

Analysis of the IHME COVID 19 Forecasting Model – June 16th Update

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Outline

- ❖ IHME revisions since June 9th
- ❖ A look at Kansas and United States mortality statistics
- ❖ Changes over the last week 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, roughly 44 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 9th 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	2	0.8%	1.8%
35-44 years	6	2.4%	2.5%
45-54 years	13	5.3%	4.8%
55-64 years	35	14.3%	12.8%
65-74 years	47	19.2%	18.2%
75-84 years	49	20.0%	23.4%
85+ years	93	38.0%	34.2%
Total	245	100%	97.6%

<https://www.coronavirus.kdheks.gov/160/COVID-19-in-Kansas>, June 16, 2020

https://www.kdheks.gov/phi/AS_Tables/AS_2018_Tables_and_Figures/general_mortality/Table_E4.pdf, June 16, 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	116	0.1%	0.2%
25-34 years	640	0.7%	1.1%
35-44 years	1,649	1.7%	2.1%
45-54 years	4,588	4.8%	6.0%
55-64 years	11,439	12.0%	13.2%
65-74 years	19,857	20.8%	18.9%
75-84 years	25,520	26.7%	23.4%
85+ years	31,778	33.2%	31.2%
Total	95,608	99.98%	98.87%

<https://data.cdc.gov/NCHS/Provisional-COVID-19-Death-Counts-by-Sex-Age-and-S/9bhg-hcku>, June 16, 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	2	0.01	1.3
35-44 years	6	0.02	1.9
45-54 years	13	0.04	3.9
55-64 years	35	0.09	9.3
65-74 years	47	0.18	18.9
75-84 years	49	0.37	47.5
85+ years	93	1.42	142.1

<https://www.coronavirus.kdheks.gov/160/COVID-19-in-Kansas>, June 16, 2020

https://www.kdheks.gov/phi/AS_Tables/AS_2018_Tables_and_Figures/general_mortality/, June 16, 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	16	0.00	0.17
15-24 years	116	0.00	0.74
25-34 years	640	0.01	1.33
35-44 years	1,649	0.04	1.95
45-54 years	4,588	0.11	4.02
55-64 years	11,439	0.27	8.86
65-74 years	19,857	0.67	17.91
75-84 years	25,520	1.74	44.73
85+ years	31,778	4.91	135.74

<https://data.cdc.gov/NCHS/Provisional-COVID-19-Death-Counts-by-Sex-Age-and-S/9bhg-hcku>, June 16, 2020

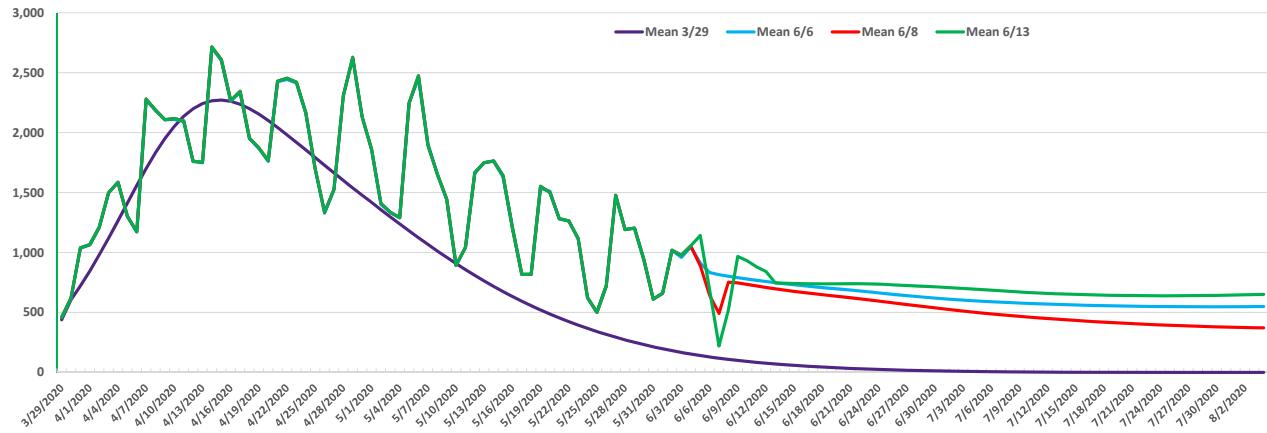


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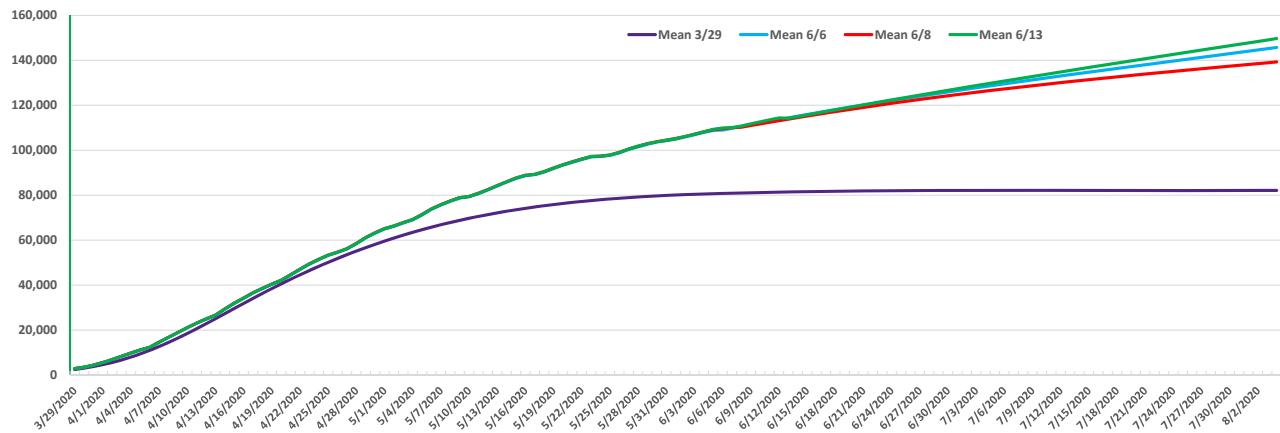
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U.S. COVID 19 Daily Death Projections Revised Forecasts



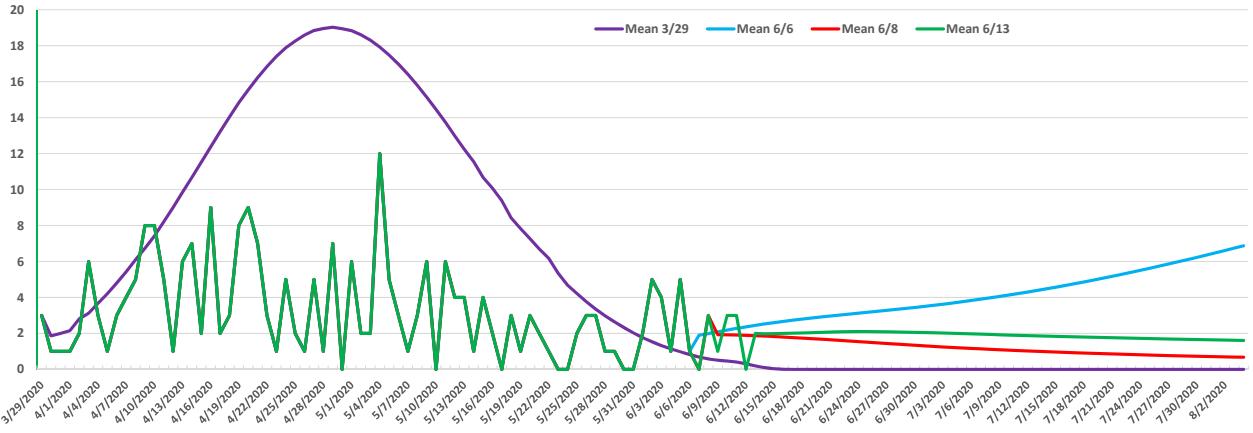
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U.S. COVID 19 Cumulative Death Projections Revised Forecasts



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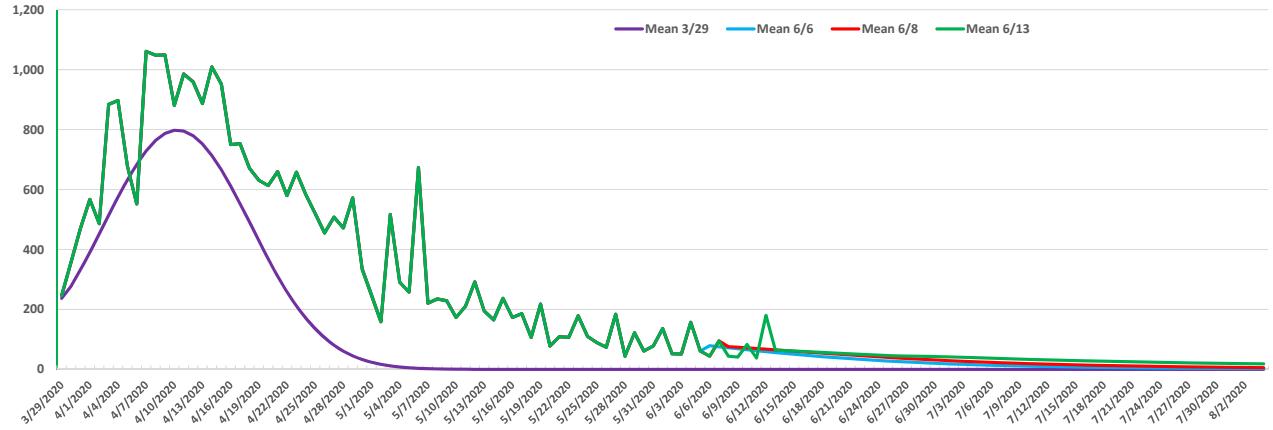
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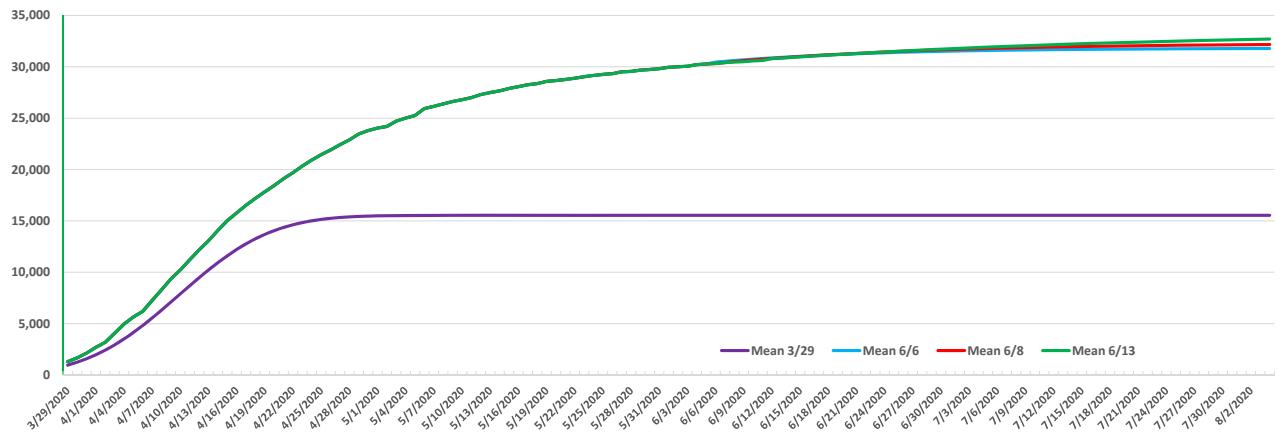
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New York COVID 19 Daily Death Projections Revised Forecasts



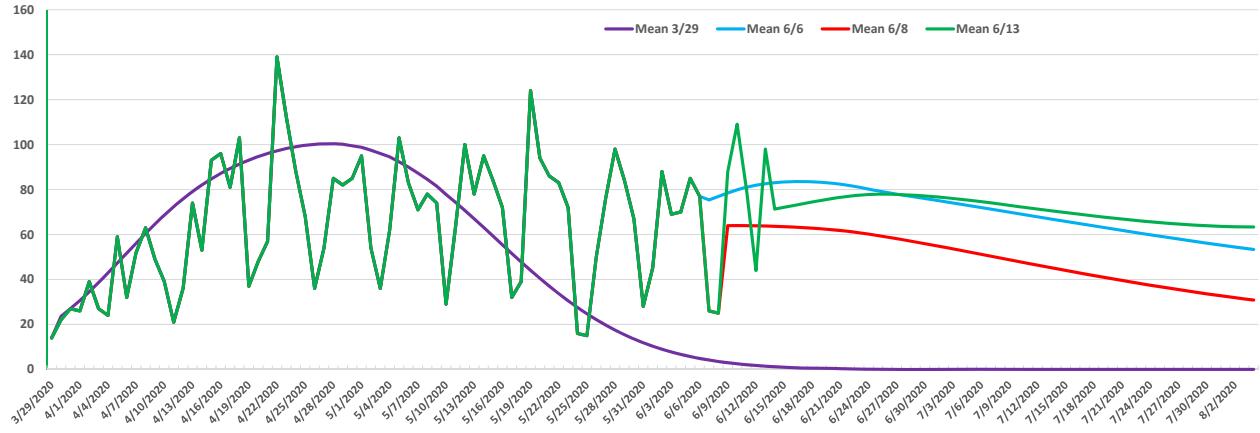
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New York COVID 19 Cumulative Death Projections Revised Forecasts



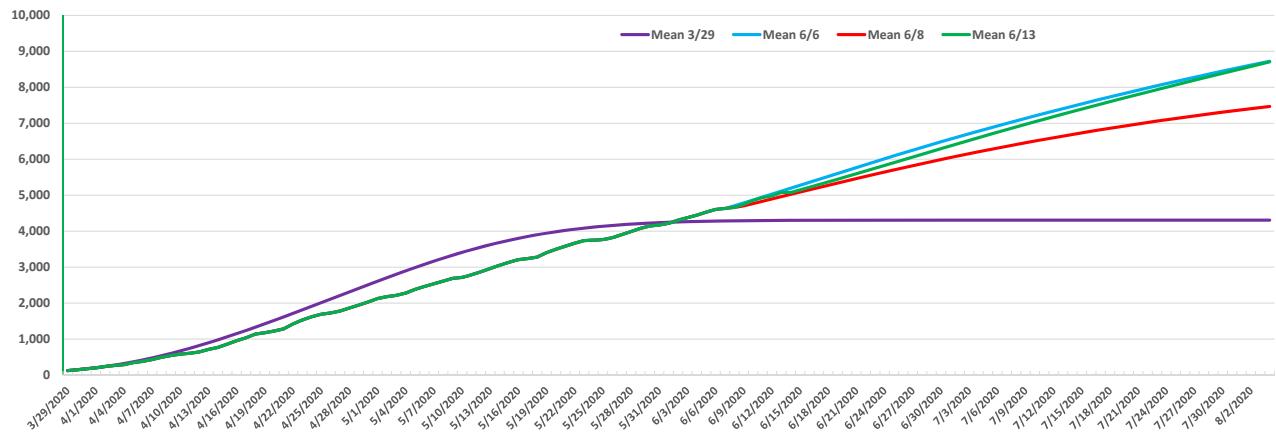
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California COVID 19 Daily Death Projections Revised Forecasts



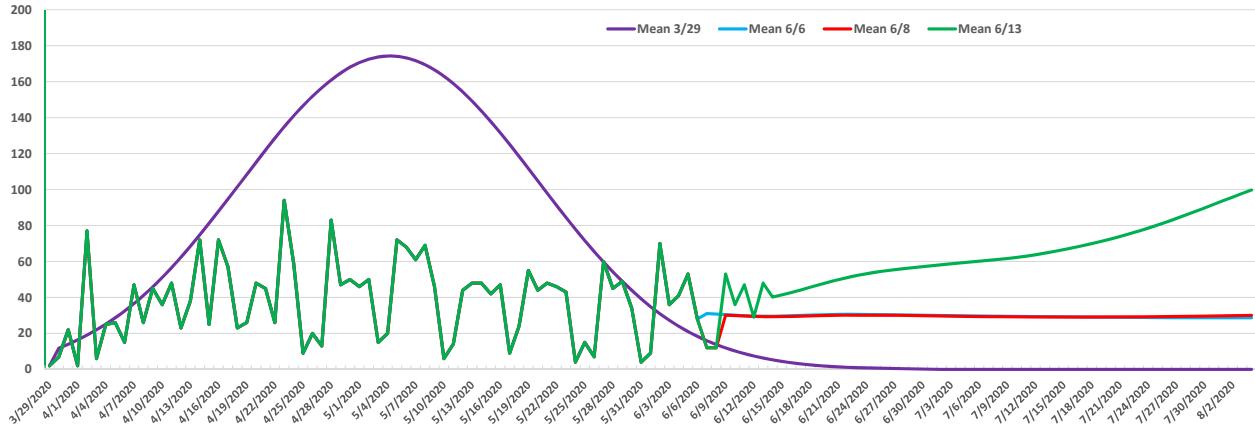
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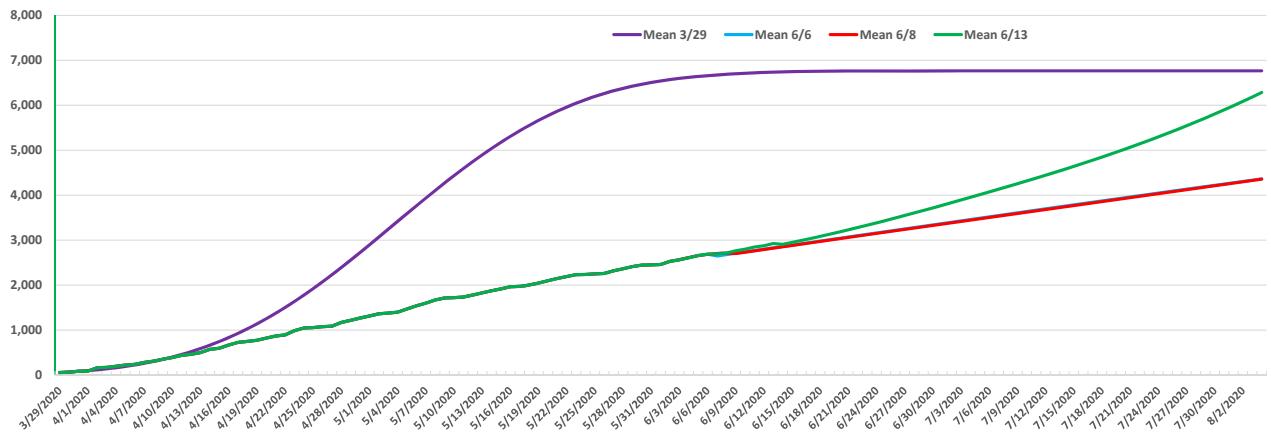
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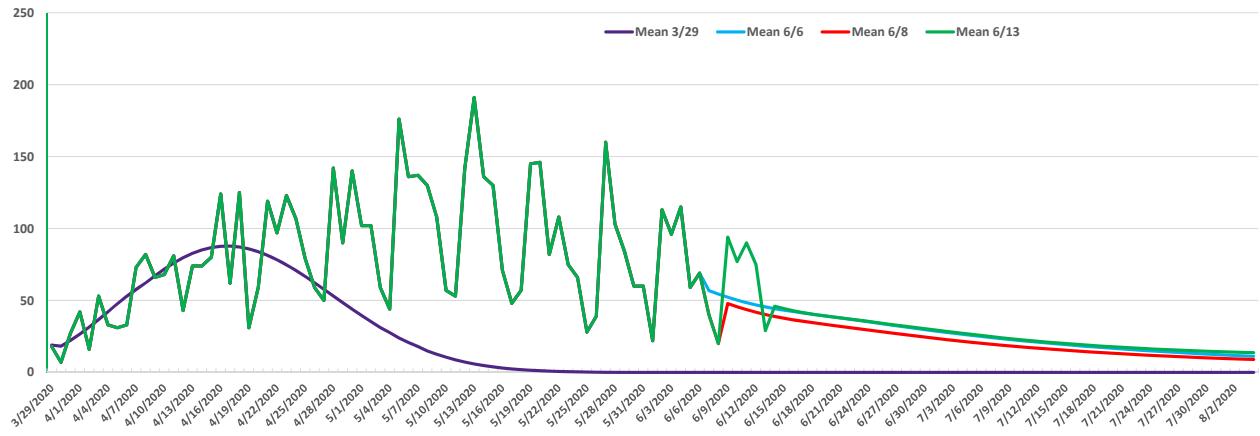
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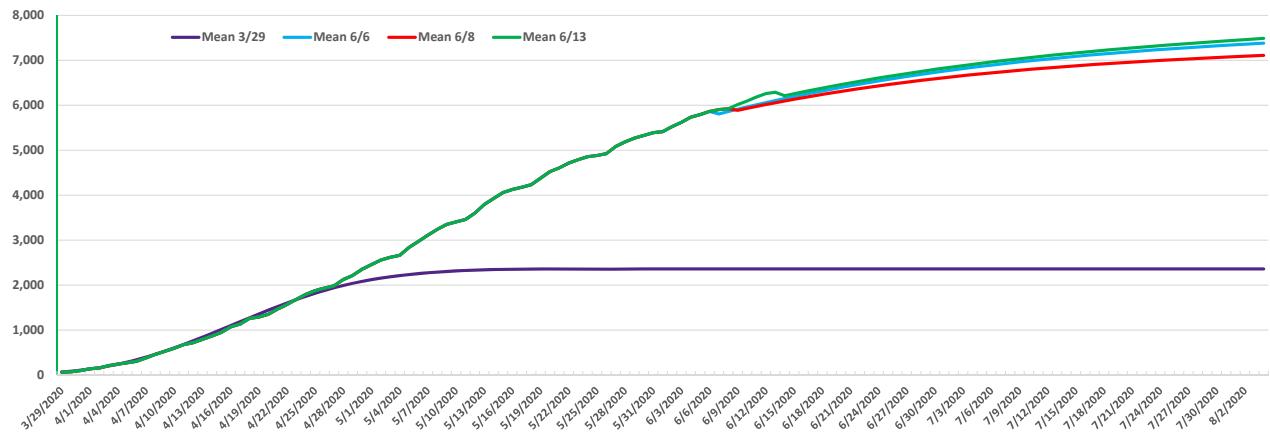
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Illinois COVID 19 Daily Death Projections Revised Forecasts



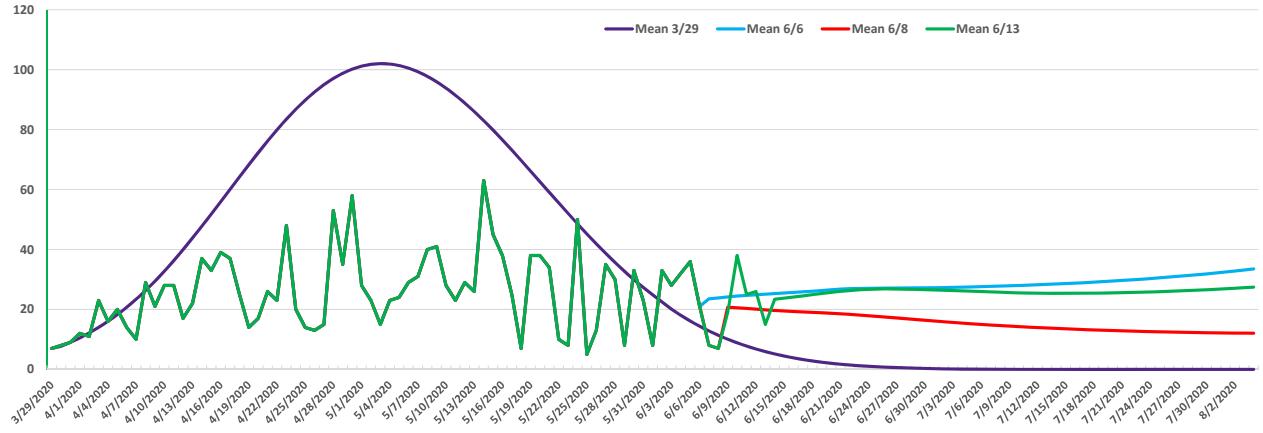
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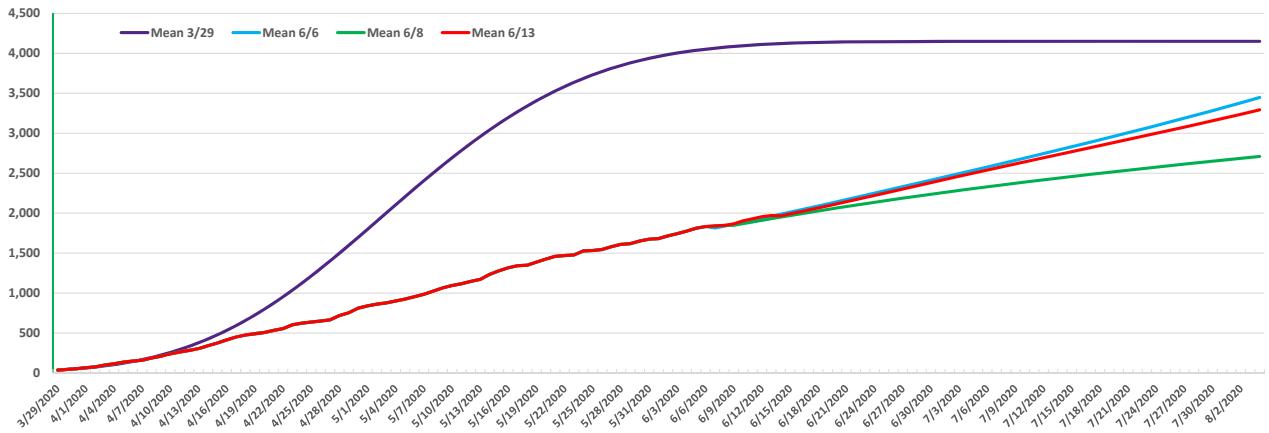
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Texas COVID 19 Daily Death Projections Revised Forecasts



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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	June 12	
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		June 10	



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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	June 10		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	June 9			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	June 5		
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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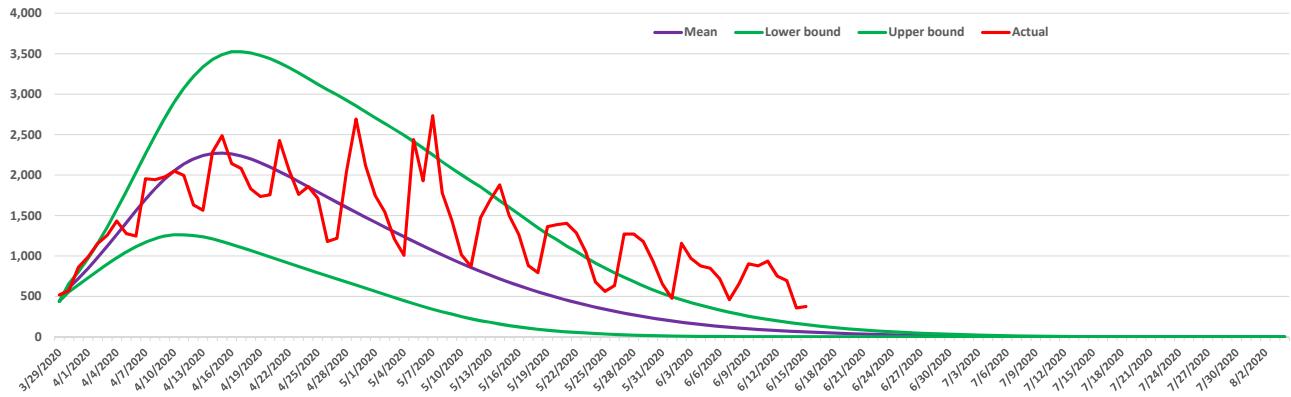
Social Distancing Summary

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



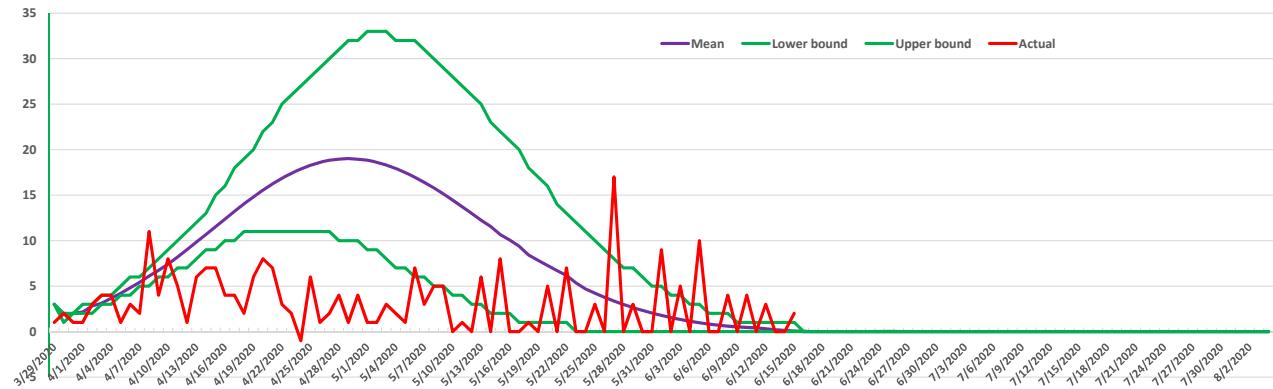
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U.S. COVID 19 Daily Death Projections March 26



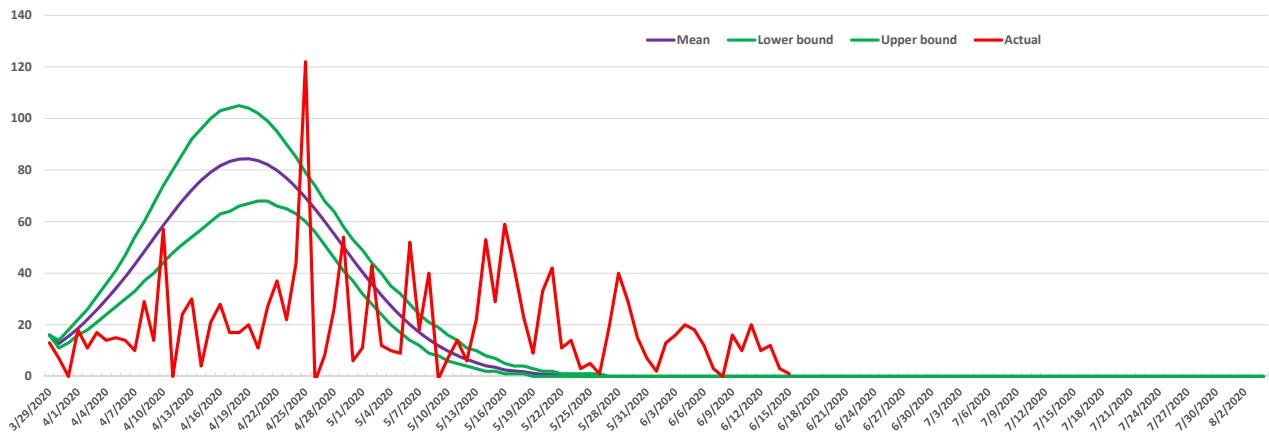
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Kansas COVID 19 Daily Death Projections March 26



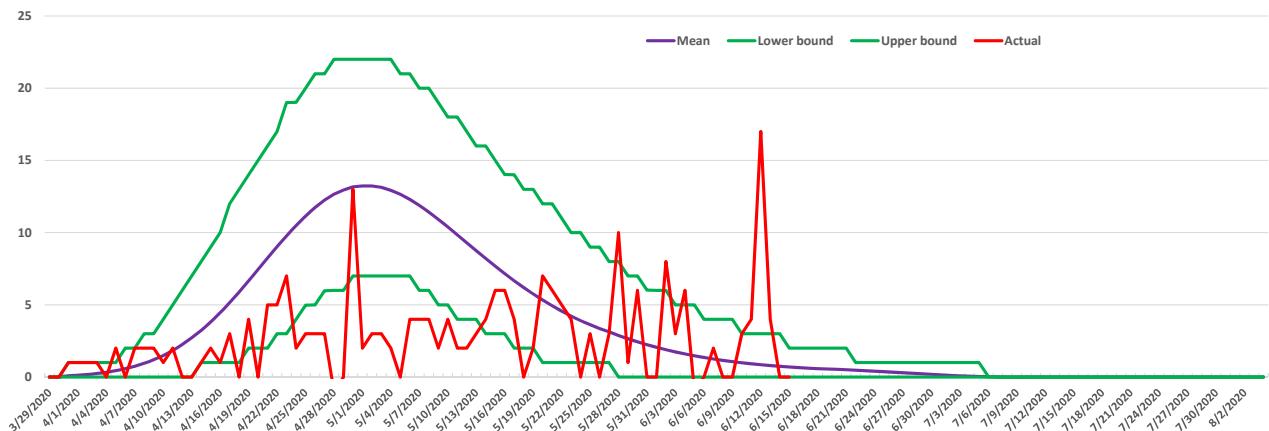
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Colorado COVID 19 Daily Death Projections March 26



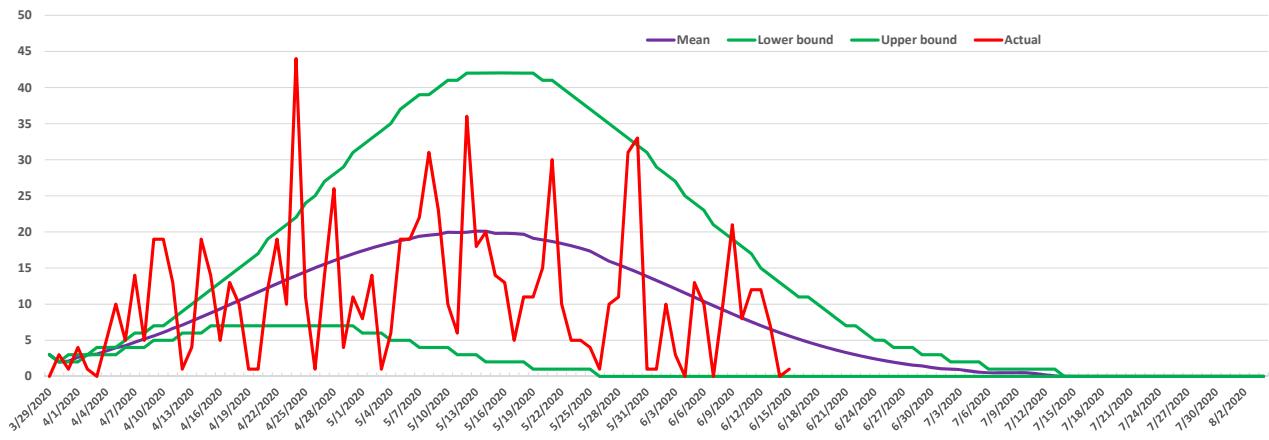
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Nebraska COVID 19 Daily Death Projections March 26



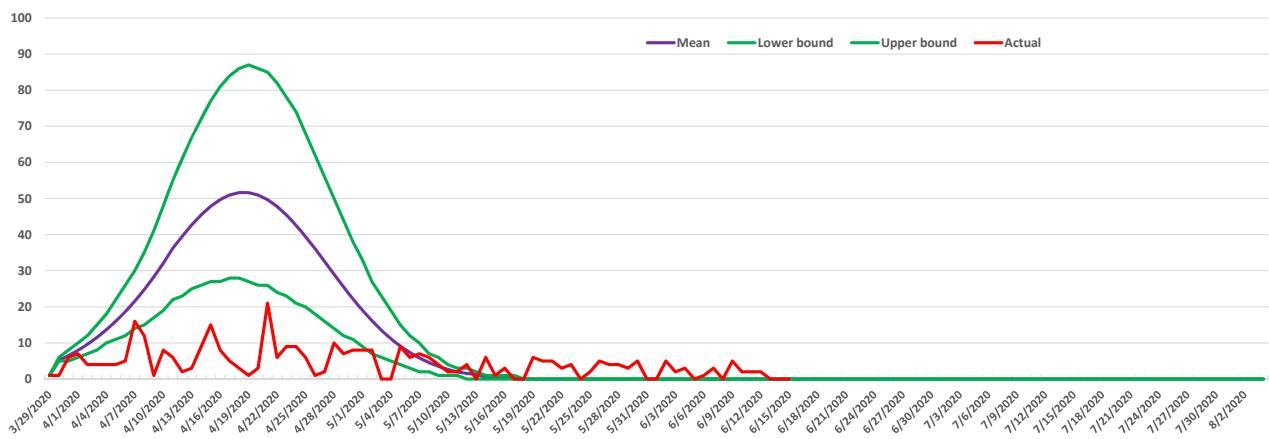
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Missouri COVID 19 Daily Death Projections March 26



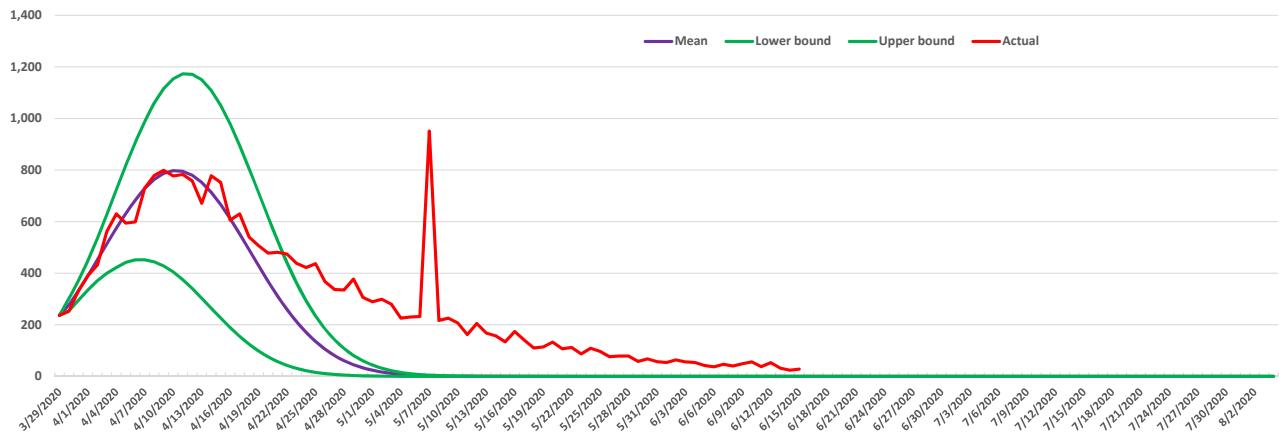
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Oklahoma COVID 19 Daily Death Projections March 26



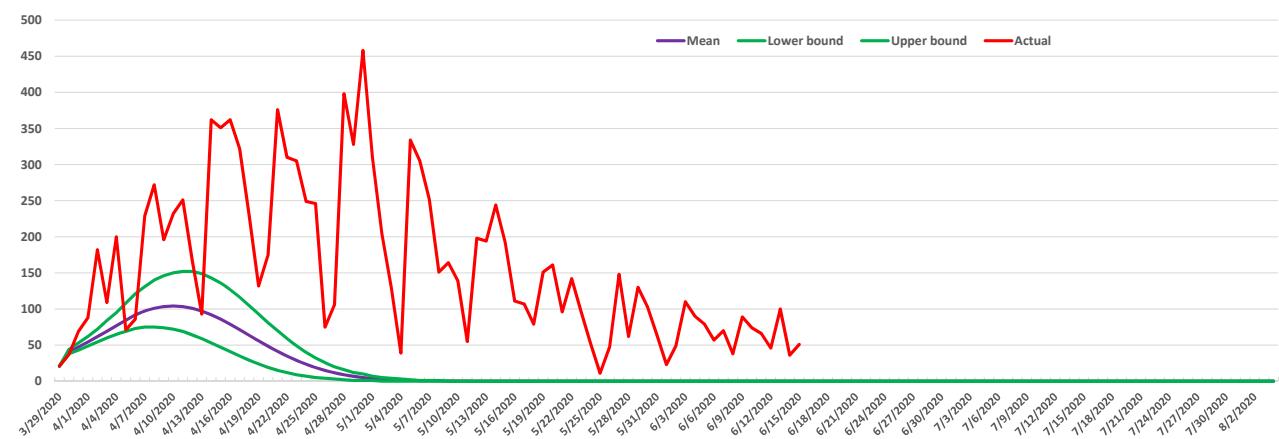
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New York COVID 19 Daily Death Projections March 26



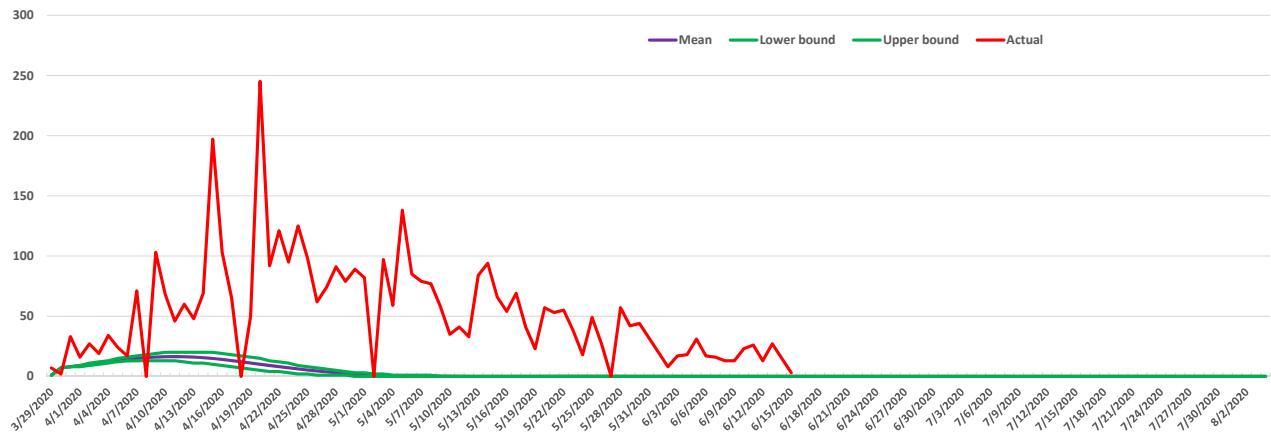
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New Jersey COVID 19 Daily Death Projections March 26



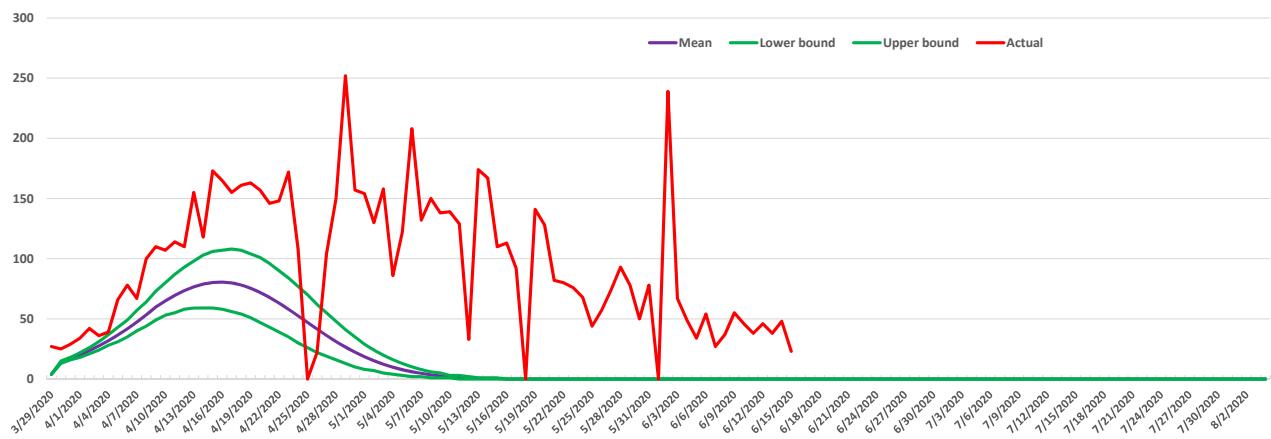
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Connecticut COVID 19 Daily Death Projections March 26



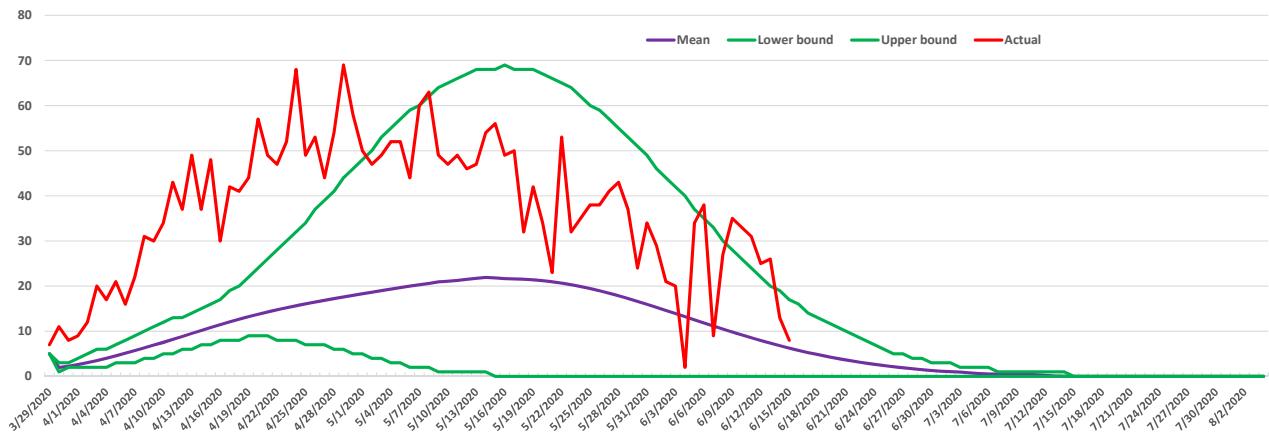
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Massachusetts COVID 19 Daily Death Projections March 26



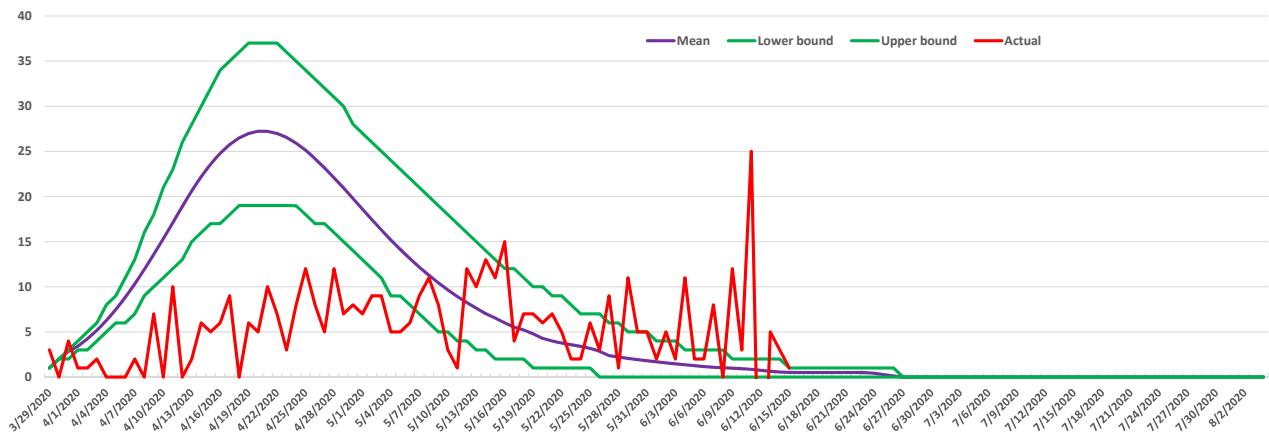
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Maryland COVID 19 Daily Death Projections March 26



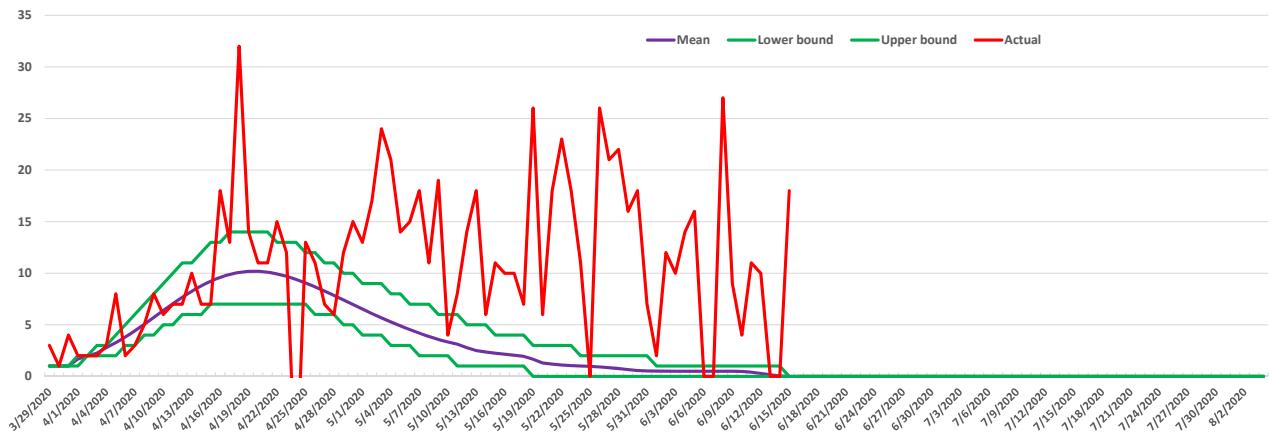
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Delaware COVID 19 Daily Death Projections March 26



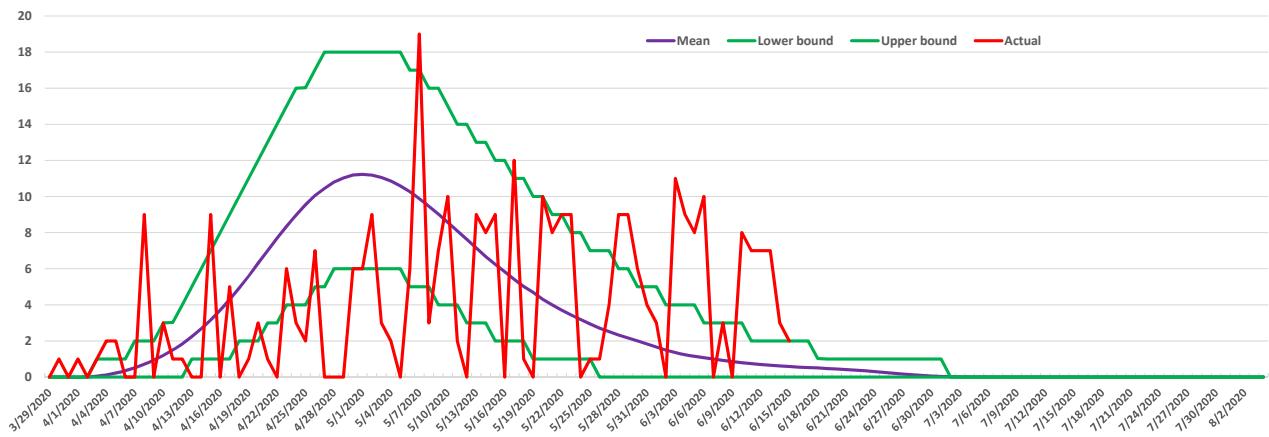
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Rhode Island COVID 19 Daily Death Projections March 26



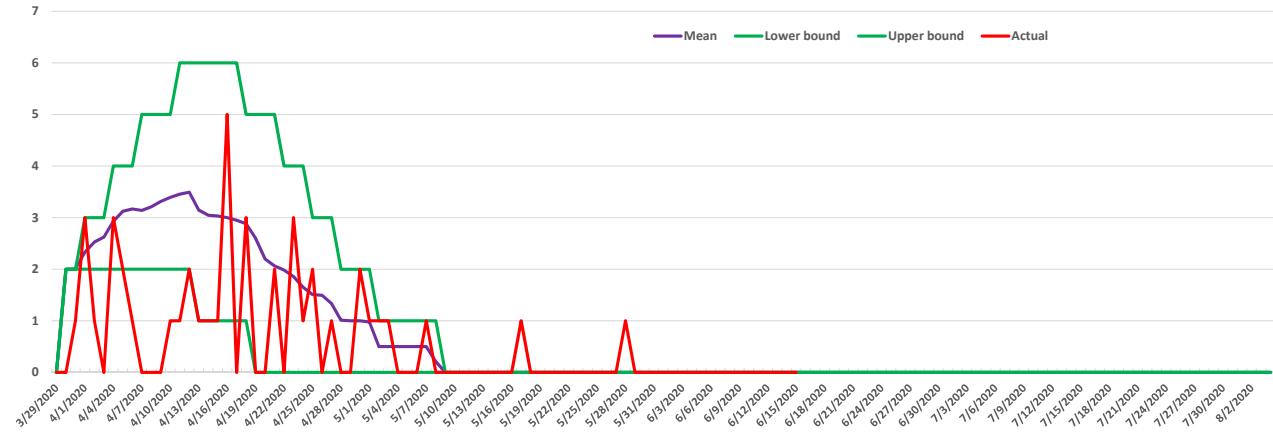
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New Hampshire COVID 19 Daily Death Projections March 26



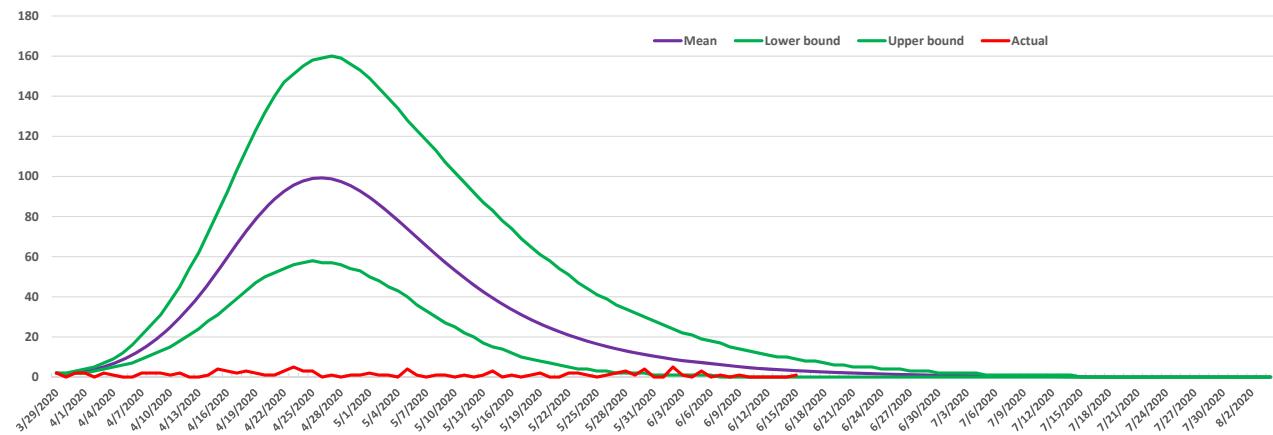
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Vermont COVID 19 Daily Death Projections March 26



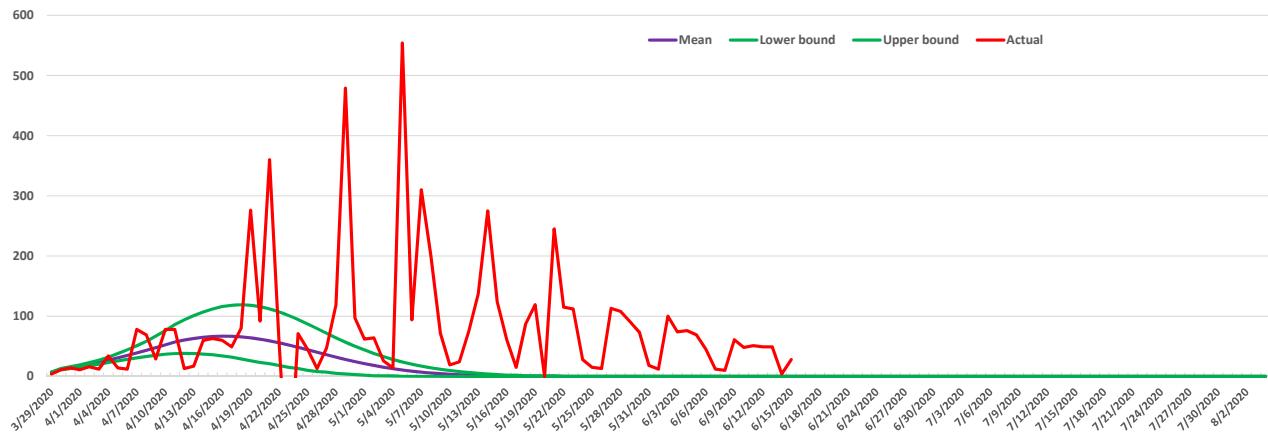
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Maine COVID 19 Daily Death Projections March 26



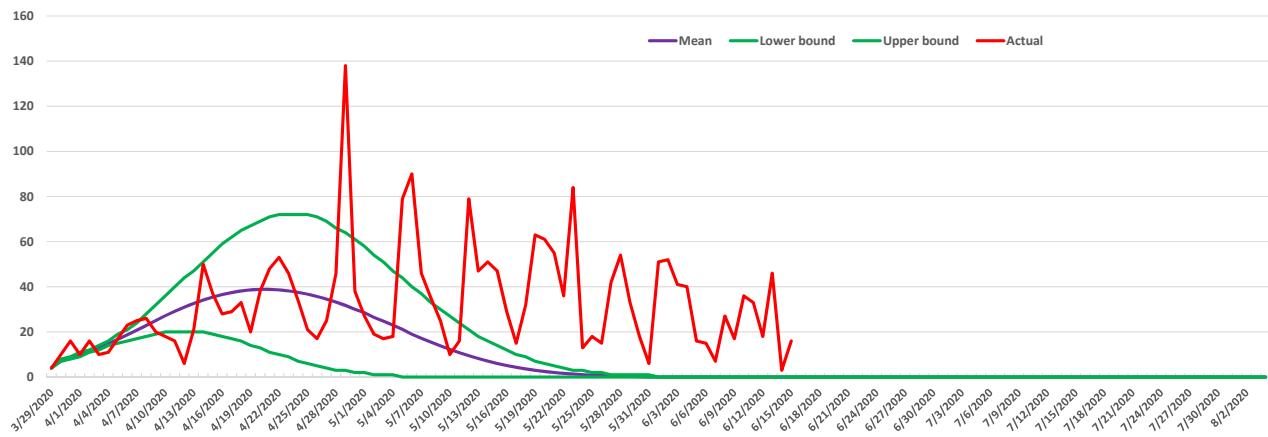
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Pennsylvania COVID 19 Daily Death Projections March 26



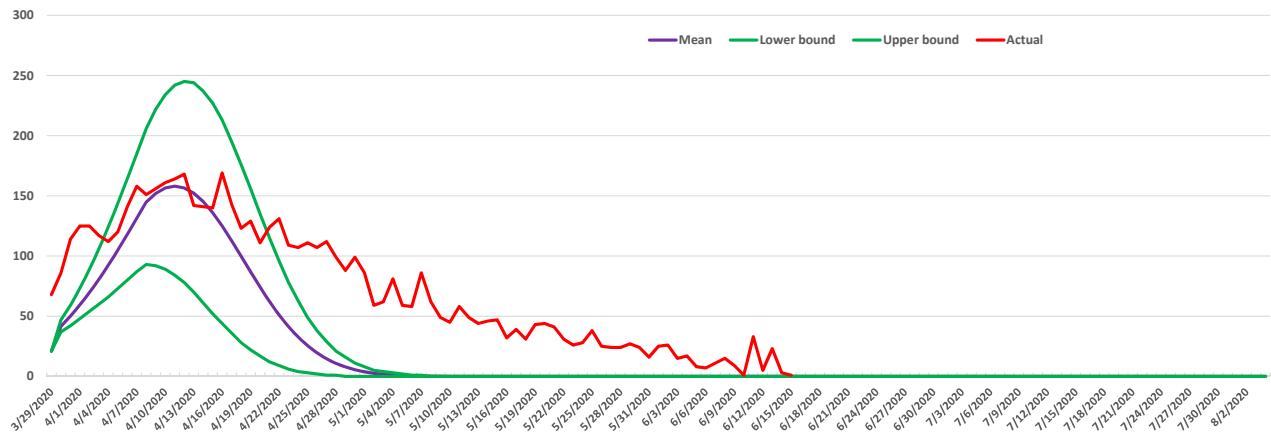
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Ohio COVID 19 Daily Death Projections March 26



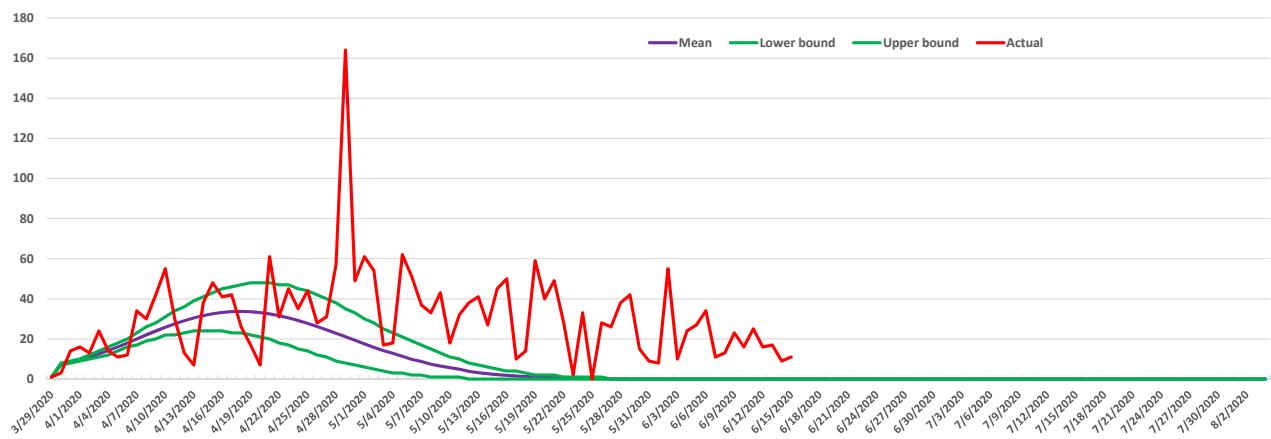
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Michigan COVID 19 Daily Death Projections March 26



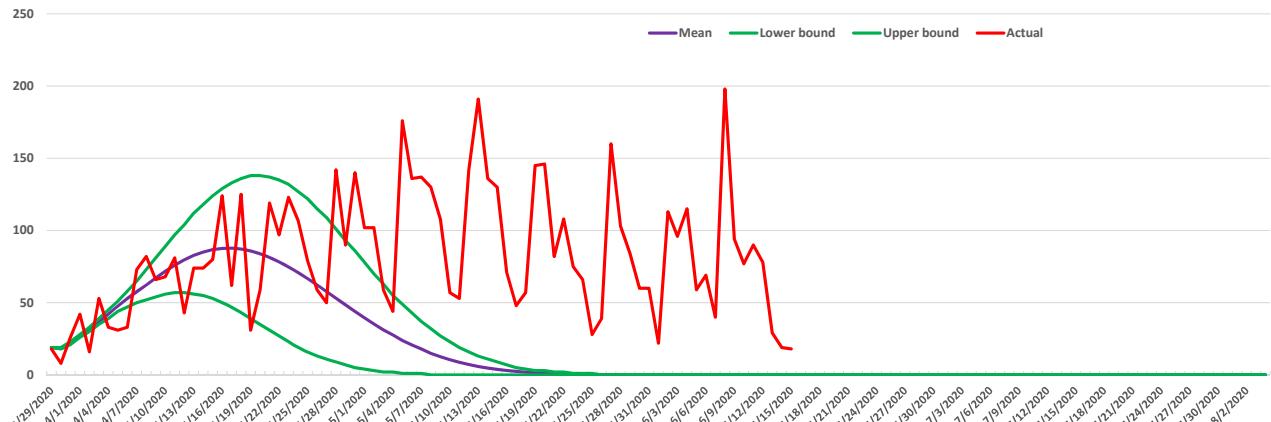
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Indiana COVID 19 Daily Death Projections March 26



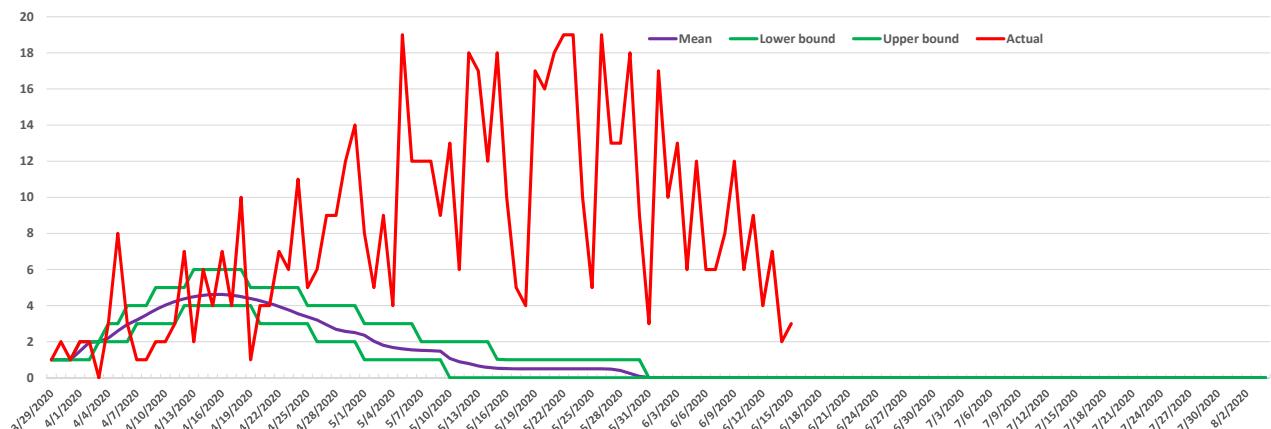
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Illinois COVID 19 Daily Death Projections March 26



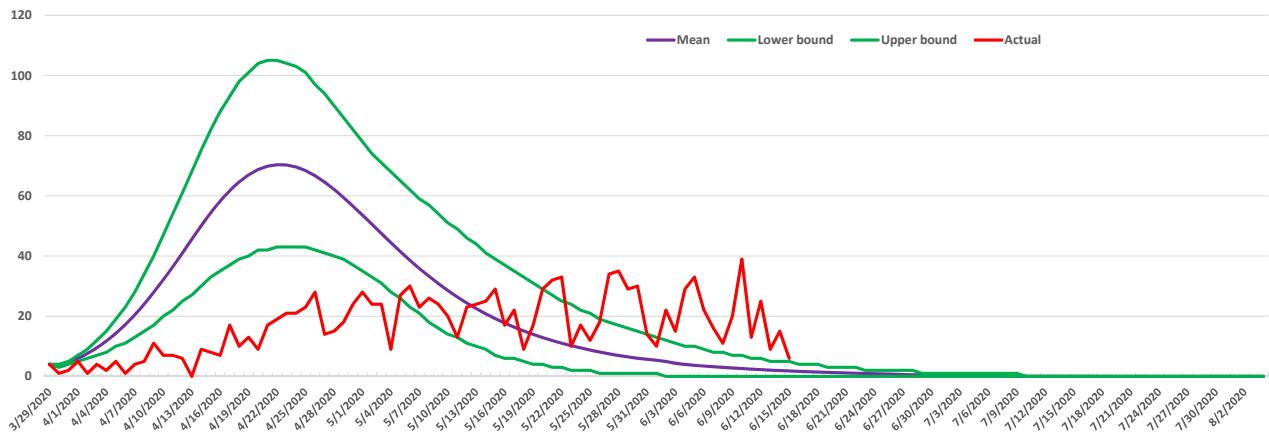
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Iowa COVID 19 Daily Death Projections March 26



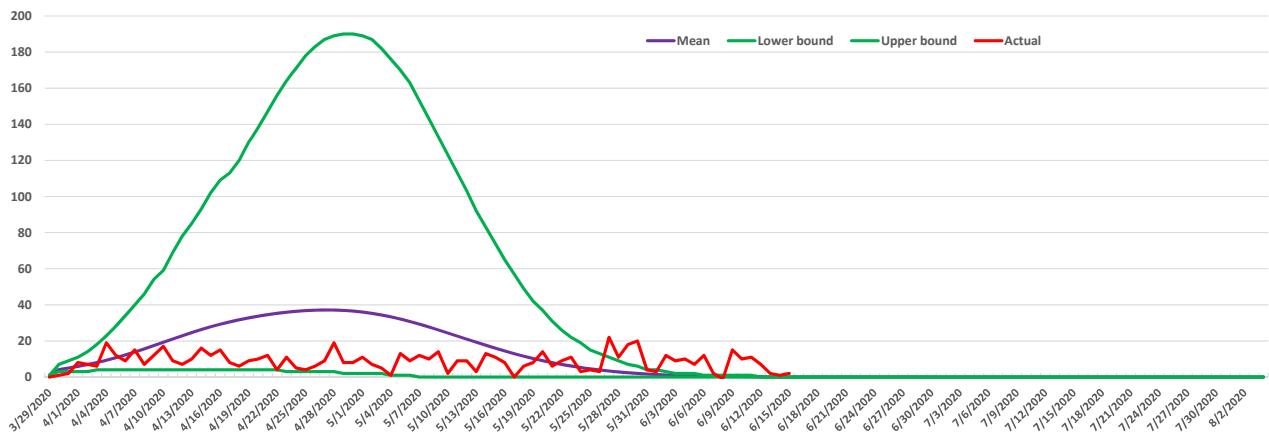
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Minnesota COVID 19 Daily Death Projections March 26



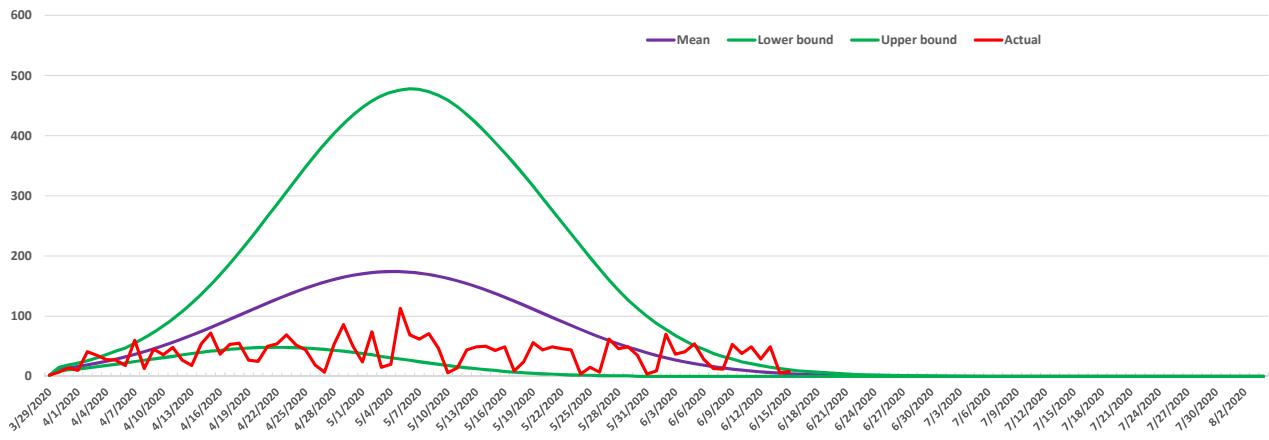
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Wisconsin COVID 19 Daily Death Projections March 26



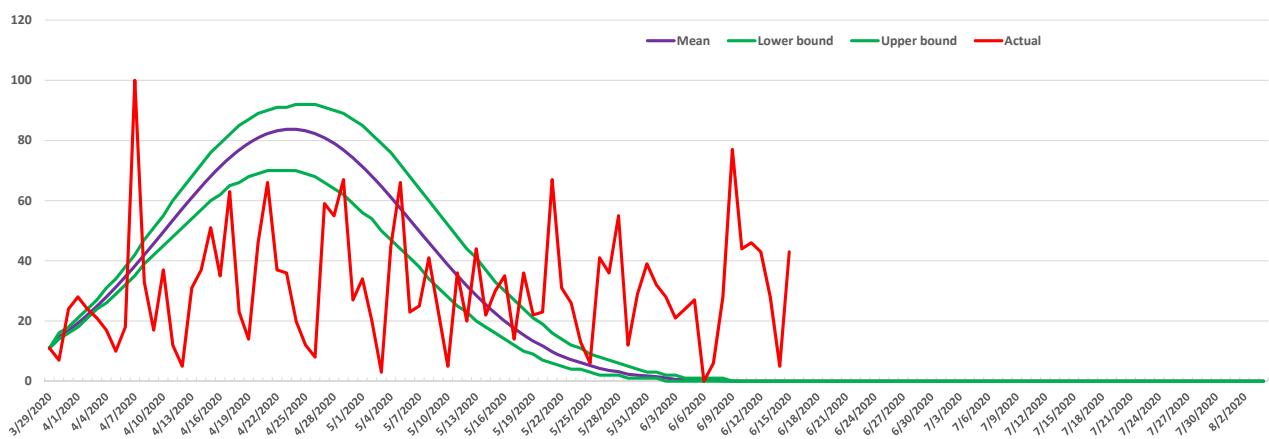
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Florida COVID 19 Daily Death Projections March 26



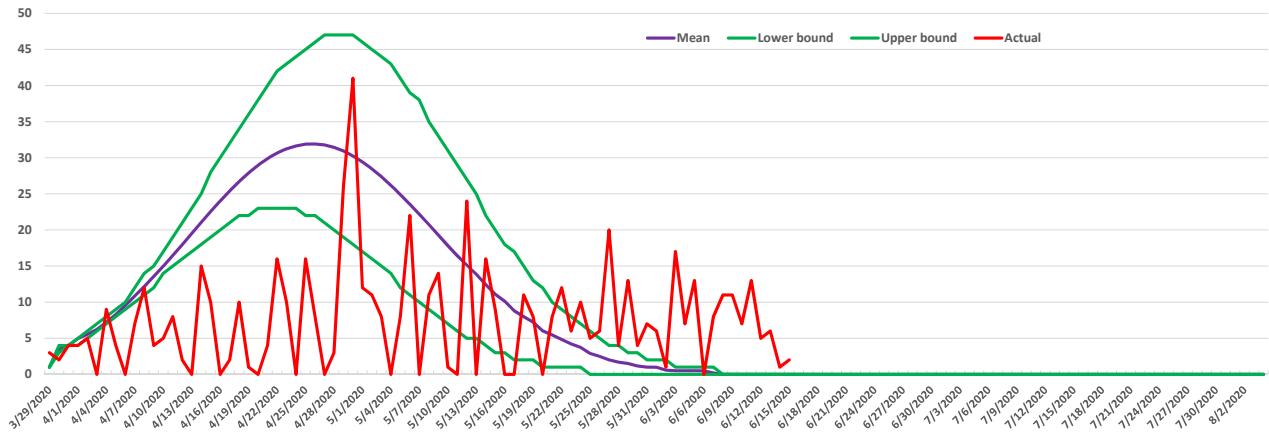
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Georgia COVID 19 Daily Death Projections March 26



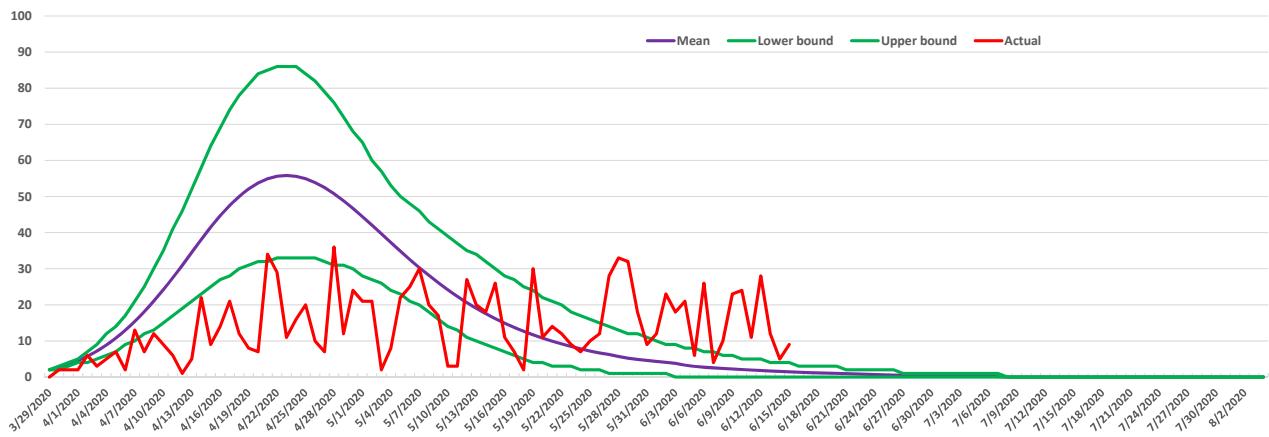
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South Carolina COVID 19 Daily Death Projections March 26



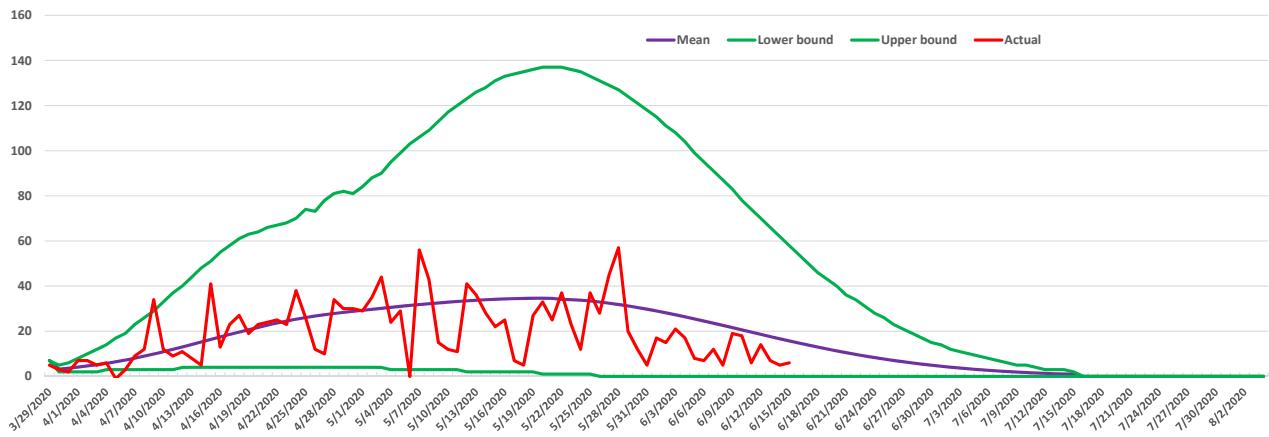
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North Carolina COVID 19 Daily Death Projections March 26



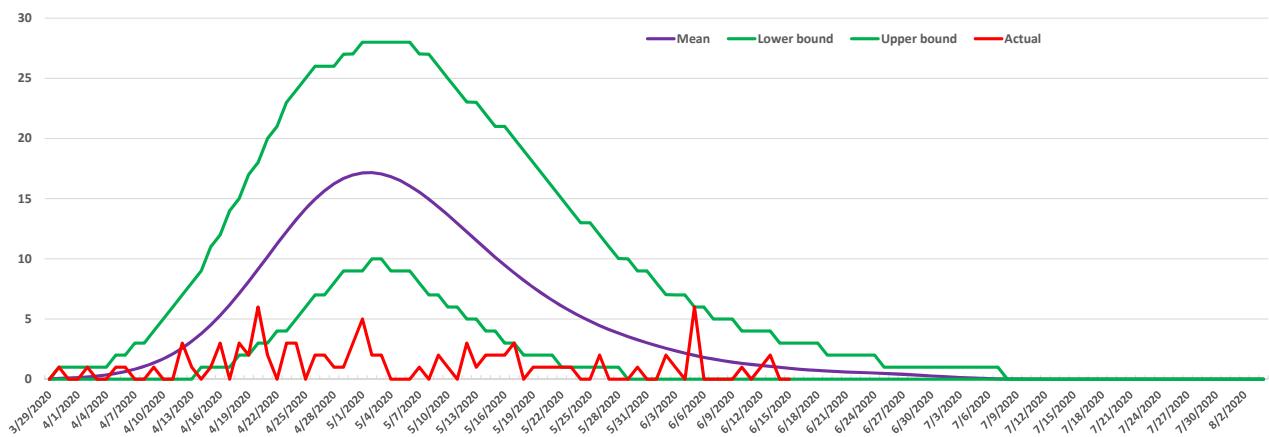
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Virginia COVID 19 Daily Death Projections March 26



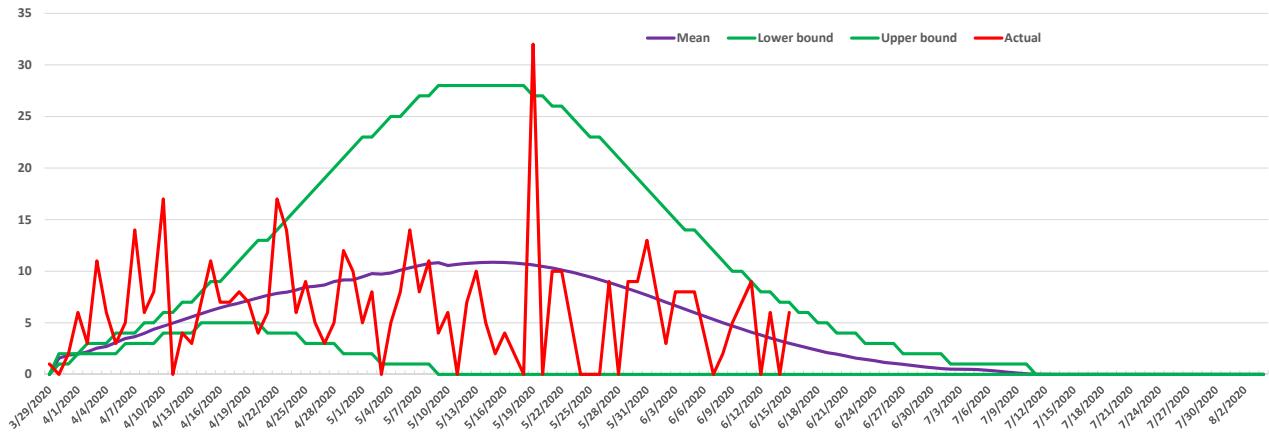
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West Virginia COVID 19 Daily Death Projections March 26



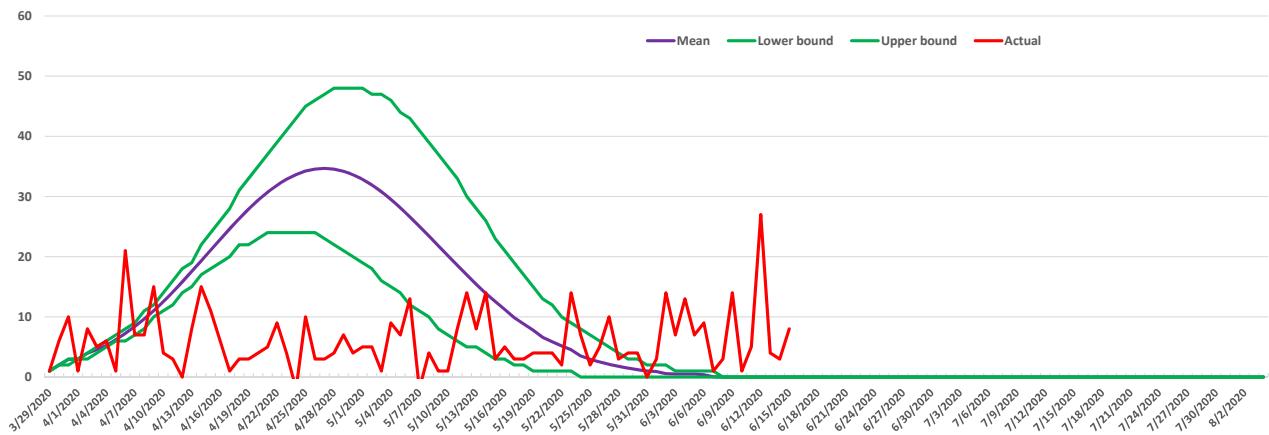
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Kentucky COVID 19 Daily Death Projections March 26



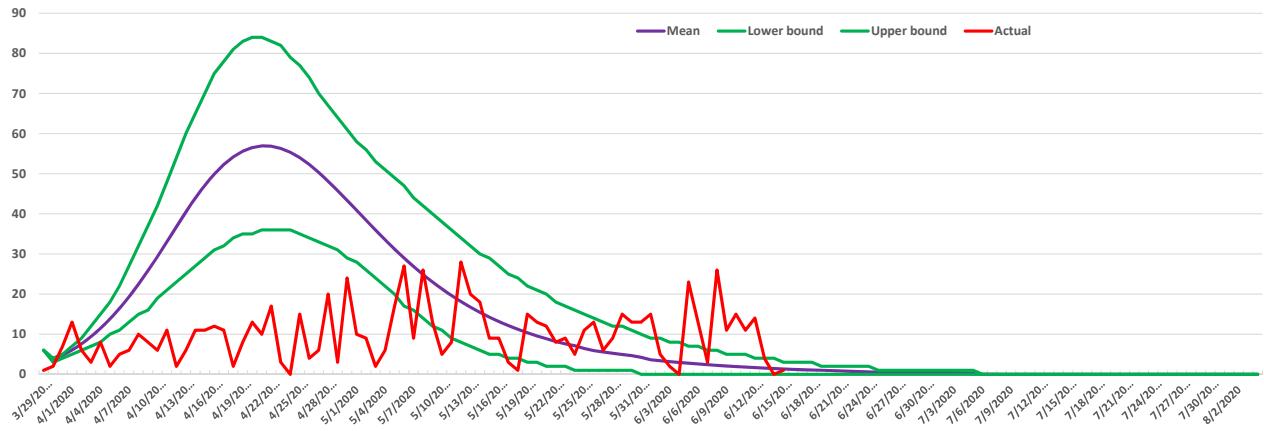
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Tennessee COVID 19 Daily Death Projections March 26



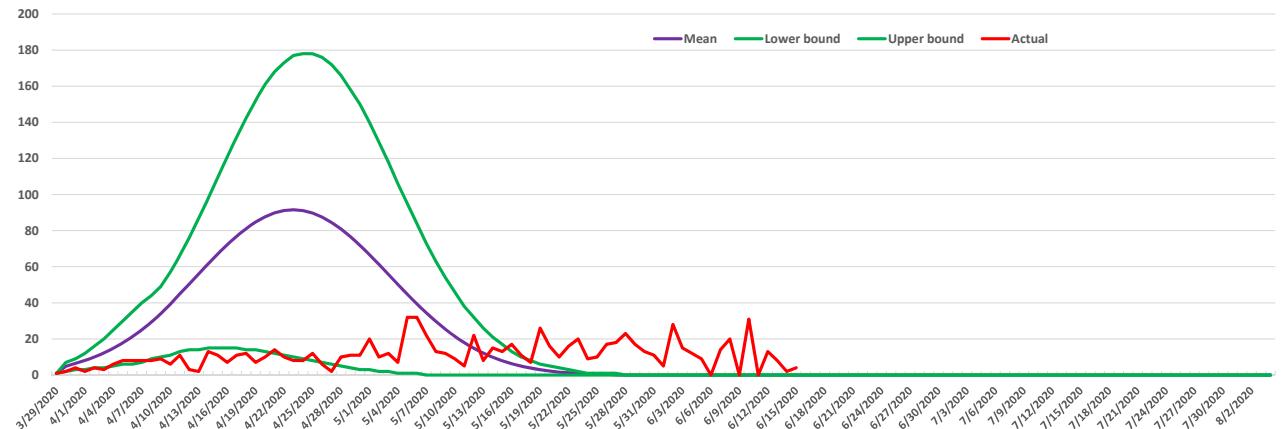
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Alabama COVID 19 Daily Death Projections March 26



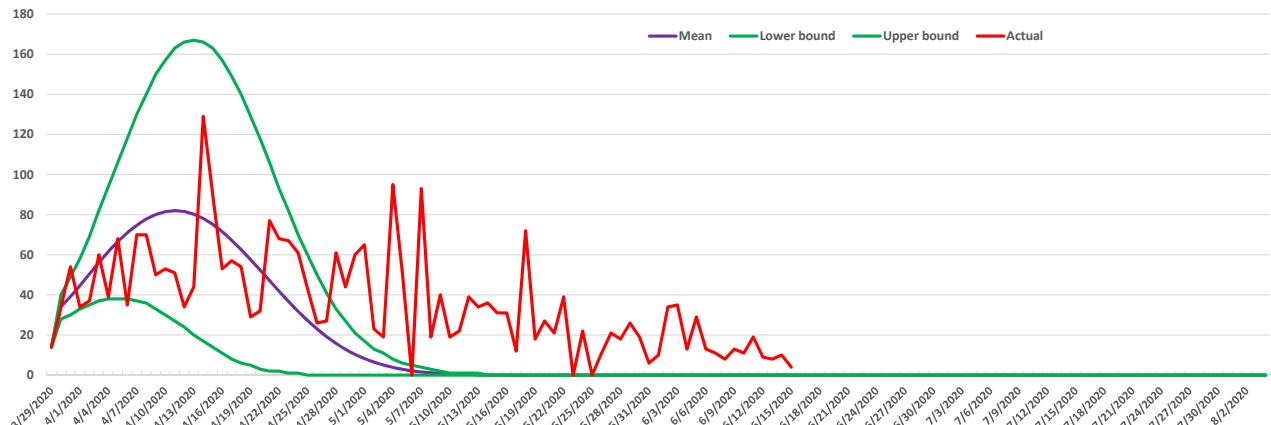
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Mississippi COVID 19 Daily Death Projections March 26



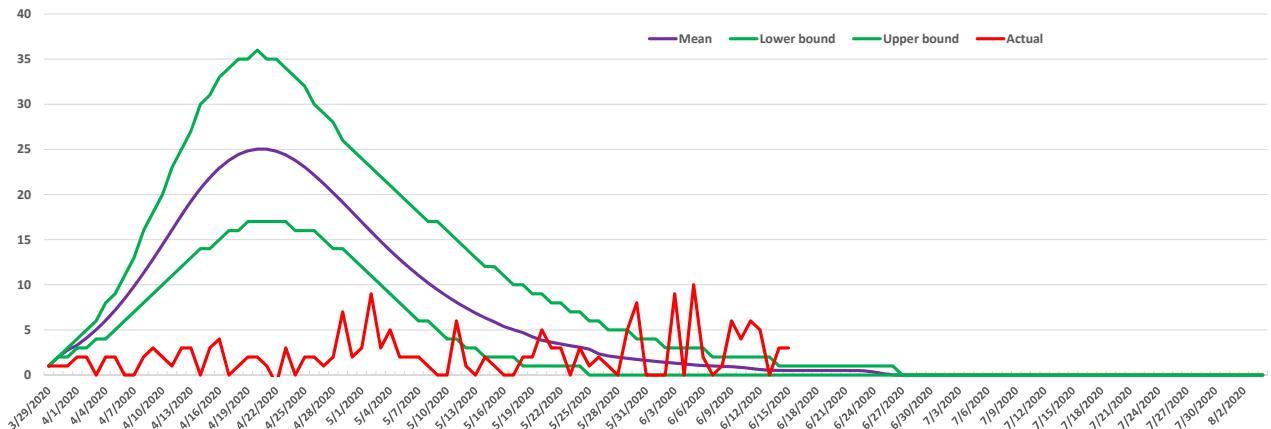
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Louisiana COVID 19 Daily Death Projections March 26



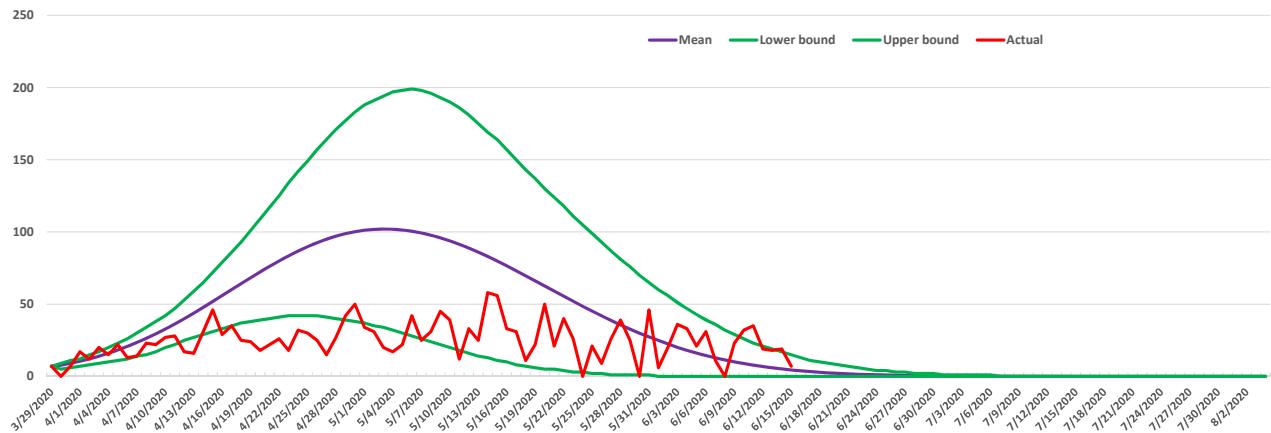
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Arkansas COVID 19 Daily Death Projections March 26



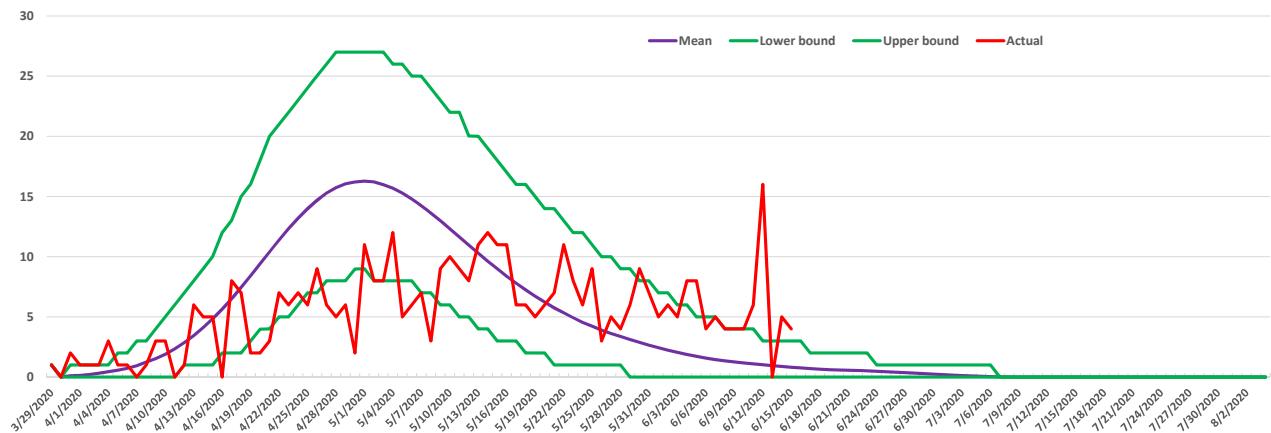
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Texas COVID 19 Daily Death Projections March 26



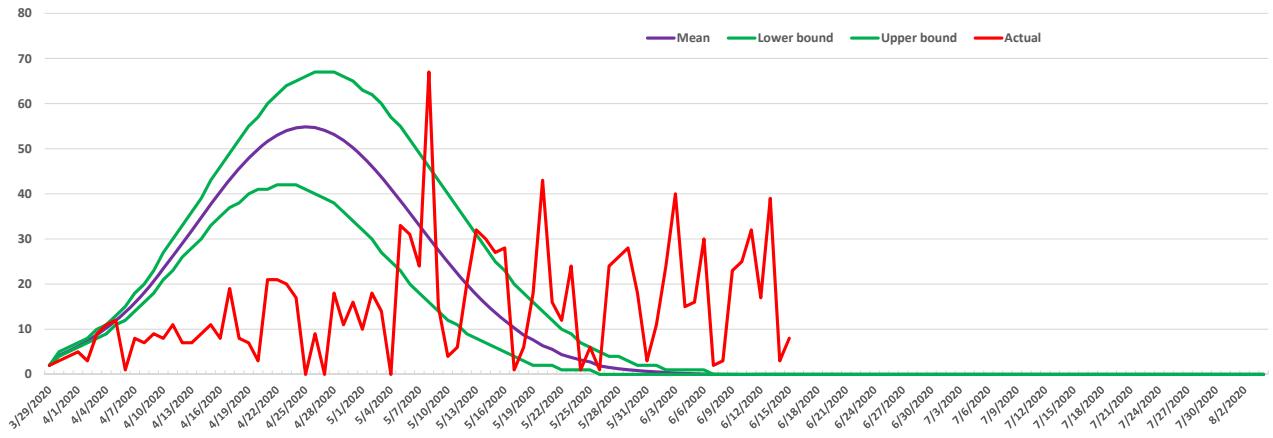
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New Mexico COVID 19 Daily Death Projections March 26



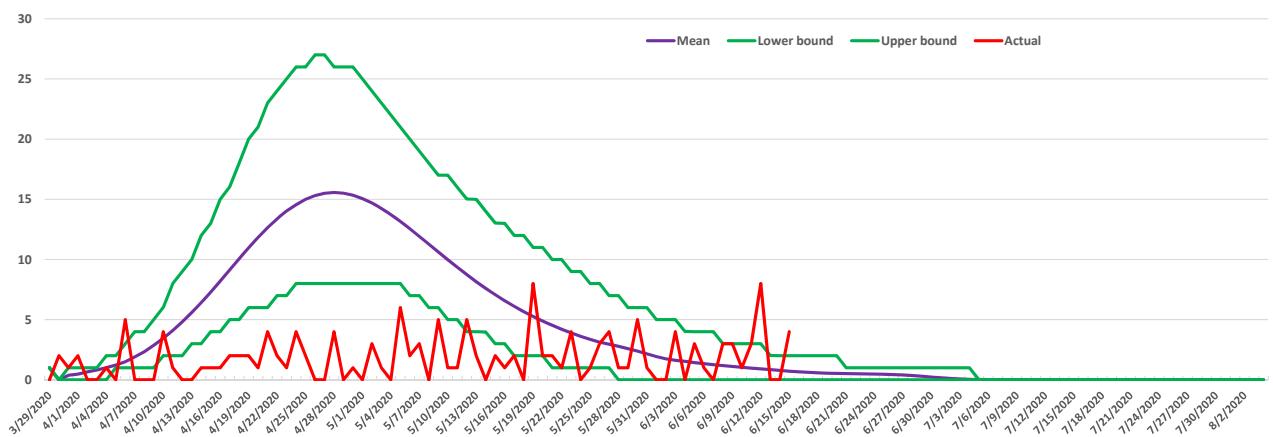
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Arizona COVID 19 Daily Death Projections March 26



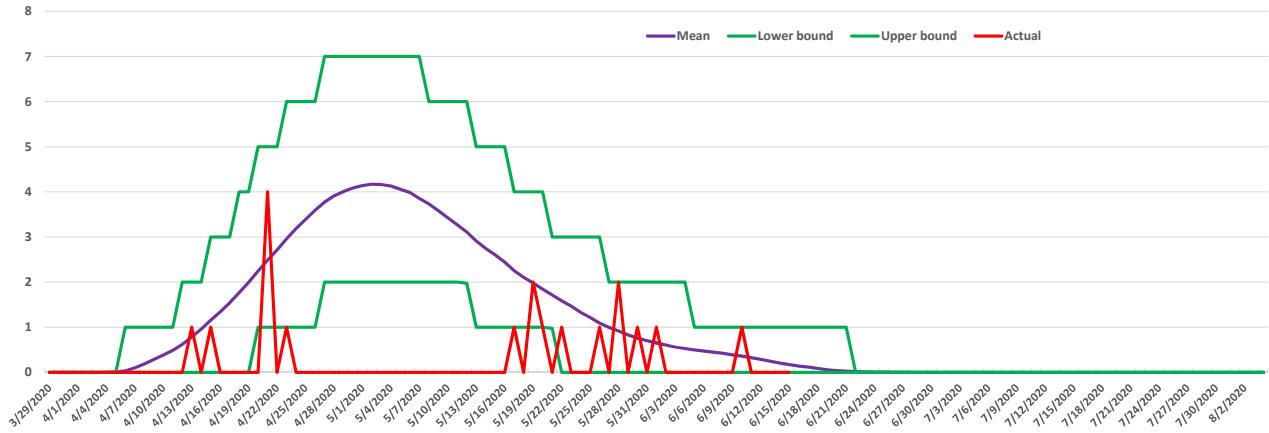
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Utah COVID 19 Daily Death Projections March 26



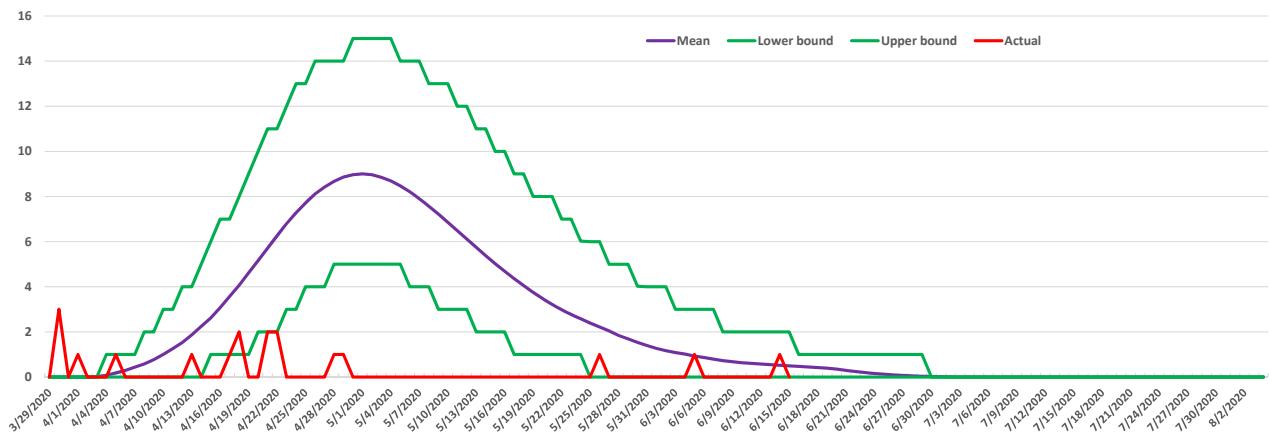
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Wyoming COVID 19 Daily Death Projections March 26



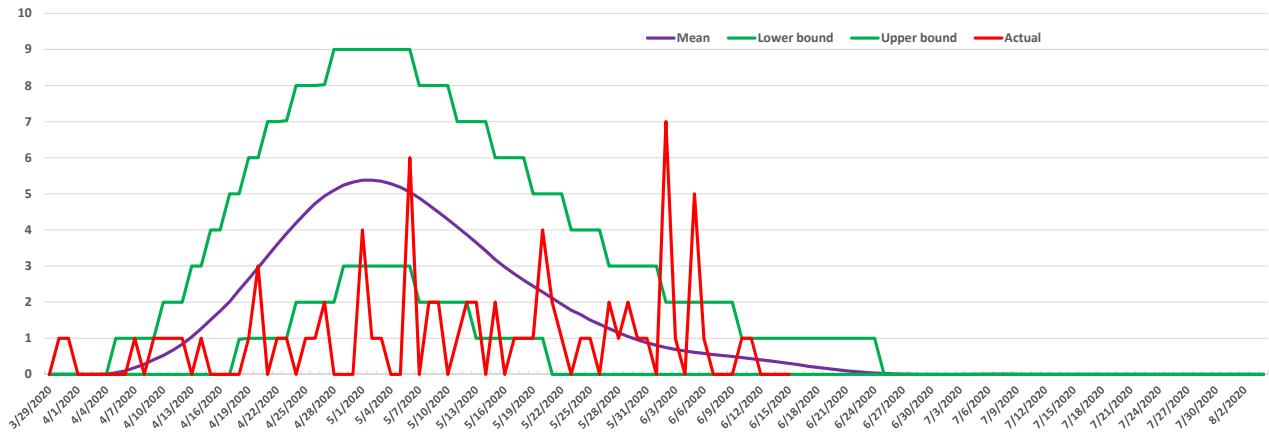
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Montana COVID 19 Daily Death Projections March 26



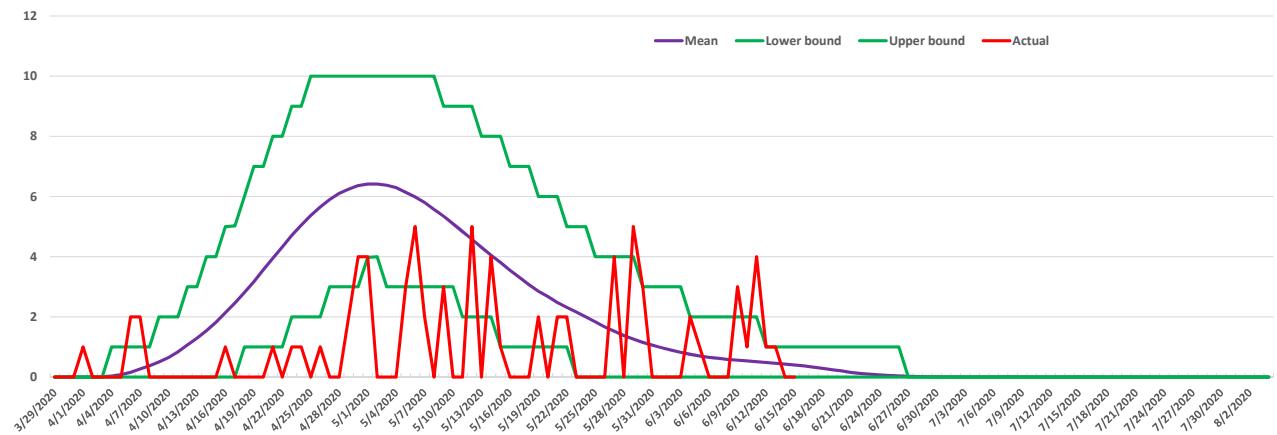
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North Dakota COVID 19 Daily Death Projections March 26



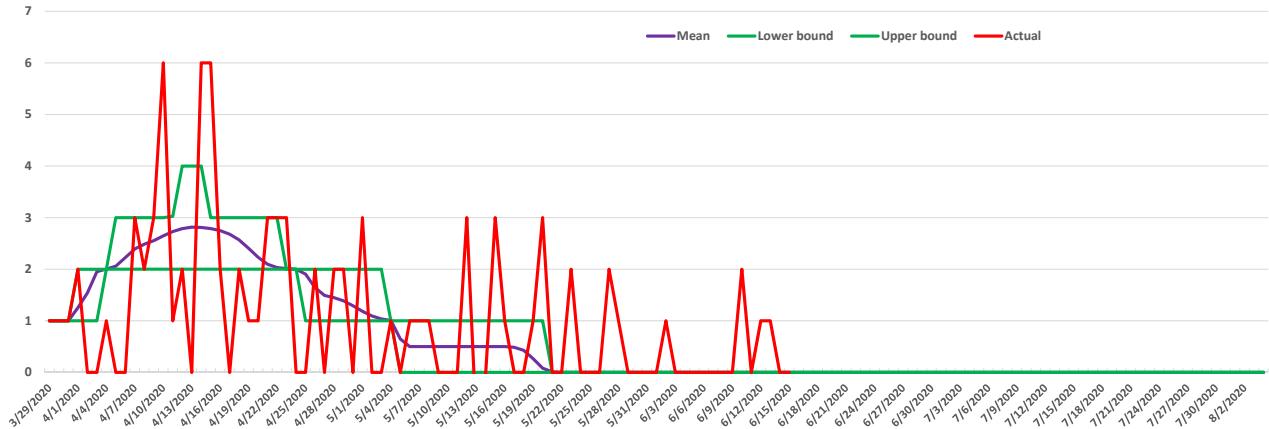
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South Dakota COVID 19 Daily Death Projections March 26



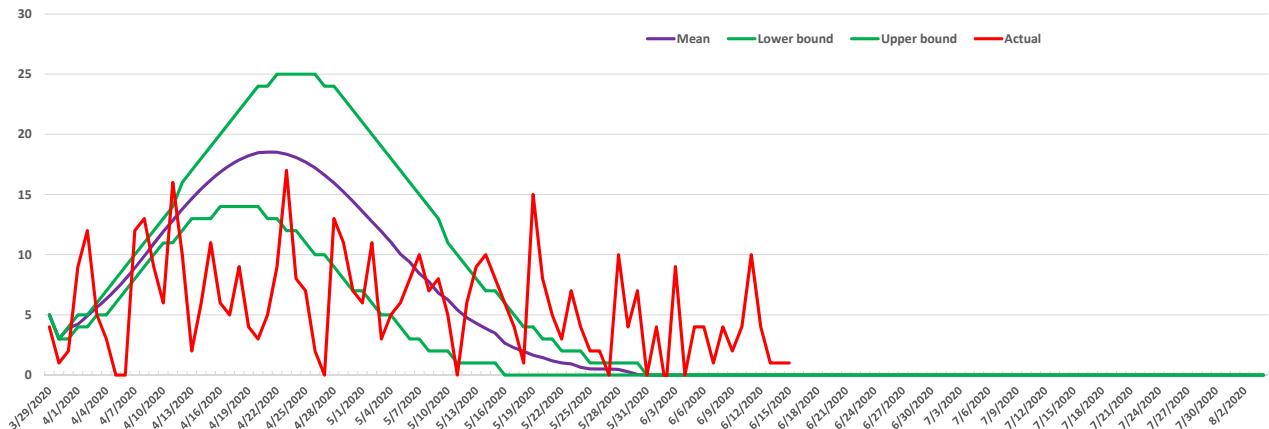
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Idaho COVID 19 Daily Death Projections March 26



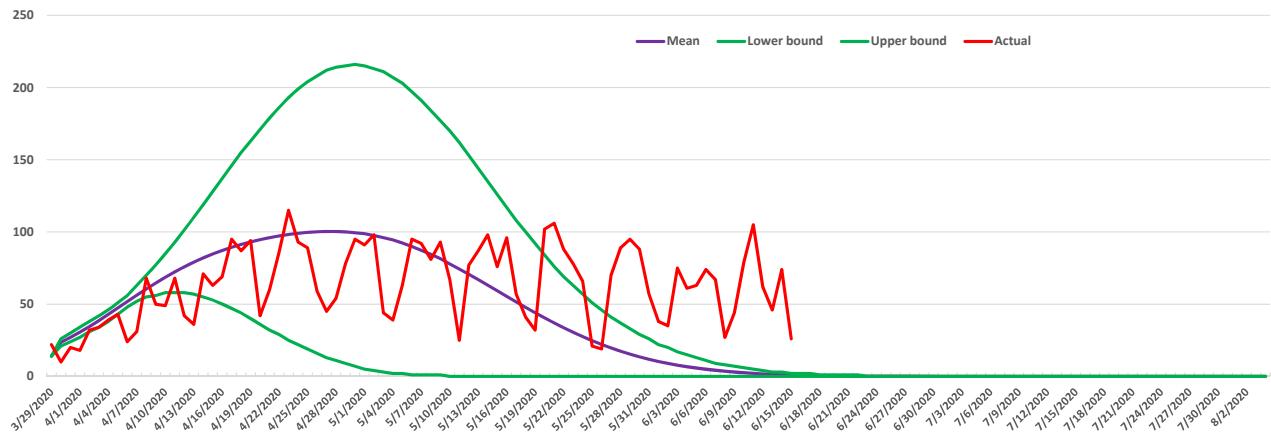
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Nevada COVID 19 Daily Death Projections March 26



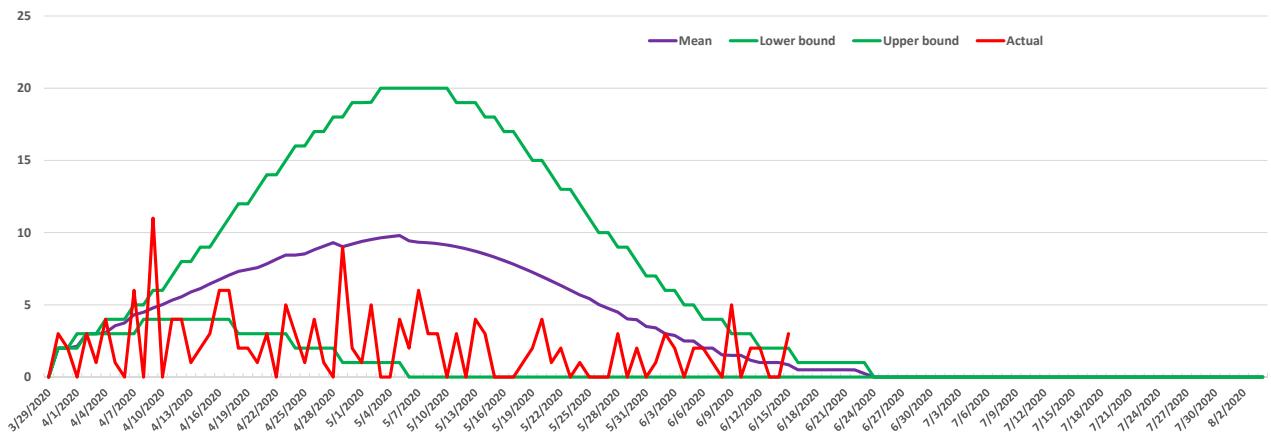
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California COVID 19 Daily Death Projections March 26



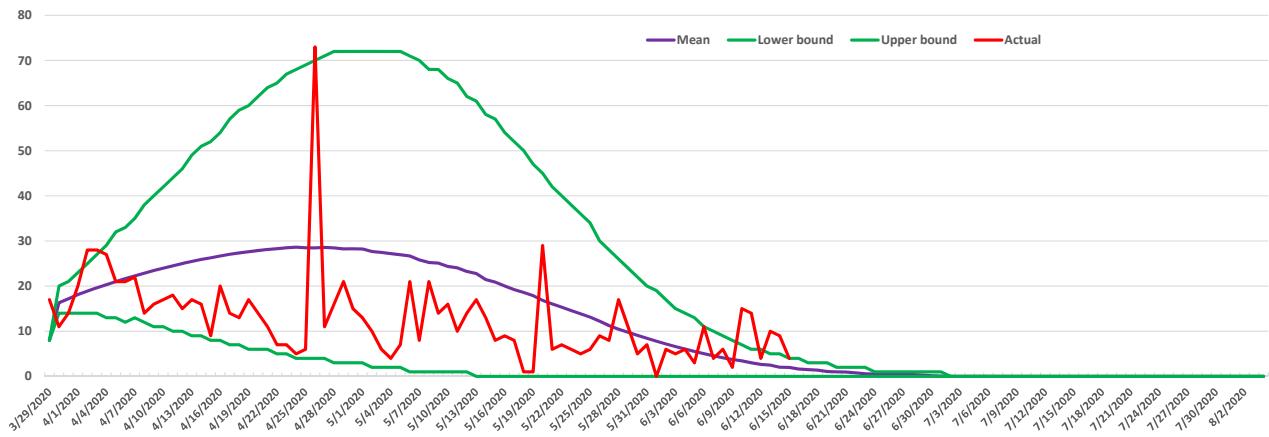
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Oregon COVID 19 Daily Death Projections March 26



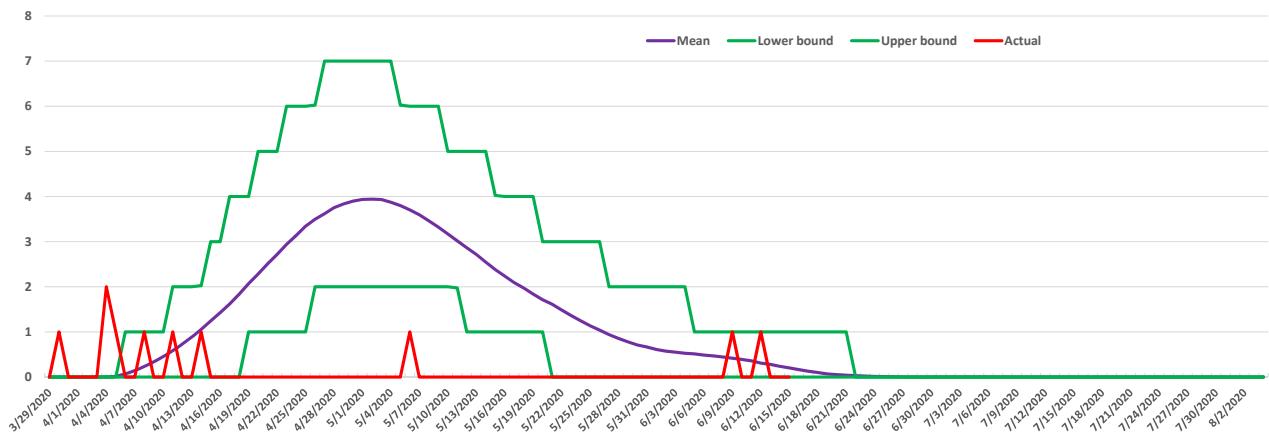
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Washington COVID 19 Daily Death Projections March 26



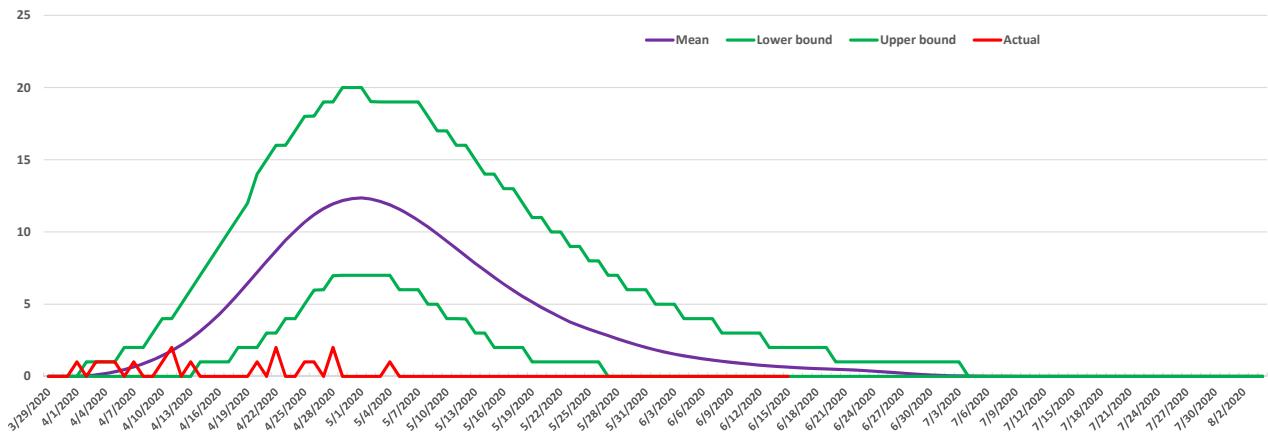
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Alaska COVID 19 Daily Death Projections March 26



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Hawaii COVID 19 Daily Death Projections March 26



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Projected August 4th Deaths from the March 26th, June 8th, June 10th, and June 15th Models

	3/26	6/8	6/10	6/15		3/26	6/8	6/10	6/15
Alabama	1,732	1,051	1,080	1,943	Hawaii	390	19	17	20
Alaska	129	11	10	19	Idaho	84	148	93	98
Arizona	1,613	4,427	2,895	3,908	Illinois	2,360	7,381	7,110	7,489
Arkansas	762	885	411	569	Indiana	940	2,950	2,773	2,900
California	4,306	8,722	7,468	8,708	Iowa	138	1,473	1,147	1,001
Colorado	2,151	2,064	2,791	2,872	Kansas	687	469	304	342
Connecticut	378	4,312	4,249	4,386	Kentucky	605	913	751	701
Delaware	827	466	545	516	Louisiana	1,897	3,219	3,368	3,774
Florida	6,766	4,363	4,358	6,285	Maine	3,013	283	210	143
Georgia	2,777	4,264	3,686	4,781	Maryland	1,171	3,619	3,874	4,040



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Projected August 4th Deaths from the March 26th, June 8th, June 10th, and June 15th Models

	3/26	6/8	6/10	6/15		3/26	6/8	6/10	6/15
Massachusetts	1,782	8,086	8,024	8,272	New Mexico	514	680	706	728
Michigan	2,862	6,466	7,284	7,229	New York	15,546	31,780	32,162	32,698
Minnesota	2,146	2,193	1,815	2,144	North Carolina	1,721	3,144	1,967	1,837
Mississippi	2,292	1,380	1,390	1,241	North Dakota	171	161	151	111
Missouri	1,055	1,232	1,170	1,297	Ohio	1,203	3,792	3,151	3,228
Montana	282	19	19	23	Oklahoma	1,149	458	449	508
Nebraska	424	611	411	360	Oregon	469	222	219	302
Nevada	568	644	605	650	Pennsylvania	1,579	7,467	6,936	7,653
New Hampshire	351	489	481	561	Rhode Island	306	992	1,136	1,075
New Jersey	2,096	13,255	13,116	13,766	South Carolina	1,043	841	1,404	1,522



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Projected August 4th Deaths from the March 26th, June 8th, June 10th, and June 15th Models

	3/26	6/8	6/10	6/15		3/26	6/8	6/10	6/15
South Dakota	204	102	87	142	Virginia	2,053	2,216	2,079	1,910
Tennessee	1,067	822	1,147	1,084	Washington	1,670	1,233	1,336	1,427
Texas	4,150	3,448	2,710	3,293	West Virginia	543	137	118	120
Utah	502	345	273	293	Wisconsin	1,309	1,793	1,107	1,034
Vermont	95	64	57	59	Wyoming	132	27	24	19
United States	82,141	145,728	139,280	149,690					



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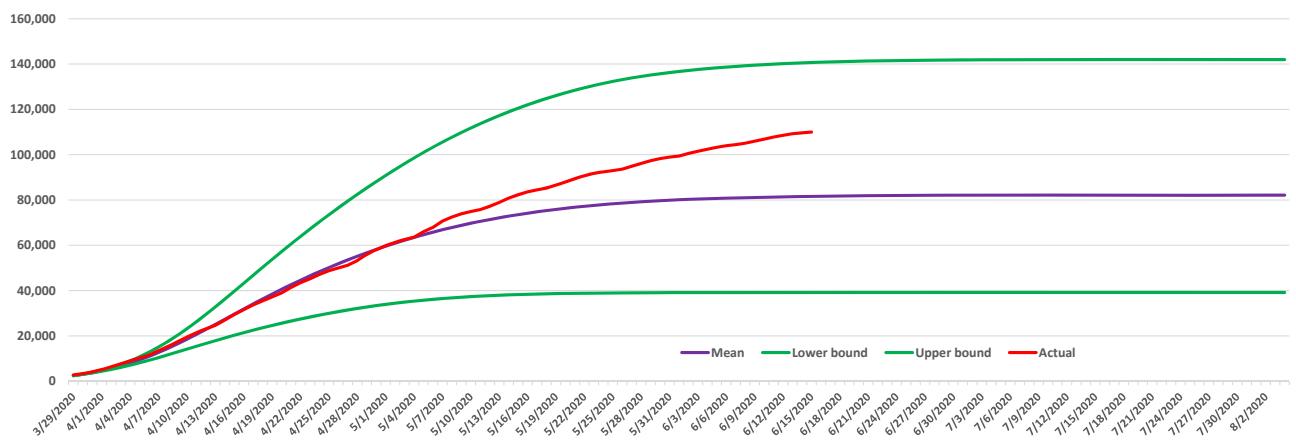
Concluding Thoughts

- 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 8 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 15th increased the cumulative expected death in 28 states and reduced it in 22 states from the June 9th model
- The model revision released on June 15th has higher cumulative expected death in 27 states and lower cumulative expected death in 23 states compared to the original model



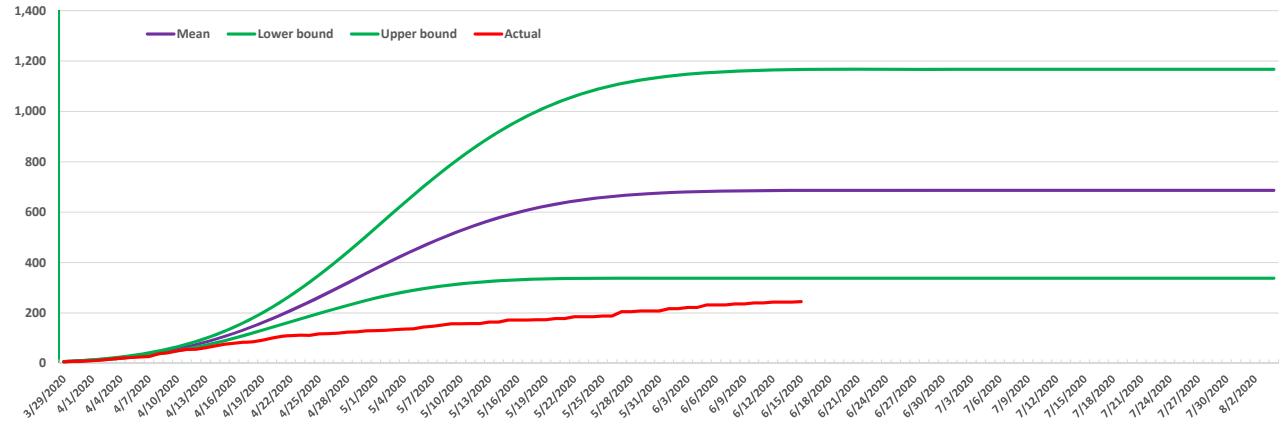
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U.S. COVID 19 Cumulative Death Projections



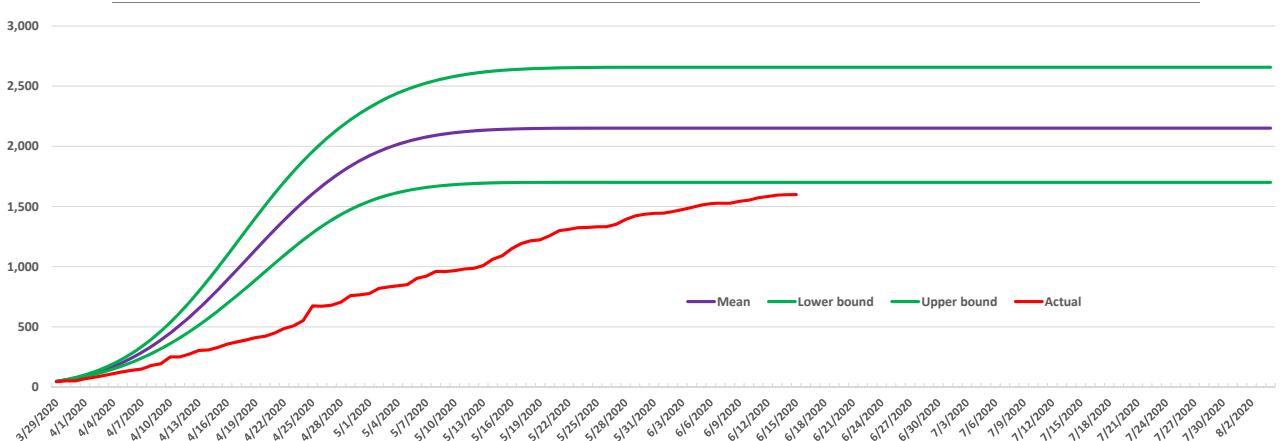
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Kansas COVID 19 Cumulative Death Projections



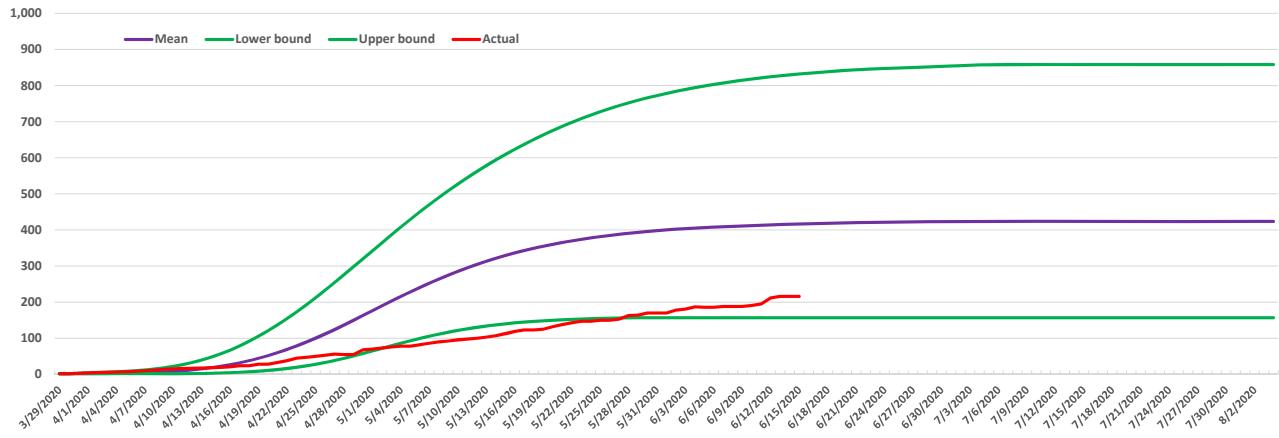
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Colorado COVID 19 Cumulative Death Projections March 26



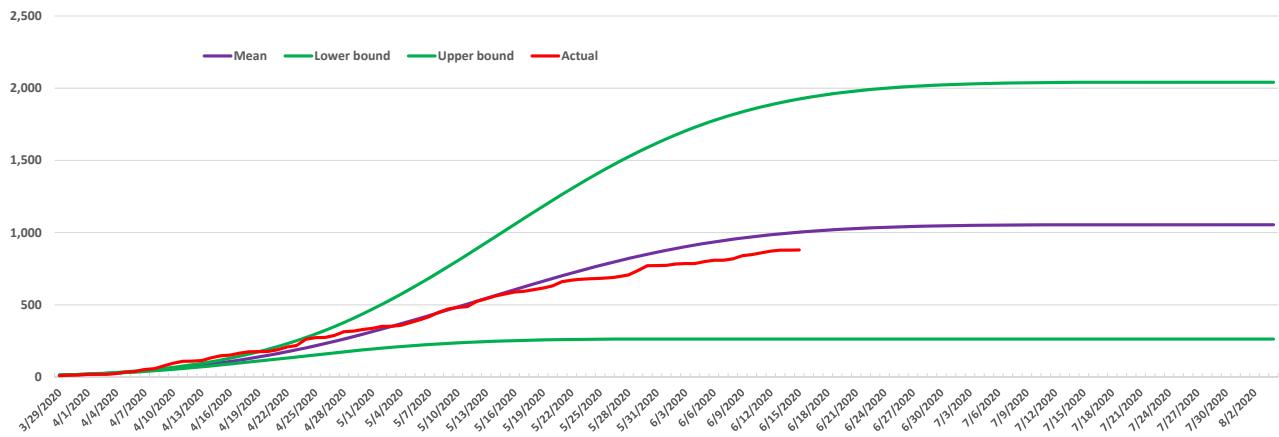
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Nebraska COVID 19 Daily Death Projections March 26



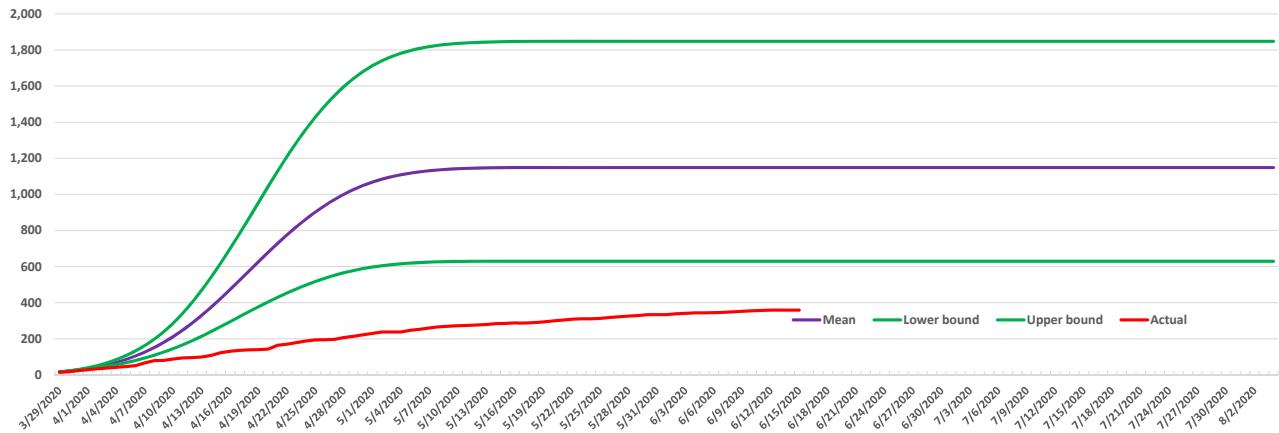
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Missouri COVID 19 Cumulative Death Projections March 26



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Oklahoma COVID 19 Daily Death Projections March 26



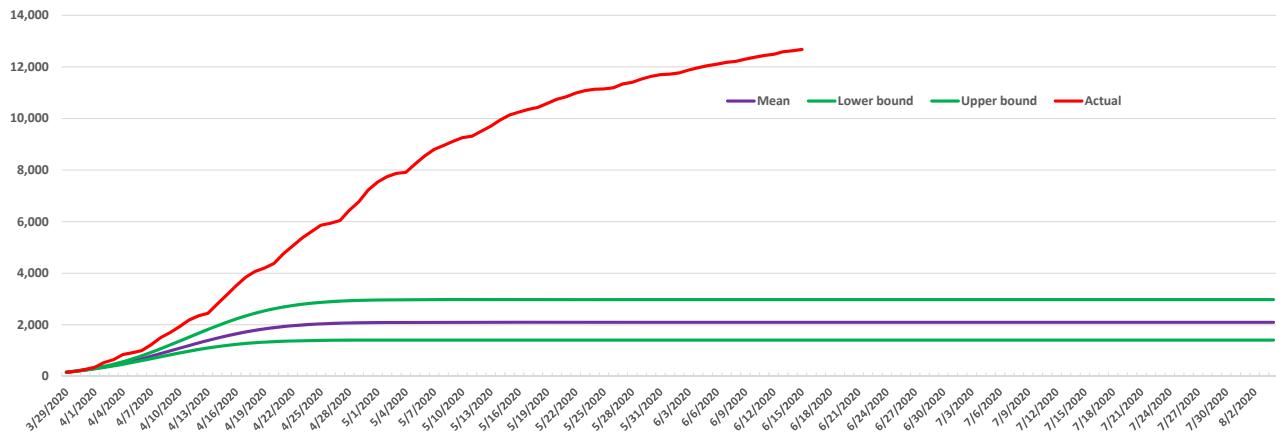
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New York COVID 19 Cumulative Death Projections



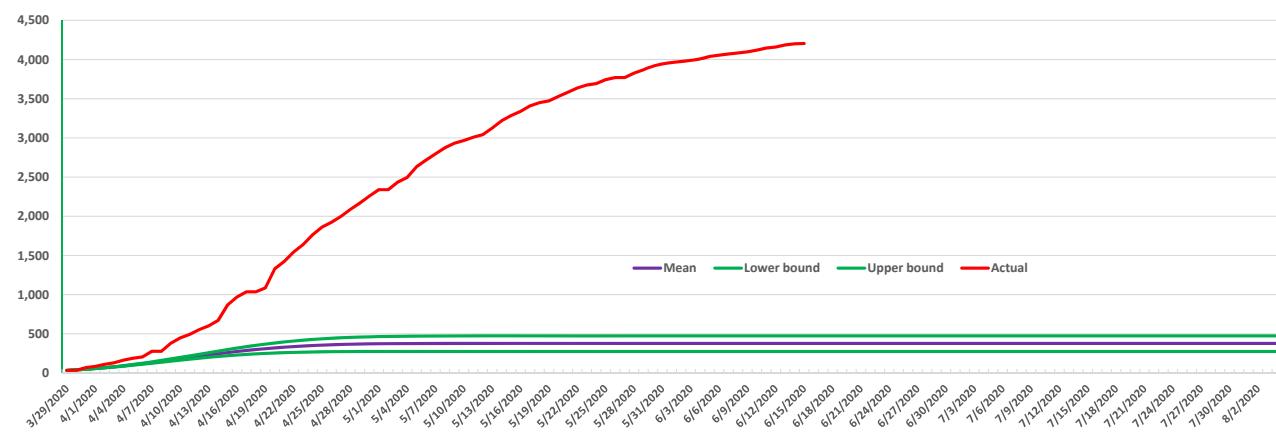
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New Jersey COVID 19 Cumulative Death Projections



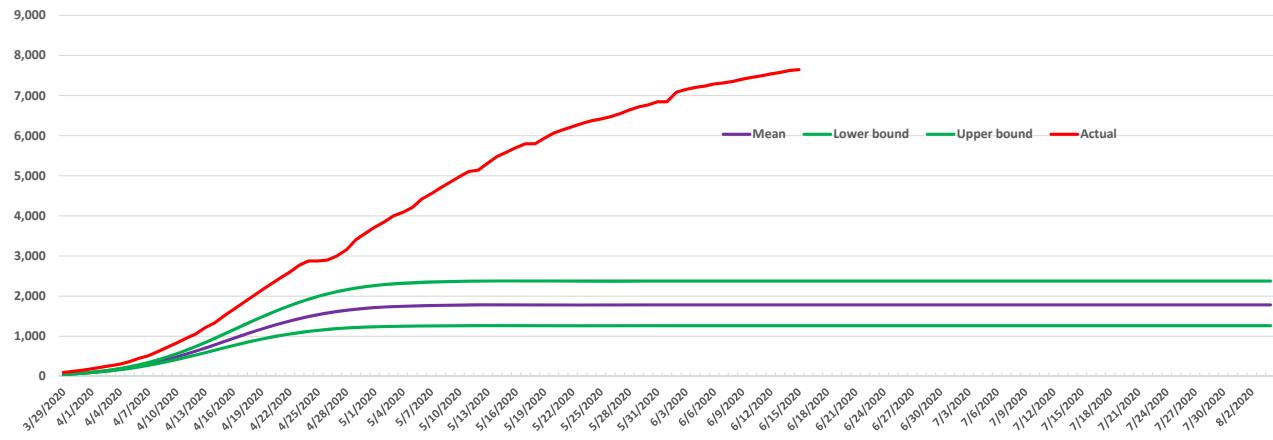
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Connecticut COVID 19 Cumulative Death Projections



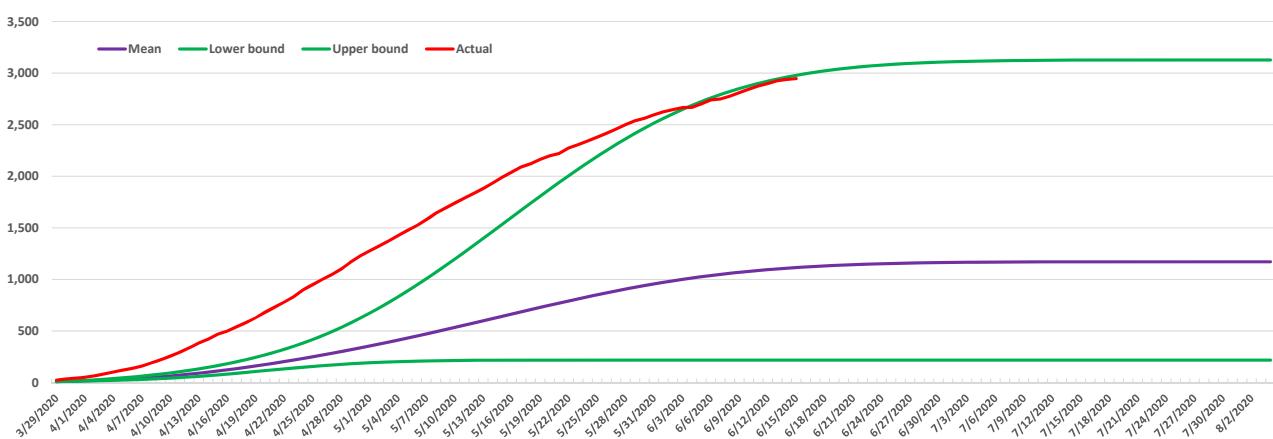
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Massachusetts COVID 19 Cumulative Death Projections



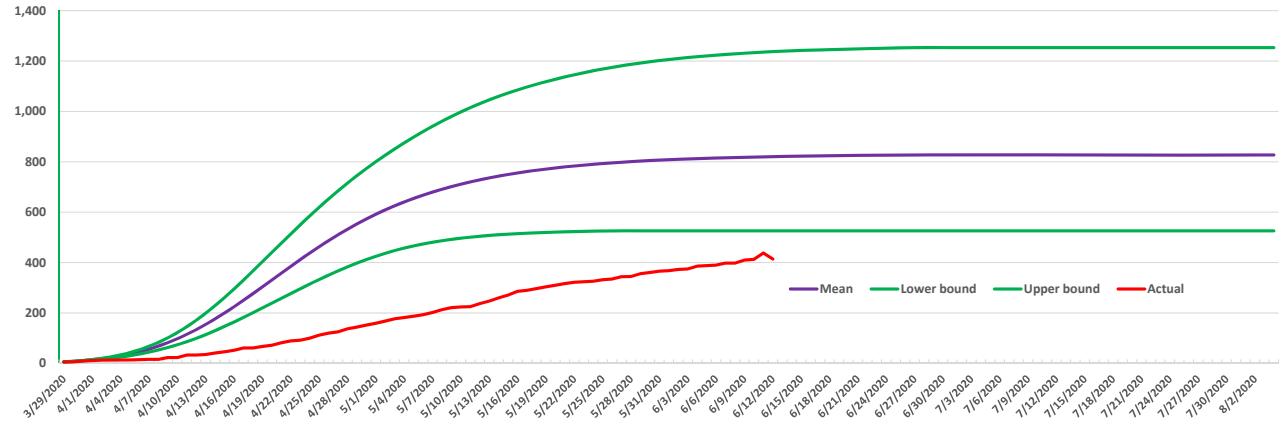
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Maryland COVID 19 Daily Death Projections March 26



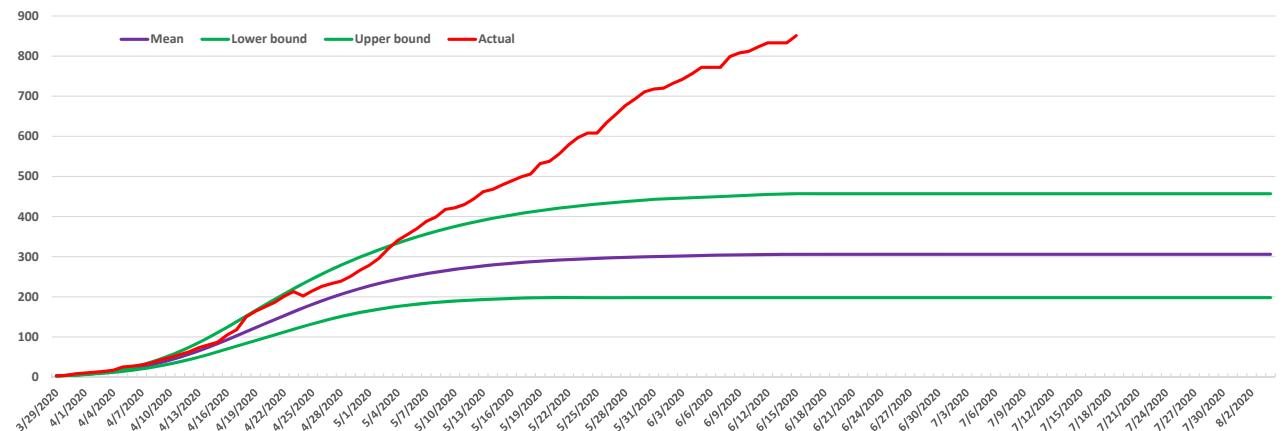
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Delaware COVID 19 Cumulative Death Projections



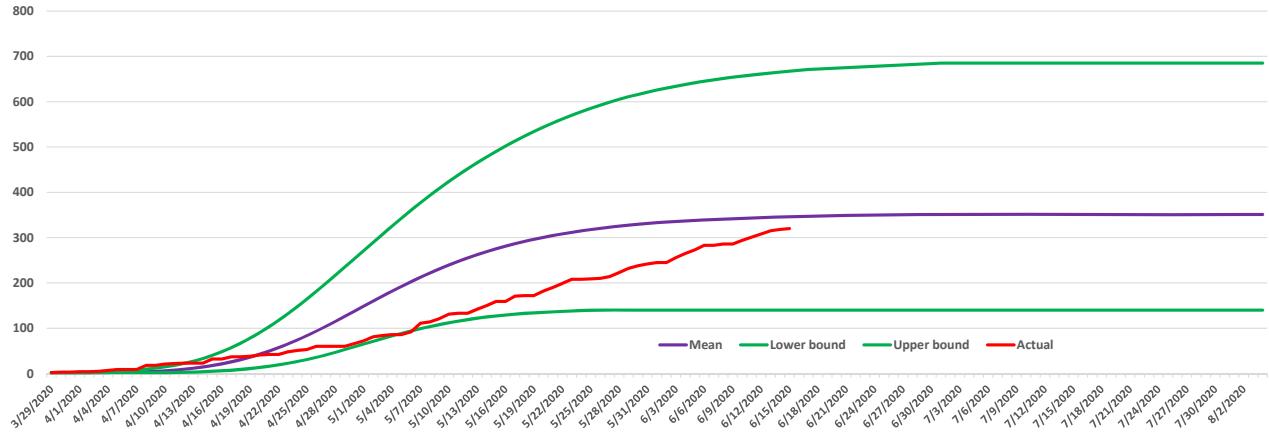
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Rhode Island COVID 19 Cumulative Death Projections March 26



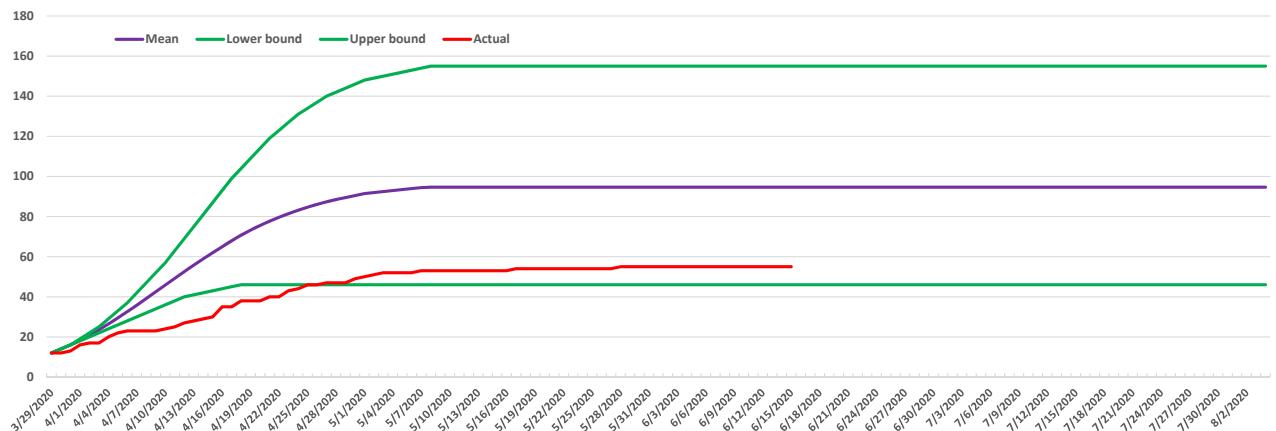
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New Hampshire COVID 19 Cumulative Death Projections



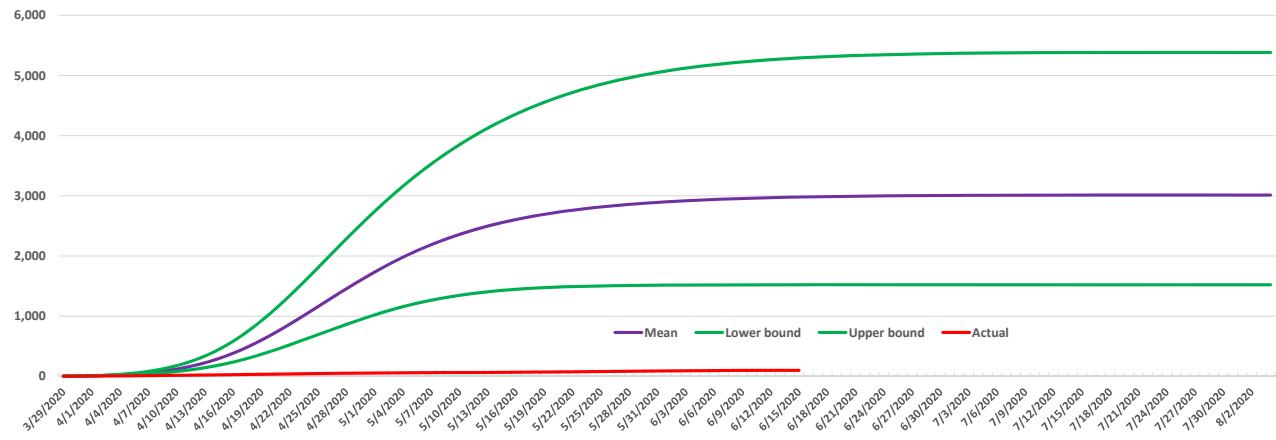
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Vermont COVID 19 Cumulative Death Projections March 26



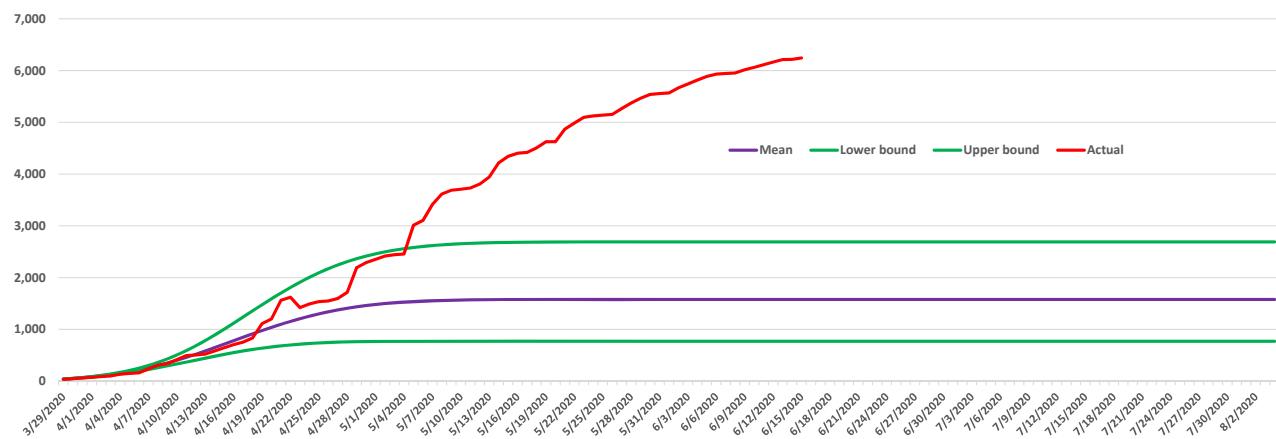
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Maine COVID 19 Cumulative Death Projections



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Pennsylvania COVID 19 Cumulative Death Projections



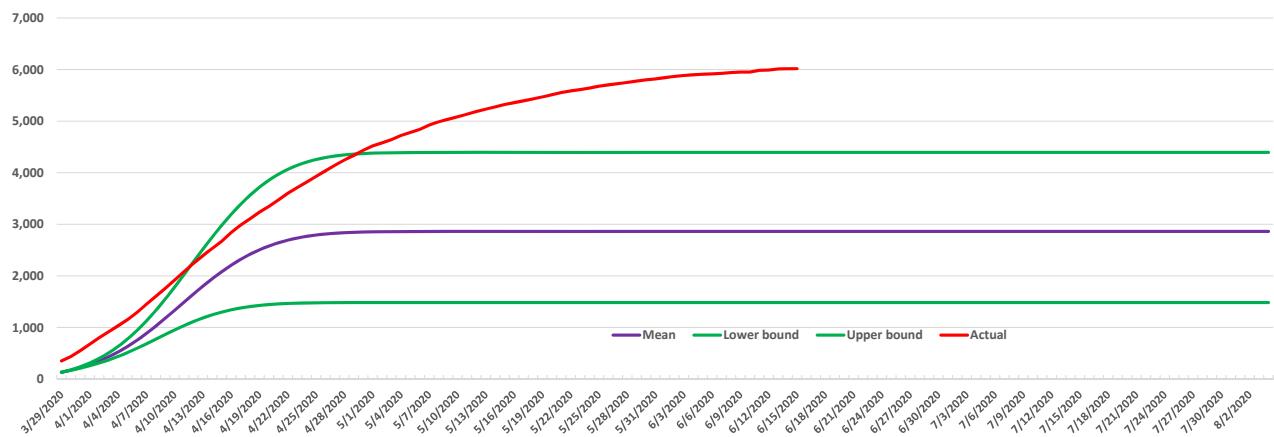
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Ohio COVID 19 Cumulative Death Projections March 26



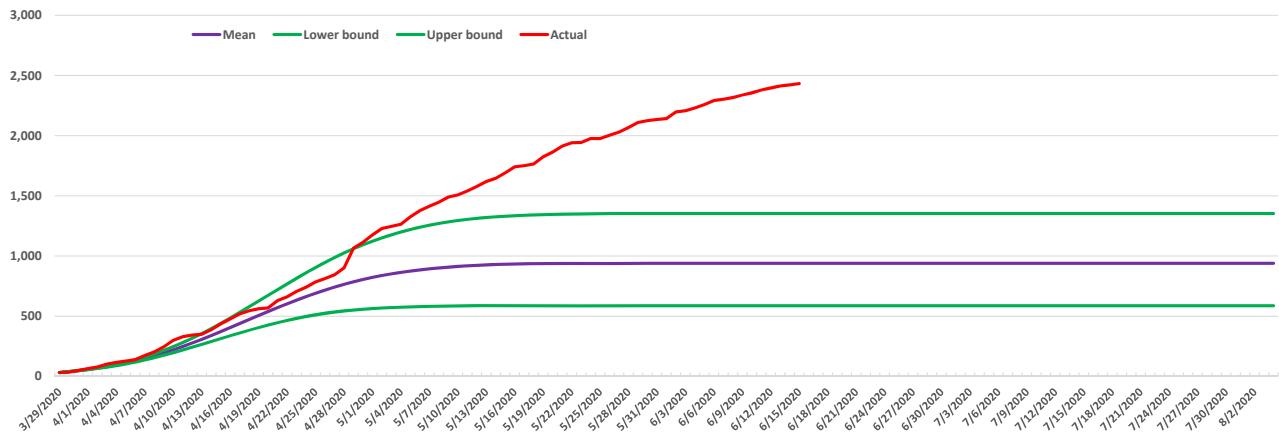
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Michigan COVID 19 Cumulative Death Projections



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Indiana COVID 19 Cumulative Death Projections March 26



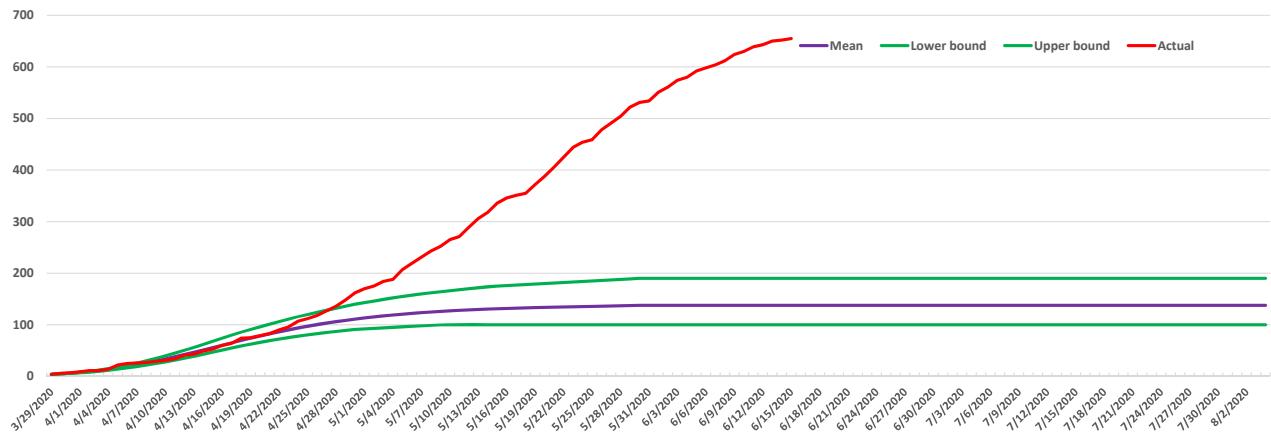
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Illinois COVID 19 Cumulative Death Projections March 26



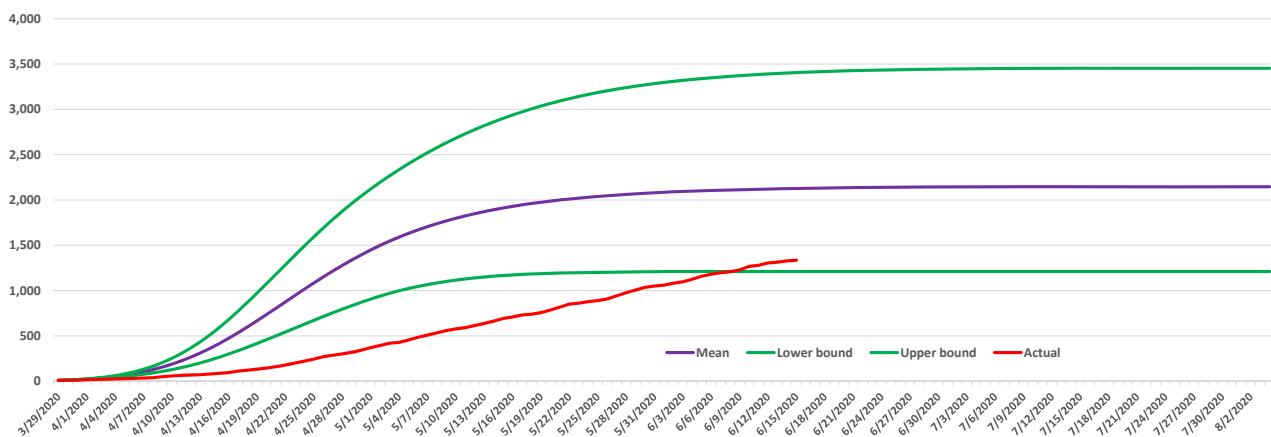
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Iowa COVID 19 Daily Death Projections March 26



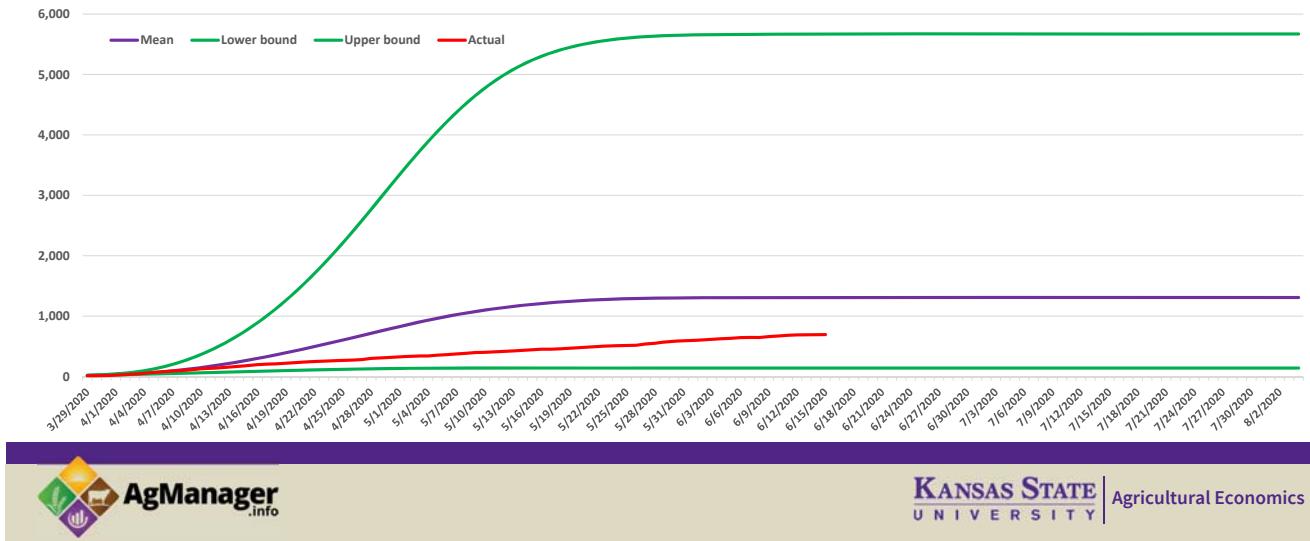
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Minnesota COVID 19 Cumulative Death Projections



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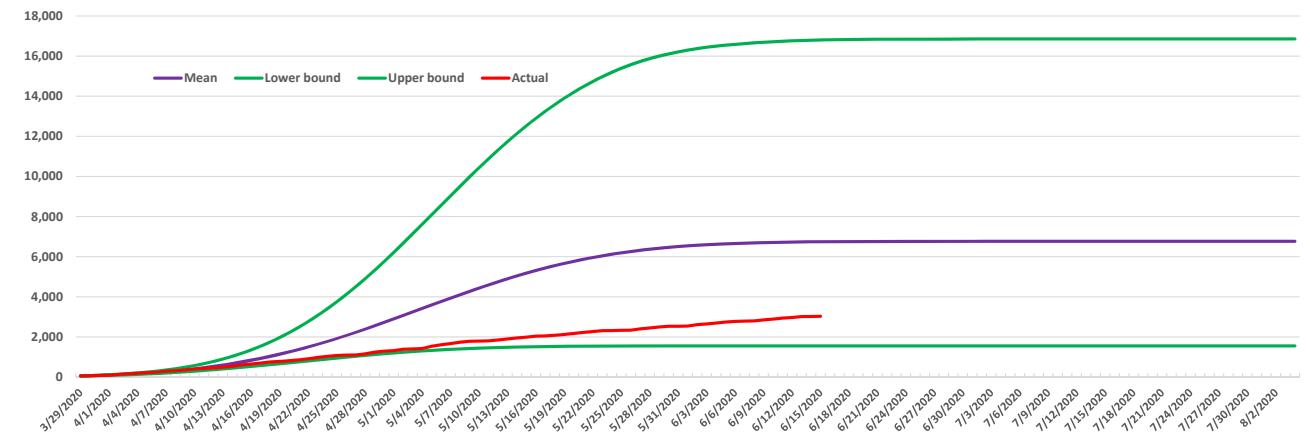
Wisconsin COVID 19 Cumulative Death Projections



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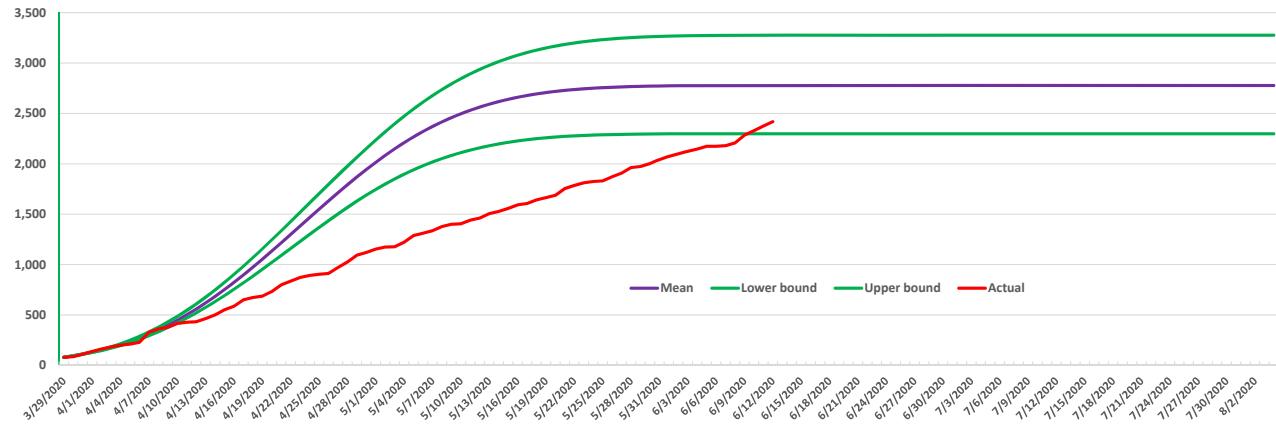
Florida COVID 19 Cumulative Death Projections March 26



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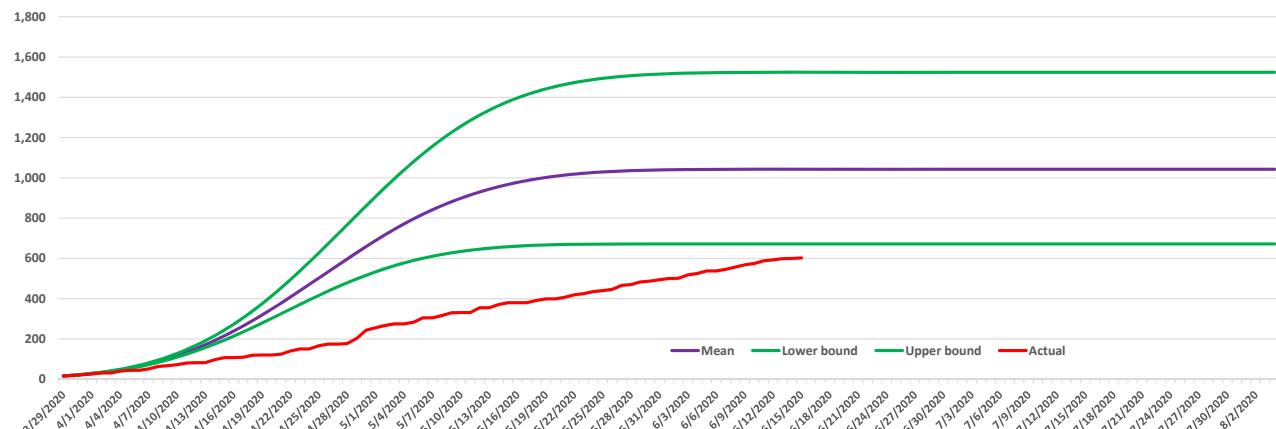
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Georgia COVID 19 Cumulative Death Projections



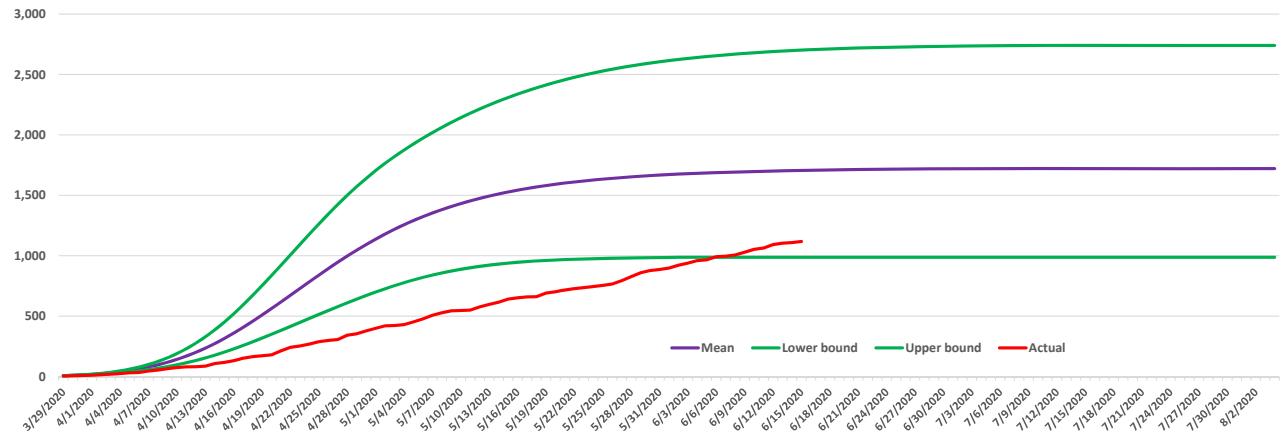
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South Carolina COVID 19 Cumulative Death Projections



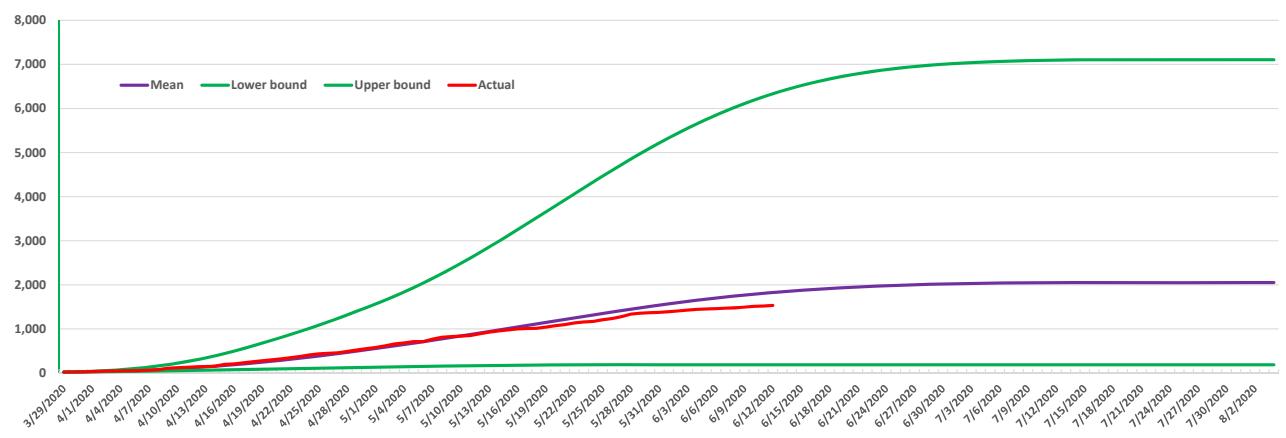
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North Carolina COVID 19 Cumulative Death Projections



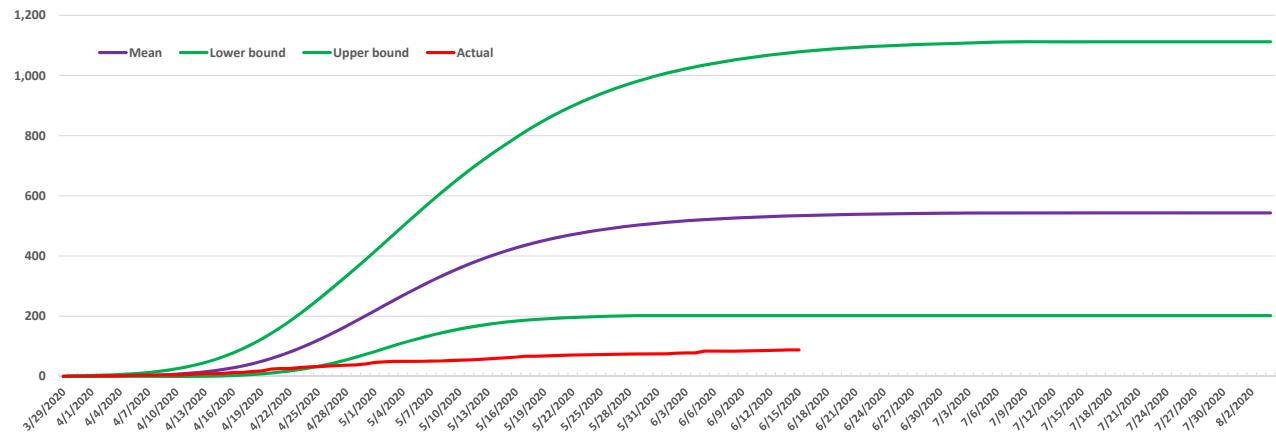
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Virginia COVID 19 Cumulative Death Projections



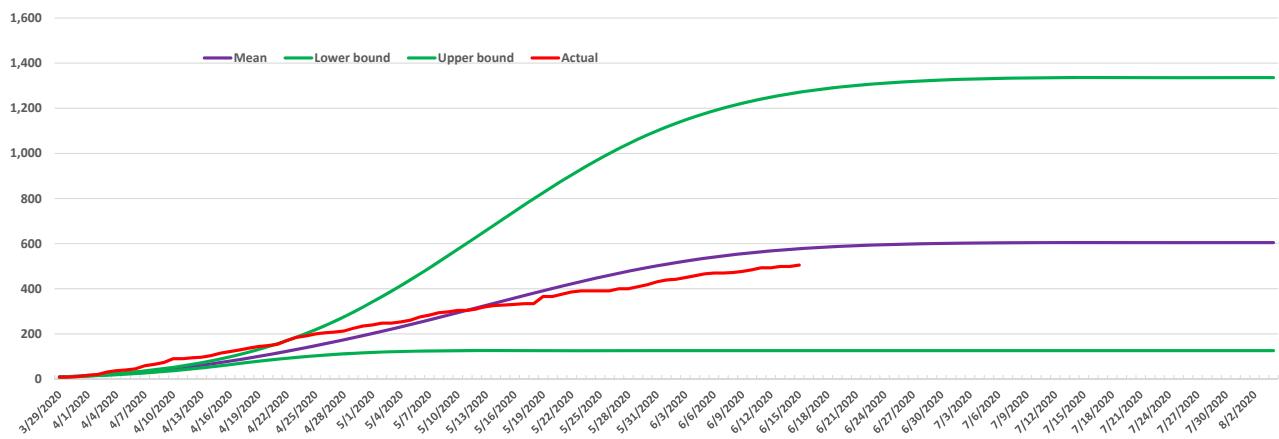
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West Virginia COVID 19 Cumulative Death Projections



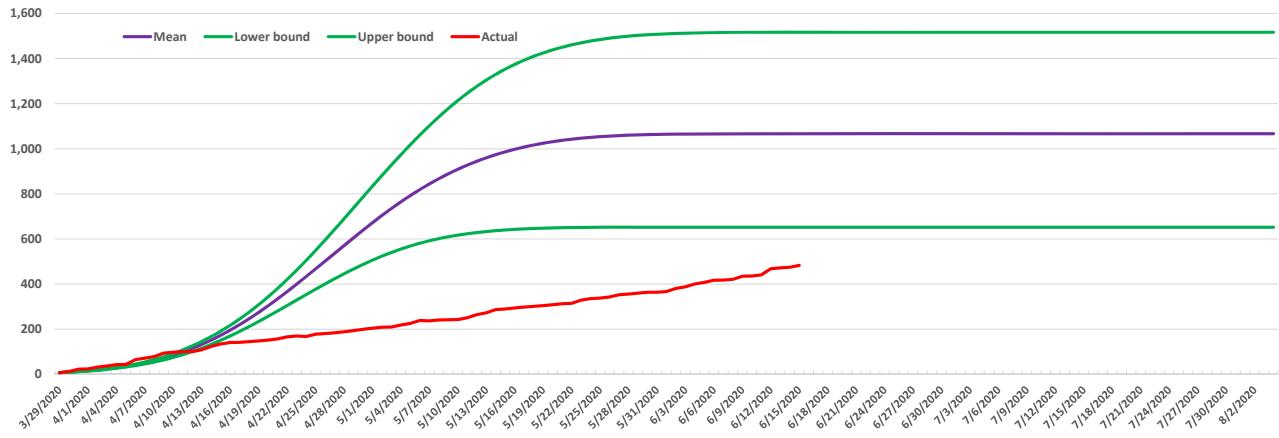
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Kentucky COVID 19 Cumulative Death Projections March 26



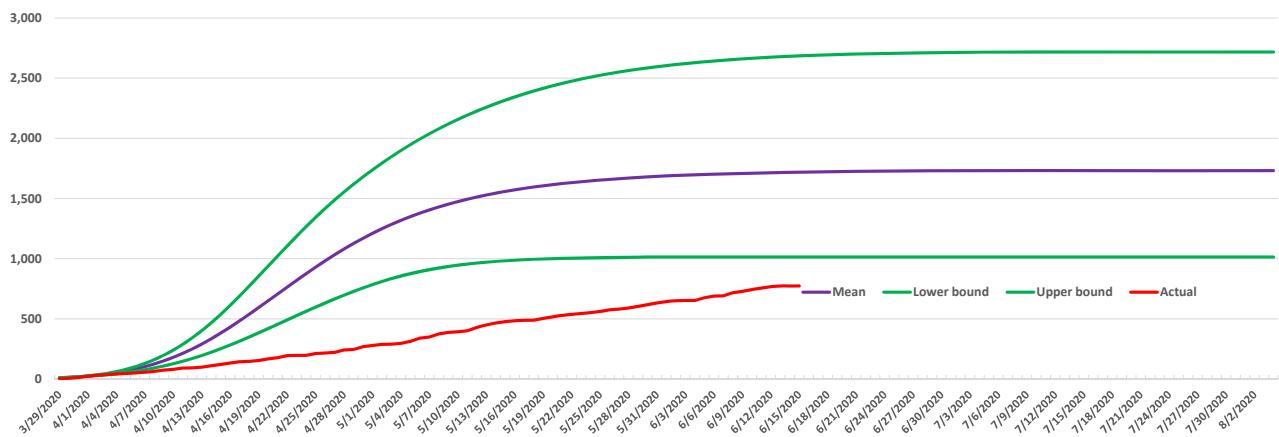
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Tennessee COVID 19 Cumulative Death Projections March 26



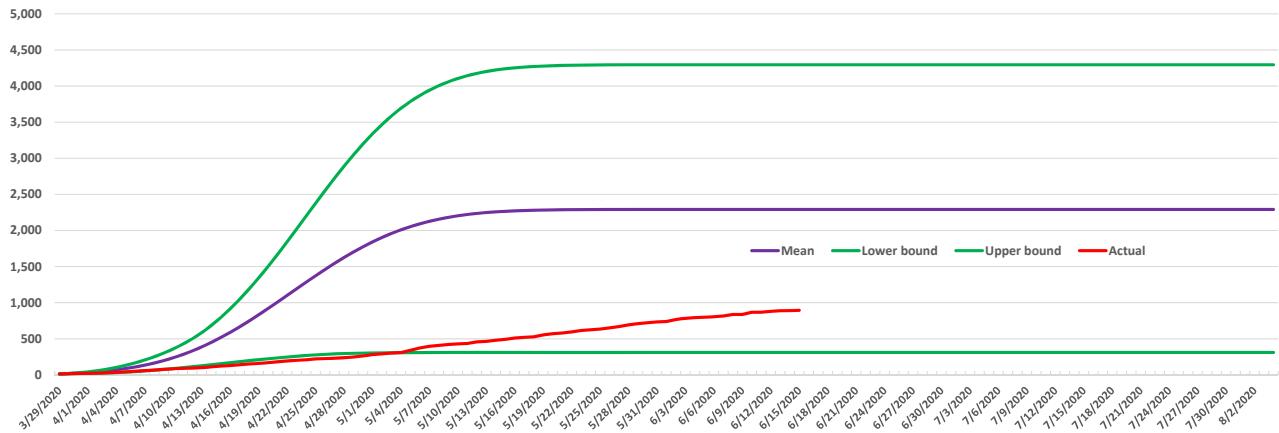
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Alabama COVID 19 Cumulative Death Projections March 26



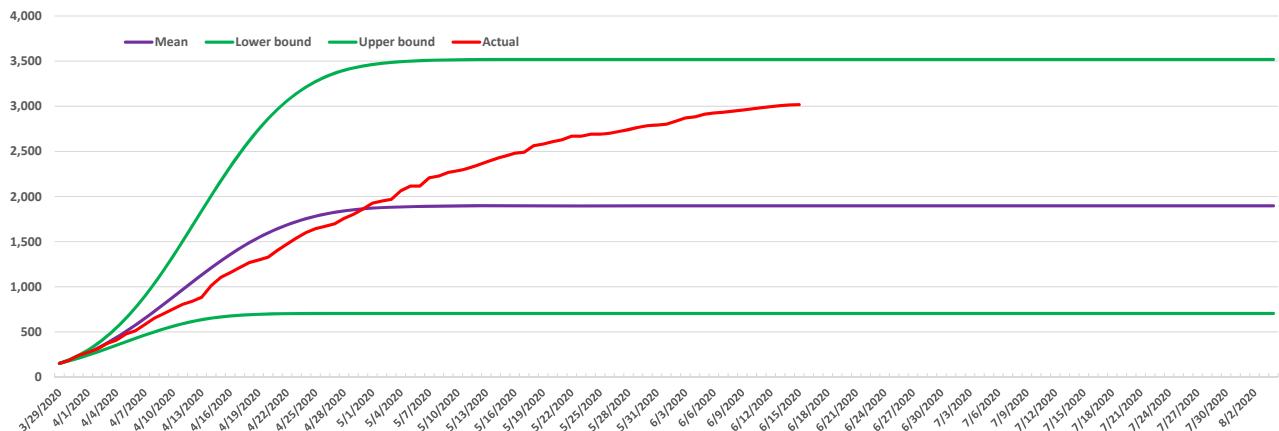
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Mississippi COVID 19 Daily Death Projections March 26



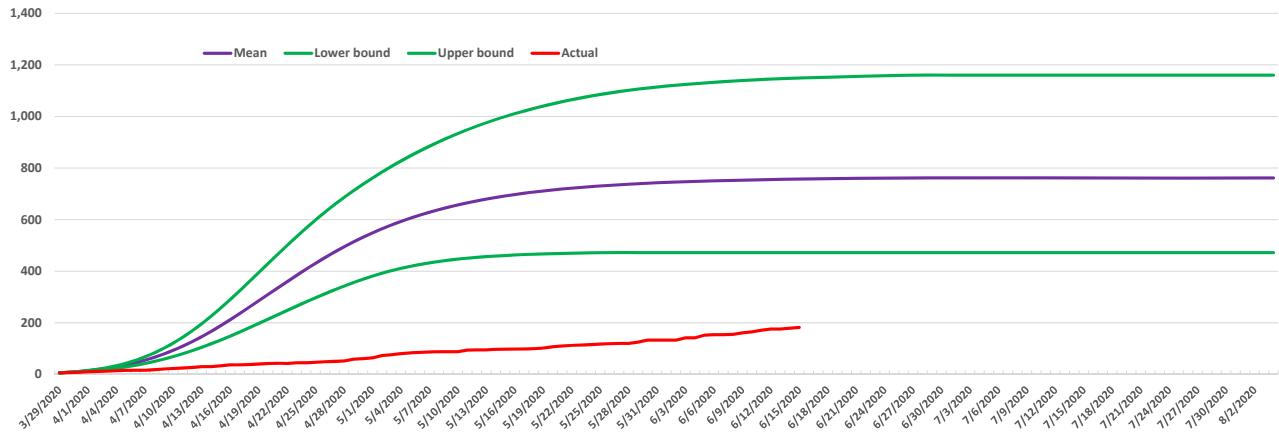
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Louisiana COVID 19 Daily Death Projections March 26



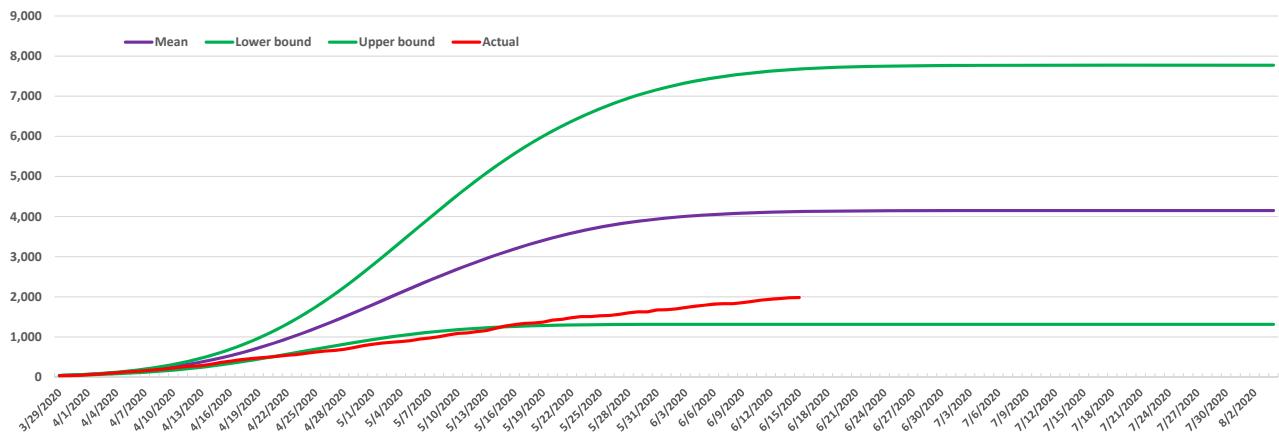
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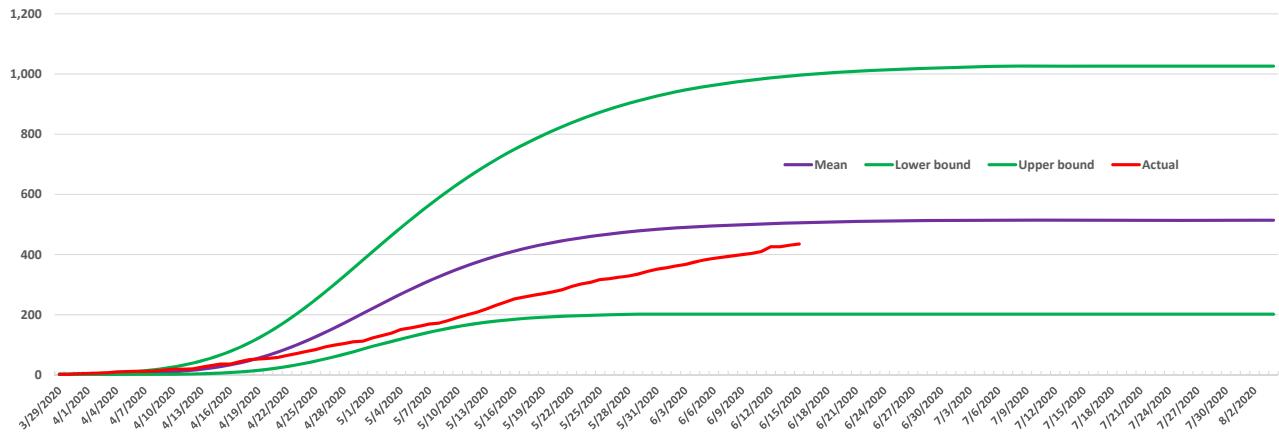
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Texas COVID 19 Daily Death Projections March 26



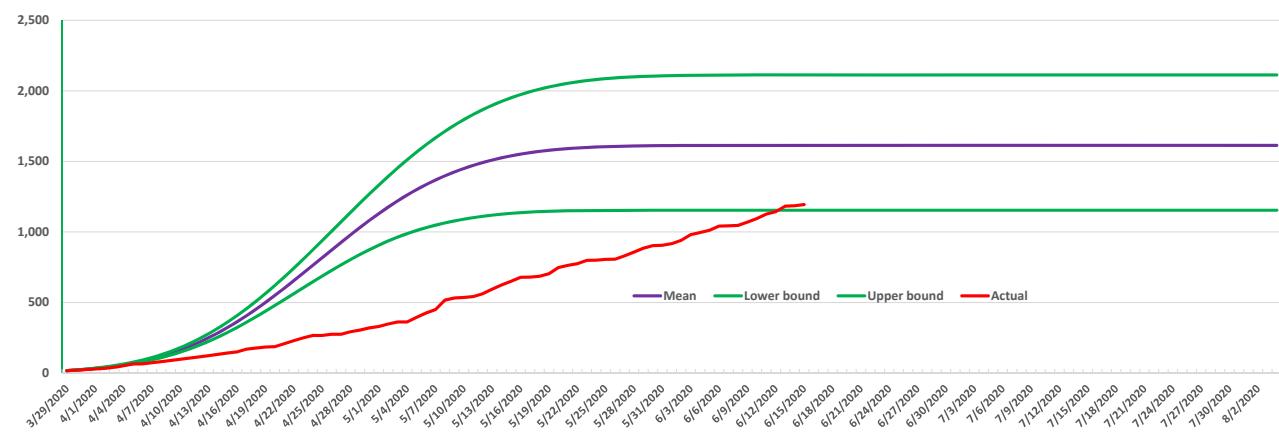
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New Mexico COVID 19 Daily Death Projections March 26



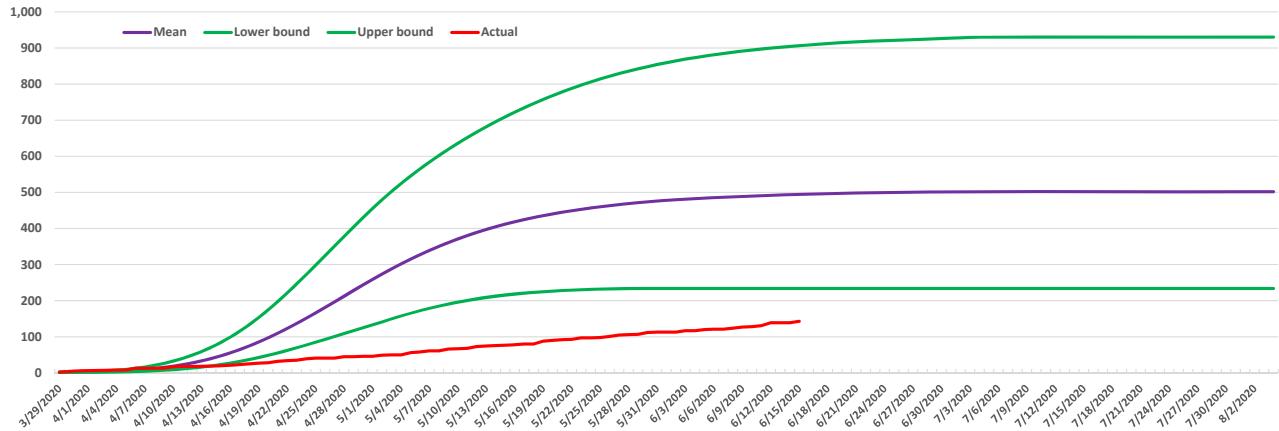
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Arizona COVID 19 Cumulative Death Projections



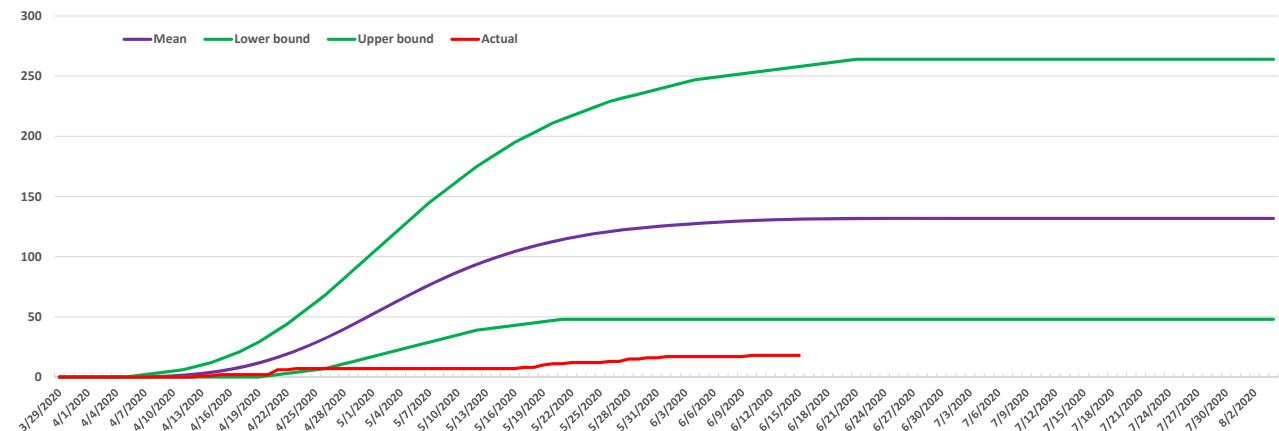
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Utah COVID 19 Daily Death Projections March 26



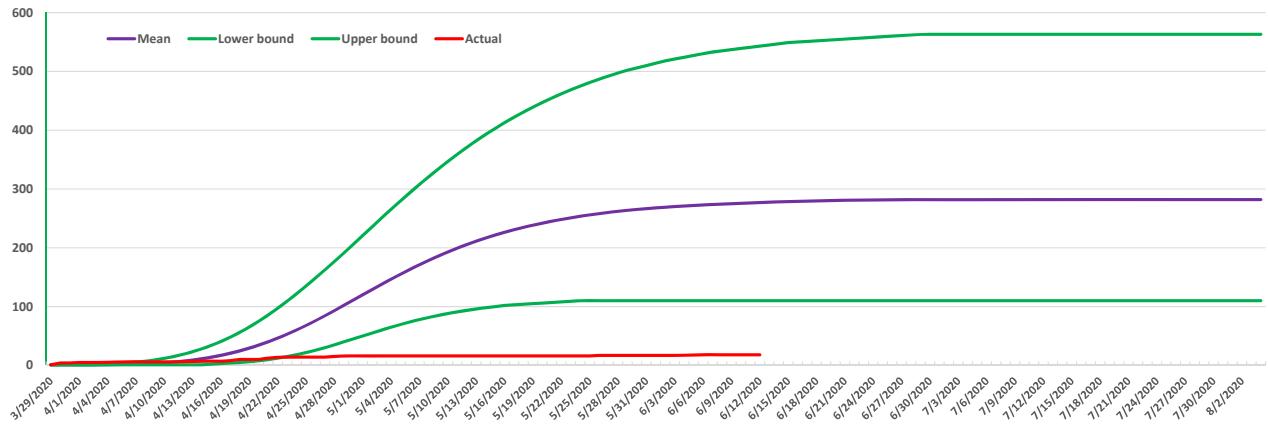
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Wyoming COVID 19 Cumulative Death Projections March 26



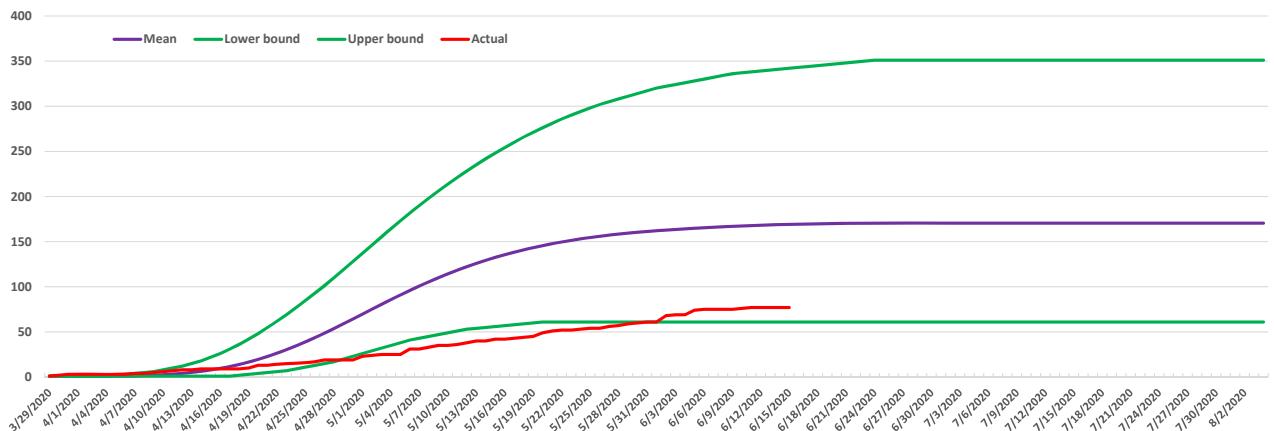
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Montana COVID 19 Cumulative Death Projections



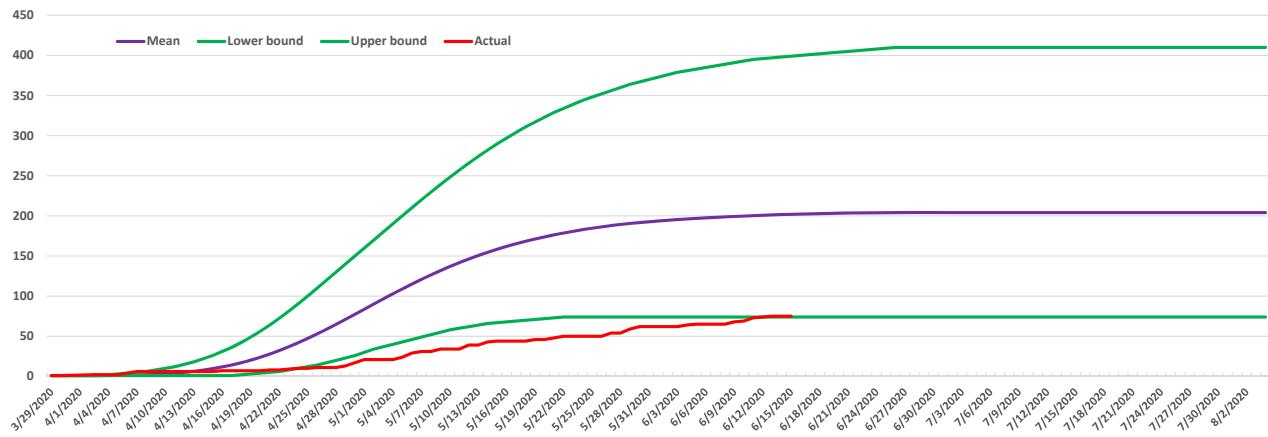
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North Dakota COVID 19 Cumulative Death Projections March 26



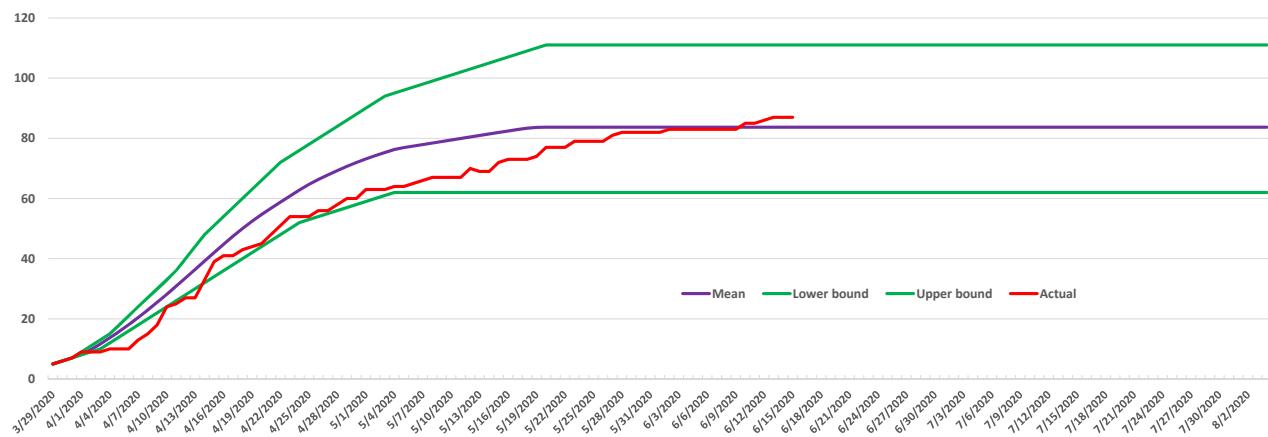
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South Dakota COVID 19 Daily Death Projections March 26



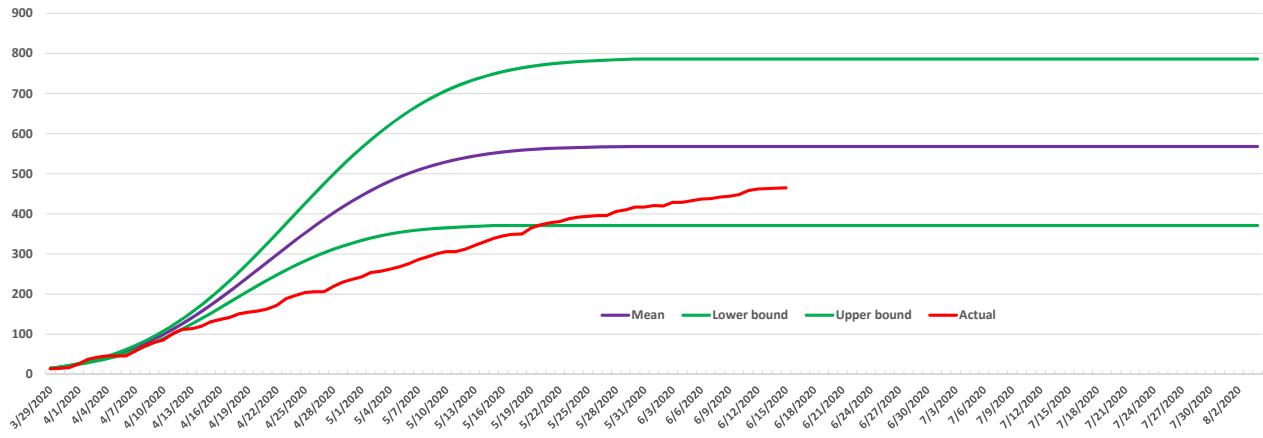
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Idaho COVID 19 Cumulative Death Projections March 26



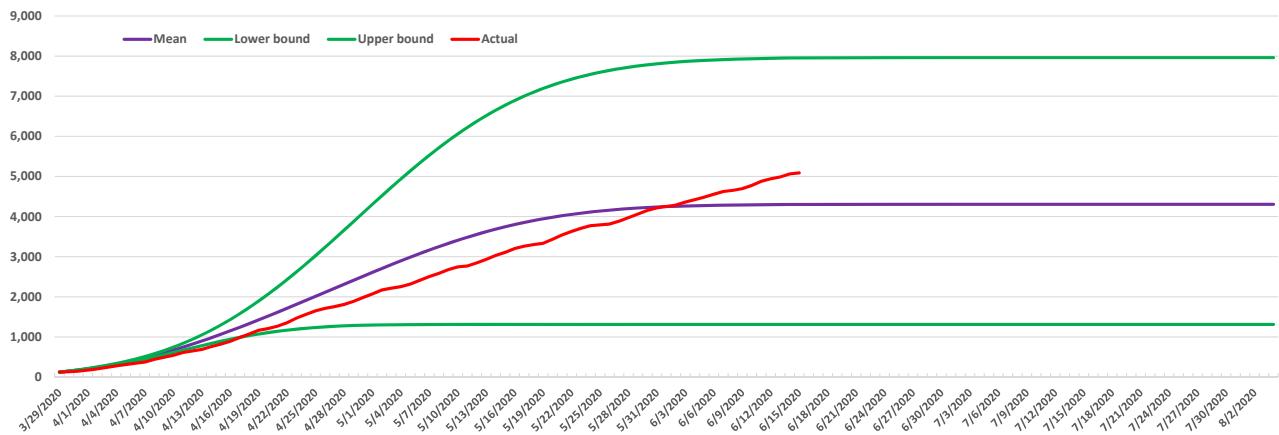
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Nevada COVID 19 Cumulative Death Projections



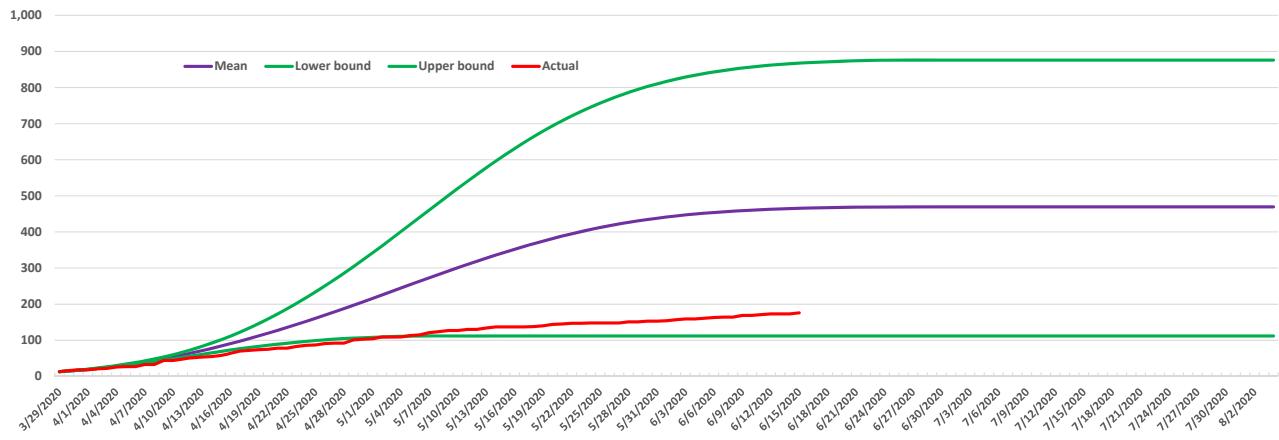
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California COVID 19 Cumulative Death Projections March 26



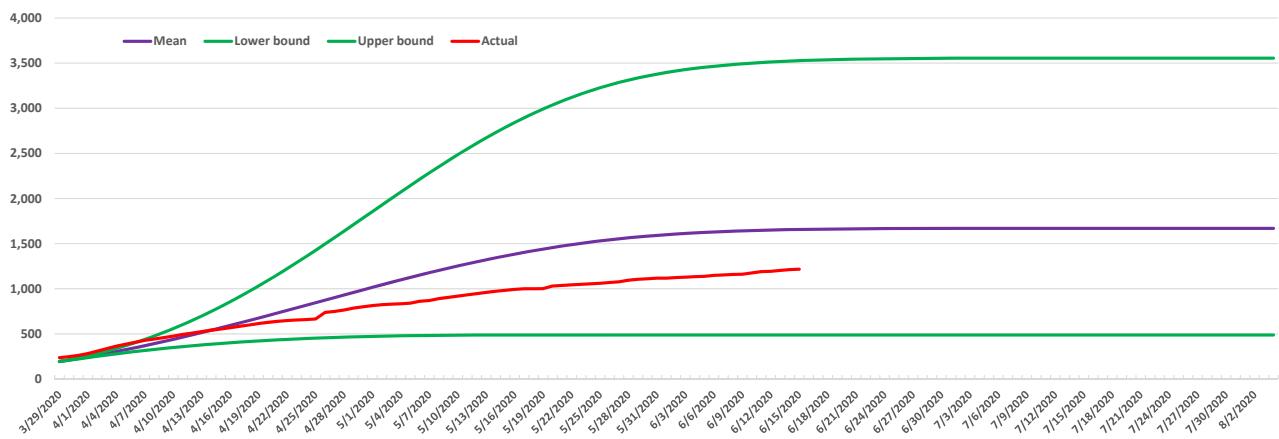
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Oregon COVID 19 Cumulative Death Projections March 26



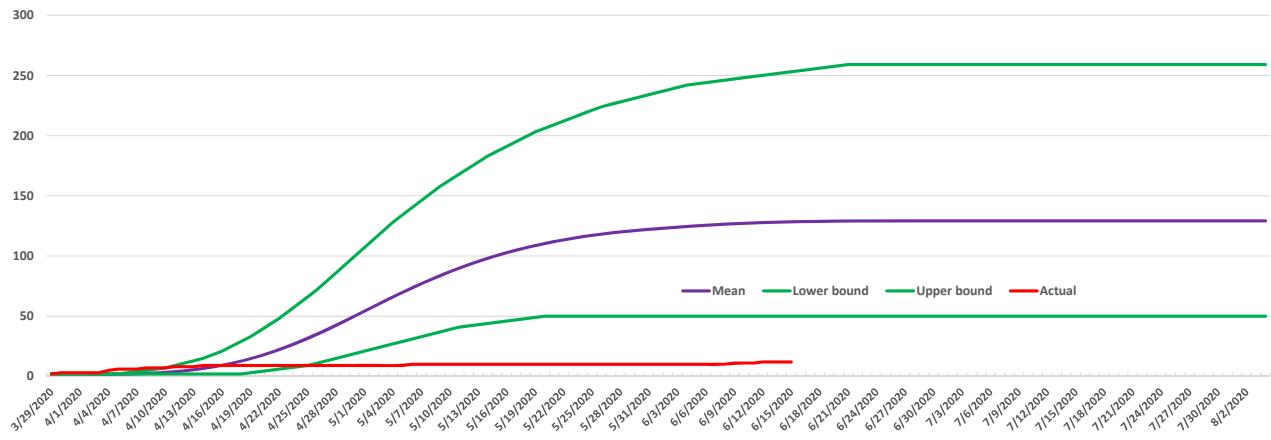
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Washington COVID 19 Cumulative Death Projections March 26



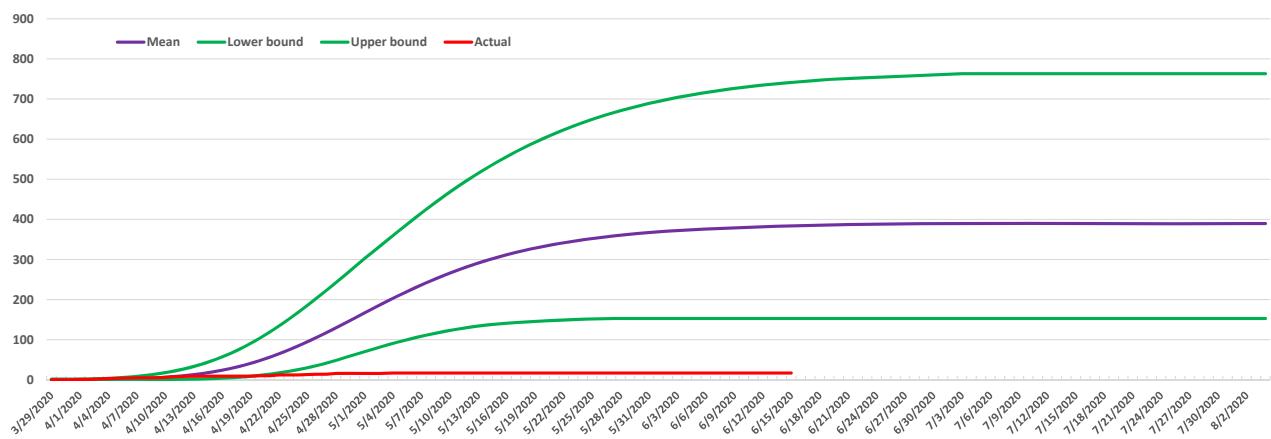
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Alaska COVID 19 Cumulative Death Projections March 26



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Hawaii COVID 19 Daily Death Projections March 26



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