Age-and-S/9bhg-hcku>, June 9, 2020



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Kansas COVID and General Mortality by Age Group

Age Group	COVID Deaths	COVID Deaths per 1000	2018 Mortality Rate per 1000
Under 1 year	0	0.00	6.3
1-24 years	0	0.00	1.2
25-34 years	1	0.00	1.3
35-44 years	6	0.02	1.9
45-54 years	13	0.04	3.9
55-64 years	33	0.09	9.3
65-74 years	44	0.17	18.9
75-84 years	49	0.37	47.5
85+ years	90	1.37	142.1

<https://www.coronavirus.kdheks.gov/160/COVID-19-in-Kansas>, June 9, 2020

https://www.kdheks.gov/phi/AS_Tables/AS_2018_Tables_and_Figures/general_mortality/, June 9, 2020



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U.S. COVID and General Mortality by Age Group

Age Group	COVID Deaths	COVID Deaths per 1000	2018 Mortality Rate per 1000
Under 1 year	5	0.00	5.67
1-14 years	15	0.00	0.17
15-24 years	106	0.00	0.74
25-34 years	583	0.01	1.33
35-44 years	1,524	0.04	1.95
45-54 years	4,238	0.10	4.02
55-64 years	10,586	0.25	8.86
65-74 years	18,360	0.62	17.91
75-84 years	23,612	1.61	44.73
85+ years	29,214	4.52	135.74

<https://data.cdc.gov/NCHS/Provisional-COVID-19-Death-Counts-by-Sex-Age-and-S/9bhg-hcku>, June 9, 2020

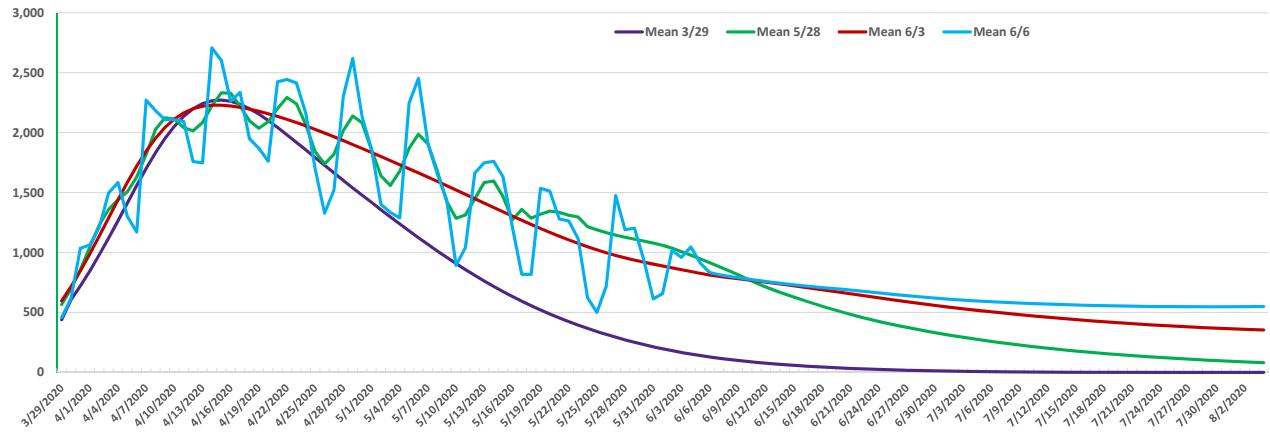


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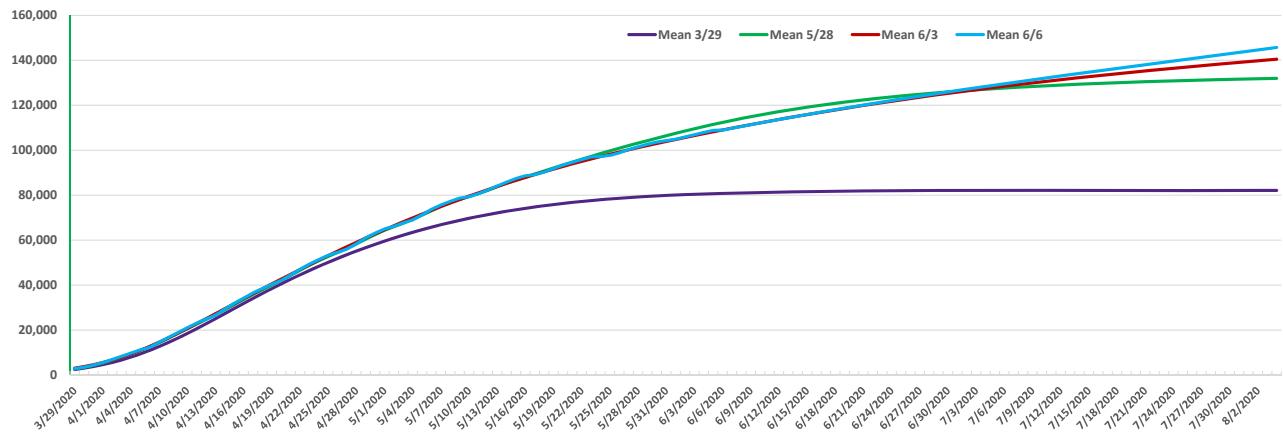
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U.S. COVID 19 Daily Death Projections Revised Forecasts



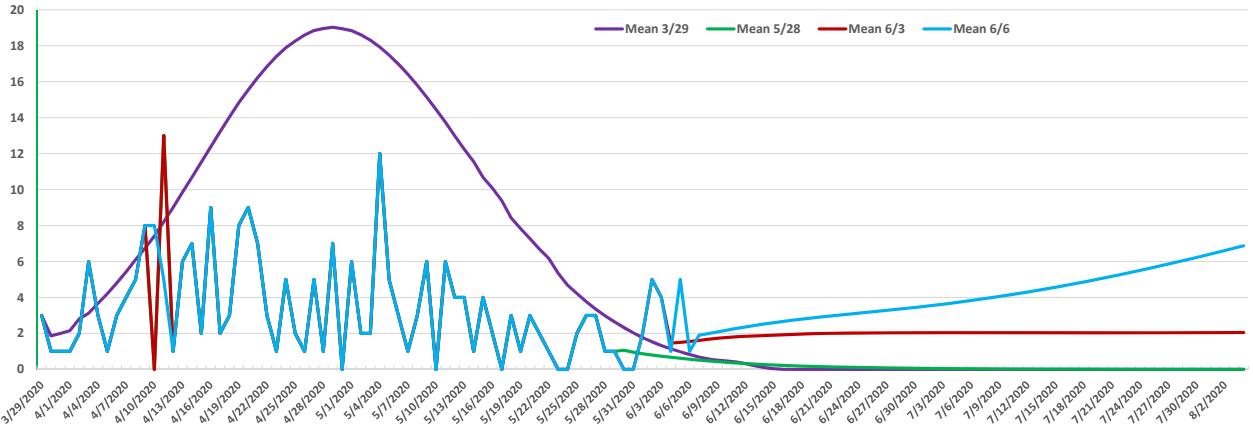
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U.S. COVID 19 Cumulative Death Projections Revised Forecasts



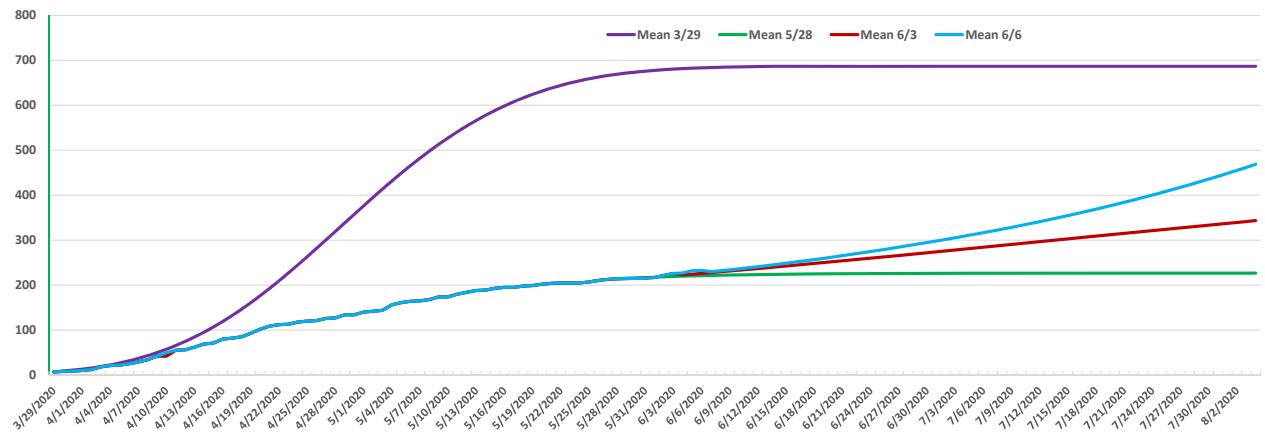
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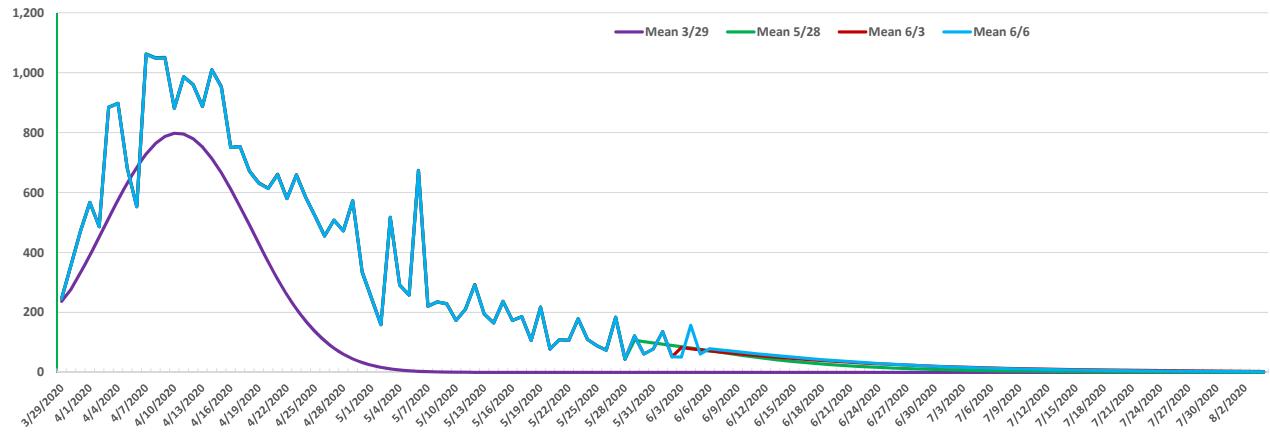
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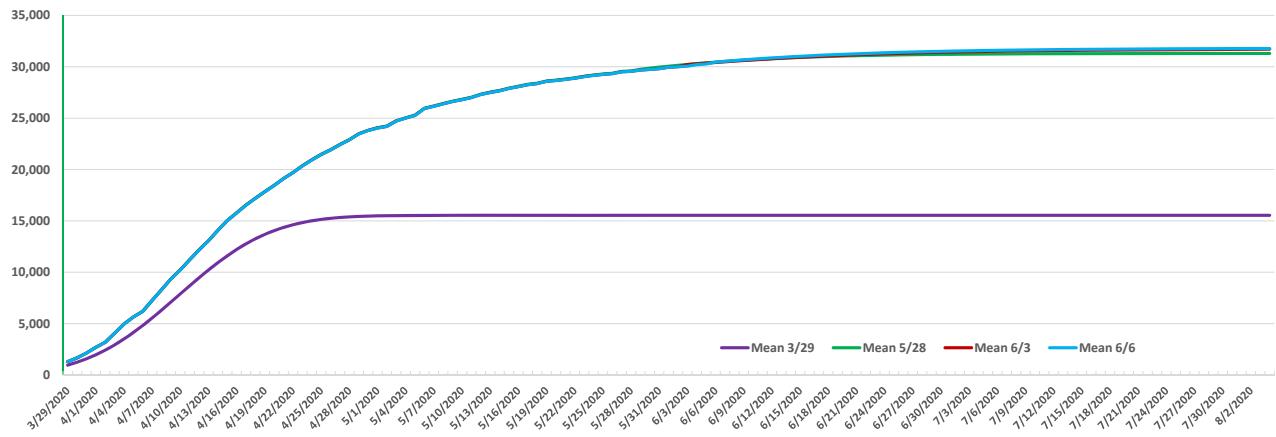
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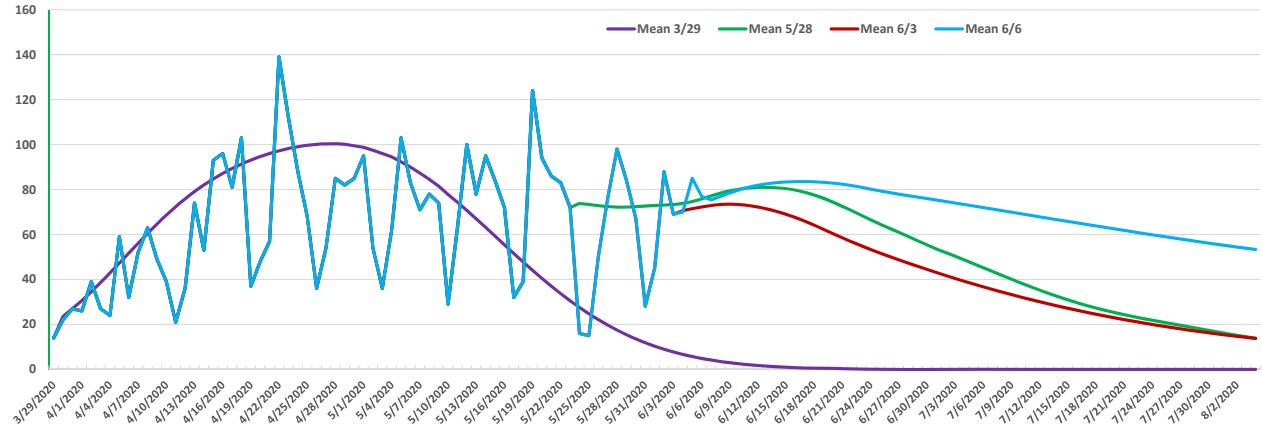
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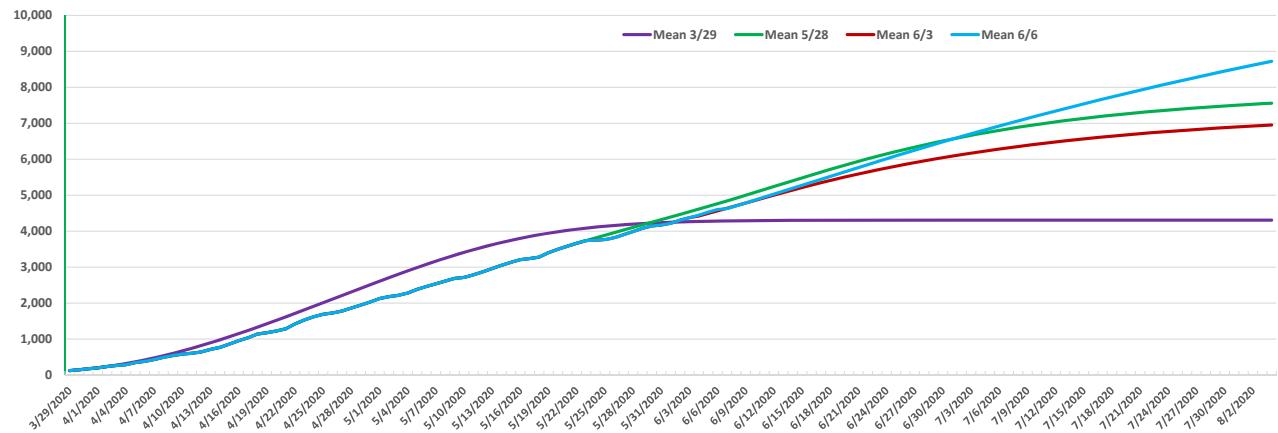
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California COVID 19 Daily Death Projections Revised Forecasts



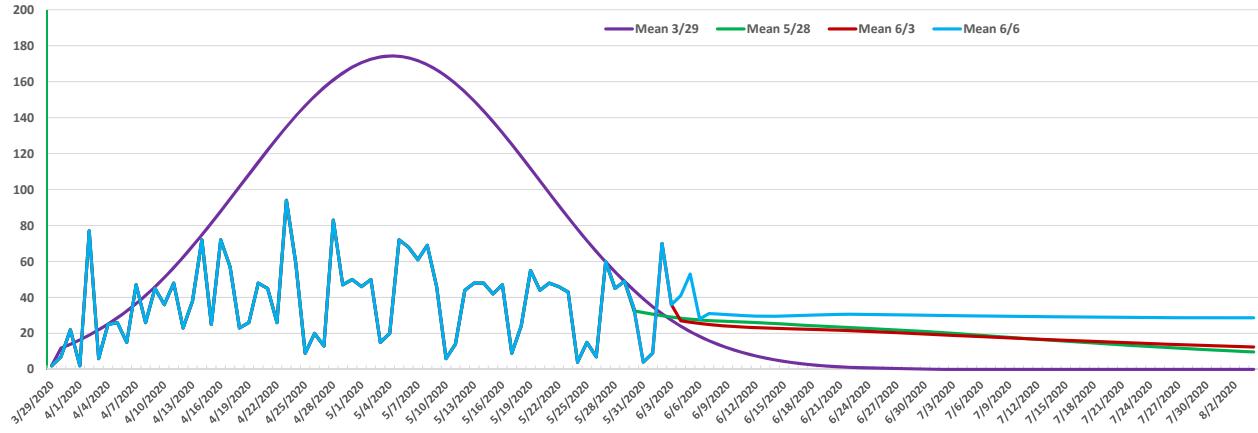
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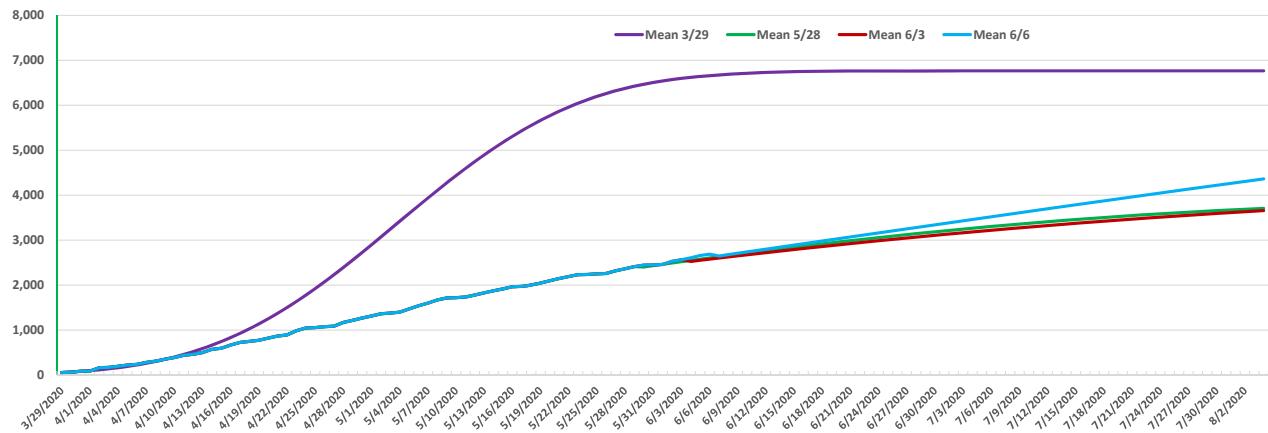
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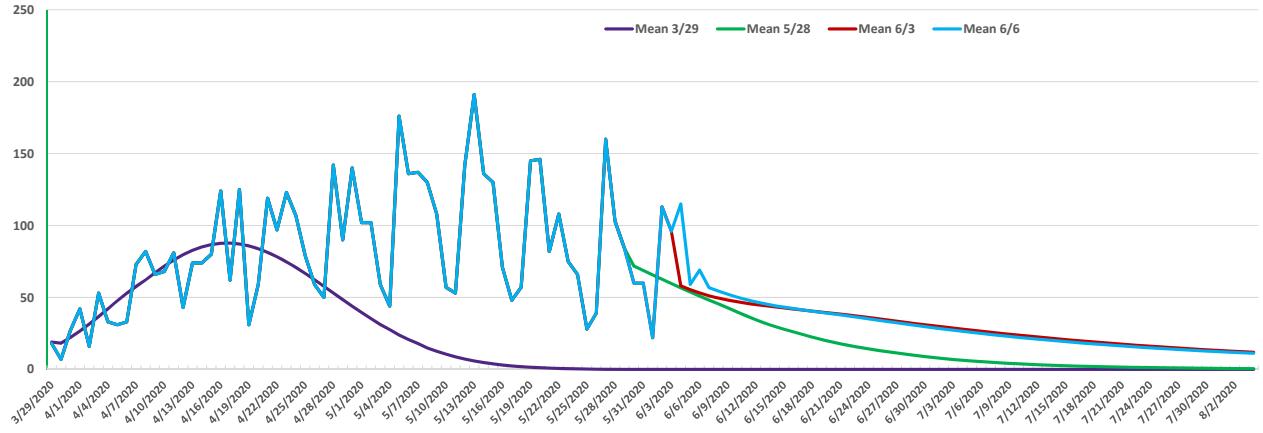
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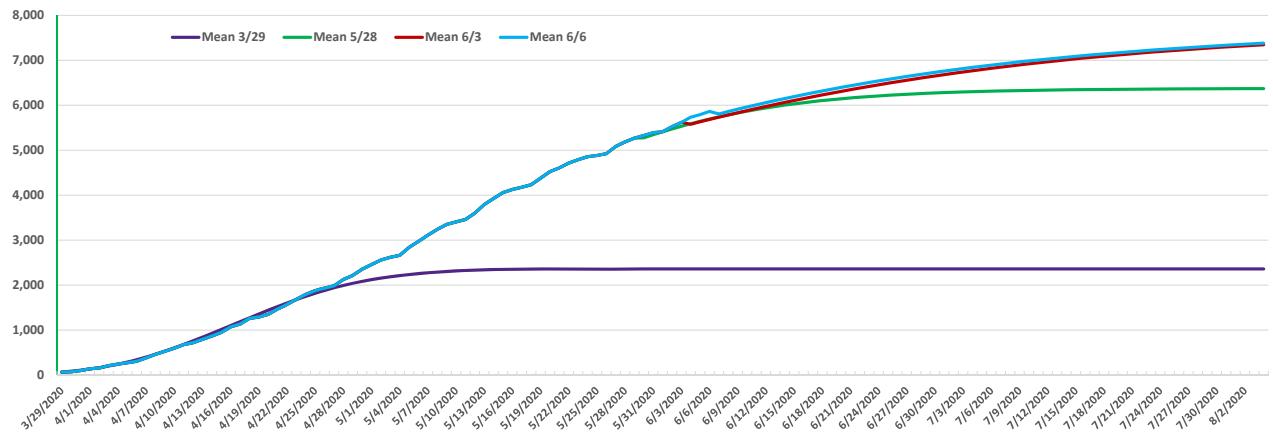
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Illinois COVID 19 Daily Death Projections Revised Forecasts



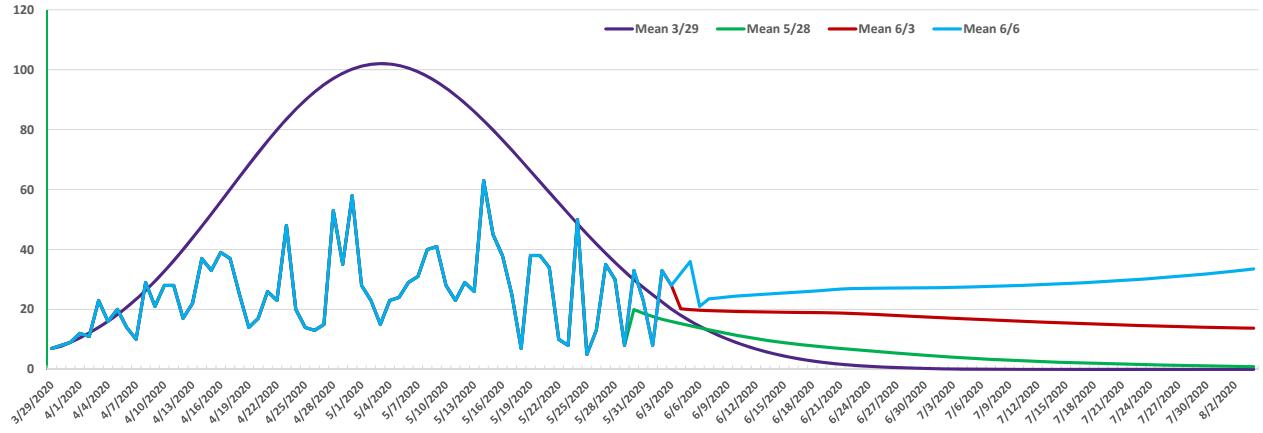
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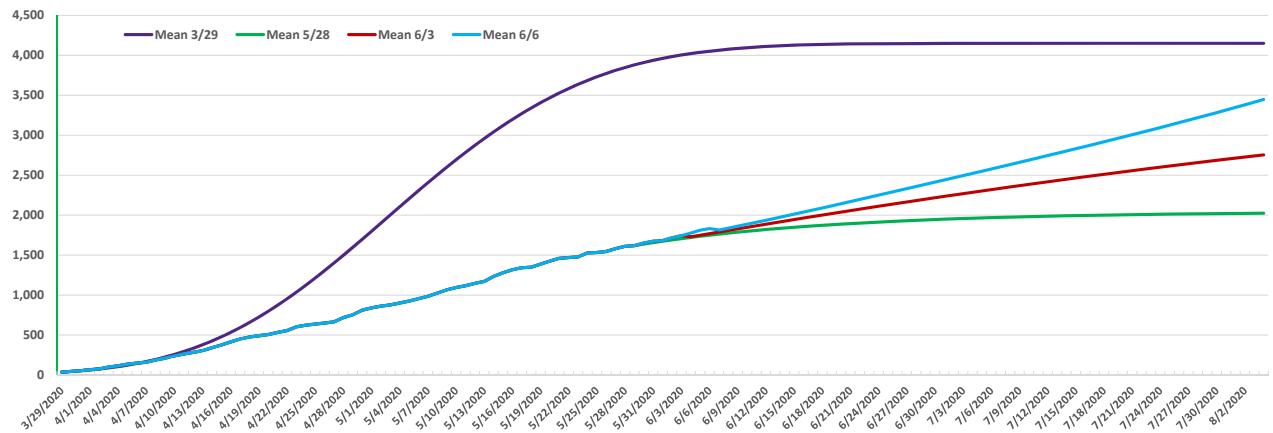
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Texas COVID 19 Daily Death Projections Revised Forecasts



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Texas COVID 19 Cumulative Death Projections Revised Forecasts



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Relaxing of Social Distancing by State

	Stay at Home	Business Closure	Gathering Restrictions		Stay at Home	Business Closure	Gathering Restrictions
Alabama	April 30	June 15		Hawaii			
Alaska	April 24	May 22	May 22	Idaho	May 1		May 1
Arizona	May 16	May 16	May 16	Illinois			
Arkansas	n/a			Indiana	May 18		
California				Iowa	n/a		
Colorado	May 9			Kansas	May 4		
Connecticut	n/a			Kentucky	n/a		
Delaware	June 1			Louisiana	May 15		May 15
Florida	May 18		June 5	Maine	May 31		
Georgia	May 1			Maryland			



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Relaxing of Social Distancing by State

	Stay at Home	Business Closure	Gathering Restrictions		Stay at Home	Business Closure	Gathering Restrictions
Massachusetts	n/a			New Mexico	n/a		
Michigan	June 1			New York			
Minnesota	May 18			North Carolina	May 8		
Mississippi	April 27			North Dakota	n/a		n/a
Missouri	May 15			Ohio	May 20		
Montana	April 26	June 1	June 1	Oklahoma	n/a	June 1	May 24
Nebraska	n/a			Oregon			
Nevada	May 9			Pennsylvania	June 5		
New Hampshire				Rhode Island	May 9		
New Jersey				South Carolina	May 4	May 31	



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Relaxing of Social Distancing by State

	Stay at Home	Business Closure	Gathering Restrictions		Stay at Home	Business Closure	Gathering Restrictions
South Dakota	n/a	n/a	April 28	Virginia			
Tennessee	April 29			Washington			
Texas	May 1			West Virginia	May 4		
Utah	n/a			Wisconsin	May 13		
Vermont	May 15			Wyoming	n/a	May 15	

Source: <https://covid19.healthdata.org/united-states-of-america/> individual State



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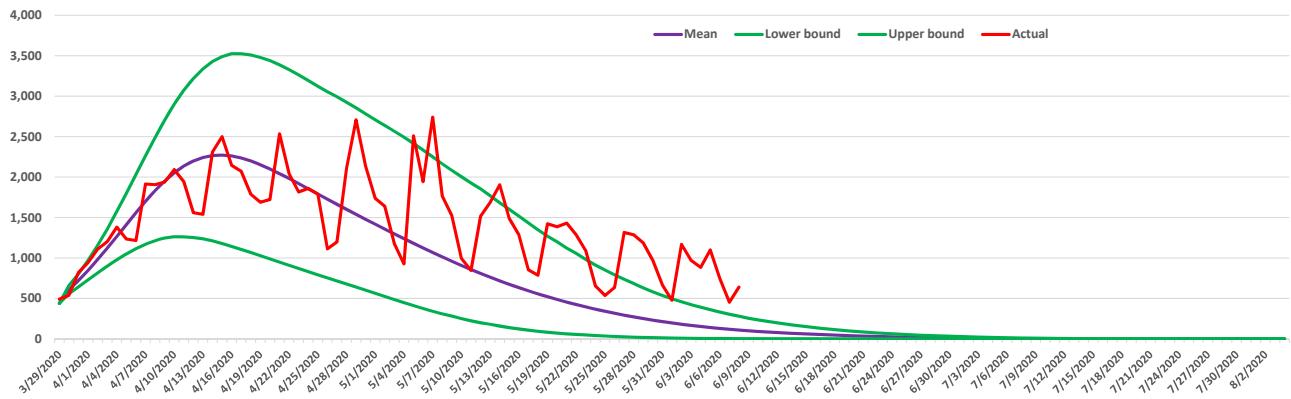
Social Distancing Summary

- ❖ 10 States have stay at home orders
 - ❖ California, Hawaii, Illinois, Maryland, New Hampshire, New Jersey, New York, Oregon, Virginia, Washington
- ❖ 5 States have relaxed all restrictions excluding education
 - ❖ Alaska, Arizona, Montana, Oklahoma, South Dakota



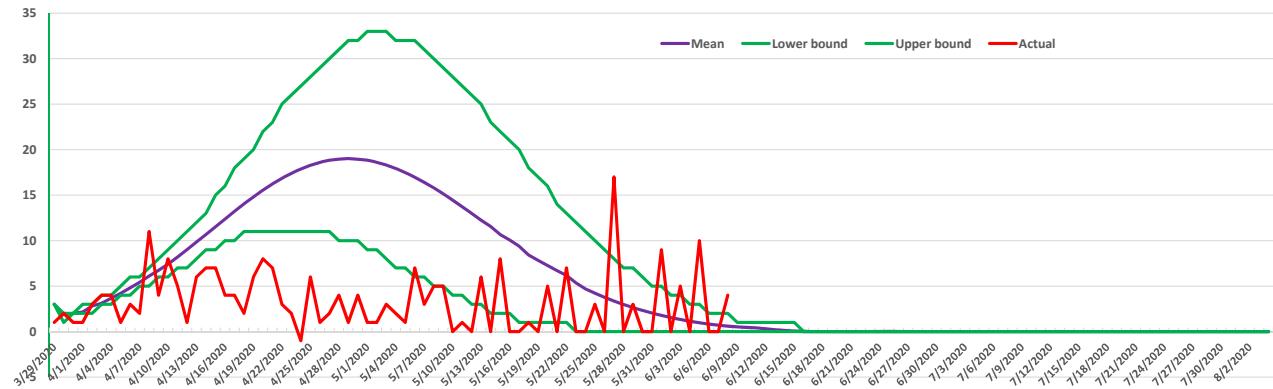
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U.S. COVID 19 Daily Death Projections March 26



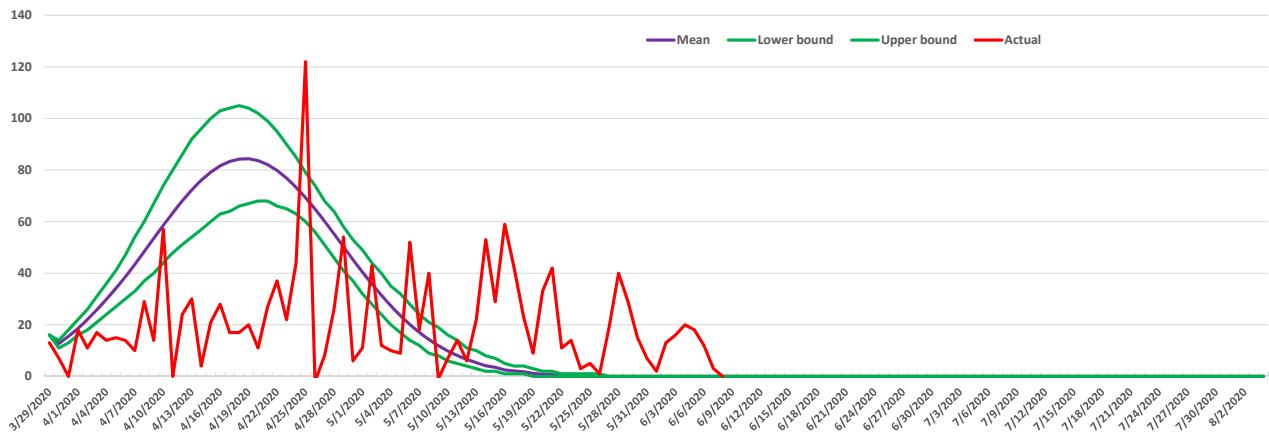
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Kansas COVID 19 Daily Death Projections March 26



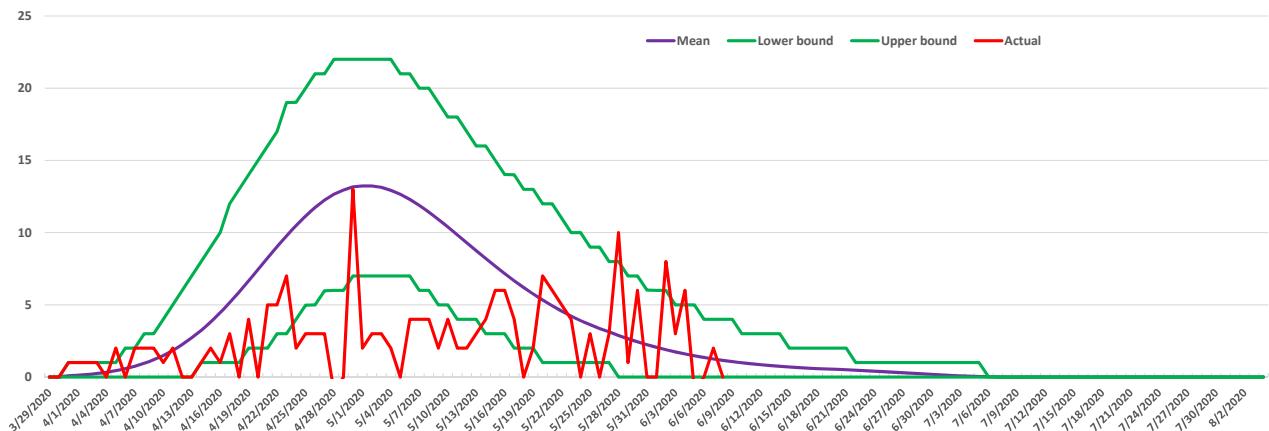
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Colorado COVID 19 Daily Death Projections March 26



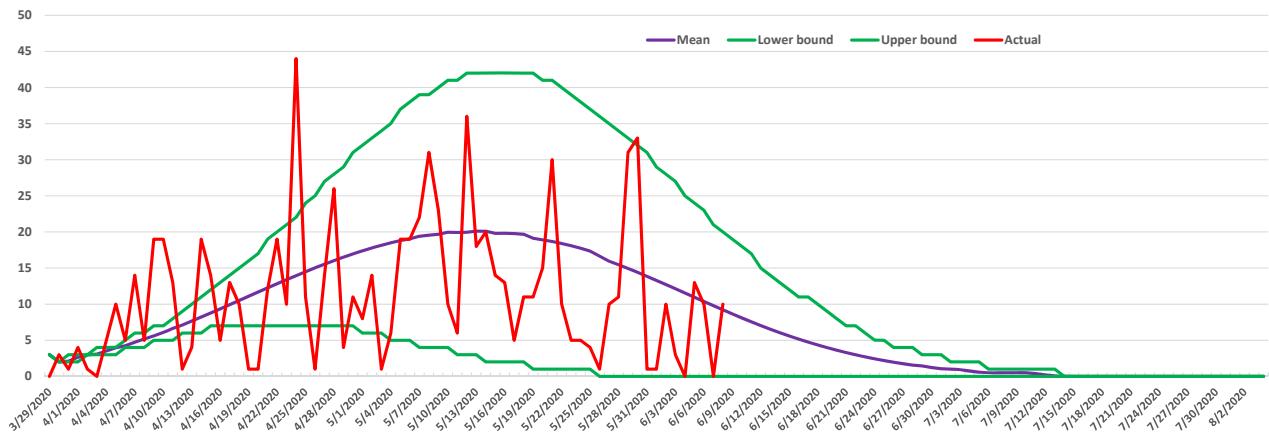
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Nebraska COVID 19 Daily Death Projections March 26



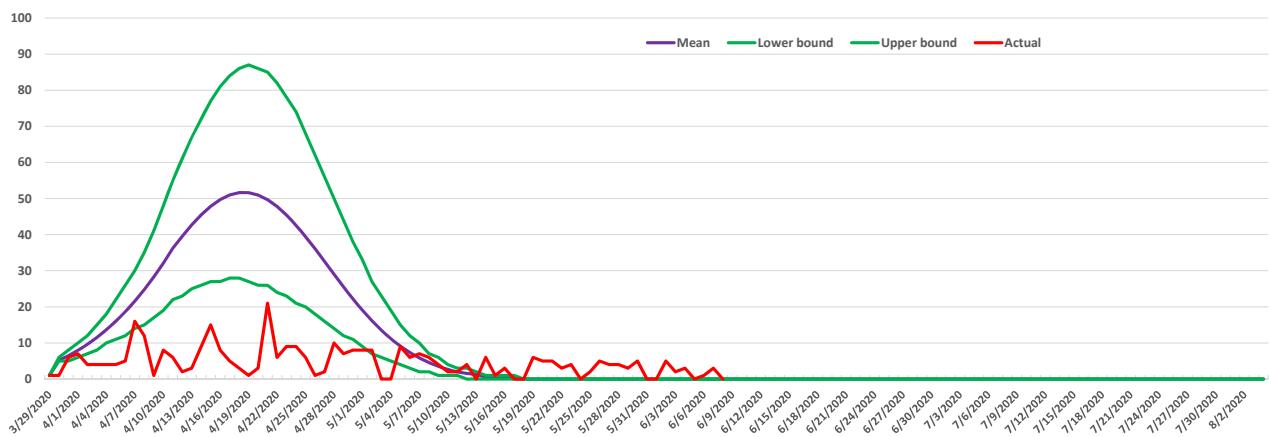
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Missouri COVID 19 Daily Death Projections March 26



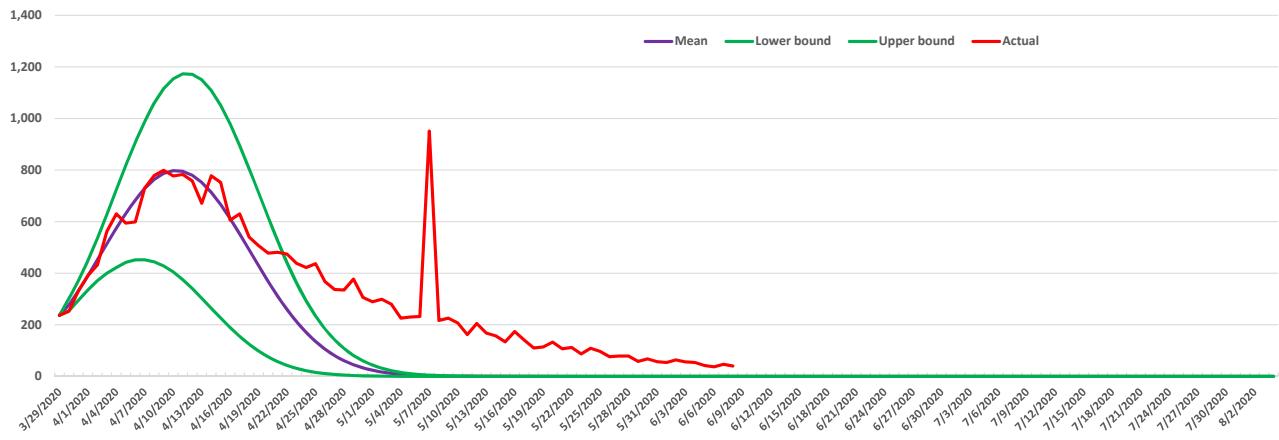
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Oklahoma COVID 19 Daily Death Projections March 26



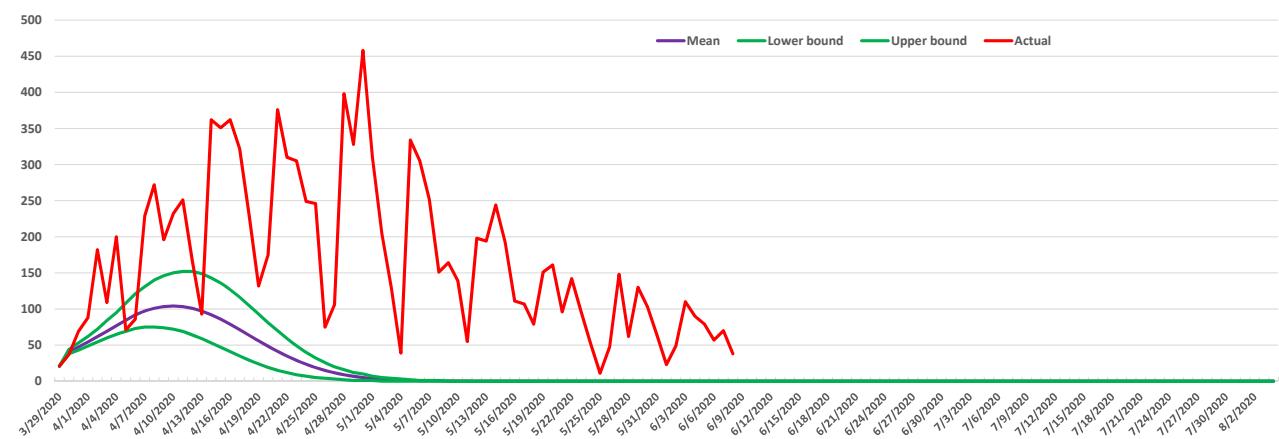
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New York COVID 19 Daily Death Projections March 26



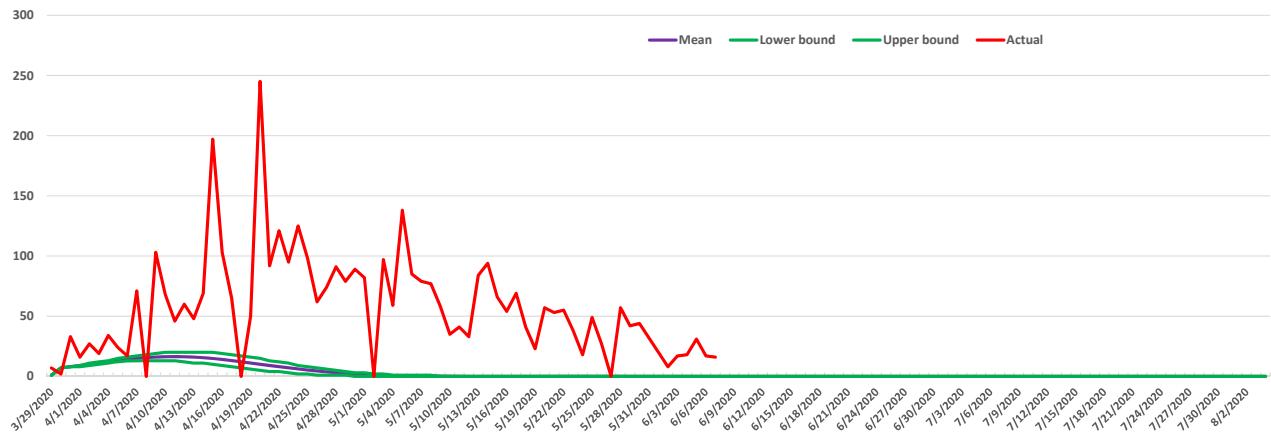
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New Jersey COVID 19 Daily Death Projections March 26



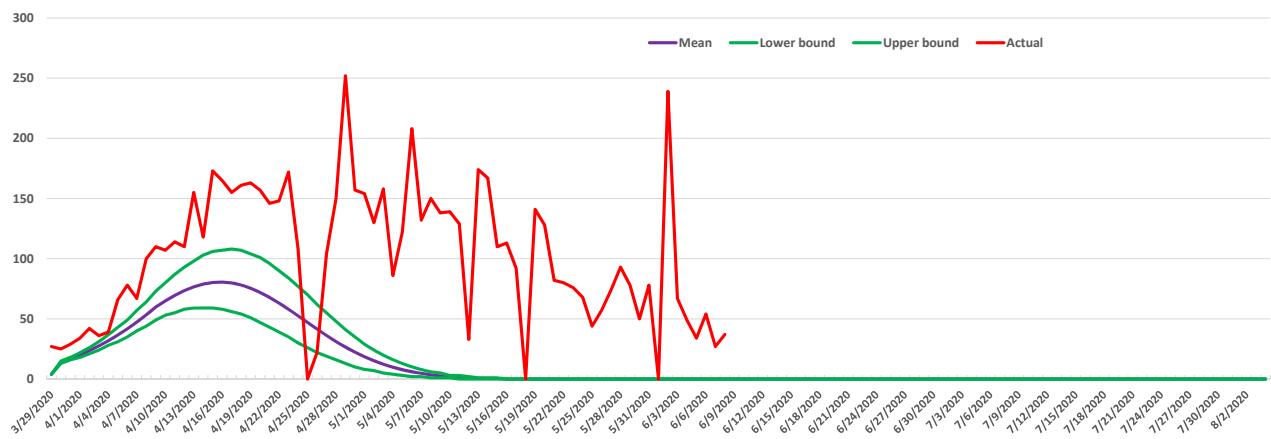
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Connecticut COVID 19 Daily Death Projections March 26



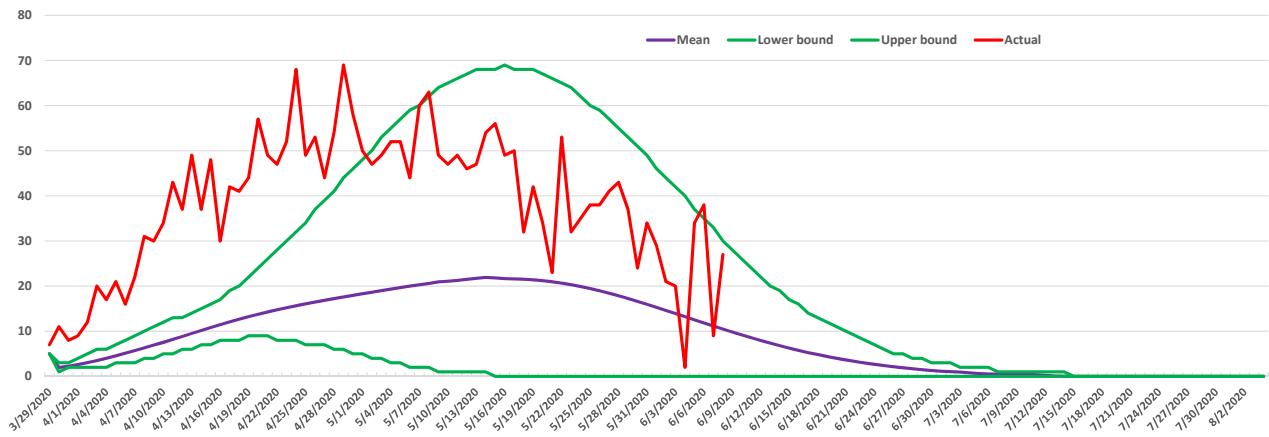
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Massachusetts COVID 19 Daily Death Projections March 26



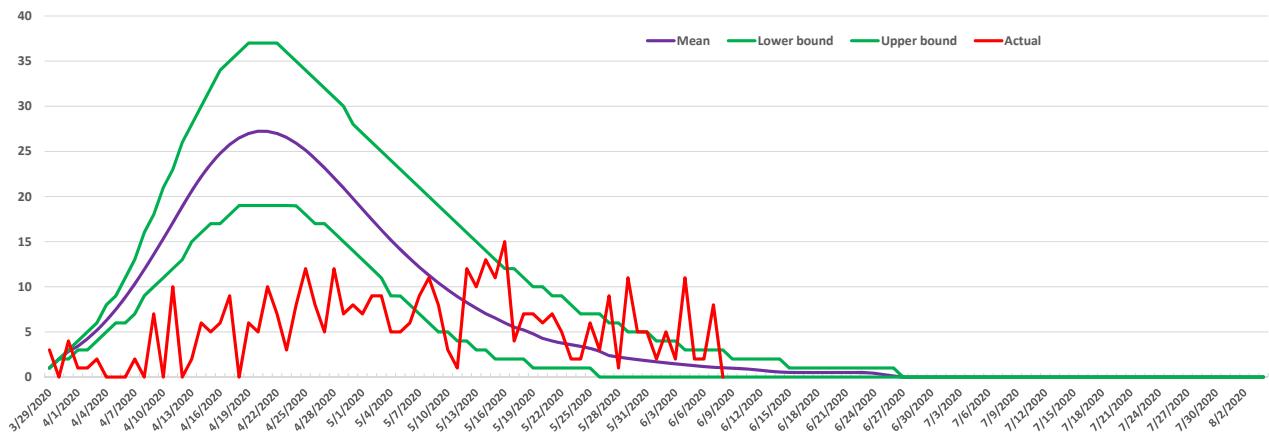
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Maryland COVID 19 Daily Death Projections March 26



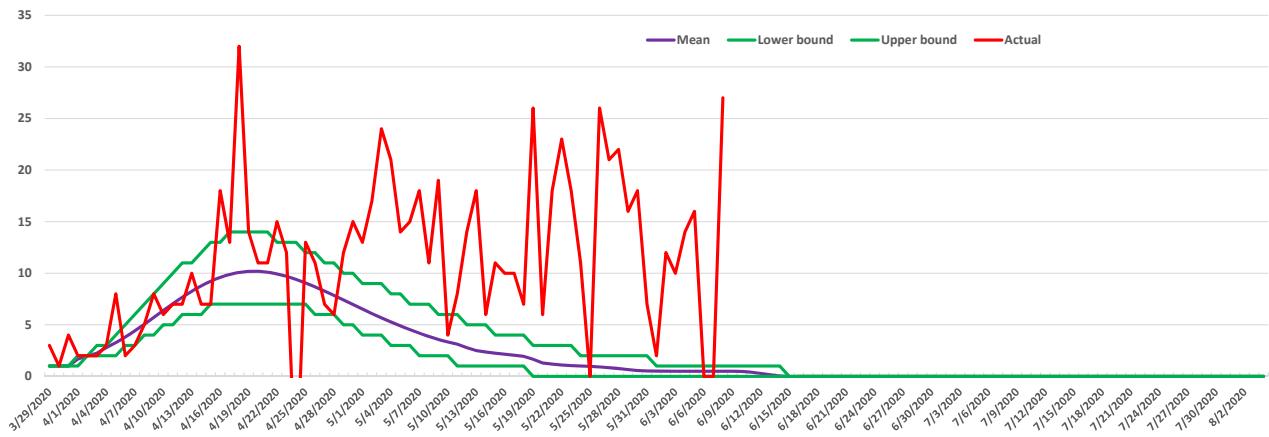
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Delaware COVID 19 Daily Death Projections March 26



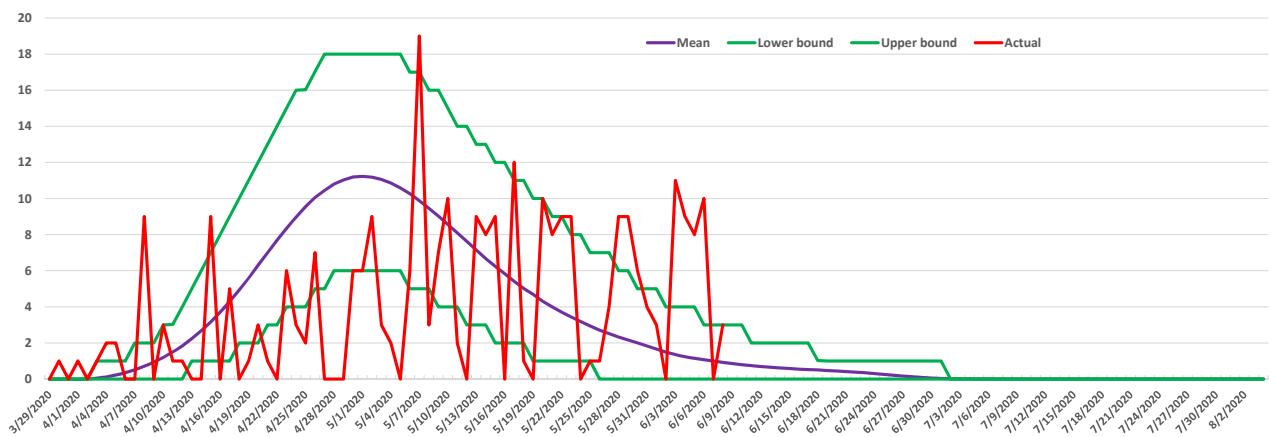
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Rhode Island COVID 19 Daily Death Projections March 26



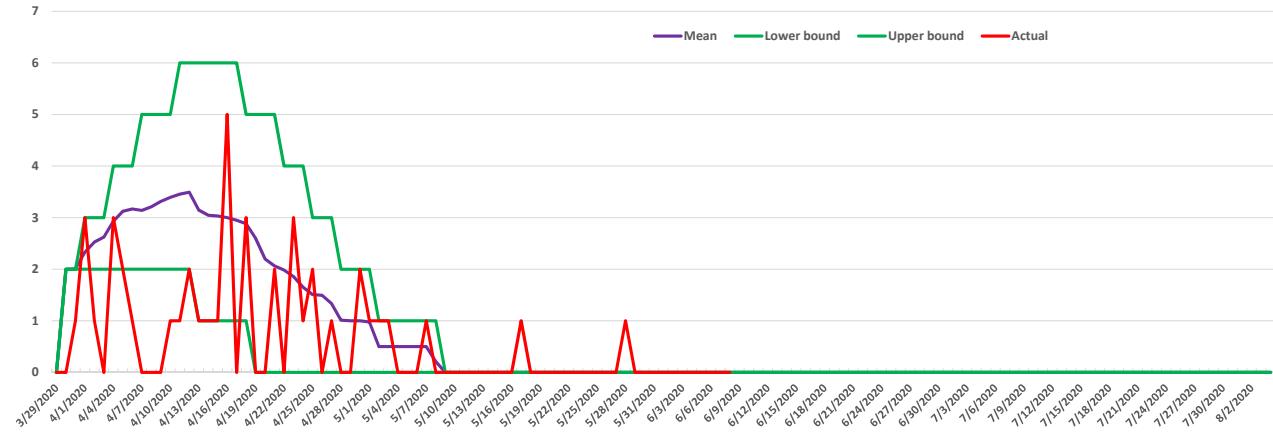
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New Hampshire COVID 19 Daily Death Projections March 26



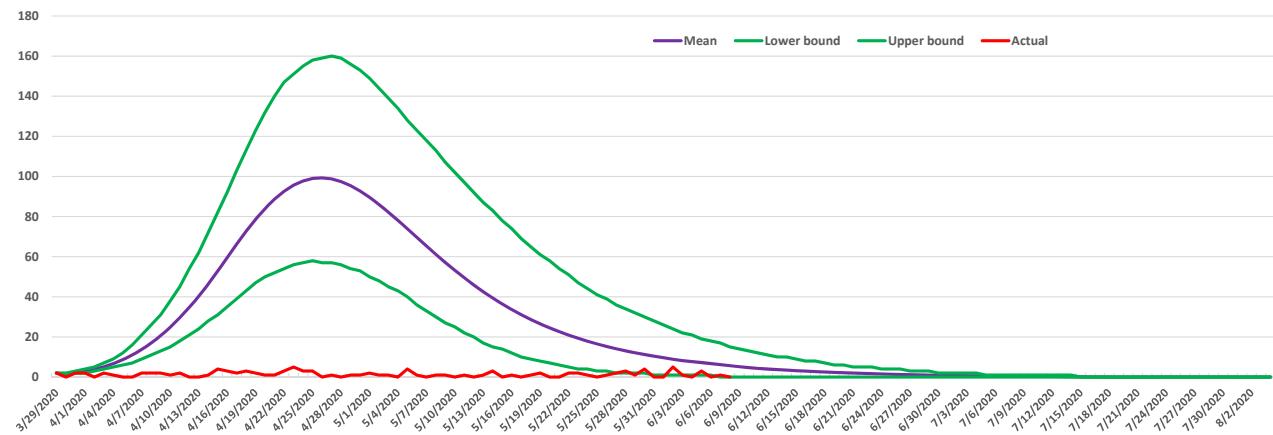
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Vermont COVID 19 Daily Death Projections March 26



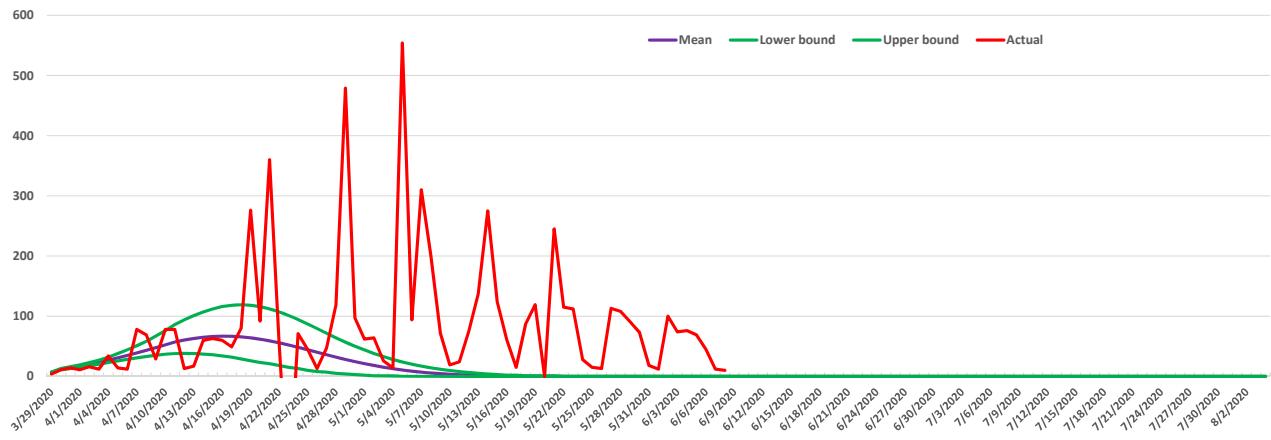
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Maine COVID 19 Daily Death Projections March 26



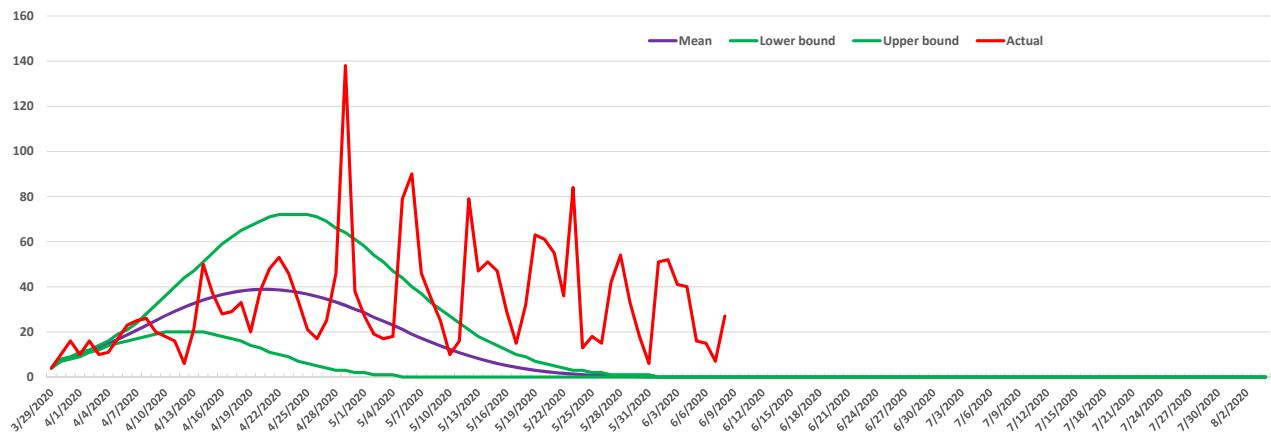
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Pennsylvania COVID 19 Daily Death Projections March 26



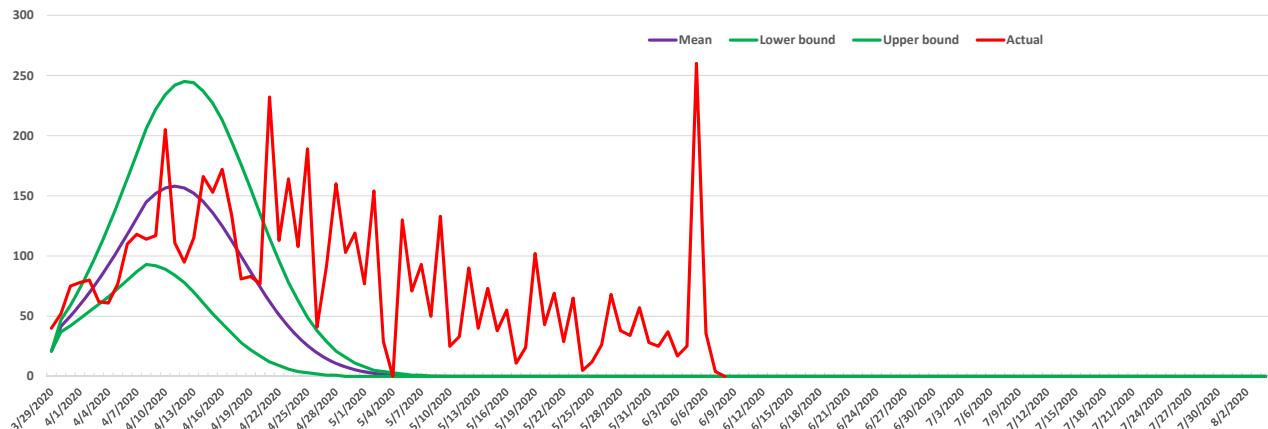
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Ohio COVID 19 Daily Death Projections March 26



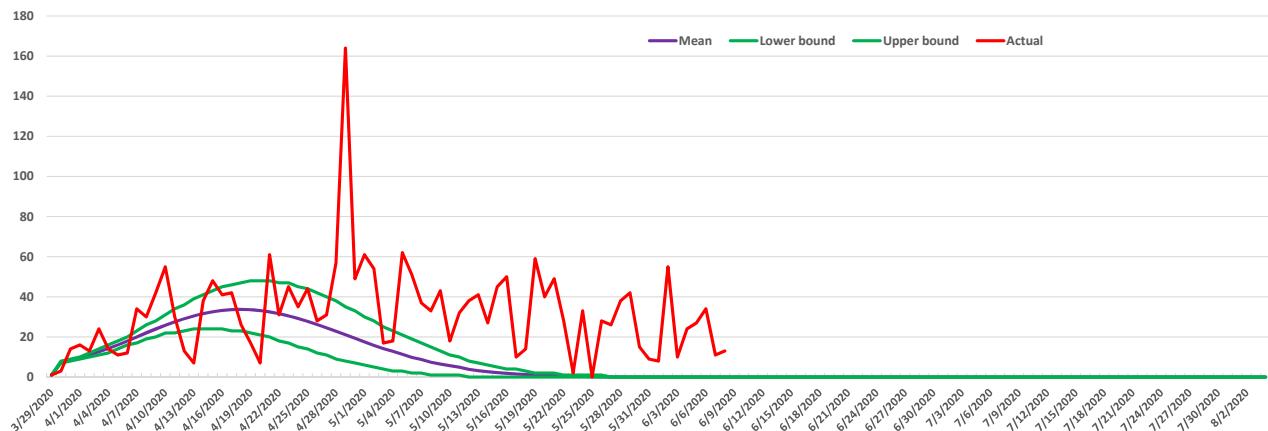
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Michigan COVID 19 Daily Death Projections March 26



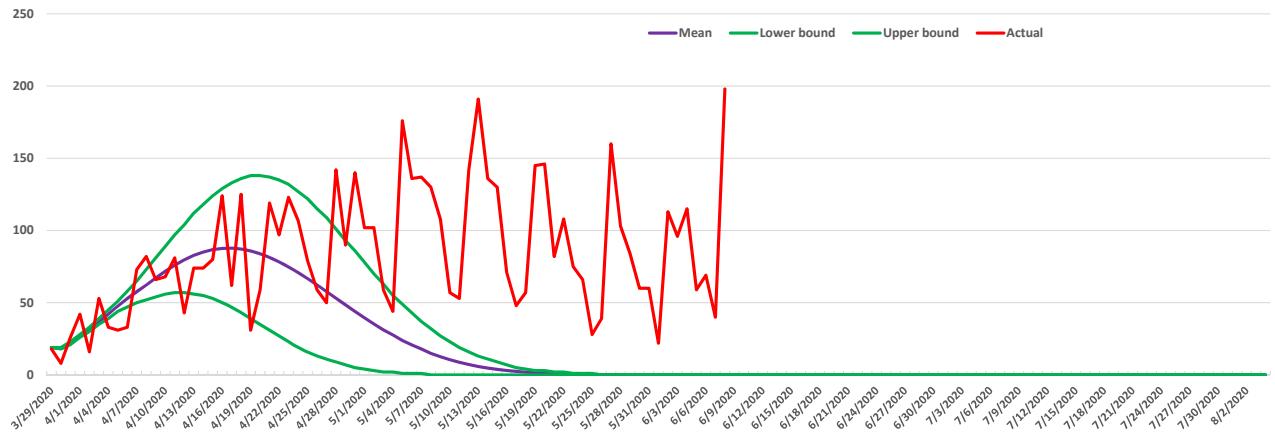
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Indiana COVID 19 Daily Death Projections March 26



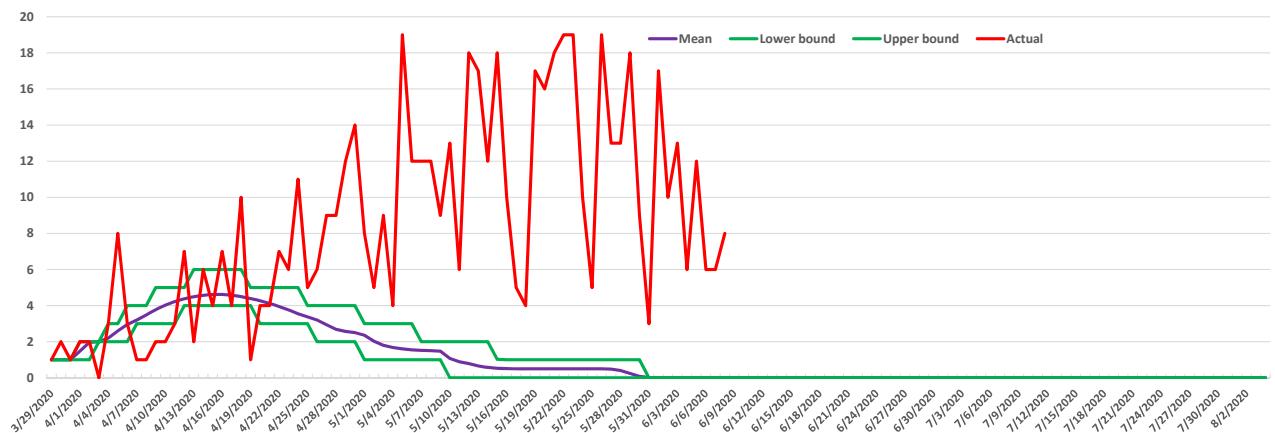
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Illinois COVID 19 Daily Death Projections March 26



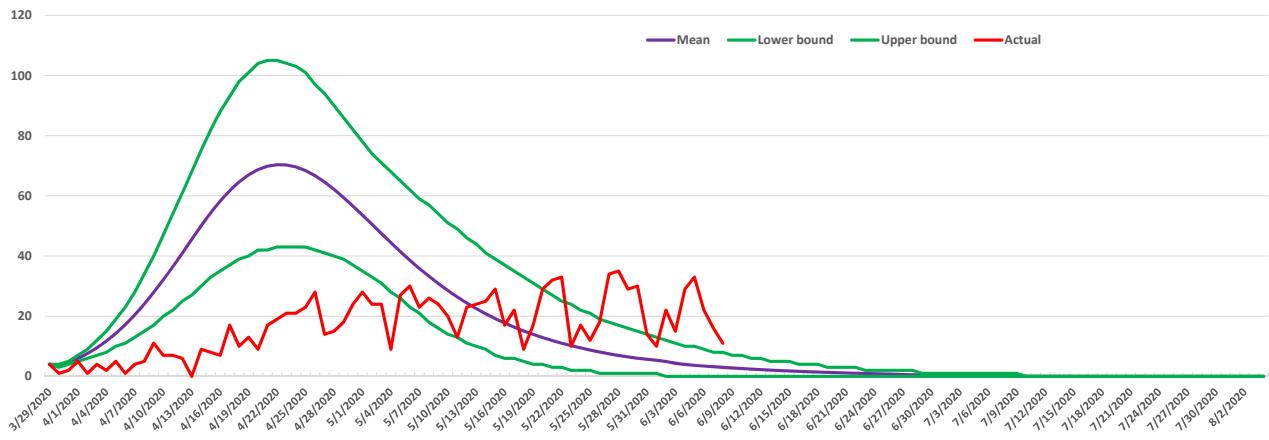
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Iowa COVID 19 Daily Death Projections March 26



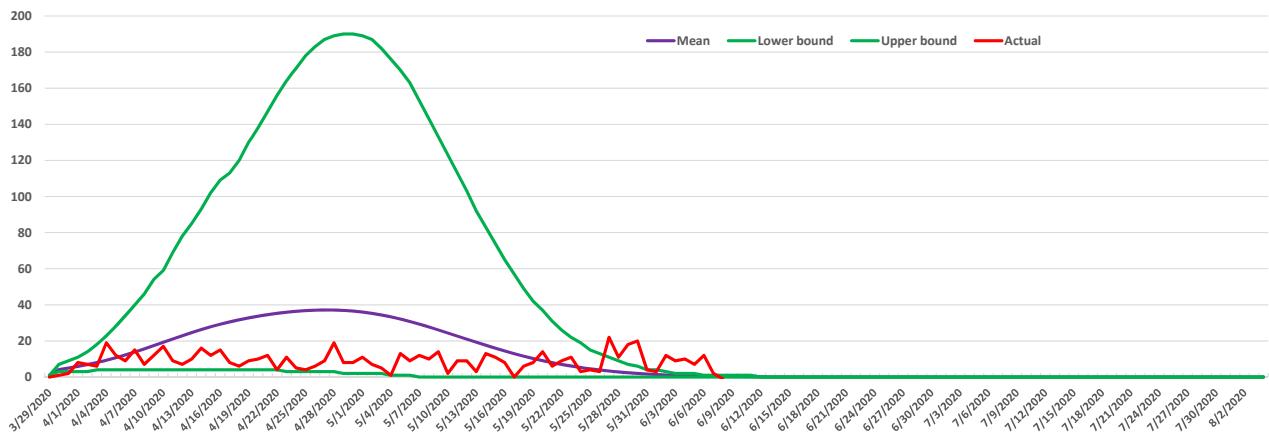
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Minnesota COVID 19 Daily Death Projections March 26



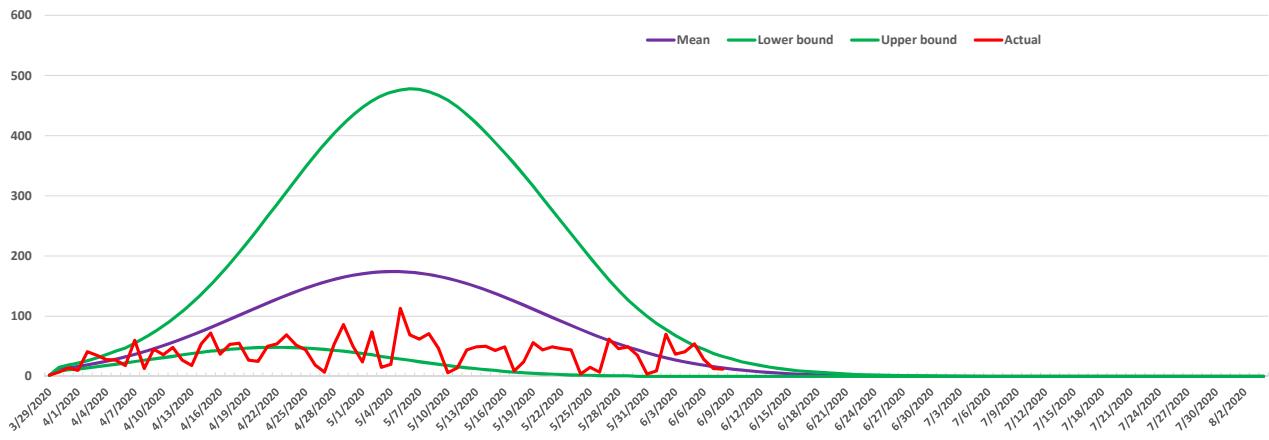
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Wisconsin COVID 19 Daily Death Projections March 26



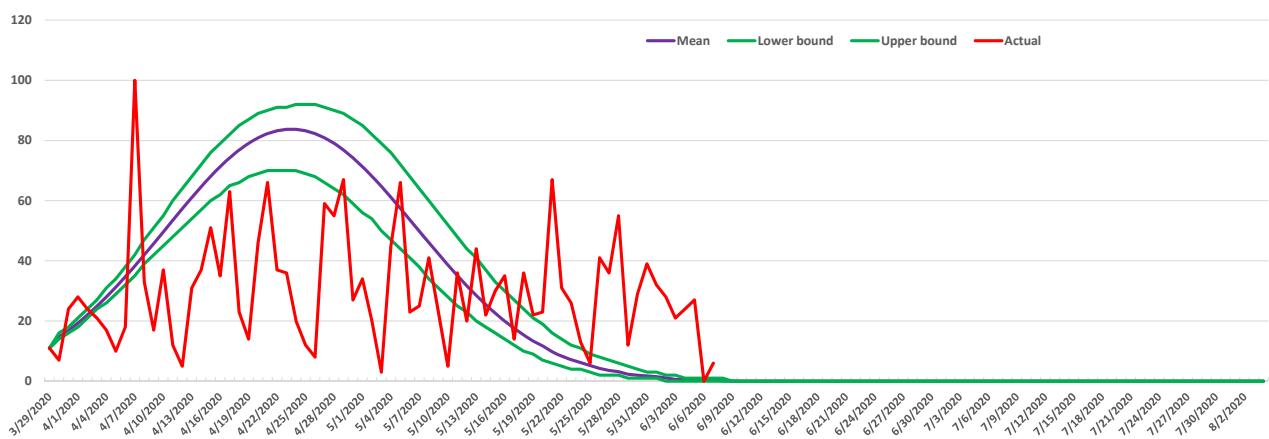
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Florida COVID 19 Daily Death Projections March 26



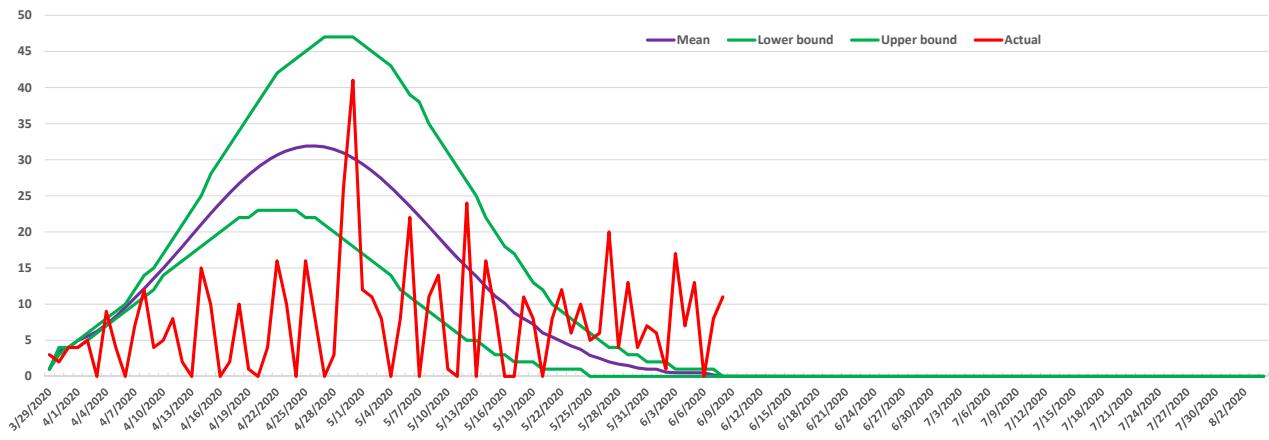
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Georgia COVID 19 Daily Death Projections March 26



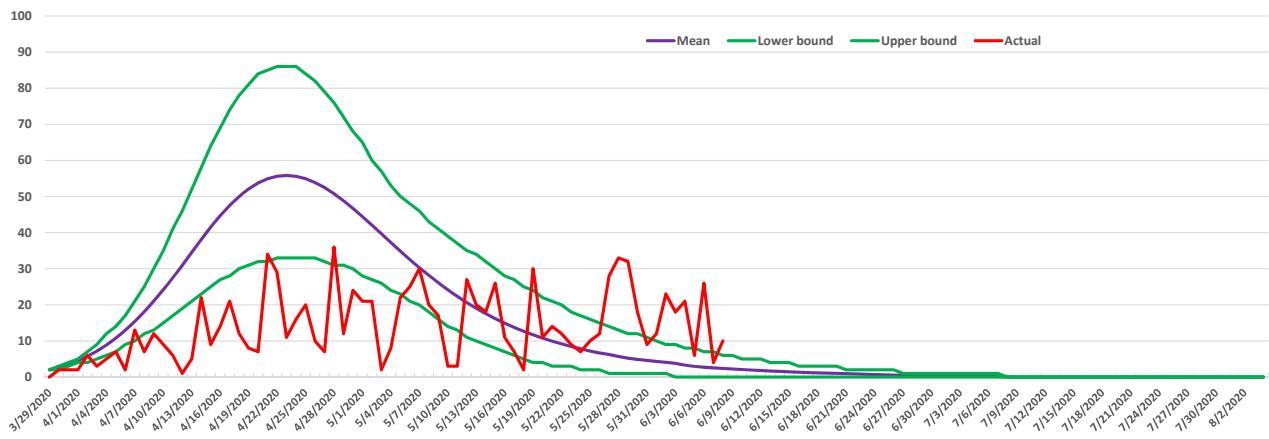
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South Carolina COVID 19 Daily Death Projections March 26



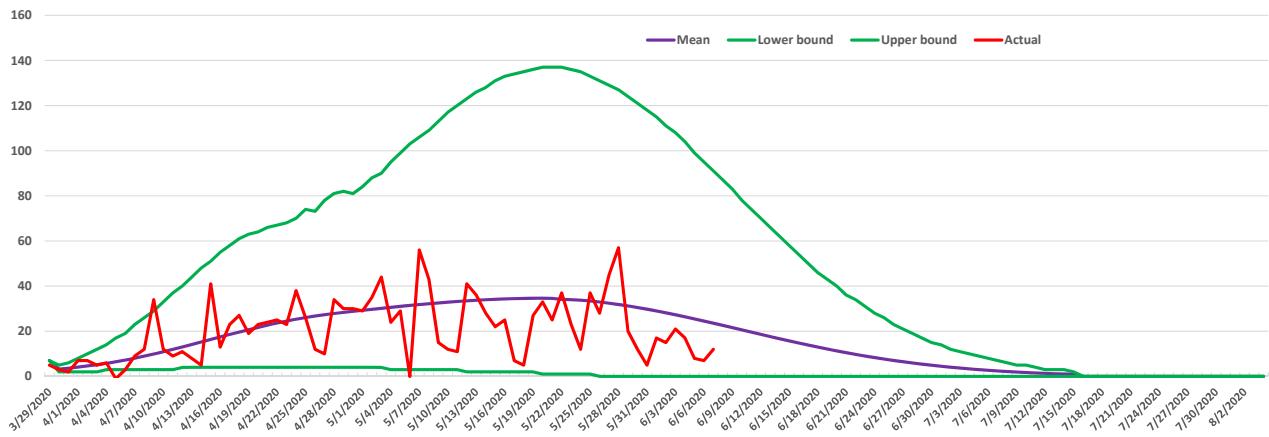
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North Carolina COVID 19 Daily Death Projections March 26



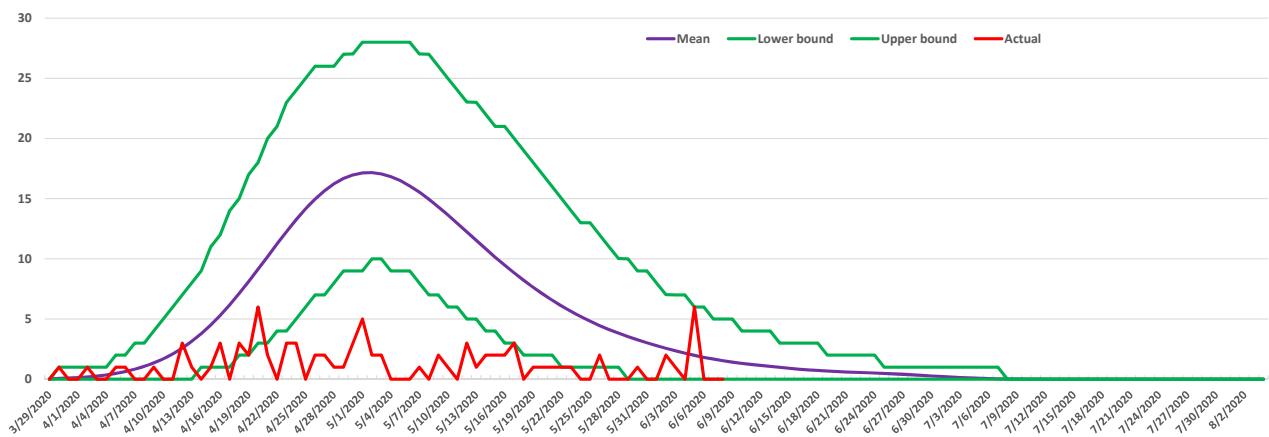
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Virginia COVID 19 Daily Death Projections March 26



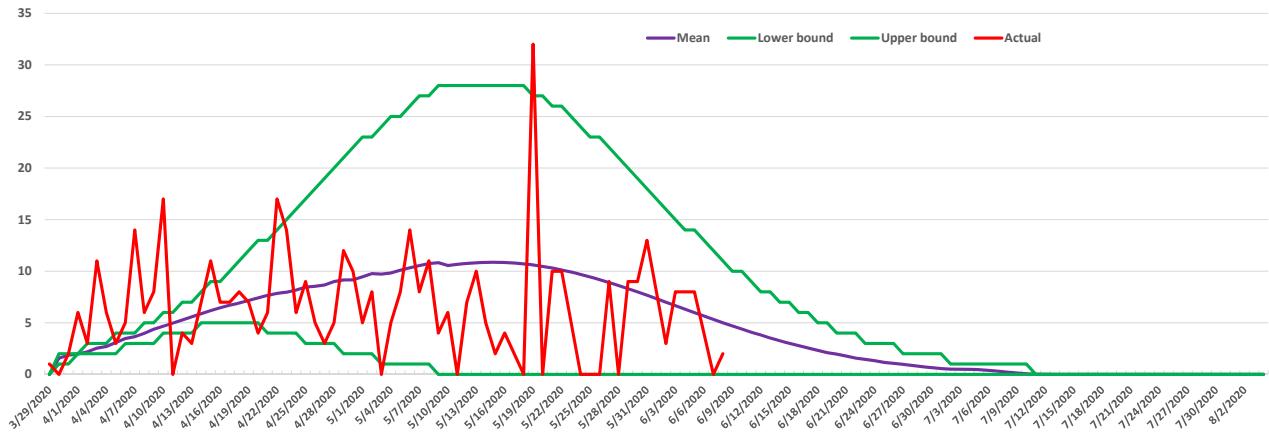
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West Virginia COVID 19 Daily Death Projections March 26



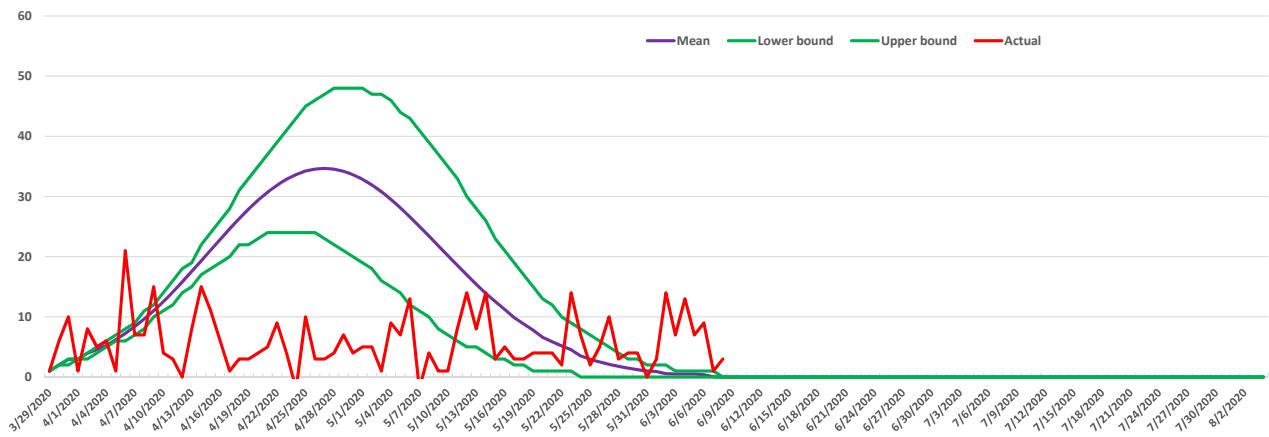
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Kentucky COVID 19 Daily Death Projections March 26



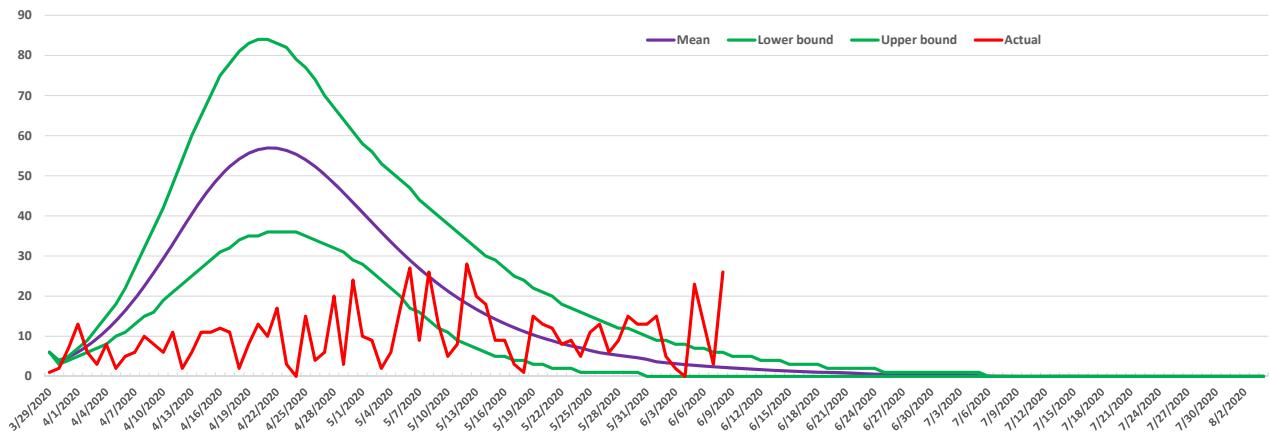
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Tennessee COVID 19 Daily Death Projections March 26



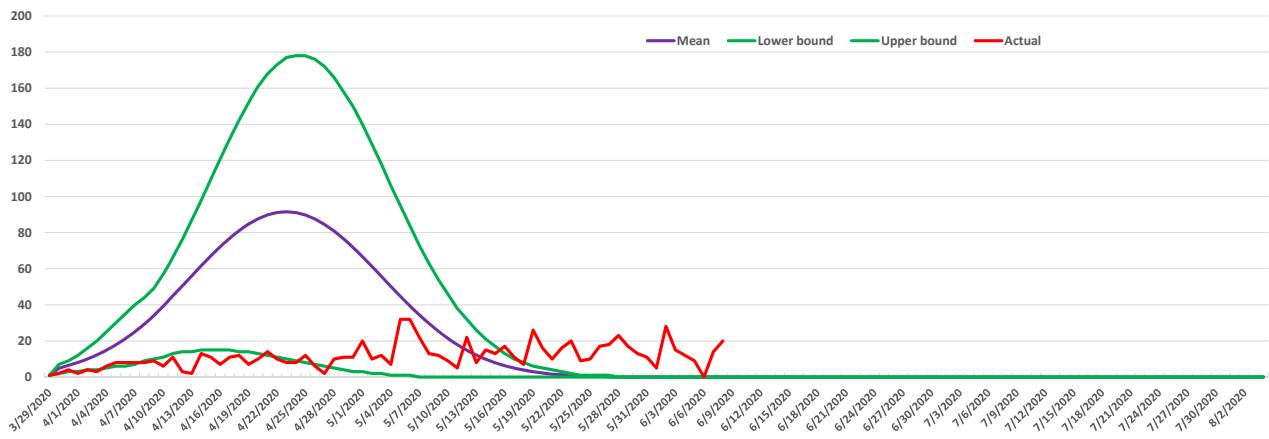
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Alabama COVID 19 Daily Death Projections March 26



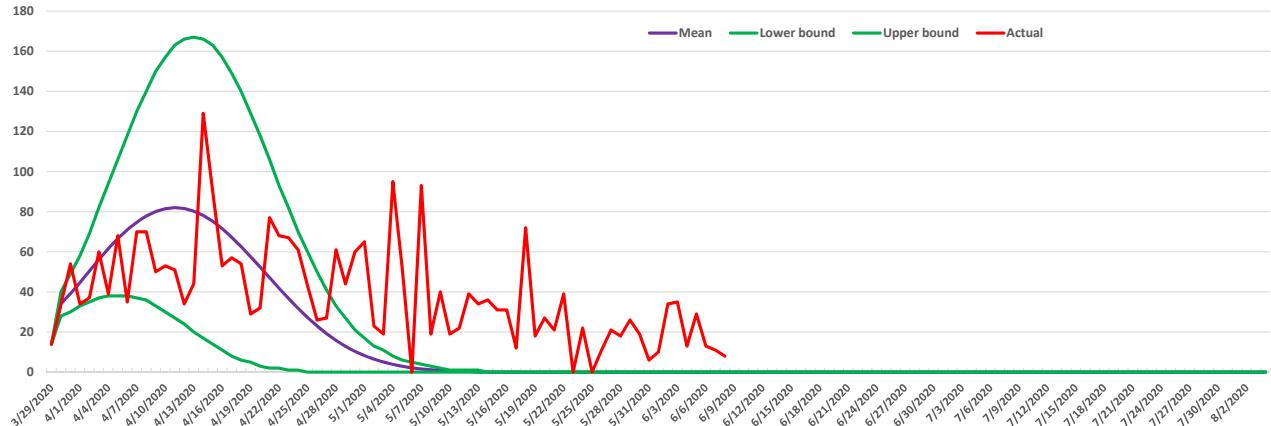
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Mississippi COVID 19 Daily Death Projections March 26



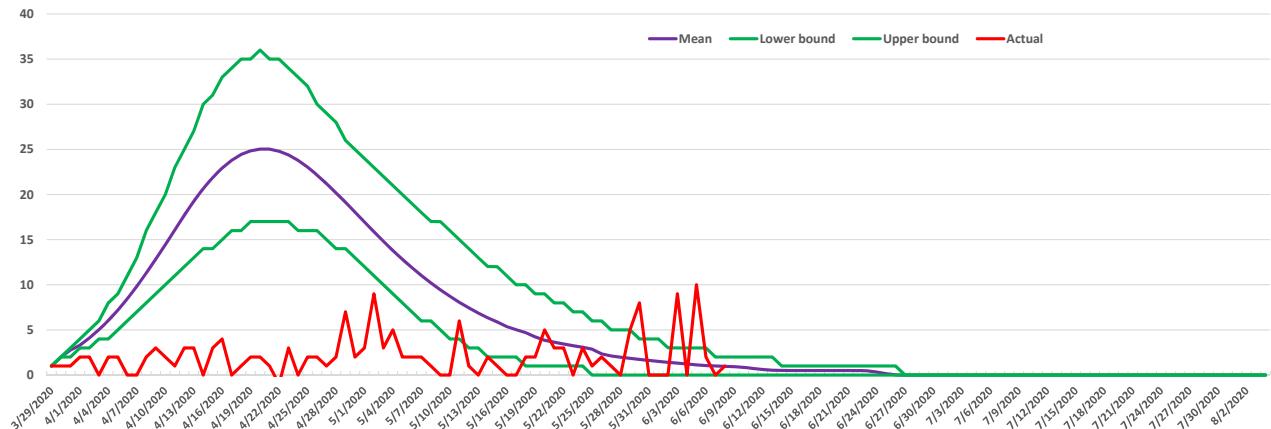
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Louisiana COVID 19 Daily Death Projections March 26



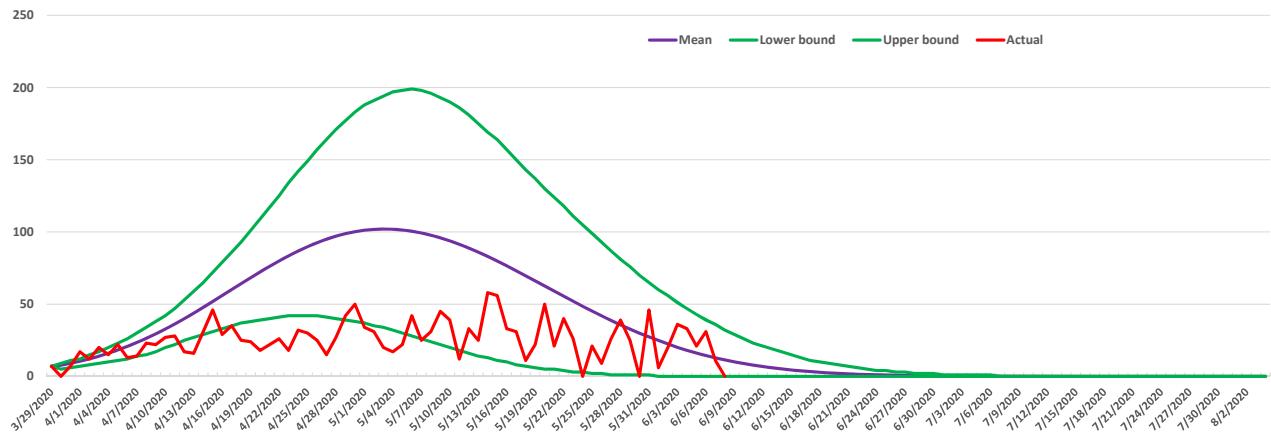
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Arkansas COVID 19 Daily Death Projections March 26



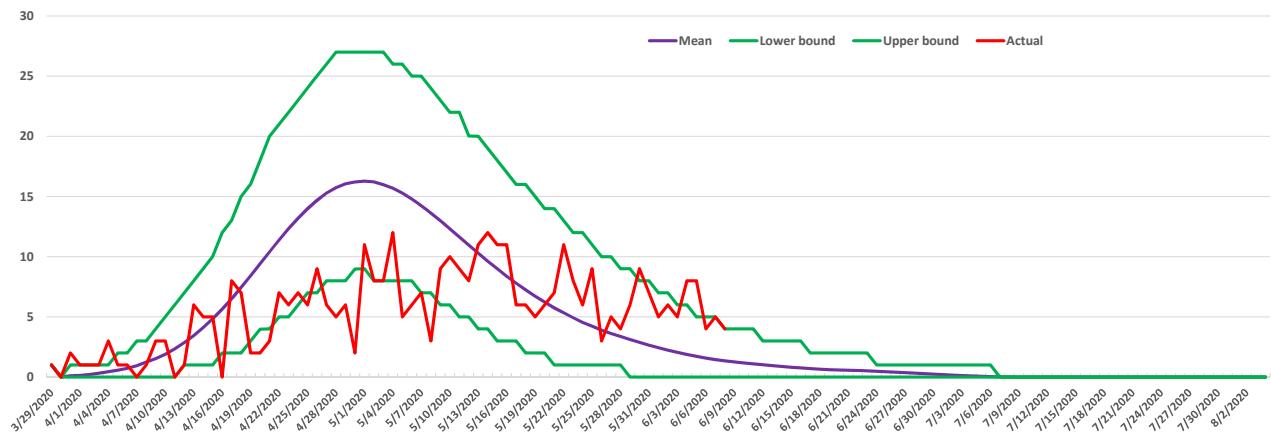
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Texas COVID 19 Daily Death Projections March 26



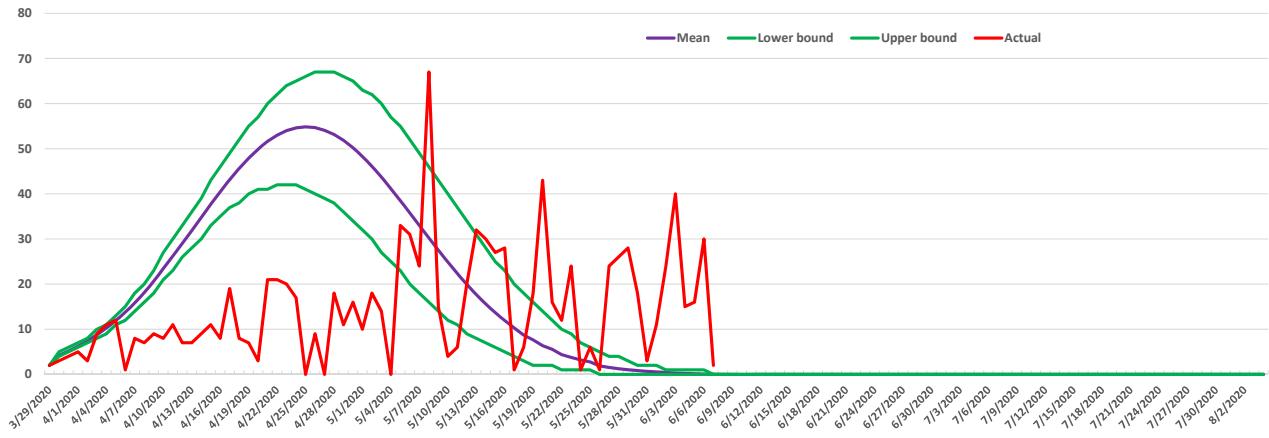
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New Mexico COVID 19 Daily Death Projections March 26



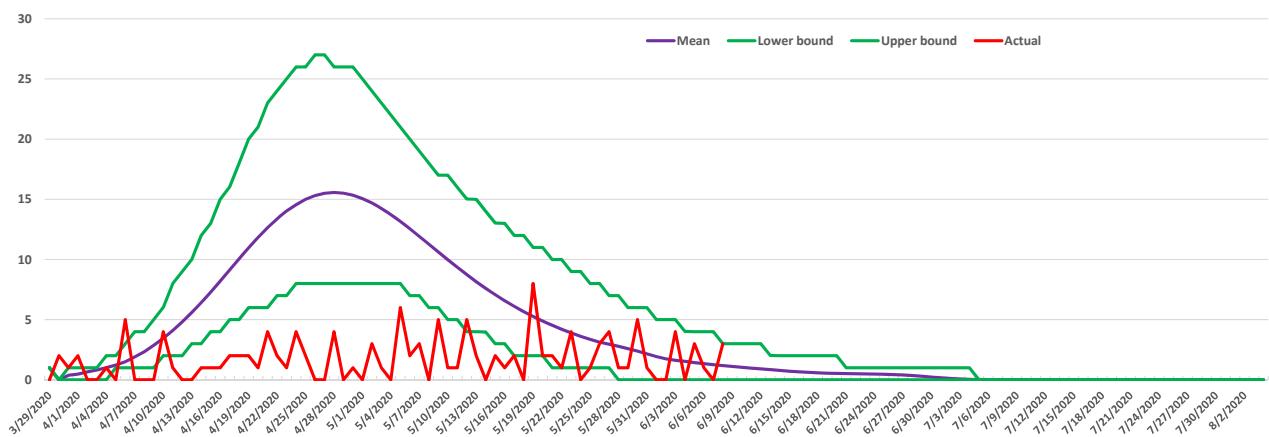
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Arizona COVID 19 Daily Death Projections March 26



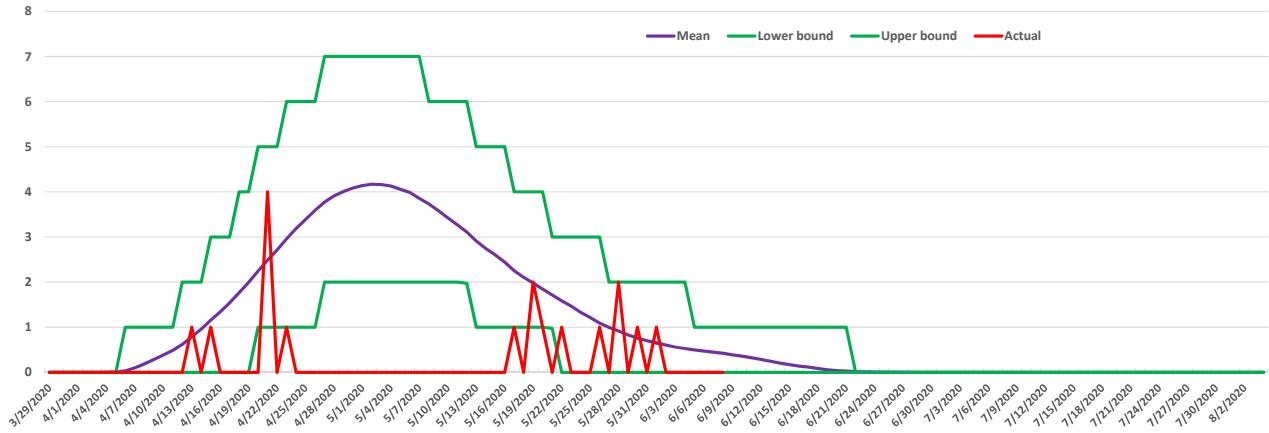
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Utah COVID 19 Daily Death Projections March 26



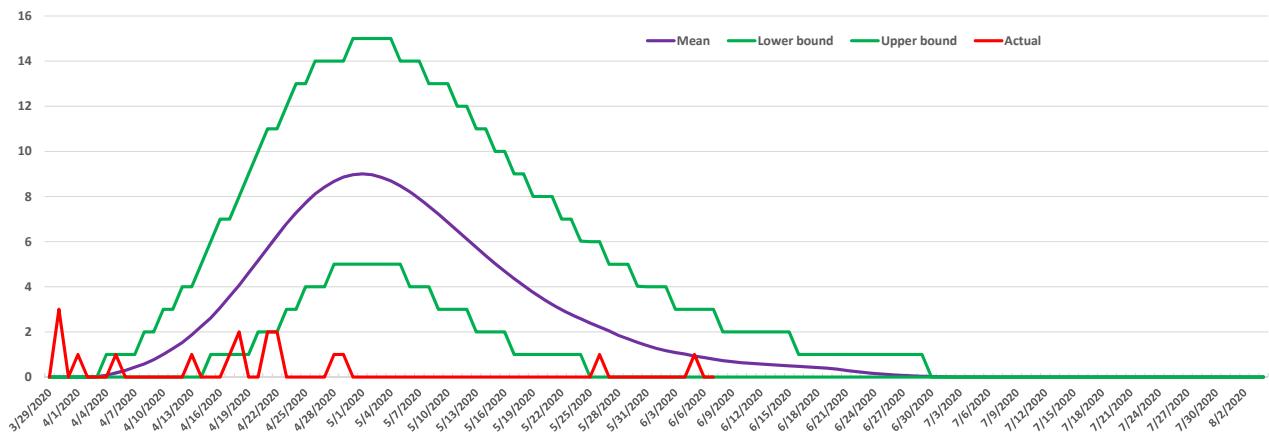
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Wyoming COVID 19 Daily Death Projections March 26



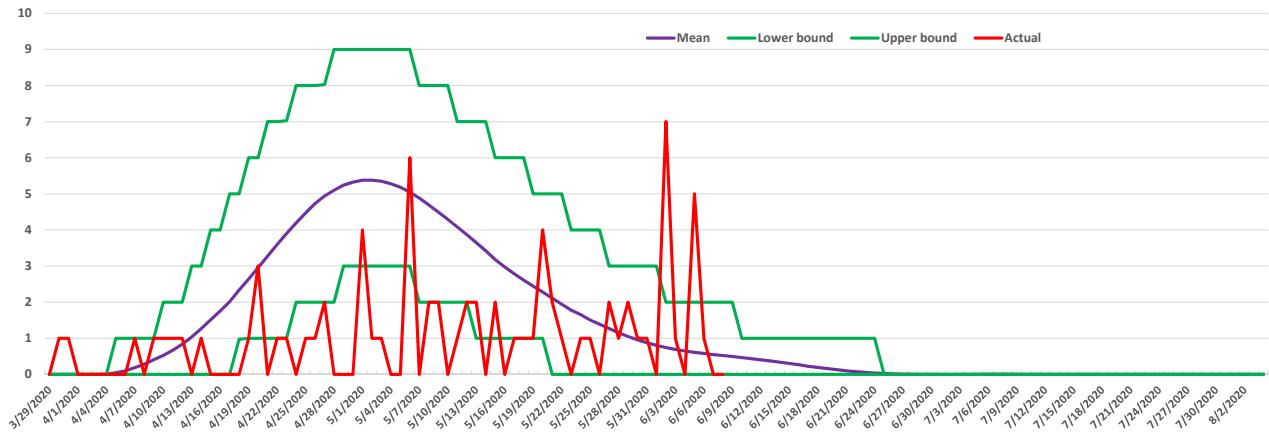
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Montana COVID 19 Daily Death Projections March 26



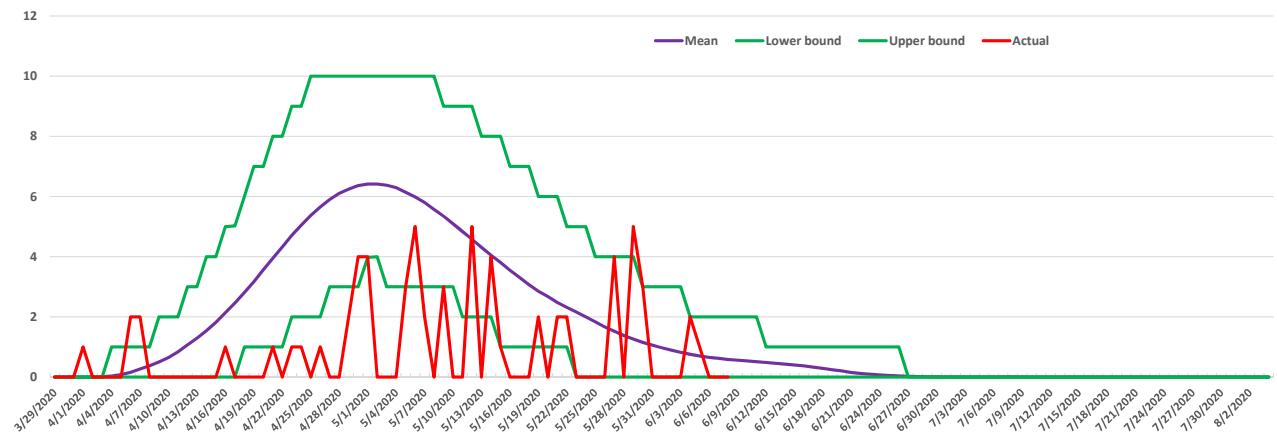
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North Dakota COVID 19 Daily Death Projections March 26



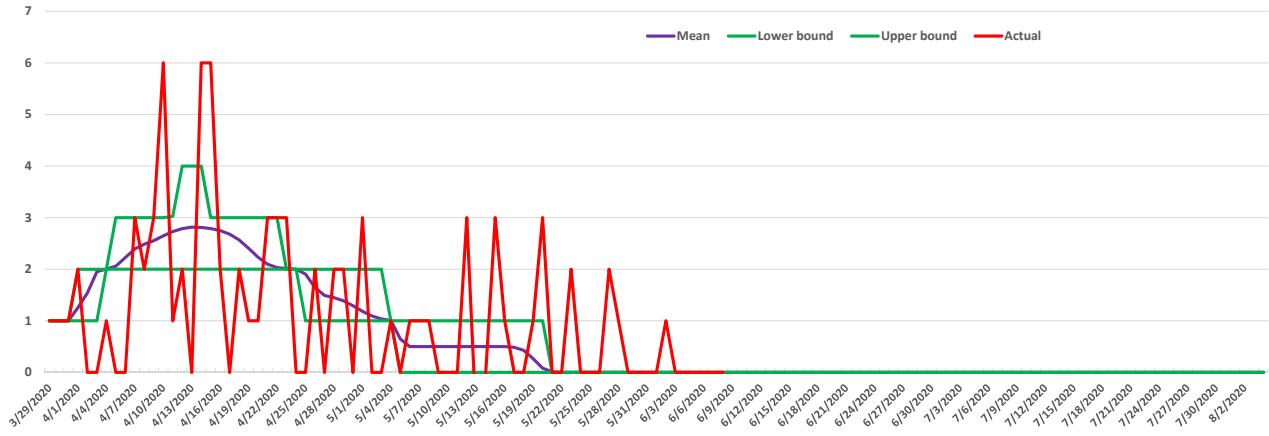
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South Dakota COVID 19 Daily Death Projections March 26



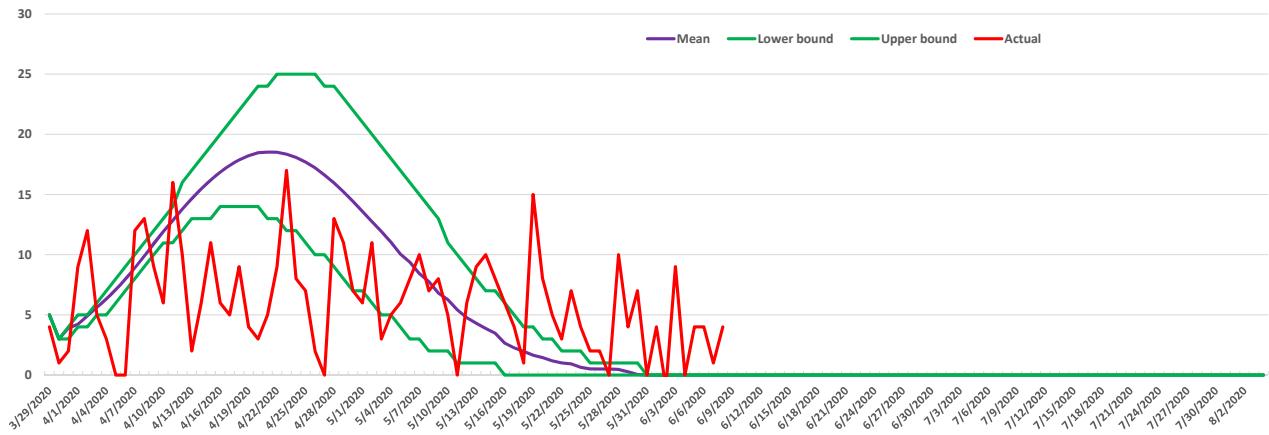
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Idaho COVID 19 Daily Death Projections March 26



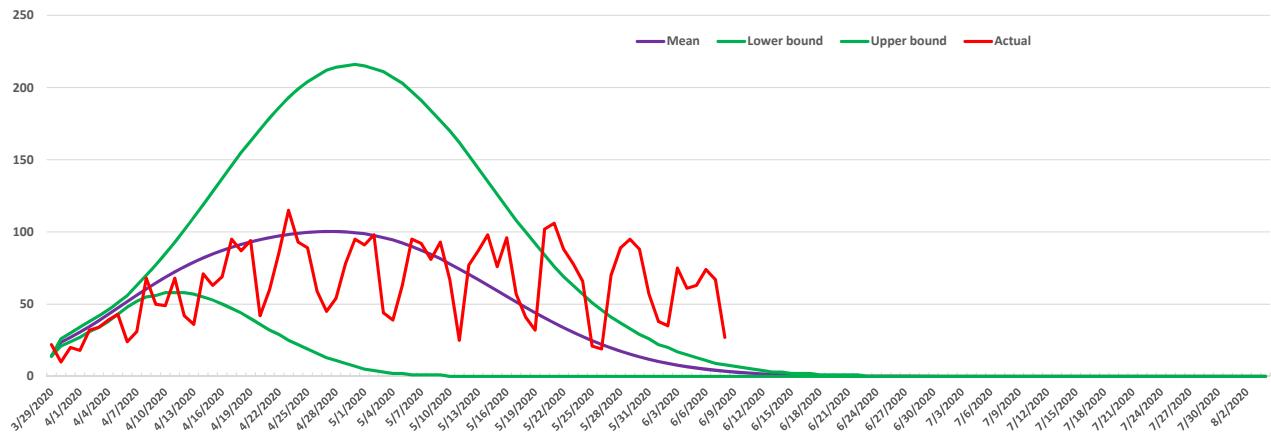
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Nevada COVID 19 Daily Death Projections March 26



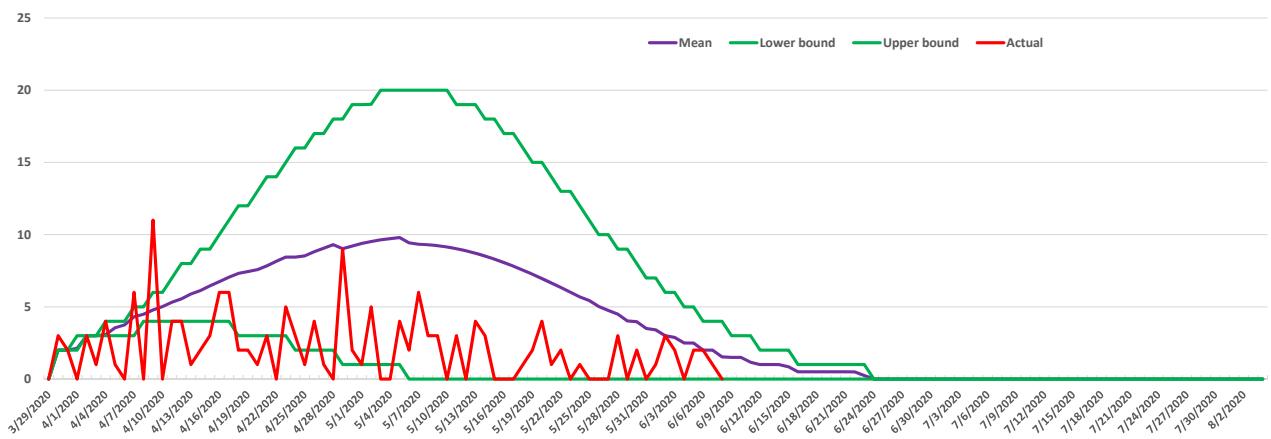
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California COVID 19 Daily Death Projections March 26



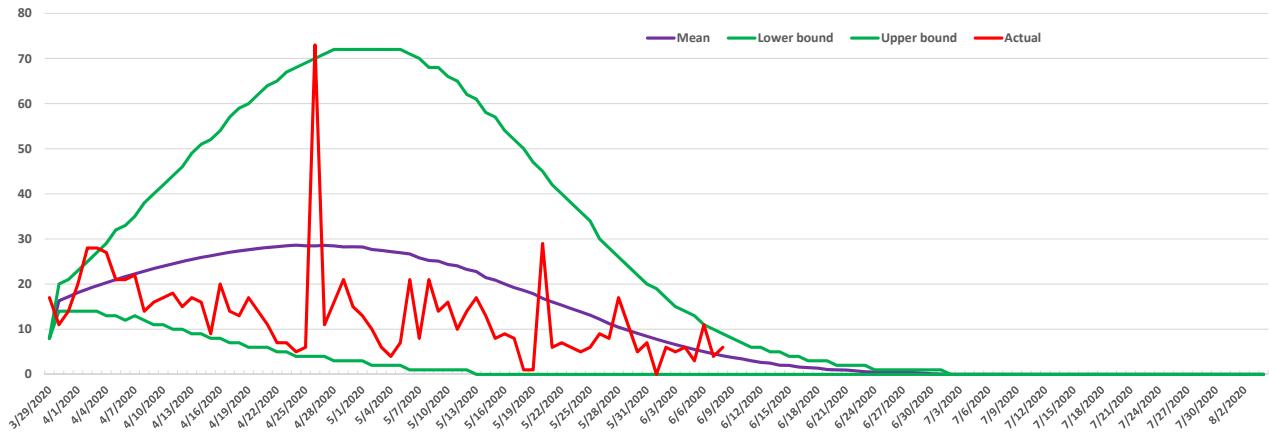
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Oregon COVID 19 Daily Death Projections March 26



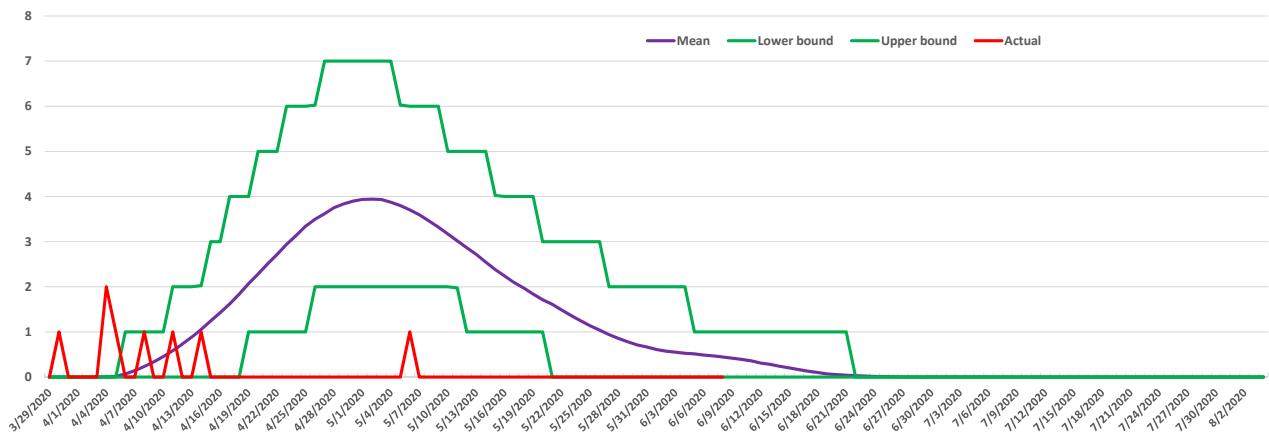
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Washington COVID 19 Daily Death Projections March 26



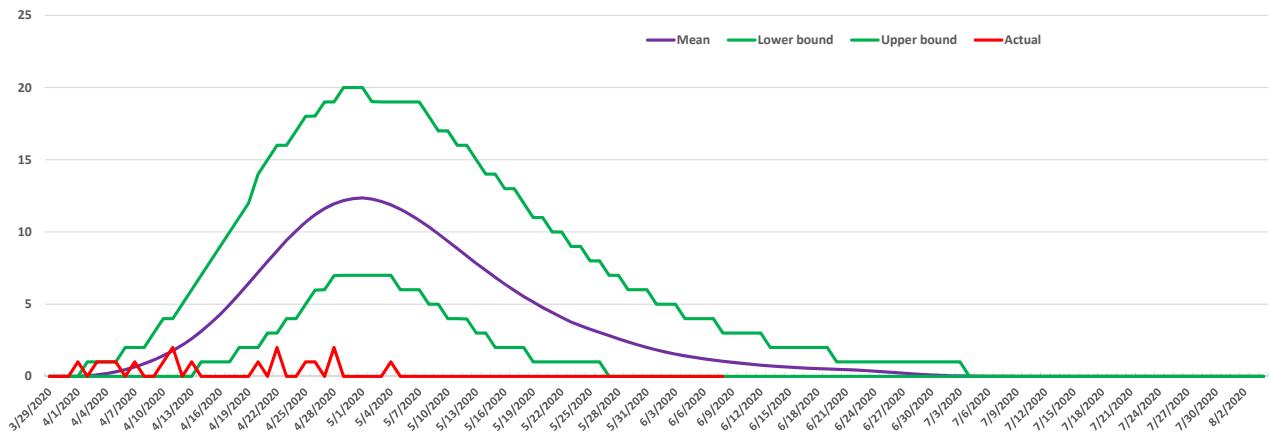
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Alaska COVID 19 Daily Death Projections March 26



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Hawaii COVID 19 Daily Death Projections March 26



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Projected August 4th Deaths from the March 26th, May 28th, June 3rd, and June 6th Models

	3/26	5/28	6/3	6/8		3/26	5/28	6/3	6/8
Alabama	1,732	833	1,297	1,051	Hawaii	390	17	23	19
Alaska	129	10	10	11	Idaho	84	98	141	148
Arizona	1,613	2,665	2,432	4,427	Illinois	2,360	6,371	7,346	7,381
Arkansas	762	608	346	885	Indiana	940	2,350	2,880	2,950
California	4,306	7,558	6,952	8,722	Iowa	138	1,040	1,663	1,473
Colorado	2,151	3,457	2,172	2,064	Kansas	687	227	344	469
Connecticut	378	4,251	4,349	4,312	Kentucky	605	540	779	913
Delaware	827	413	482	466	Louisiana	1,897	2,947	3,080	3,219
Florida	6,766	3,707	3,658	4,363	Maine	3,013	167	344	283
Georgia	2,777	2,759	3,012	4,264	Maryland	1,171	2,883	3,614	3,619



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Projected August 4th Deaths from the March 26th, May 28th, June 3rd, and June 6th Models

	3/26	5/28	6/3	6/8		3/26	5/28	6/3	6/8
Massachusetts	1,782	9,003	8,461	8,086	New Mexico	514	556	634	680
Michigan	2,862	5,986	6,716	6,466	New York	15,546	31,295	31,712	31,780
Minnesota	2,146	1,712	2,466	2,193	North Carolina	1,721	1,505	2,453	3,144
Mississippi	2,292	947	1,404	1,380	North Dakota	171	96	177	161
Missouri	1,055	996	1,187	1,232	Ohio	1,203	3,227	4,727	3,792
Montana	282	16	18	19	Oklahoma	1,149	361	405	458
Nebraska	424	475	552	611	Oregon	469	177	192	222
Nevada	568	692	604	644	Pennsylvania	1,579	6,418	7,402	7,467
New Hampshire	351	350	418	489	Rhode Island	306	1,159	1,114	992
New Jersey	2,096	12,577	13,231	13,255	South Carolina	1,043	734	865	841



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Projected August 4th Deaths from the March 26th, May 28th, June 3rd, and June 6th Models

	3/26	5/28	6/3	6/8		3/26	5/28	6/3	6/8
South Dakota	204	81	88	102	Virginia	2,053	2,576	2,375	2,216
Tennessee	1,067	734	1,224	822	Washington	1,670	1,200	1,196	1,233
Texas	4,150	2,025	2,754	3,448	West Virginia	543	107	108	137
Utah	502	220	411	345	Wisconsin	1,309	799	1,931	1,793
Vermont	95	56	58	64	Wyoming	132	38	72	27
United States	82,141	131,967	140,496	145,728					



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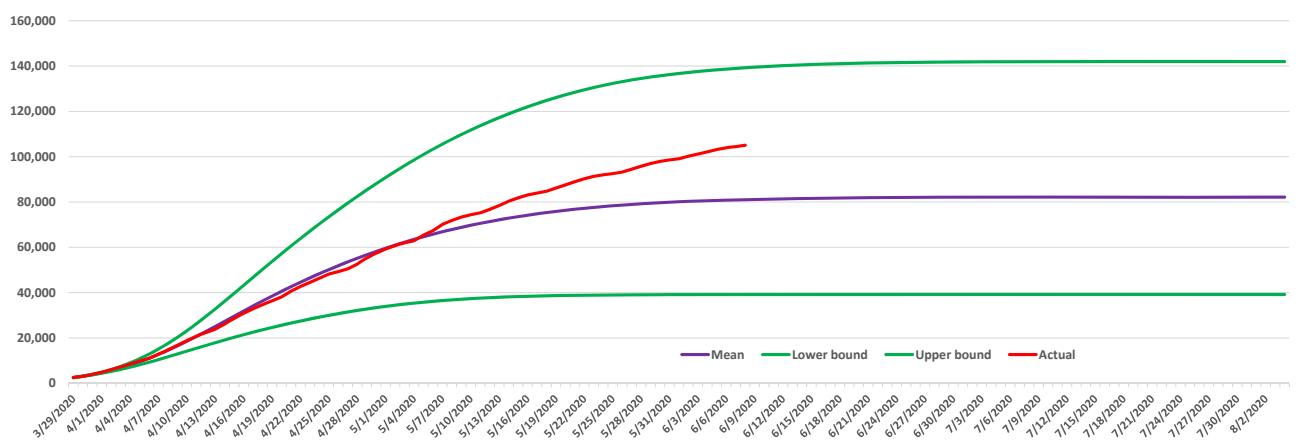
Concluding Thoughts

- The IMHE model continues to be revised
- It continues to be used to drive policy decisions that have resulted in large negative economic effects for the agricultural economy
- Differential effects regarding opening states
 - All but 10 states do not have stay at home orders
- The distribution of death by age group for COVID 19 is not substantially different than death from all causes
- The model revision released on June 6th increased the cumulative expected death in 44 states and reduced it in 6 states from the May 28th model
- The model revision released on June 6th has higher cumulative expected death in 29 states and lower cumulative expected death in 21 states compared to the original model



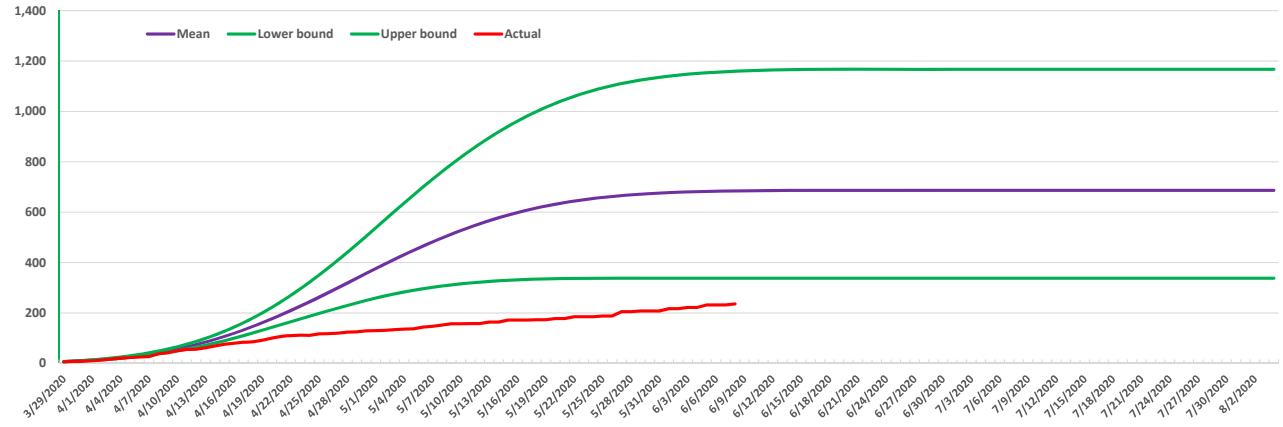
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U.S. COVID 19 Cumulative Death Projections



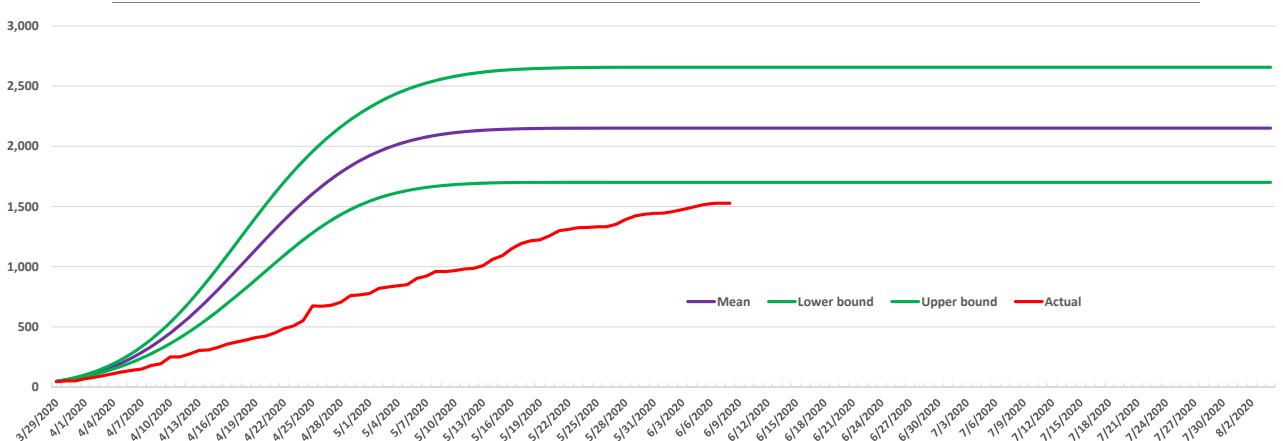
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Kansas COVID 19 Cumulative Death Projections



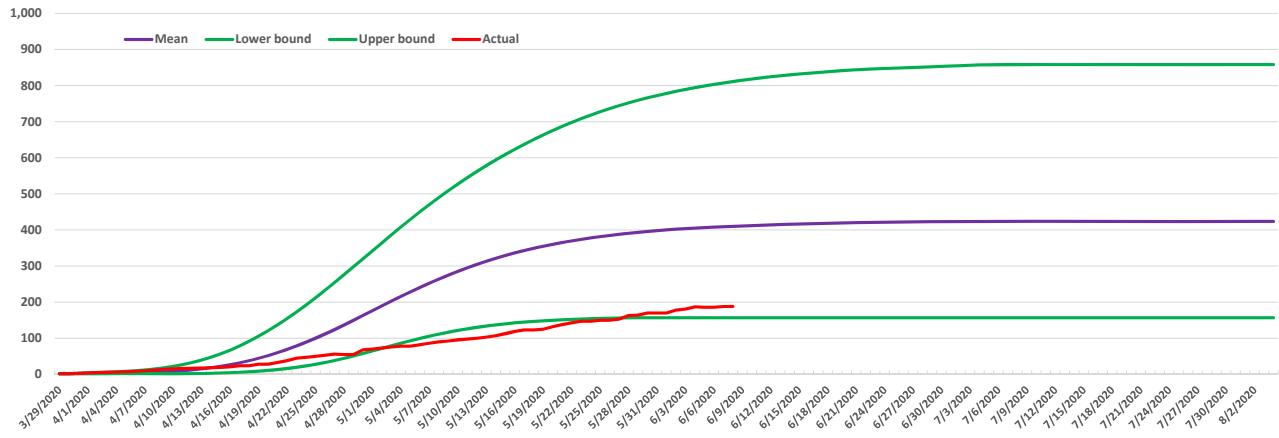
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Colorado COVID 19 Cumulative Death Projections March 26



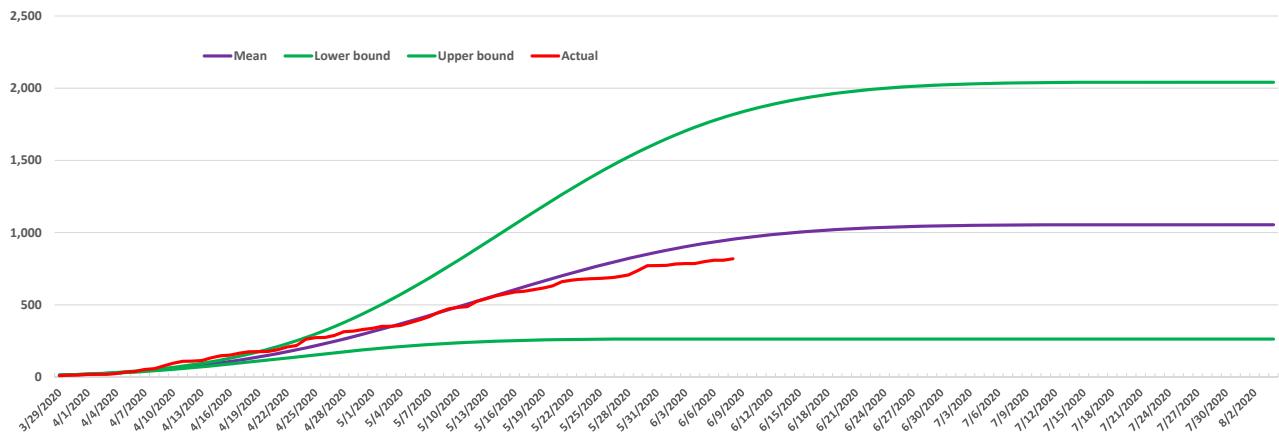
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Nebraska COVID 19 Daily Death Projections March 26



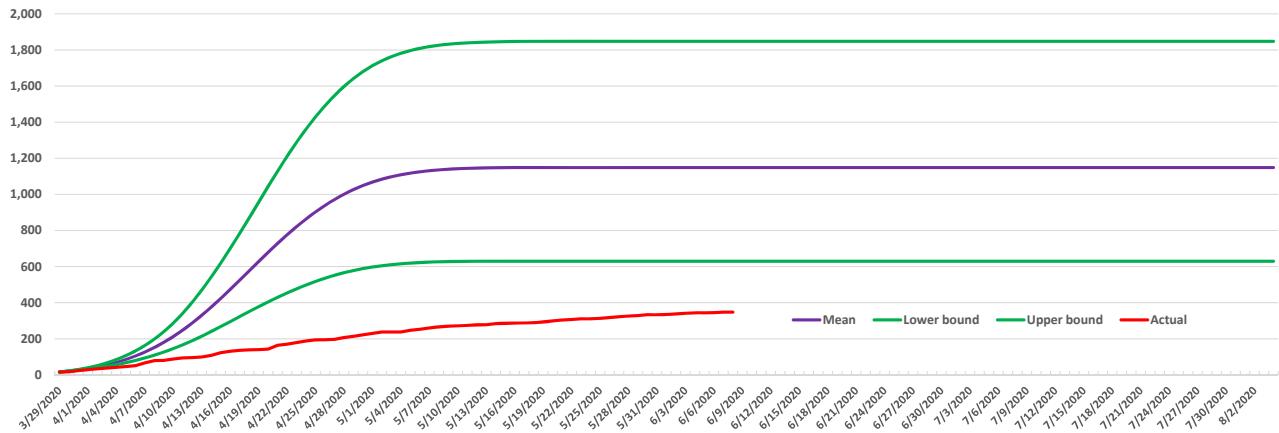
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Missouri COVID 19 Cumulative Death Projections March 26



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Oklahoma COVID 19 Daily Death Projections March 26



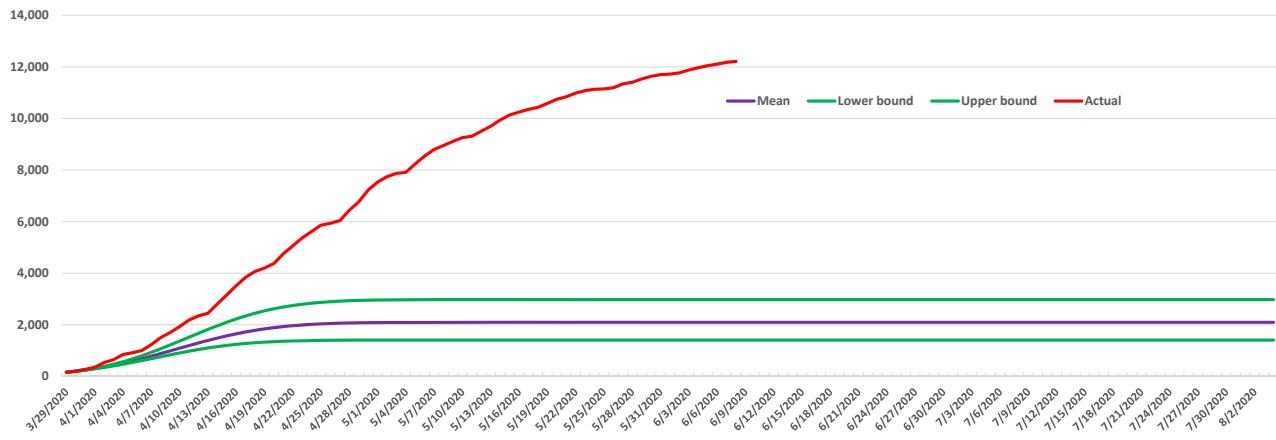
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New York COVID 19 Cumulative Death Projections



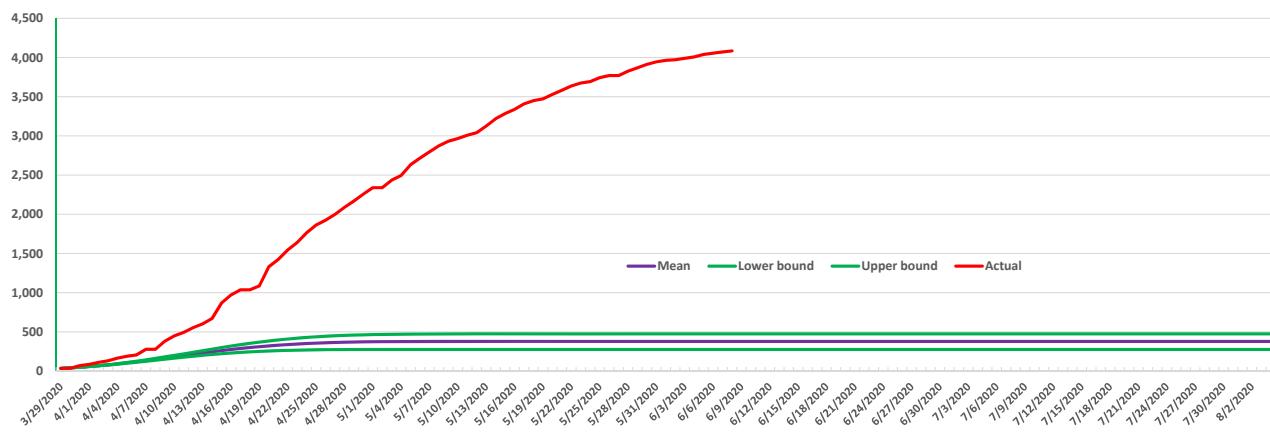
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New Jersey COVID 19 Cumulative Death Projections



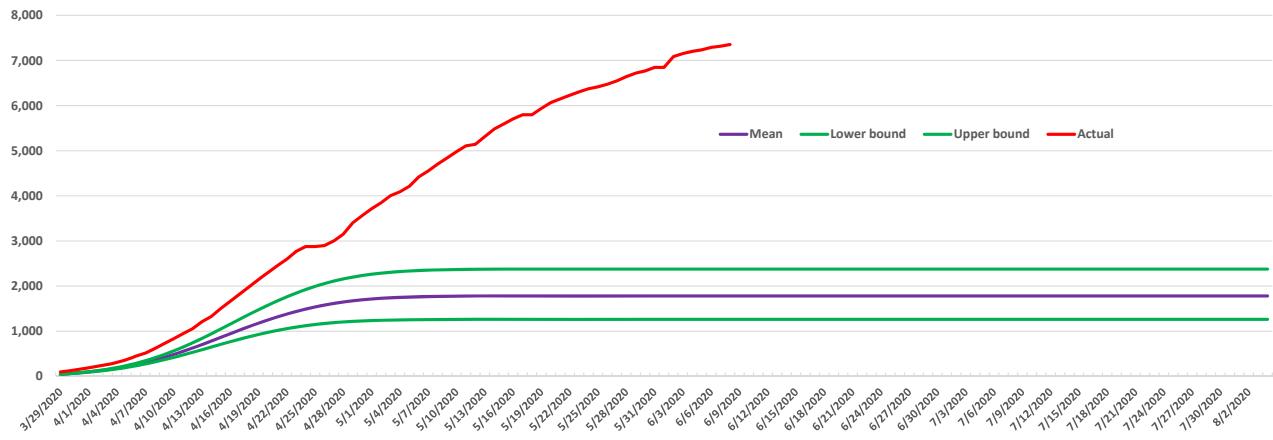
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Connecticut COVID 19 Cumulative Death Projections



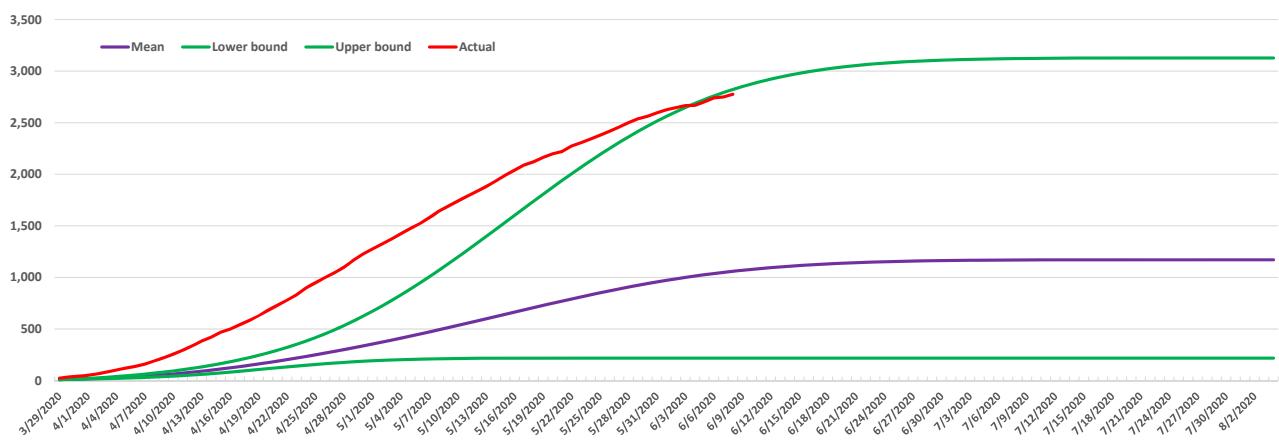
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Massachusetts COVID 19 Cumulative Death Projections



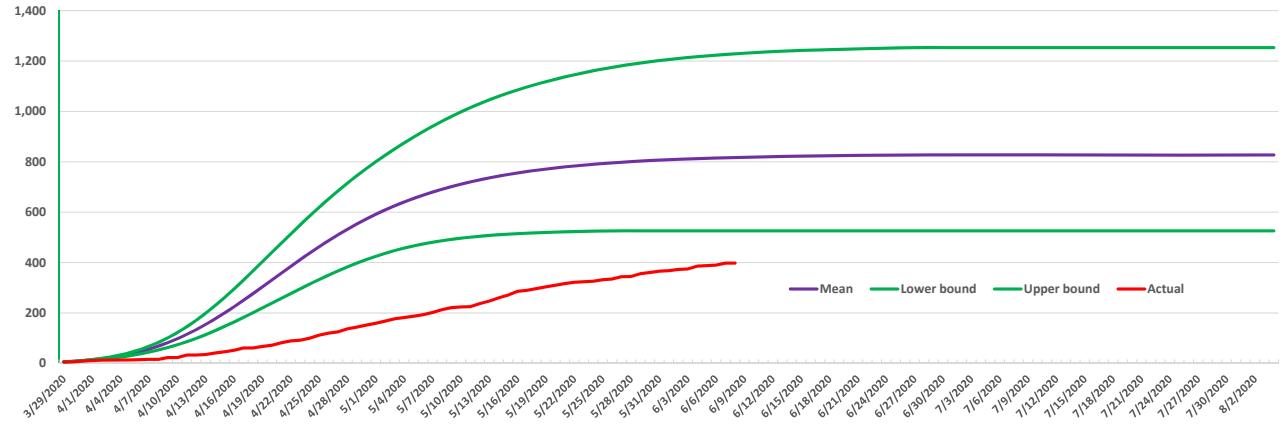
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Maryland COVID 19 Daily Death Projections March 26



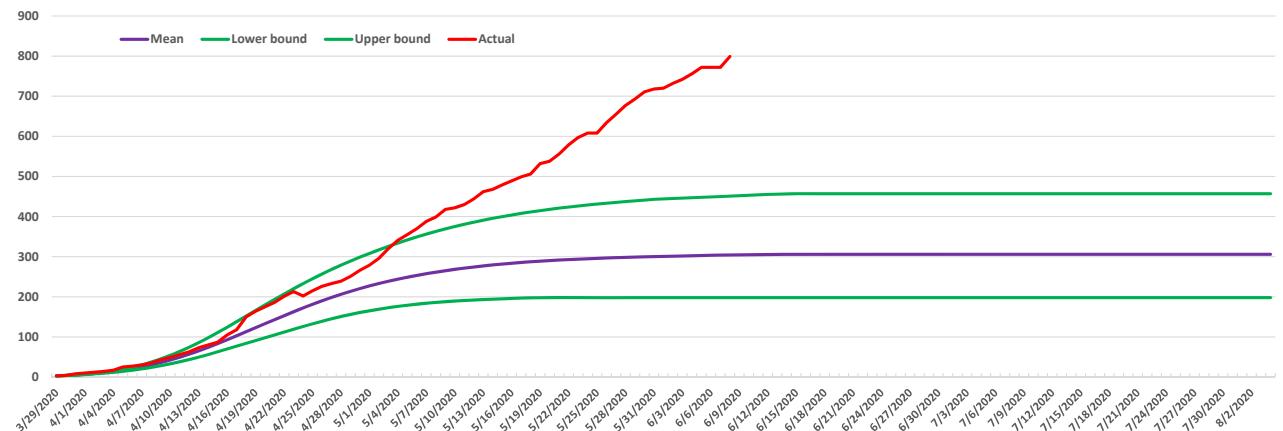
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Delaware COVID 19 Cumulative Death Projections



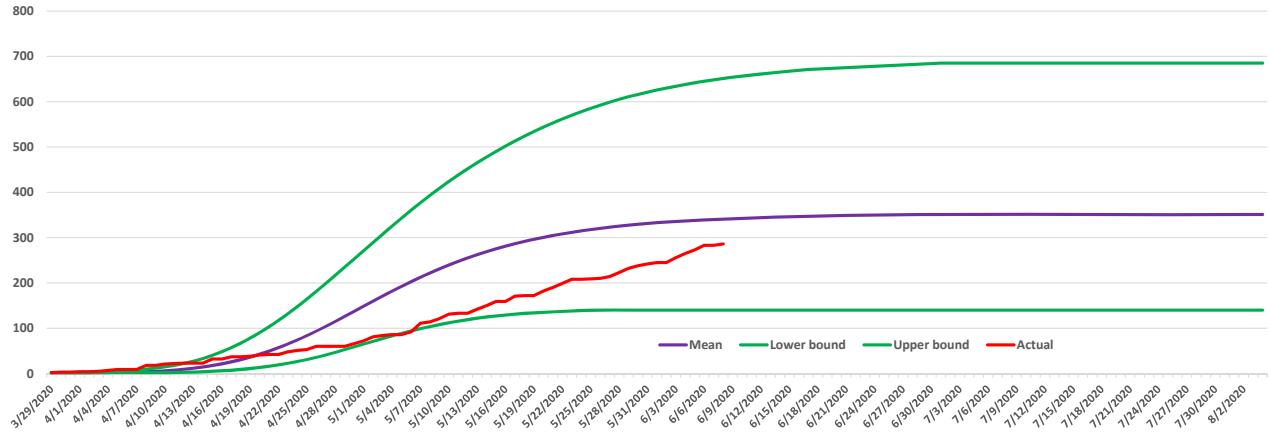
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Rhode Island COVID 19 Cumulative Death Projections March 26



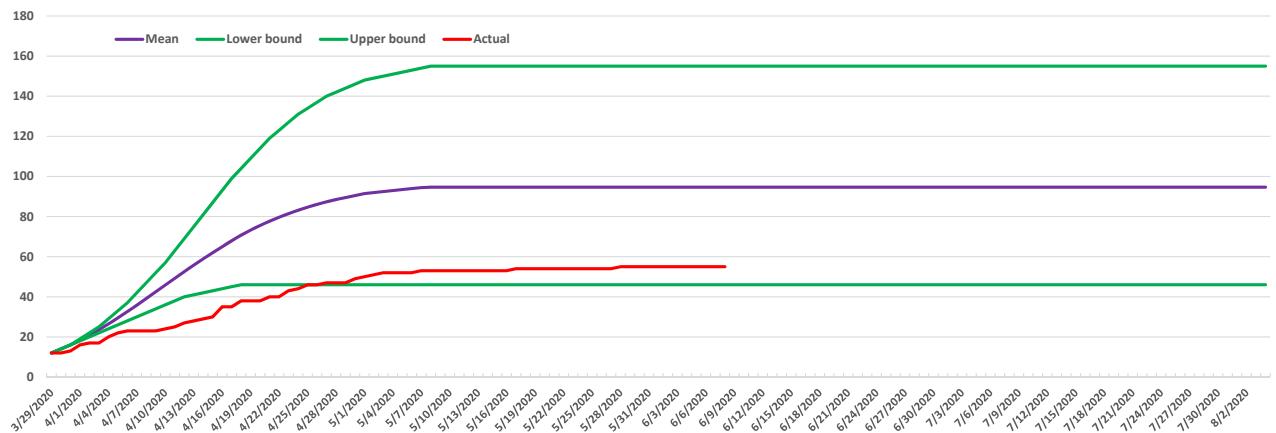
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New Hampshire COVID 19 Cumulative Death Projections



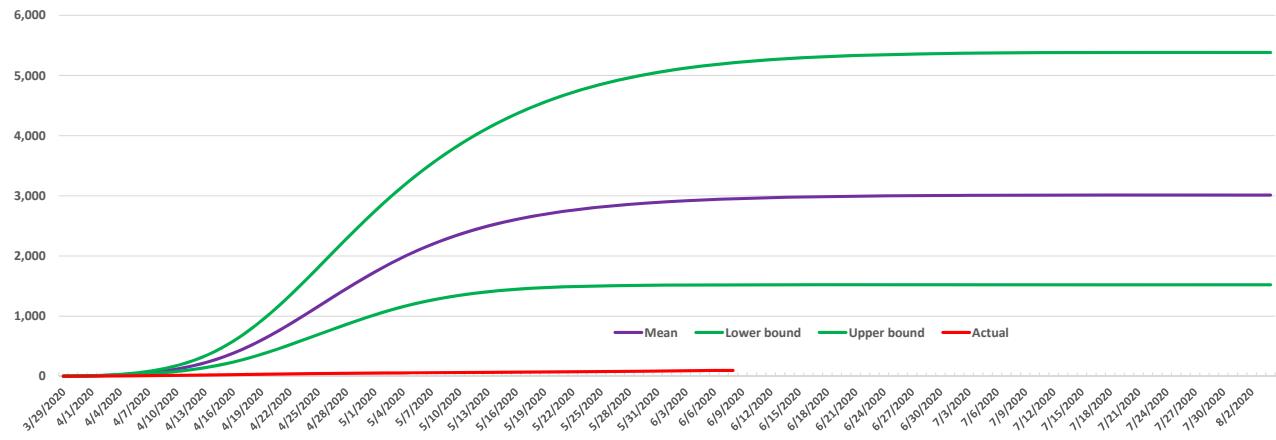
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Vermont COVID 19 Cumulative Death Projections March 26



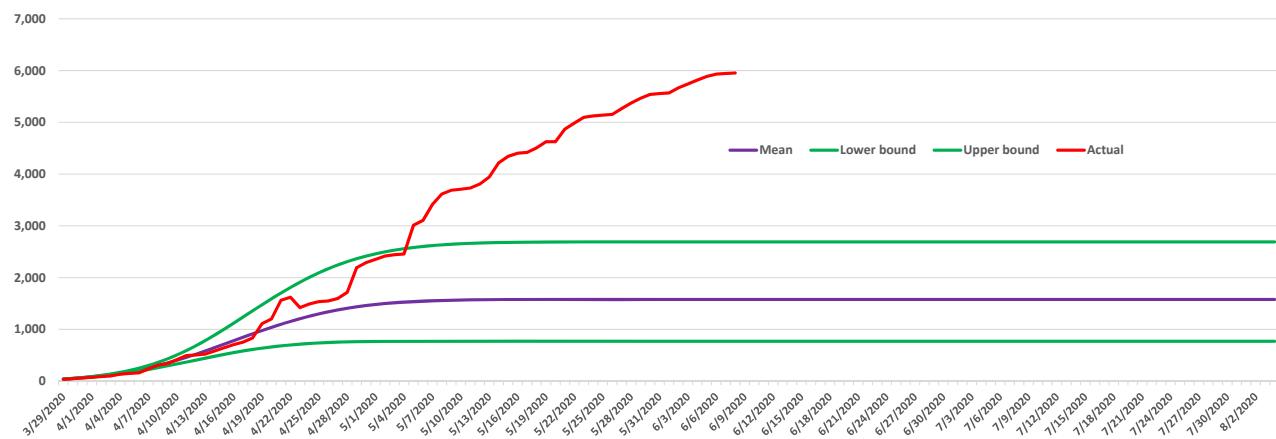
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Maine COVID 19 Cumulative Death Projections



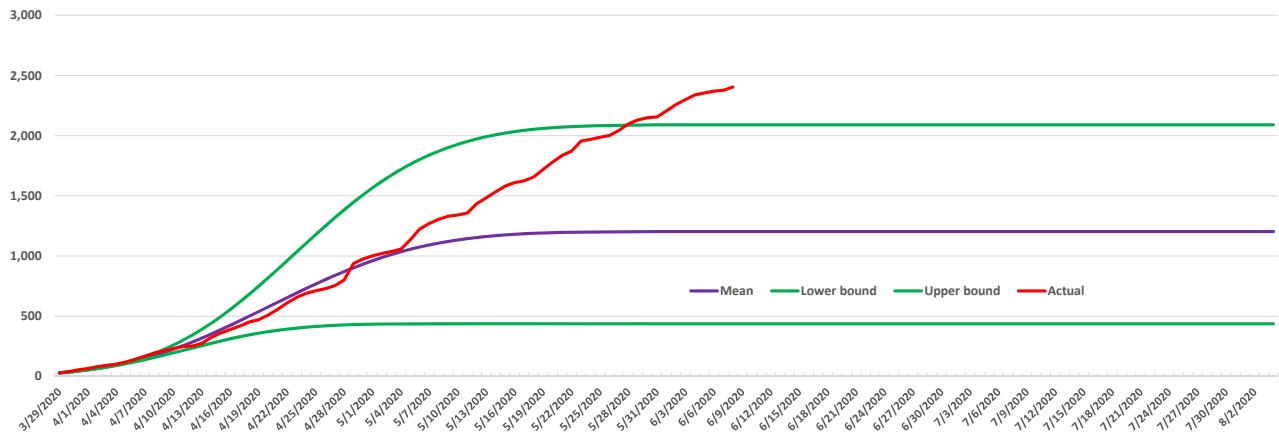
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Pennsylvania COVID 19 Cumulative Death Projections



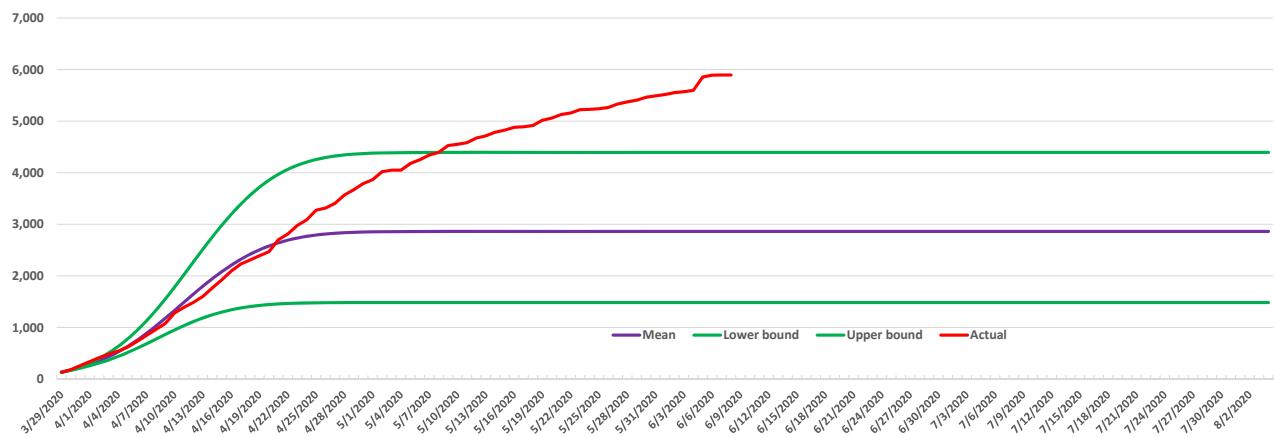
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Ohio COVID 19 Cumulative Death Projections March 26



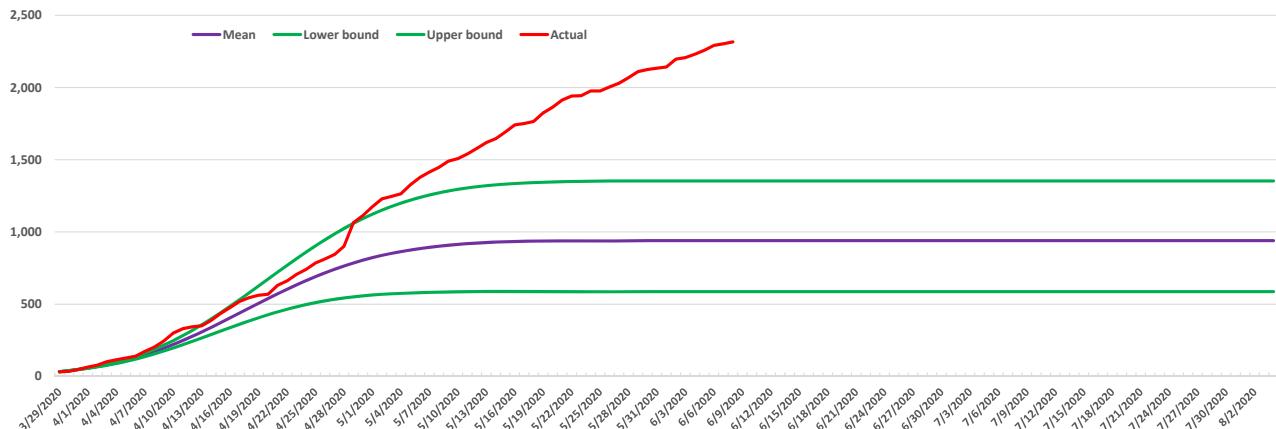
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Michigan COVID 19 Cumulative Death Projections



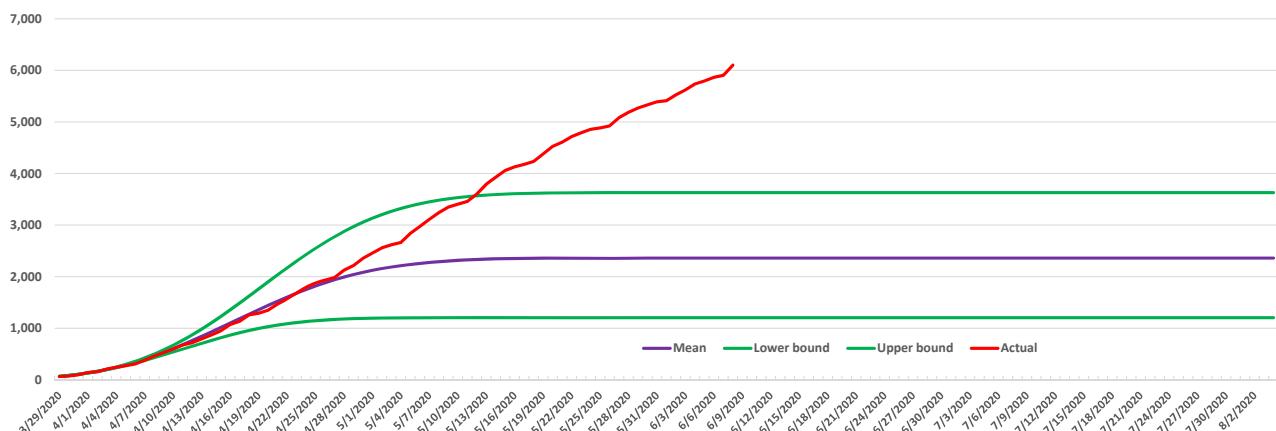
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Indiana COVID 19 Cumulative Death Projections March 26



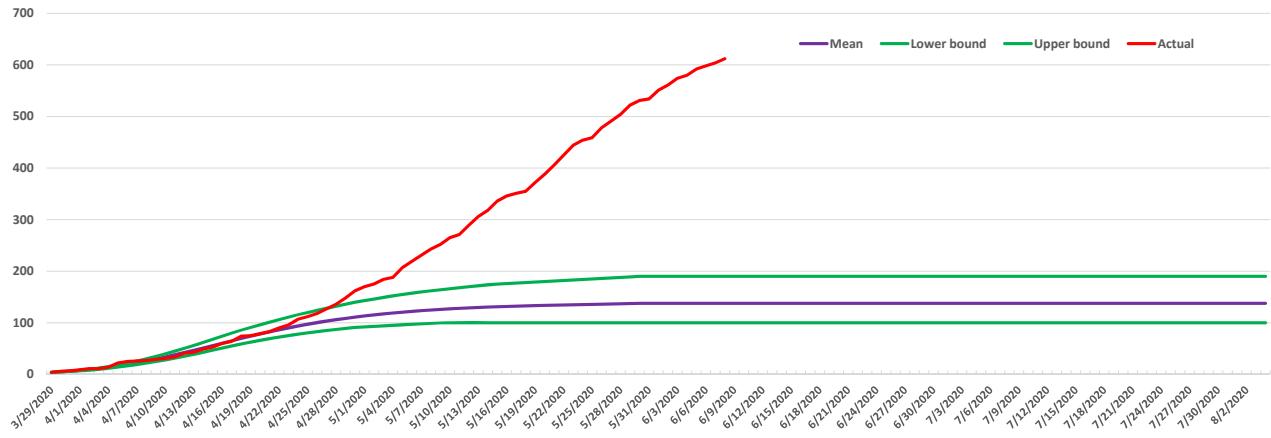
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Illinois COVID 19 Cumulative Death Projections March 26



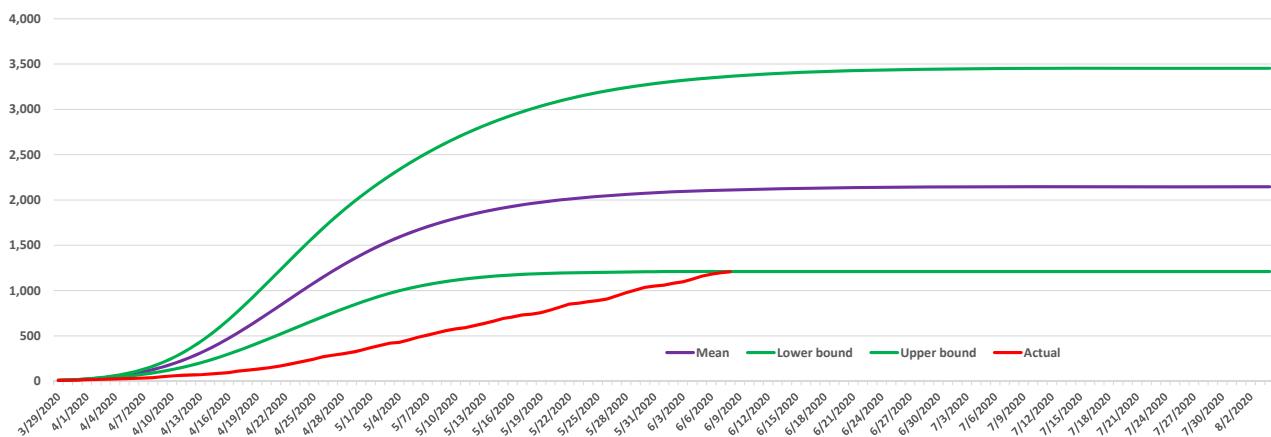
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Iowa COVID 19 Daily Death Projections March 26



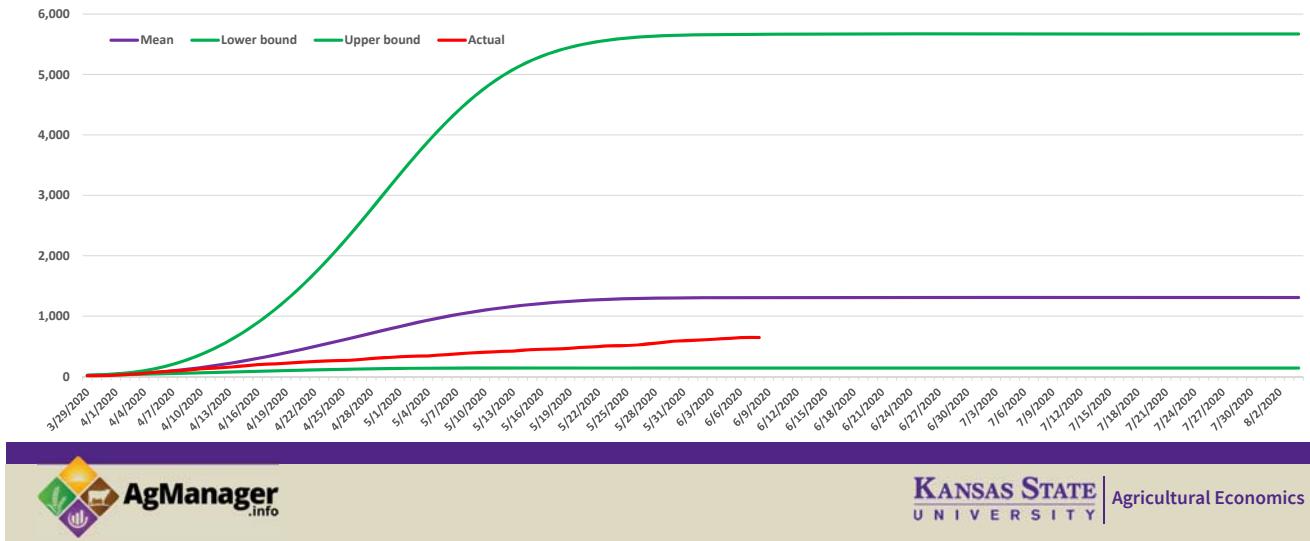
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Minnesota COVID 19 Cumulative Death Projections



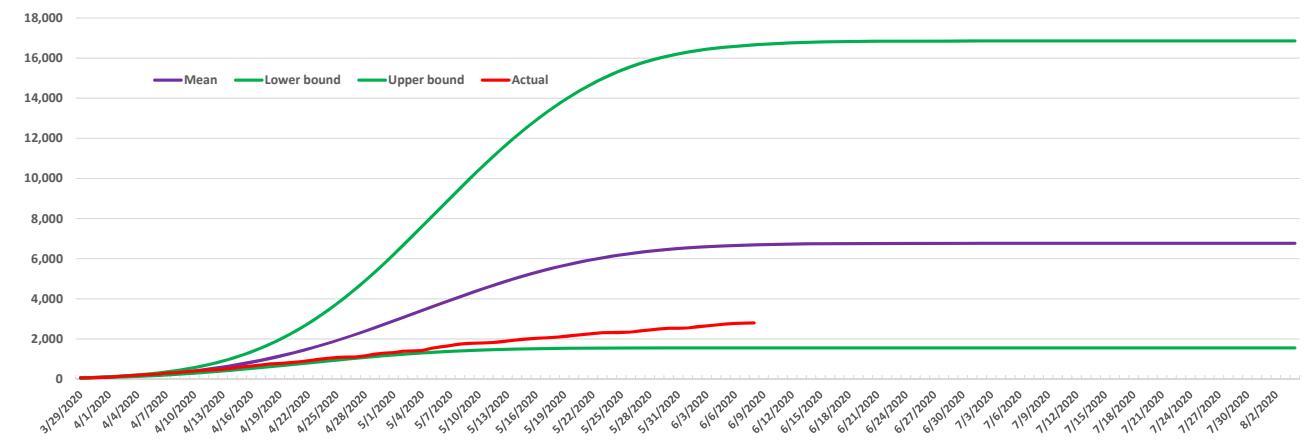
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Wisconsin COVID 19 Cumulative Death Projections



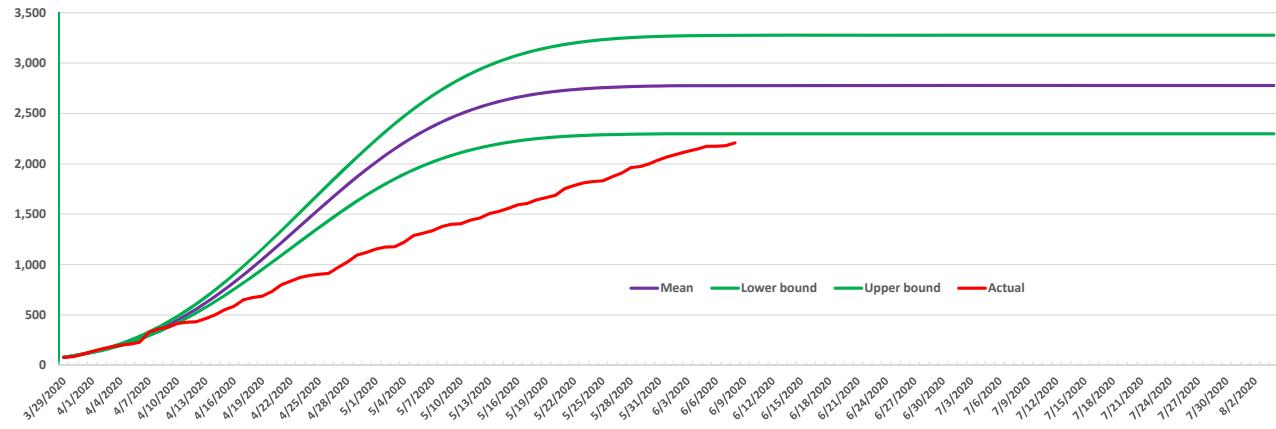
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Florida COVID 19 Cumulative Death Projections March 26



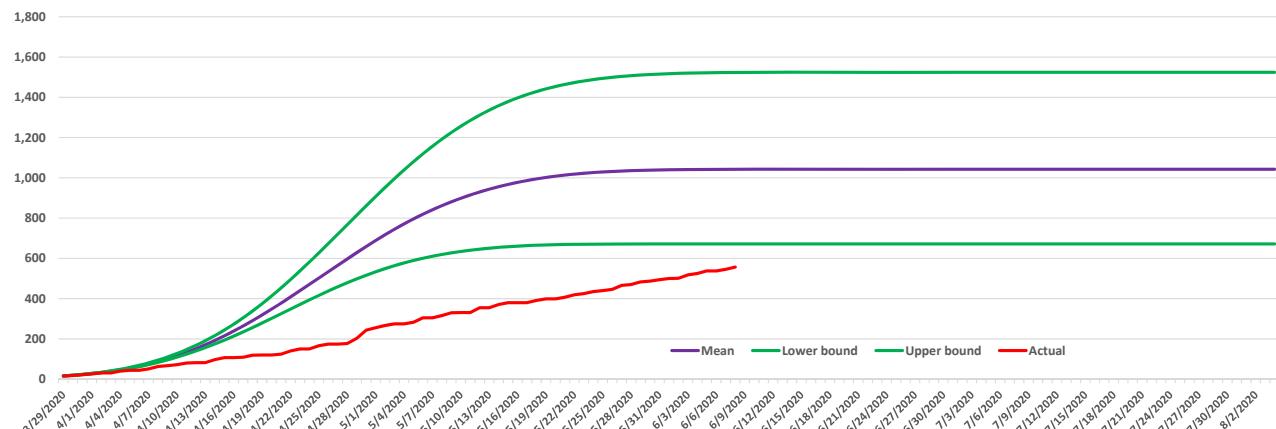
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Georgia COVID 19 Cumulative Death Projections



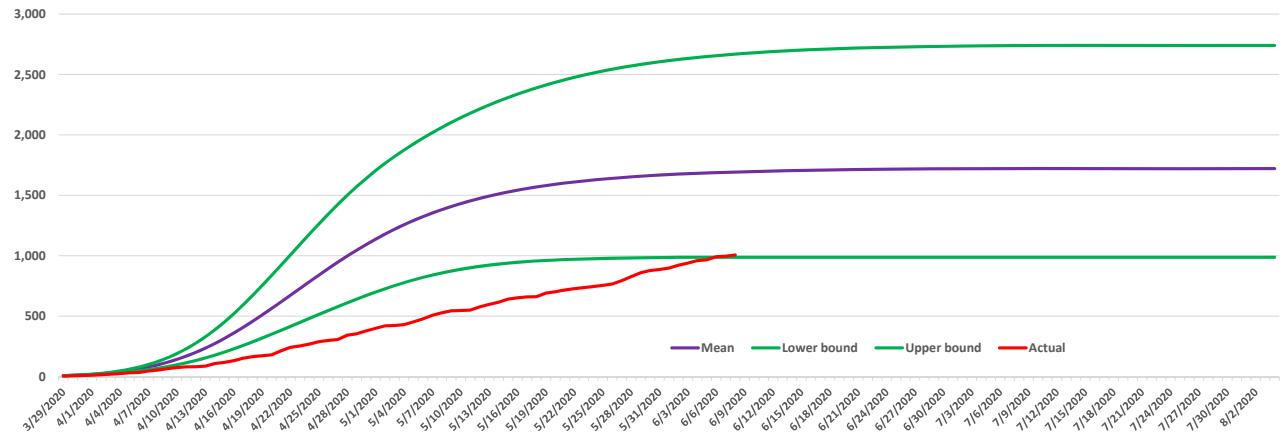
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South Carolina COVID 19 Cumulative Death Projections



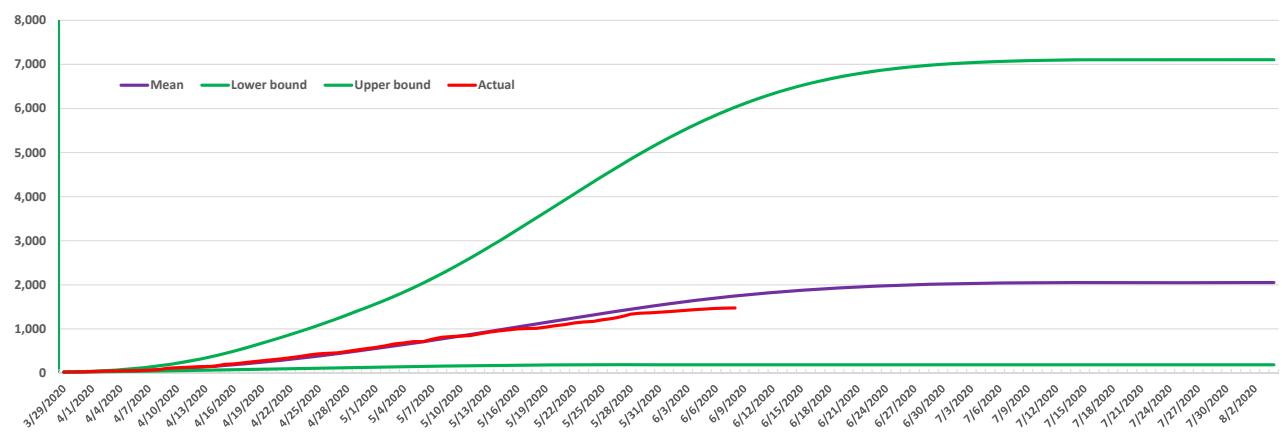
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North Carolina COVID 19 Cumulative Death Projections



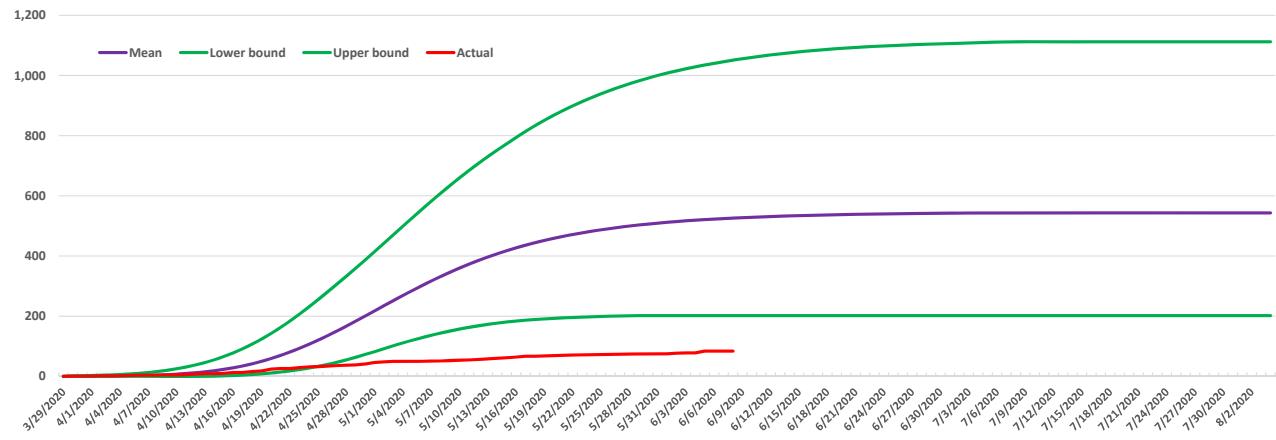
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Virginia COVID 19 Cumulative Death Projections



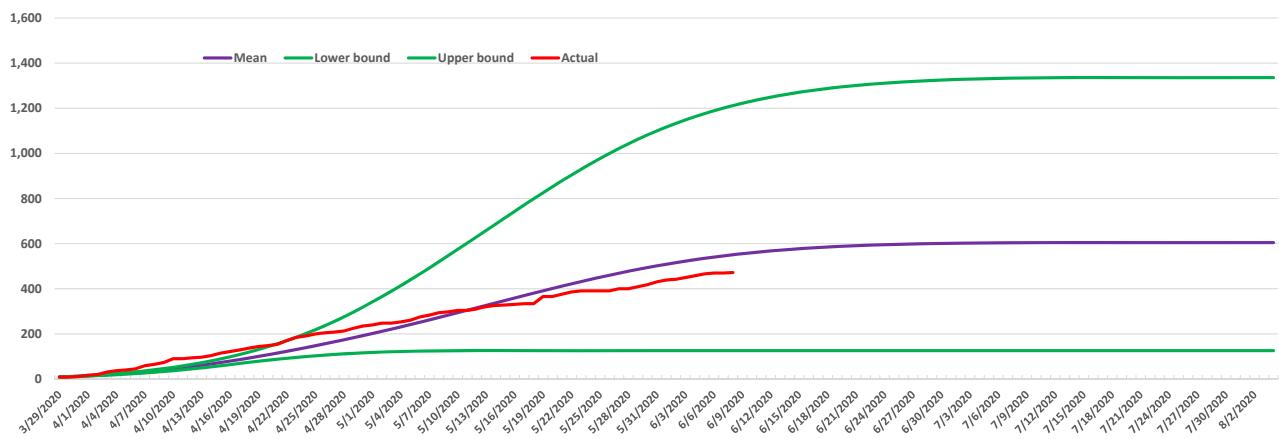
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West Virginia COVID 19 Cumulative Death Projections



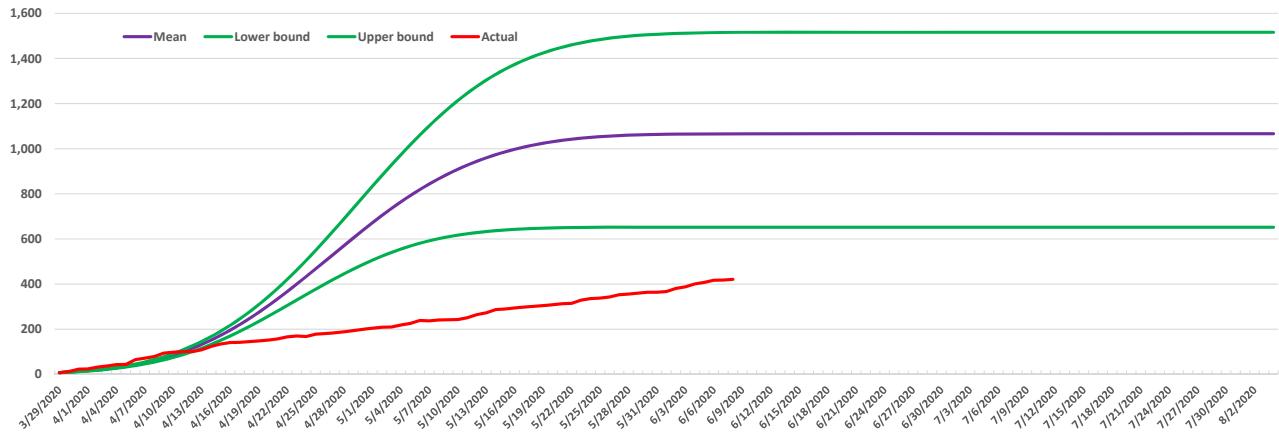
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Kentucky COVID 19 Cumulative Death Projections March 26



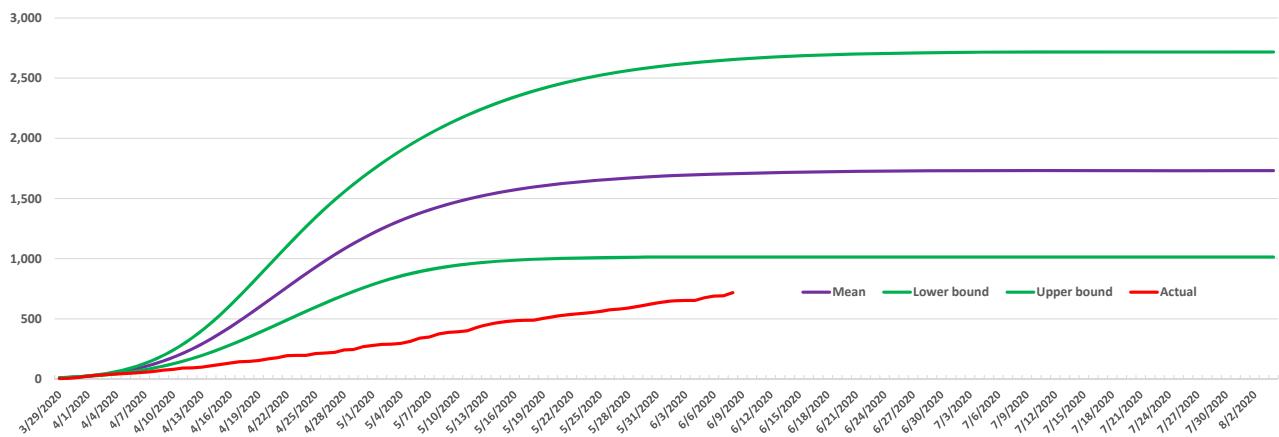
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Tennessee COVID 19 Cumulative Death Projections March 26



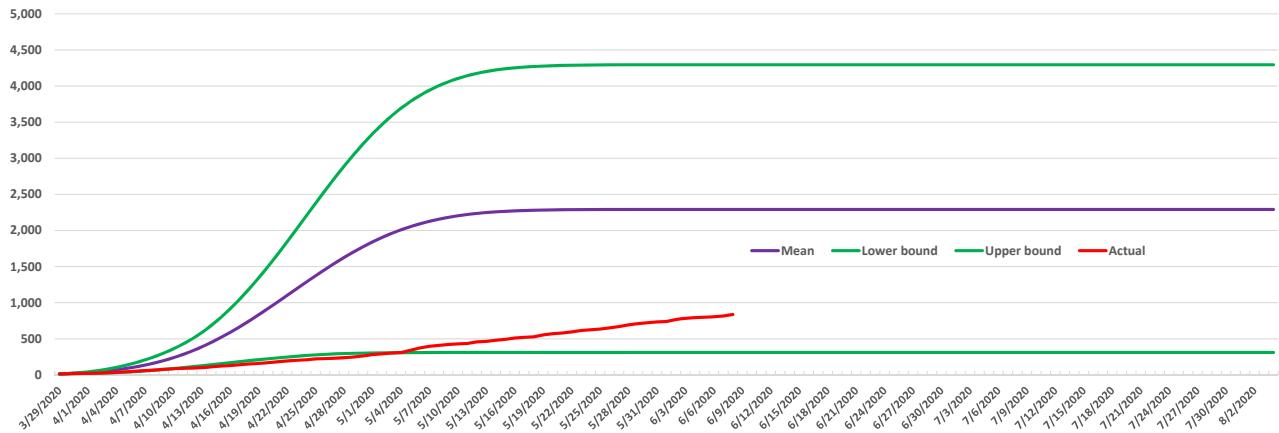
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Alabama COVID 19 Cumulative Death Projections March 26



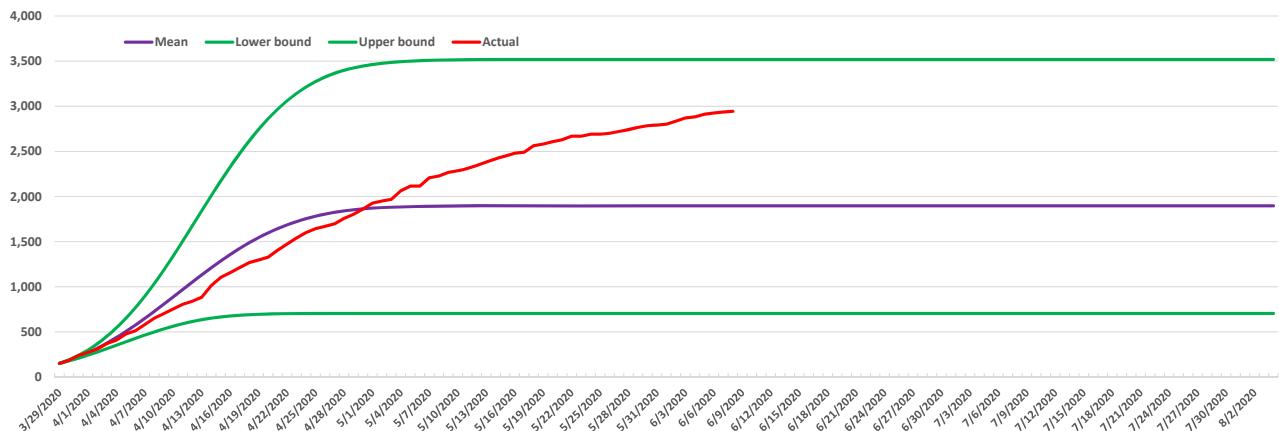
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Mississippi COVID 19 Daily Death Projections March 26



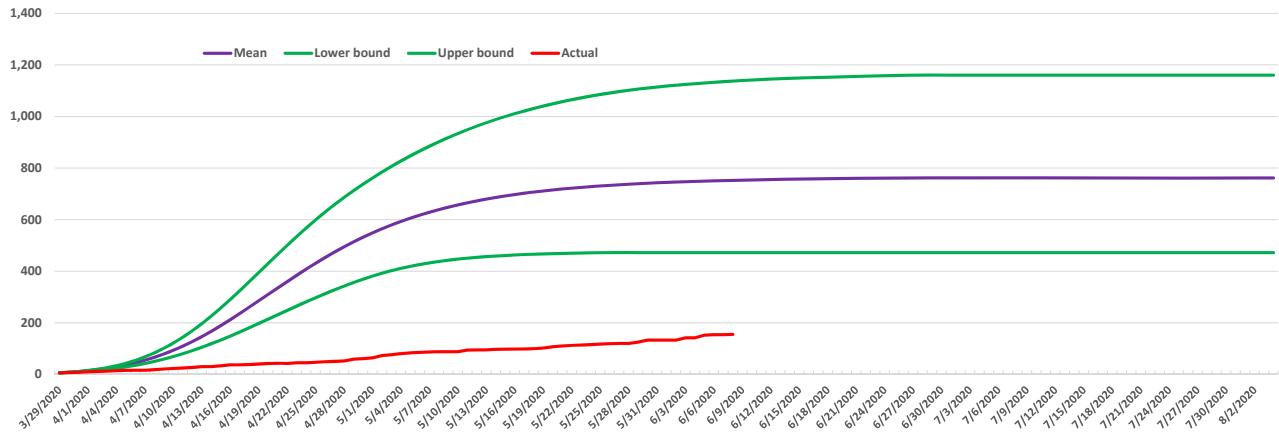
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Louisiana COVID 19 Daily Death Projections March 26



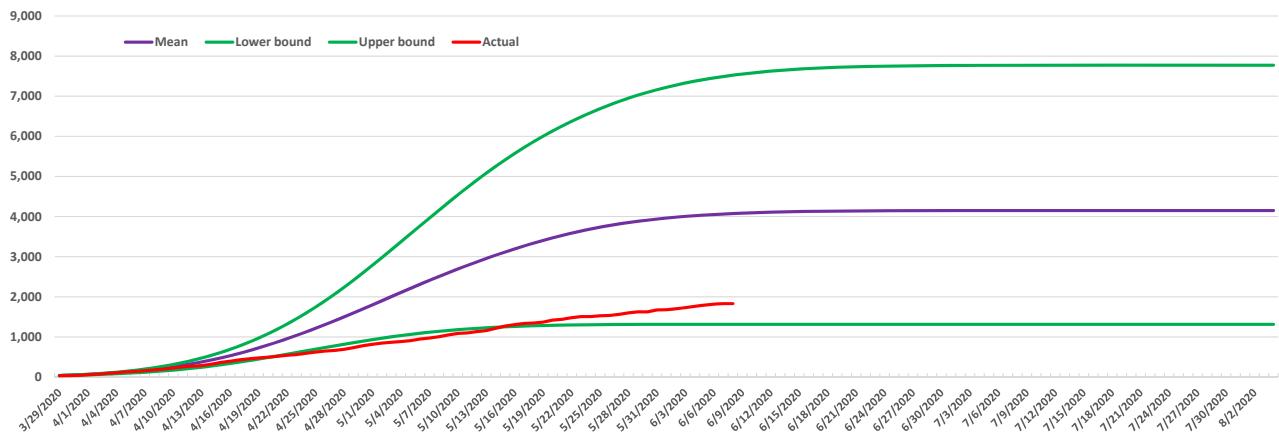
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Arkansas COVID 19 Cumulative Death Projections March 26



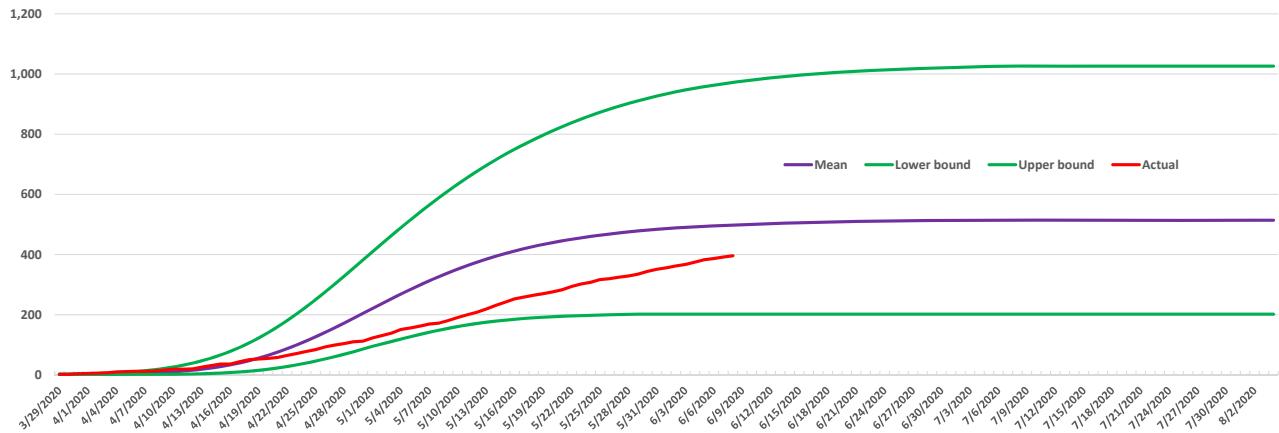
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Texas COVID 19 Daily Death Projections March 26



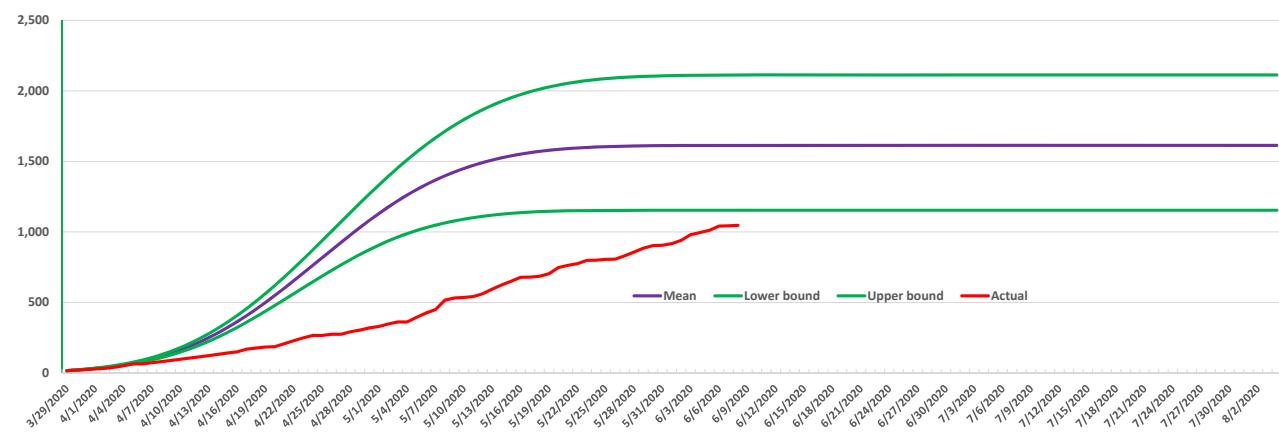
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New Mexico COVID 19 Daily Death Projections March 26



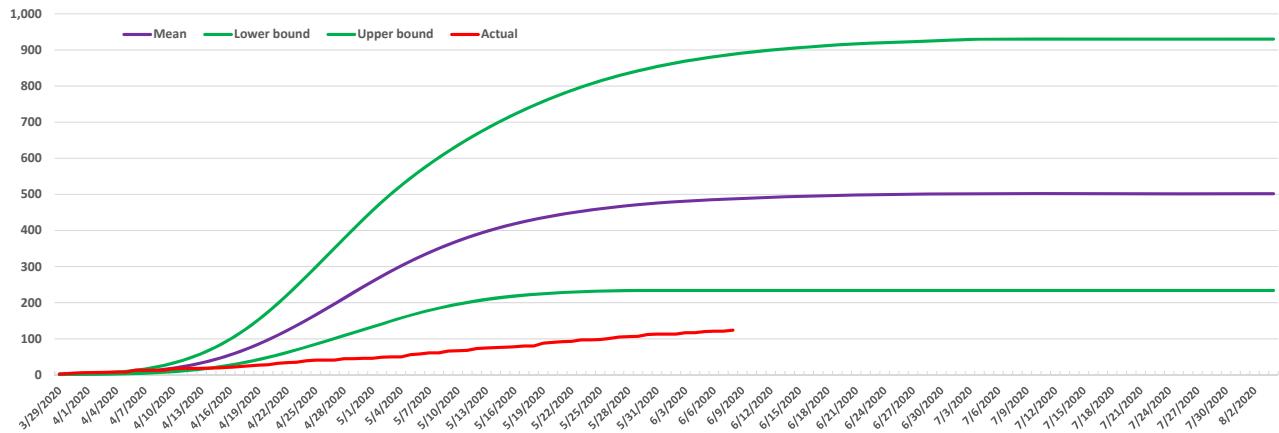
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Arizona COVID 19 Cumulative Death Projections



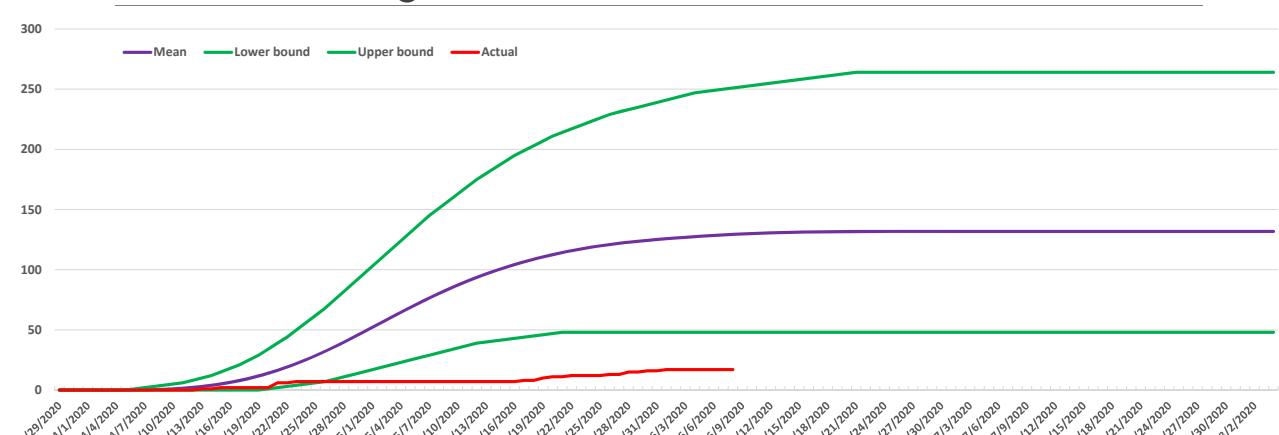
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Utah COVID 19 Daily Death Projections March 26



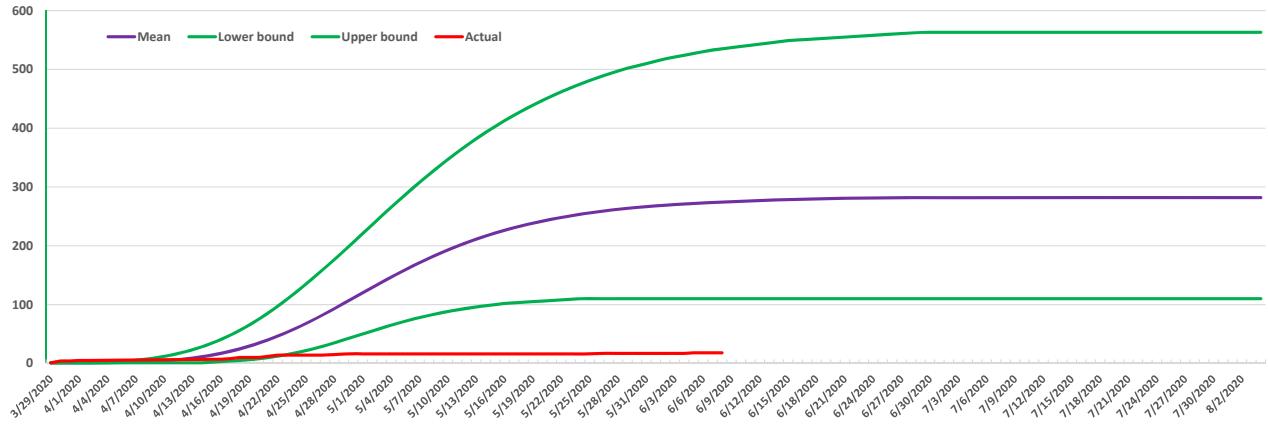
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Wyoming COVID 19 Cumulative Death Projections March 26



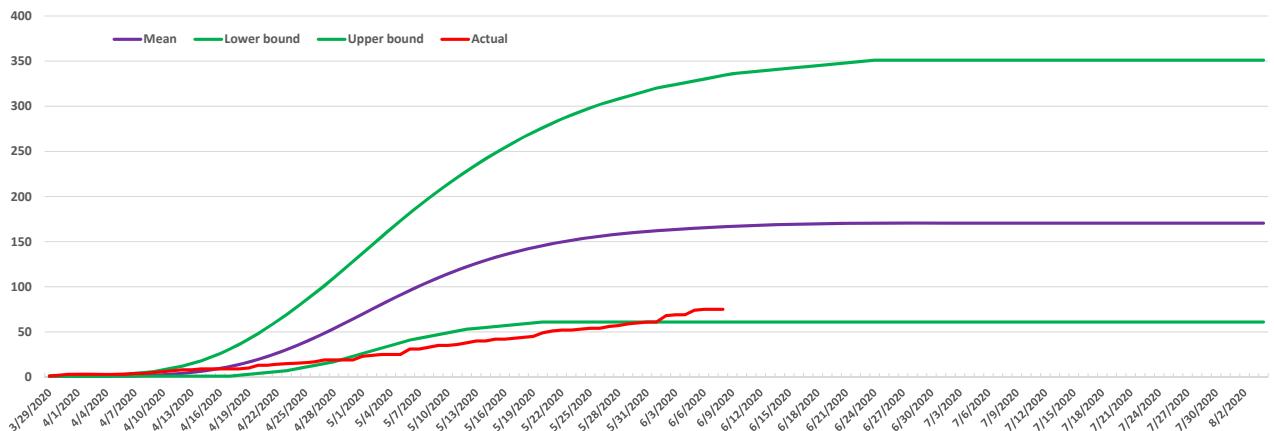
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Montana COVID 19 Cumulative Death Projections



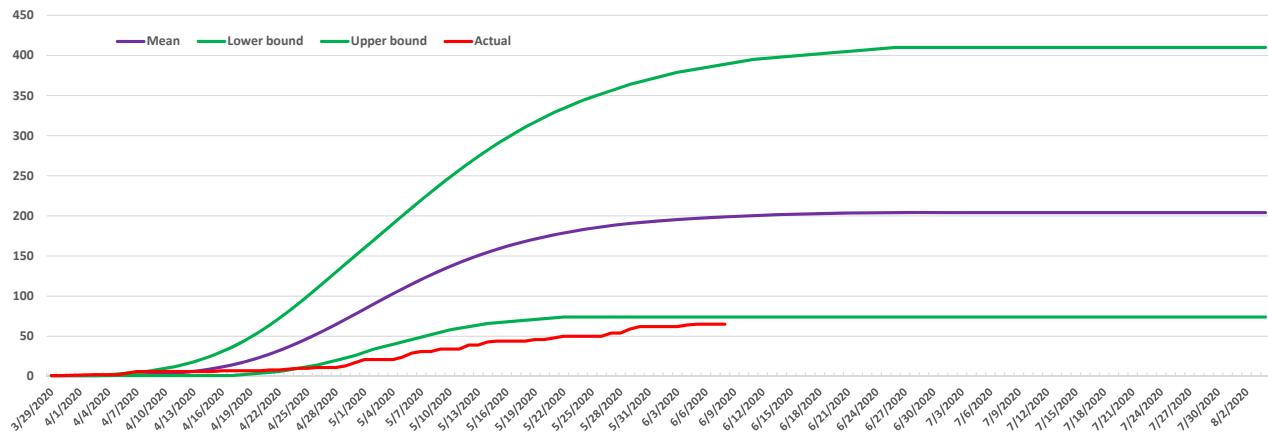
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North Dakota COVID 19 Cumulative Death Projections March 26



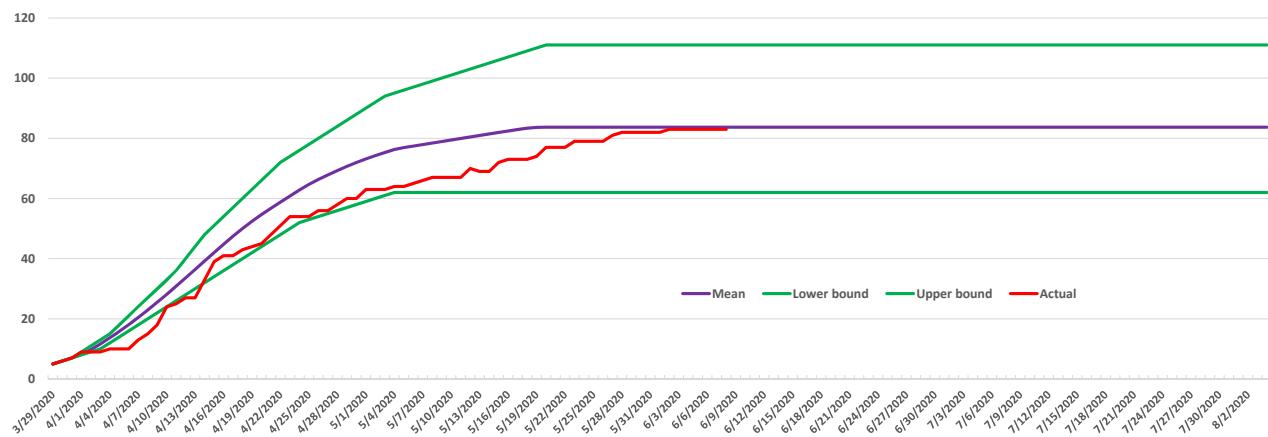
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South Dakota COVID 19 Daily Death Projections March 26



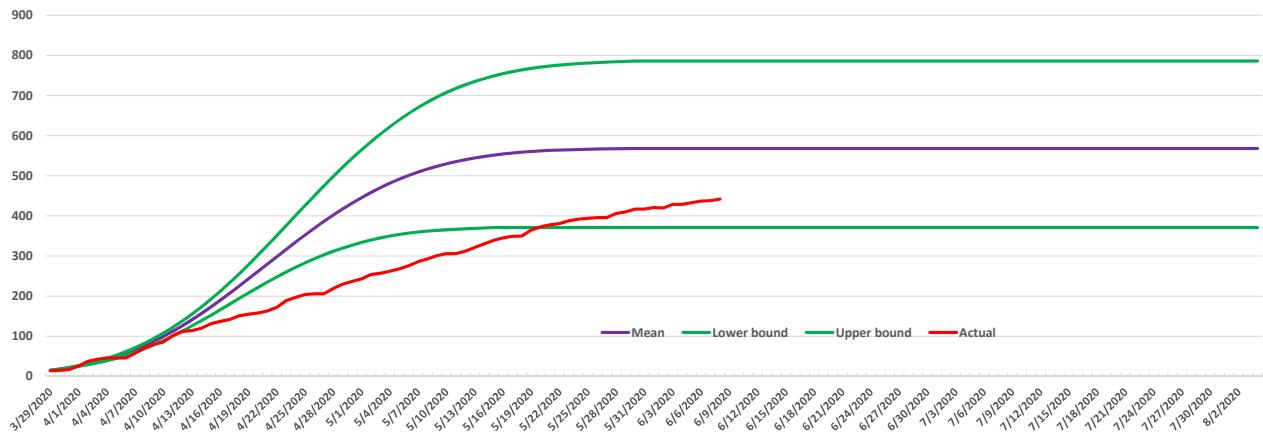
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Idaho COVID 19 Cumulative Death Projections March 26



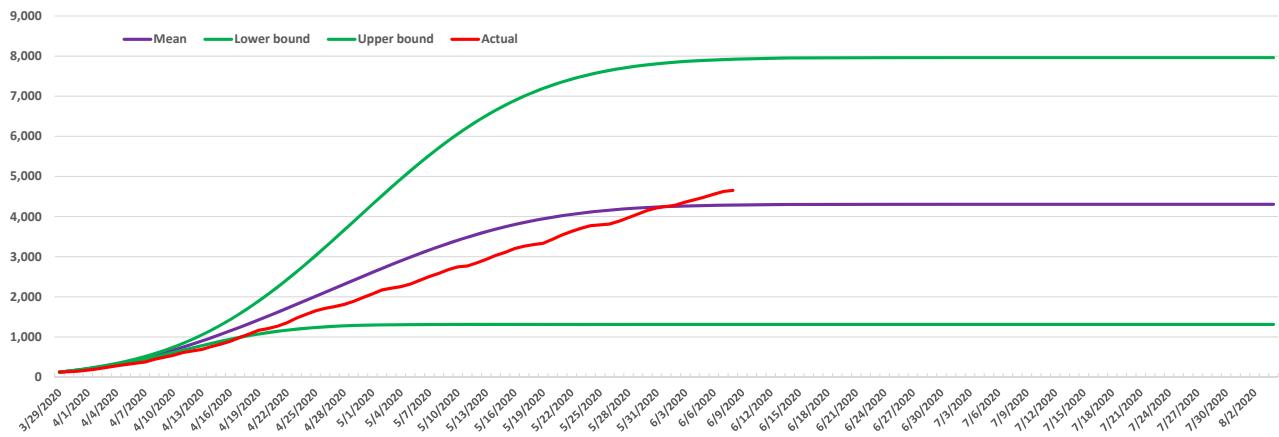
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Nevada COVID 19 Cumulative Death Projections



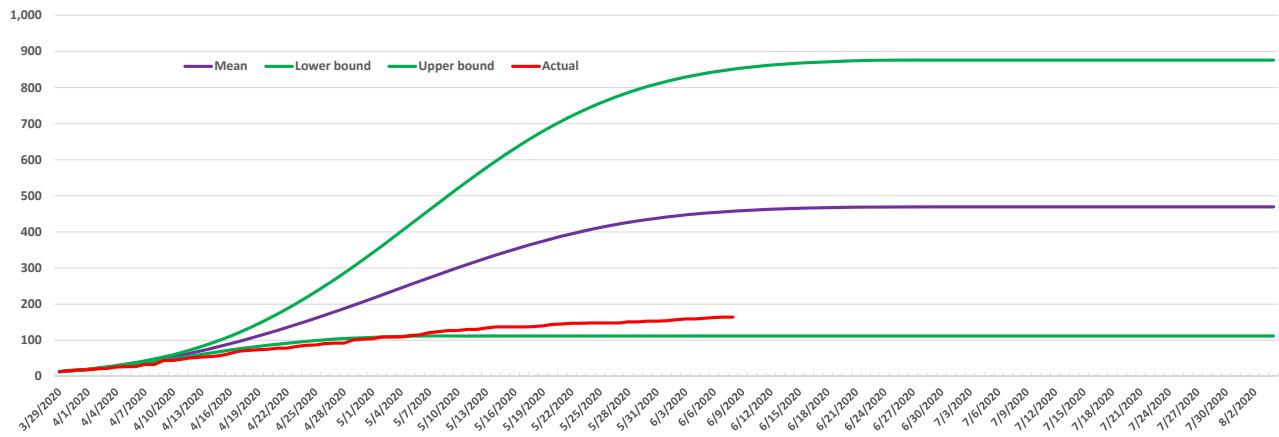
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California COVID 19 Cumulative Death Projections March 26



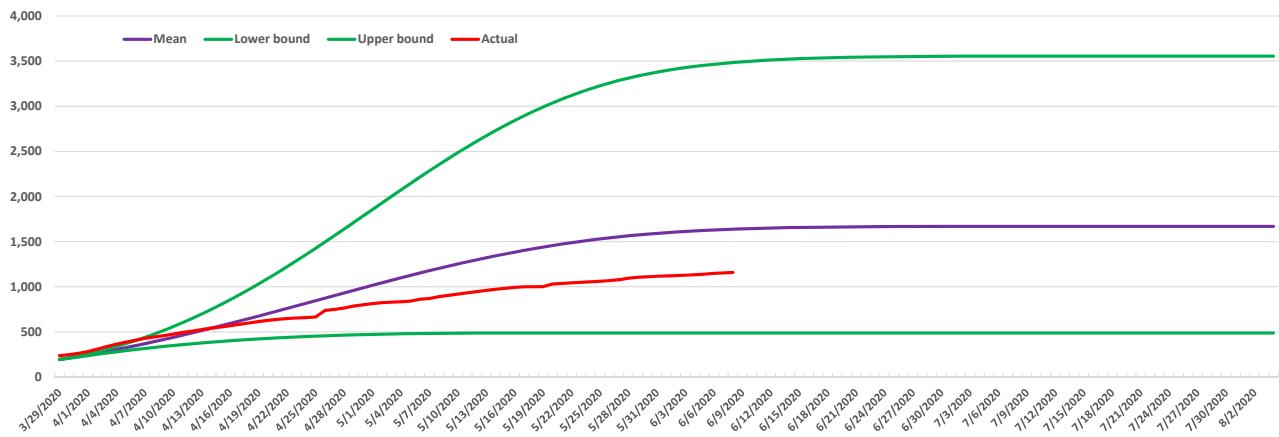
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Oregon COVID 19 Cumulative Death Projections March 26



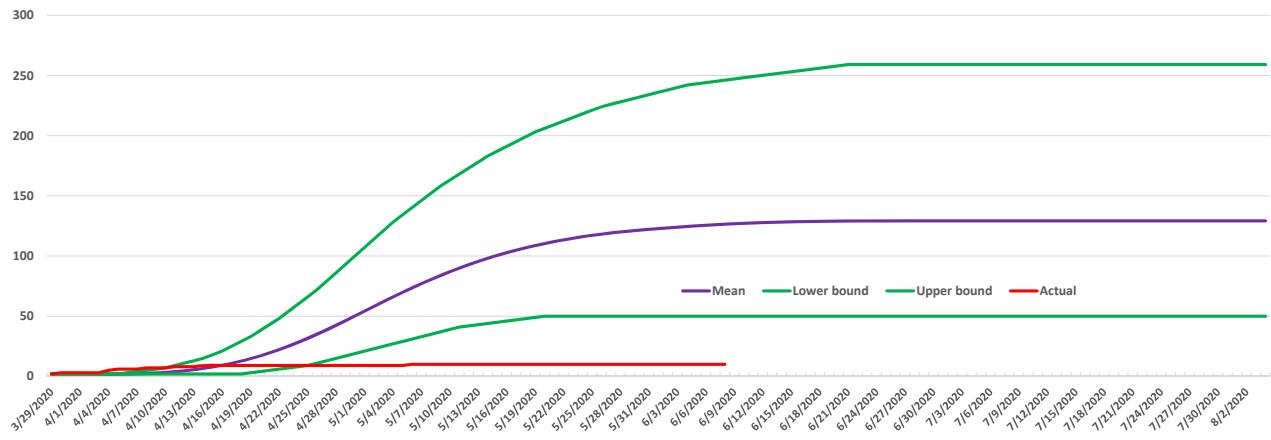
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Washington COVID 19 Cumulative Death Projections March 26



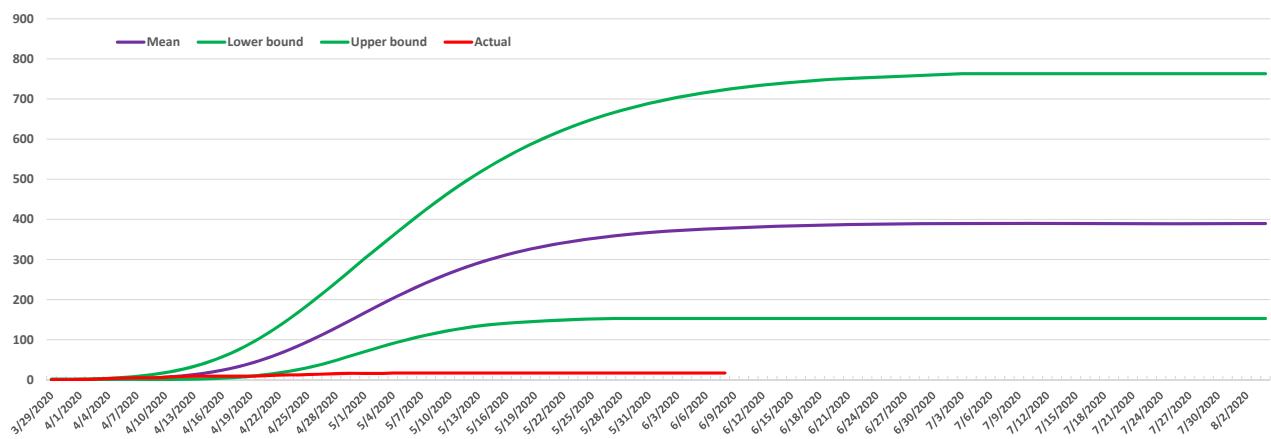
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Alaska COVID 19 Cumulative Death Projections March 26



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Hawaii COVID 19 Daily Death Projections March 26



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