

Analysis of the IHME COVID 19 Forecasting Model – June 30th Update

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Outline

- ❖ Two revisions to IHME model since June 23rd
- ❖ A look at projected death through August 4th
- ❖ A look at Kansas and United States mortality statistics
- ❖ 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, over 45 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 23th discussion



The 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
- Provide estimates based upon what is expected to happen, mandates easing, and estimates with 95% wearing masks
- Expected to happen assumes easing occurs until a threshold of a daily death rate of 8 per million
 - In Kansas, 8 per million would be 22.4 per day
 - In the U.S., 8 per million would be 2,605
- Paper is still in the peer review process



Kansas COVID Deaths by Age Group

Age Group	Number of Deaths	Percent of COVID Deaths	2018 Mortality Rates
25-34	2	0.7%	1.8%
35-44 years	6	2.2%	2.5%
45-54 years	13	4.8%	4.8%
55-64 years	38	14.1%	12.8%
65-74 years	52	19.3%	18.2%
75-84 years	60	22.2%	23.4%
85+ years	99	36.7%	34.2%
Total	270	100%	97.6%

<https://www.coronavirus.kdheks.gov/160/COVID-19-in-Kansas>, June 30, 2020

https://www.kdheks.gov/phi/AS_Tables/AS_2018_Tables_and_Figures/general_mortality/Table_E4.pdf, June 30, 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	132	0.1%	0.2%
25-34 years	732	0.7%	1.1%
35-44 years	1,860	1.7%	2.1%
45-54 years	5,238	4.9%	6.0%
55-64 years	12,895	11.9%	13.2%
65-74 years	22,429	20.8%	18.9%
75-84 years	28,735	26.6%	23.4%
85+ years	35,948	33.3%	31.2%
Total	107,997	99.97%	98.87%

<https://data.cdc.gov/NCHS/Provisional-COVID-19-Death-Counts-by-Sex-Age-and-S/9bhg-hcku>, June 30, 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	38	0.10	9.3
65-74 years	52	0.20	18.9
75-84 years	60	0.45	47.5
85+ years	99	1.51	142.1

<https://www.coronavirus.kdheks.gov/160/COVID-19-in-Kansas>, June 30, 2020

https://www.kdheks.gov/phi/AS_Tables/AS_2018_Tables_and_Figures/general_mortality/, June 30, 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	9	0.00	5.67
1-14 years	19	0.00	0.17
15-24 years	132	0.00	0.74
25-34 years	732	0.02	1.33
35-44 years	1,860	0.05	1.95
45-54 years	5,238	0.12	4.02
55-64 years	12,895	0.31	8.86
65-74 years	22,429	0.76	17.91
75-84 years	28,735	1.95	44.73
85+ years	35,948	5.56	135.74

<https://data.cdc.gov/NCHS/Provisional-COVID-19-Death-Counts-by-Sex-Age-and-S/9bhg-hcku>, June 30, 2020



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Projected August 4th Deaths from the March 26th, June 15th, June 24th, and June 29th Models

	3/26	6/15	6/24	6/29		3/26	6/15	6/24	6/29
Alabama	1,732	1,943	1,415	1,395	Hawaii	390	20	21	21
Alaska	129	19	16	14	Idaho	84	98	110	105
Arizona	1,613	3,908	3,440	3,111	Illinois	2,360	7,489	7,814	7,936
Arkansas	762	569	605	513	Indiana	940	2,900	2,908	2,760
California	4,306	8,708	8,613	8,167	Iowa	138	1,001	823	793
Colorado	2,151	2,872	1,783	1,854	Kansas	687	342	341	343
Connecticut	378	4,386	4,465	4,487	Kentucky	605	701	688	670
Delaware	827	516	490	557	Louisiana	1,897	3,774	3,816	3,822
Florida	6,766	6,285	6,663	6,006	Maine	3,013	143	113	114
Georgia	2,777	4,781	4,387	3,982	Maryland	1,171	4,040	3,446	3,390



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

	3/26	6/15	6/24	6/29		3/26	6/15	6/24	6/29
Massachusetts	1,782	8,272	8,490	8,868	New Mexico	514	728	686	660
Michigan	2,862	7,229	6,369	6,375	New York	15,546	32,698	31,714	32,566
Minnesota	2,146	2,144	1,725	1,711	North Carolina	1,721	1,837	1,669	1,797
Mississippi	2,292	1,241	1,164	1,507	North Dakota	171	111	88	86
Missouri	1,055	1,297	1,672	1,367	Ohio	1,203	3,228	3,345	3,515
Montana	282	23	27	29	Oklahoma	1,149	508	464	447
Nebraska	424	360	381	380	Oregon	469	302	353	301
Nevada	568	650	667	684	Pennsylvania	1,579	7,653	7,215	7,395
New Hampshire	351	561	526	523	Rhode Island	306	1,075	1,083	1,137
New Jersey	2,096	13,766	13,581	15,713	South Carolina	1,043	1,522	951	1,033



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

	3/26	6/15	6/24	6/29		3/26	6/15	6/24	6/29
South Dakota	204	142	138	147	Virginia	2,053	1,910	1,745	2,024
Tennessee	1,067	1,084	829	1,028	Washington	1,670	1,427	1,538	1,563
Texas	4,150	3,293	5,114	4,712	West Virginia	543	120	105	116
Utah	502	293	277	264	Wisconsin	1,309	1,034	940	1,014
Vermont	95	59	61	62	Wyoming	132	19	20	21
United States	82,141	149,690	145,490	147,693					



Changes from June 15

- The model revision released on June 29th increased the cumulative expected death in 21 states and reduced it in 29 states from the June 15th model
 - Increases in Connecticut, Delaware, Hawaii, Idaho, Illinois, Kansas, Louisiana, Massachusetts, Mississippi, Missouri, Montana, Nebraska, Nevada, Ohio, Rhode Island, South Dakota, Texas, Vermont, Virginia, Washington, Wyoming
- The model revision released on June 29th has higher cumulative expected death in 23 states and lower cumulative expected death in 27 states compared to the original model
 - Increases in Arizona, California, Connecticut, Georgia, Idaho, Illinois, Indiana, Iowa, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Missouri, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, Texas



Trend Analysis in Daily Death for June

	Trend		Trend		Trend		Trend		Trend
Alabama	0.01	Hawaii	0.01	Massachusetts	-1.81	New Mexico	-0.12	South Dakota	0.02
Alaska	0.01	Idaho	0.00	Michigan	-0.34	New York	-1.78	Tennessee	-0.02
Arizona	0.41	Illinois	-2.53	Minnesota	-0.61	North Carolina	-0.19	Texas	0.33
Arkansas	0.13	Indiana	-0.59	Mississippi	-0.03	North Dakota	-0.05	Utah	-0.01
California	0.03	Iowa	-0.35	Missouri	-0.05	Ohio	-0.89	Vermont	0.00
Colorado	-0.38	Kansas	-0.07	Montana	0.00	Oklahoma	0.00	Virginia	0.03
Connecticut	-0.52	Kentucky	-0.09	Nebraska	0.00	Oregon	0.01	Washington	0.03
Delaware	-0.11	Louisiana	-0.39	Nevada	-0.07	Pennsylvania	-1.51	West Virginia	-0.03
Florida	-0.05	Maine	-0.04	New Hampshire	-0.10	Rhode Island	-0.14	Wisconsin	-0.11
Georgia	-0.57	Maryland	-0.51	New Jersey	7.32	South Carolina	0.02	Wyoming	-0.01

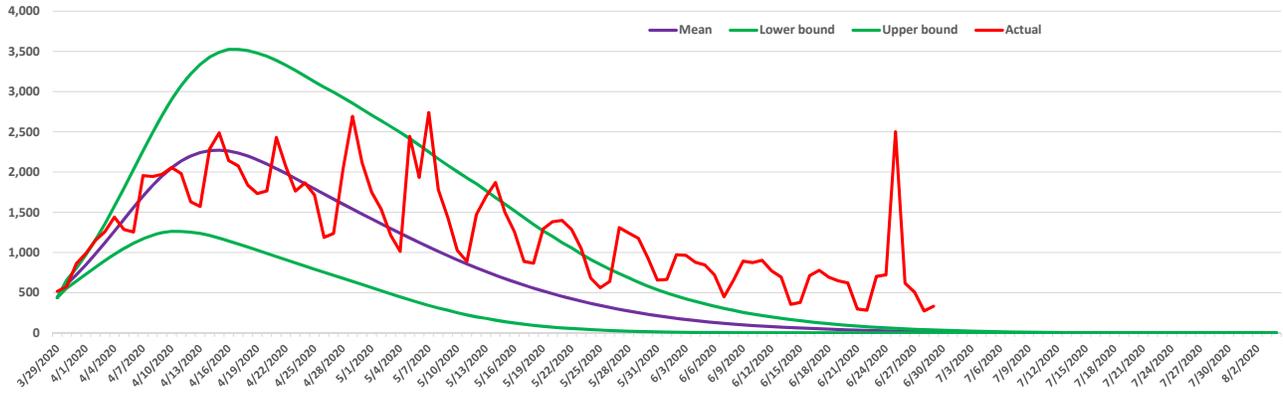


Trend Analysis Summary

- Since June 1, 32 States have had a decrease in daily death of greater than 0.01 per day
- Since June 1, 13 States have had an increase in daily death of greater than 0.01 per day
- Since June 1, 5 States have had a 0.00 increase/decrease in death per day
- The U.S. has experienced a 5.76 decrease per day since June 1.

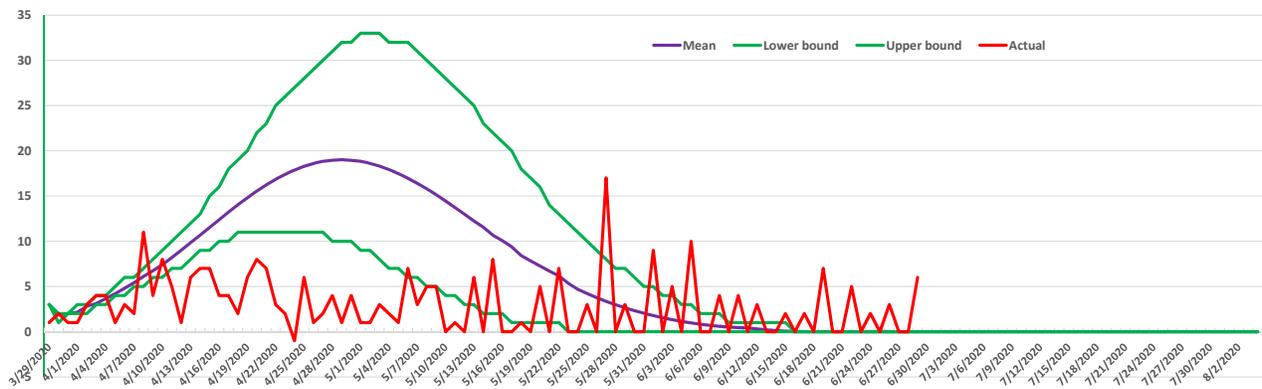


U.S. COVID 19 Daily Death Projections March 26



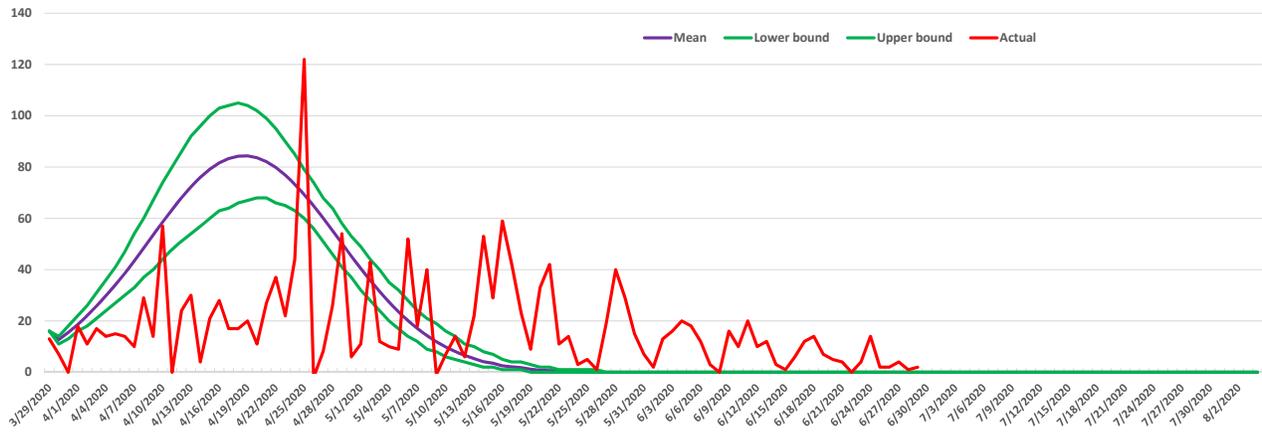
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Kansas COVID 19 Daily Death Projections March 26



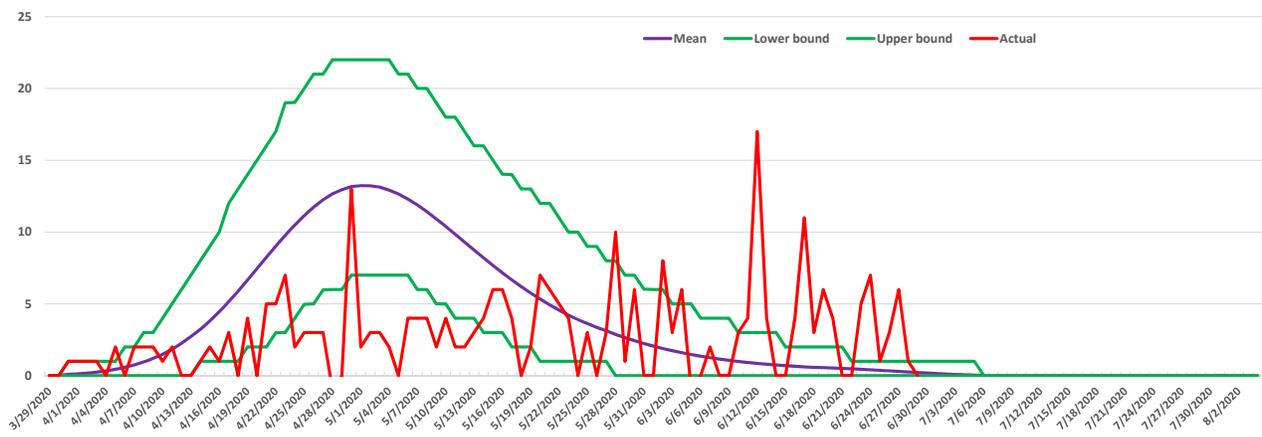
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Colorado COVID 19 Daily Death Projections March 26



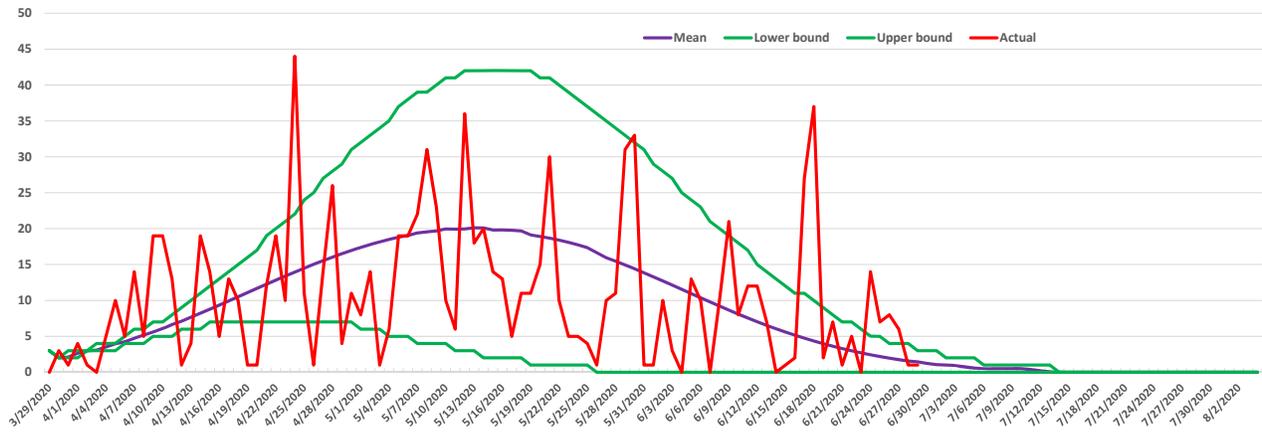
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Nebraska COVID 19 Daily Death Projections March 26



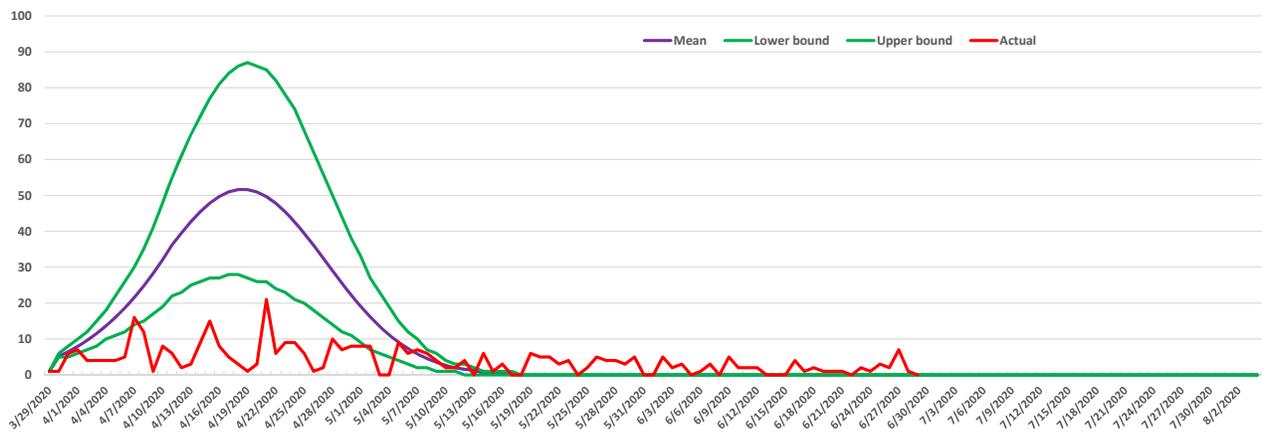
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Missouri COVID 19 Daily Death Projections March 26



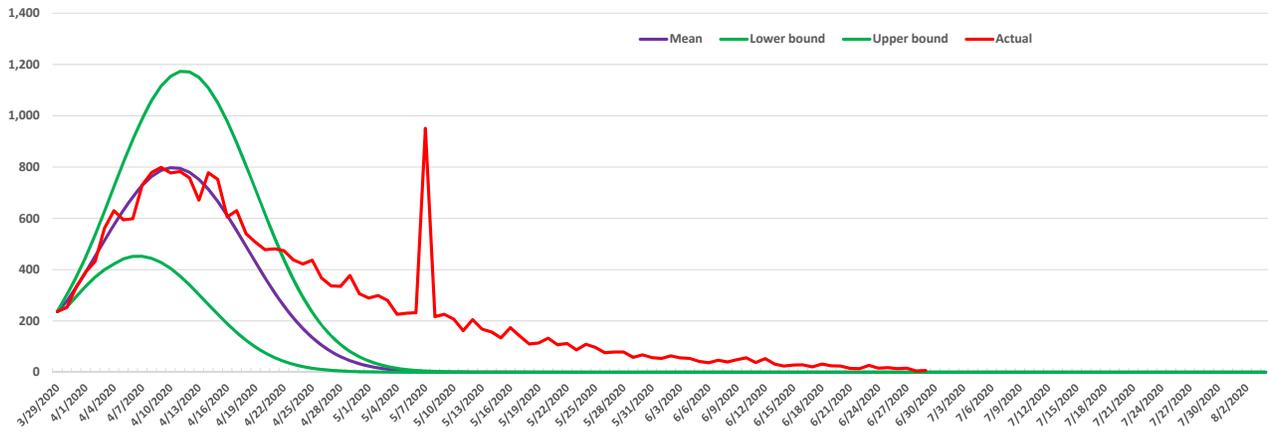
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Oklahoma COVID 19 Daily Death Projections March 26



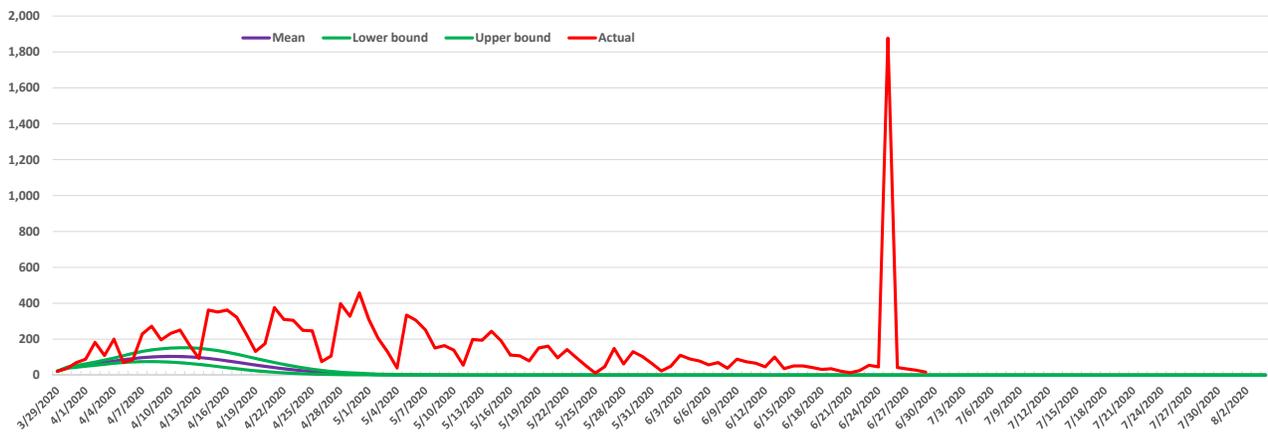
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New York COVID 19 Daily Death Projections March 26



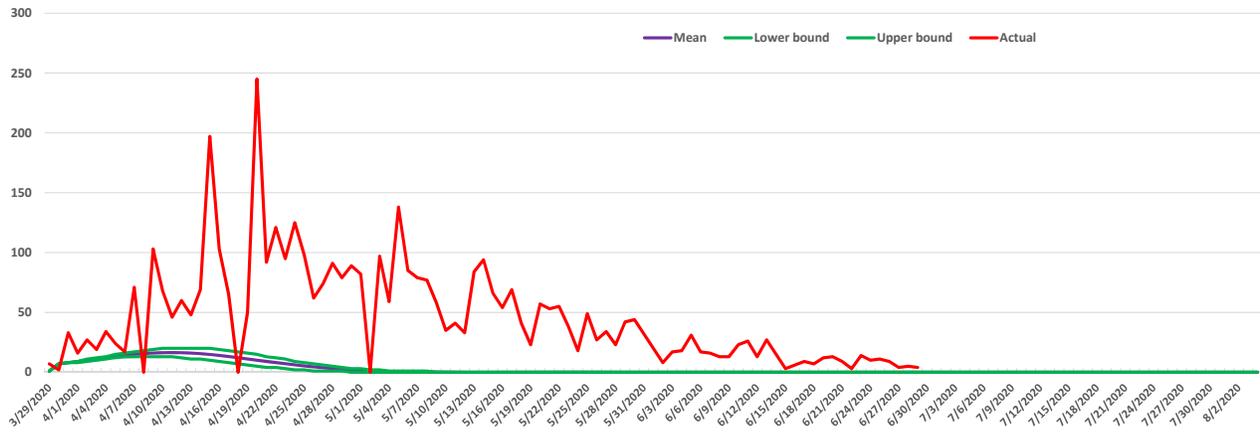
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New Jersey COVID 19 Daily Death Projections March 26



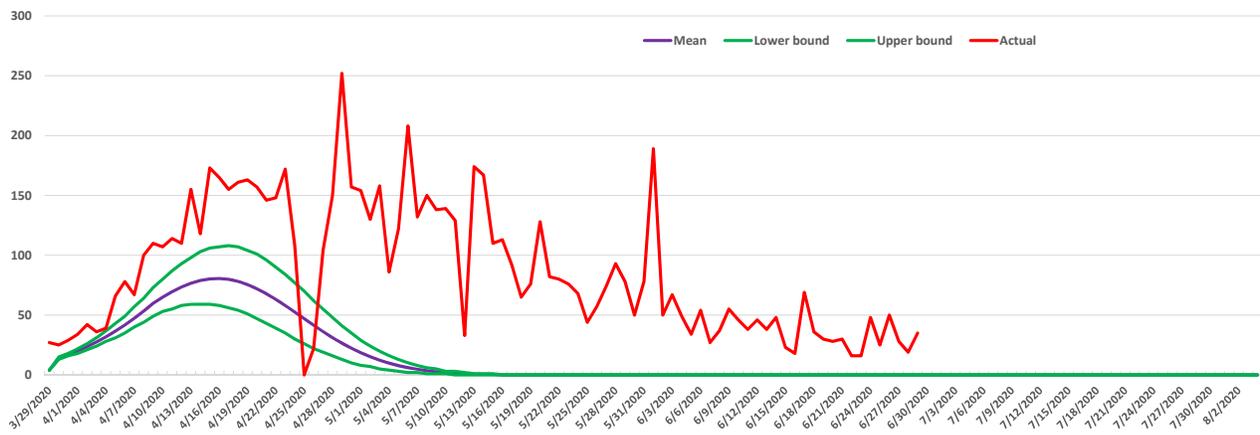
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Connecticut COVID 19 Daily Death Projections March 26



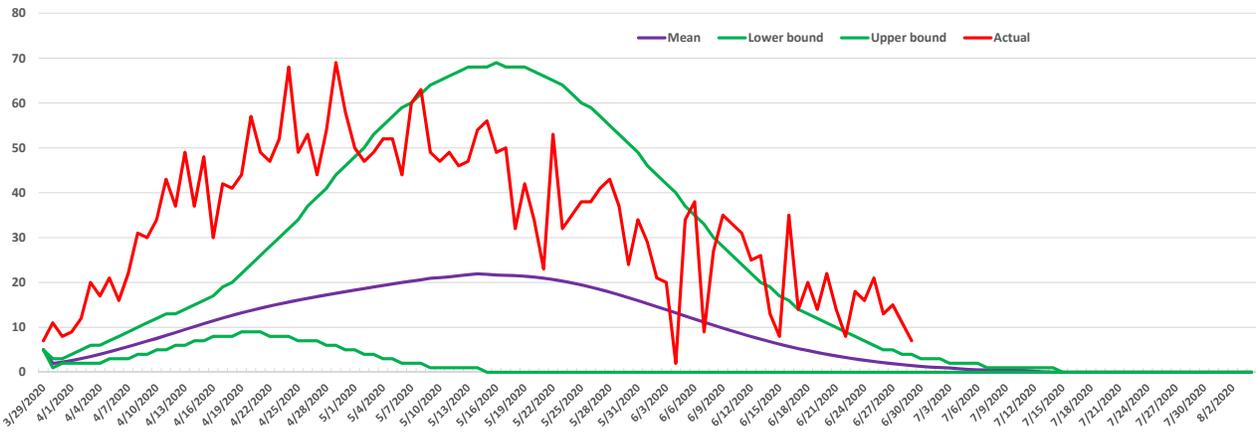
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Massachusetts COVID 19 Daily Death Projections March 26



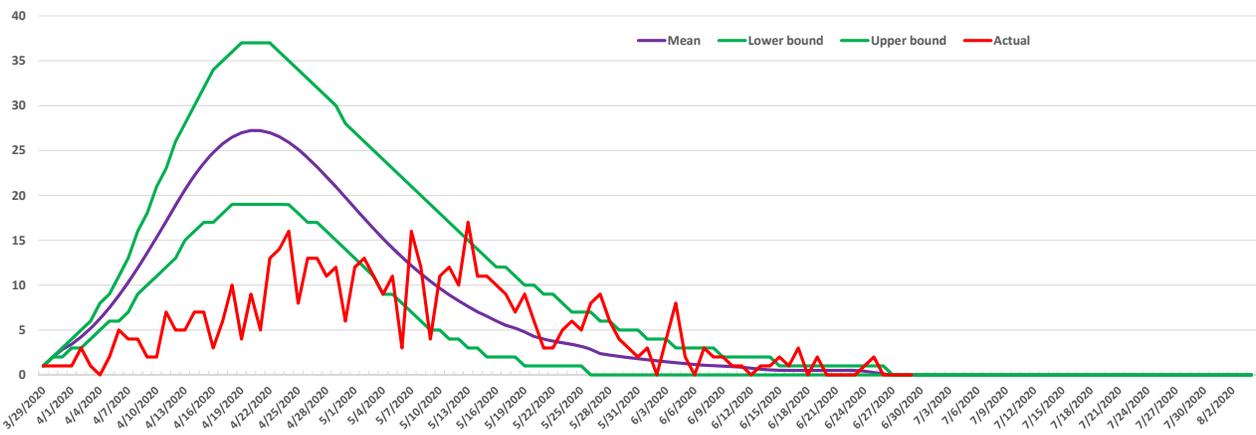
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Maryland COVID 19 Daily Death Projections March 26



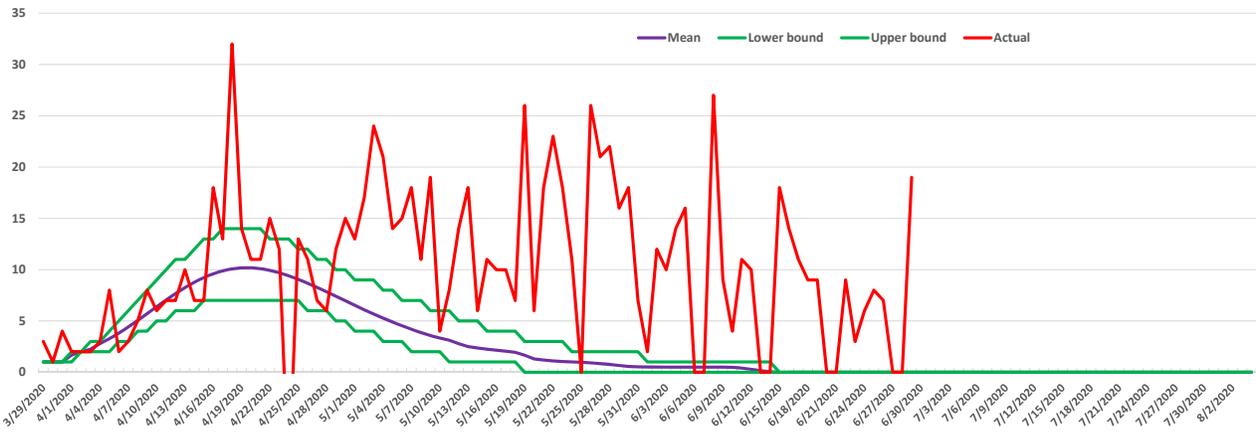
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Delaware COVID 19 Daily Death Projections March 26



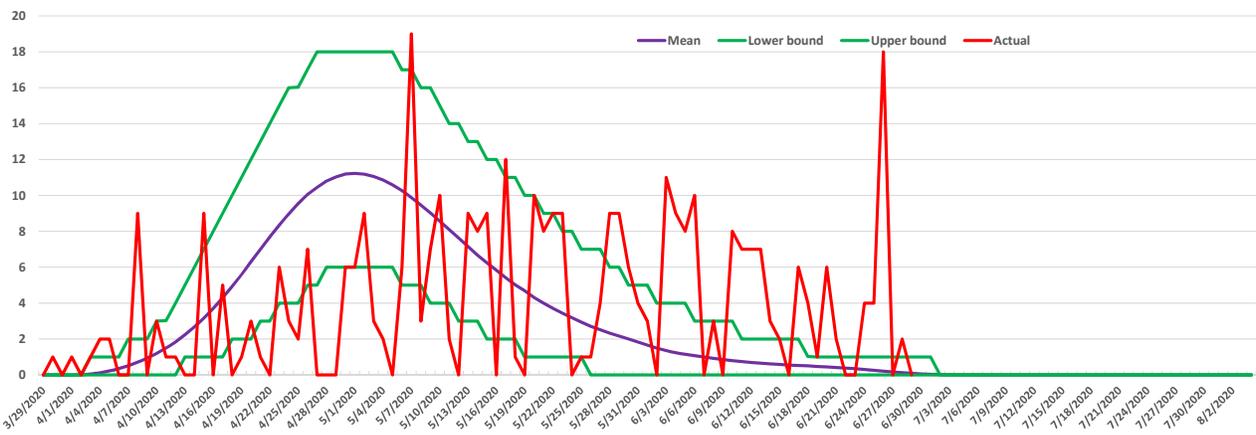
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Rhode Island COVID 19 Daily Death Projections March 26



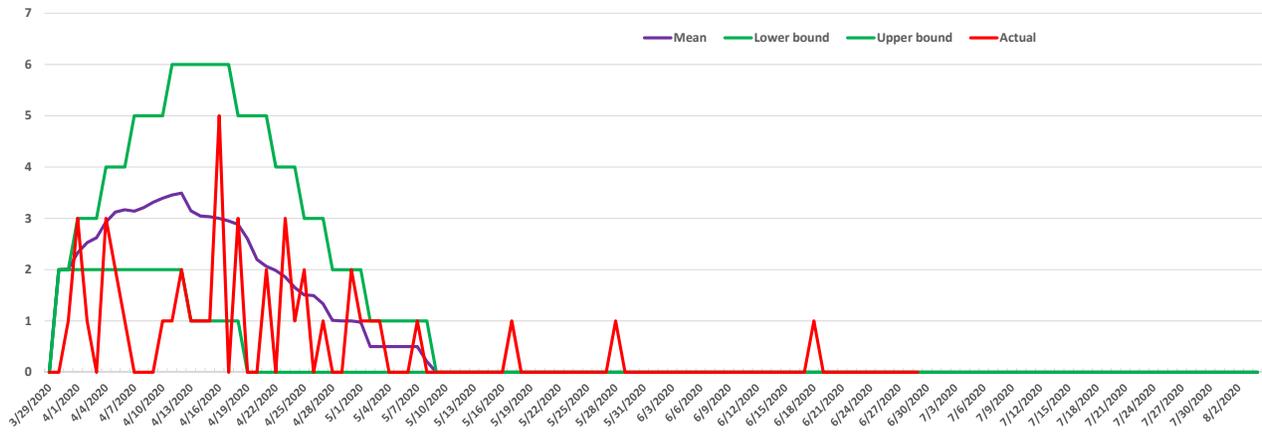
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New Hampshire COVID 19 Daily Death Projections March 26



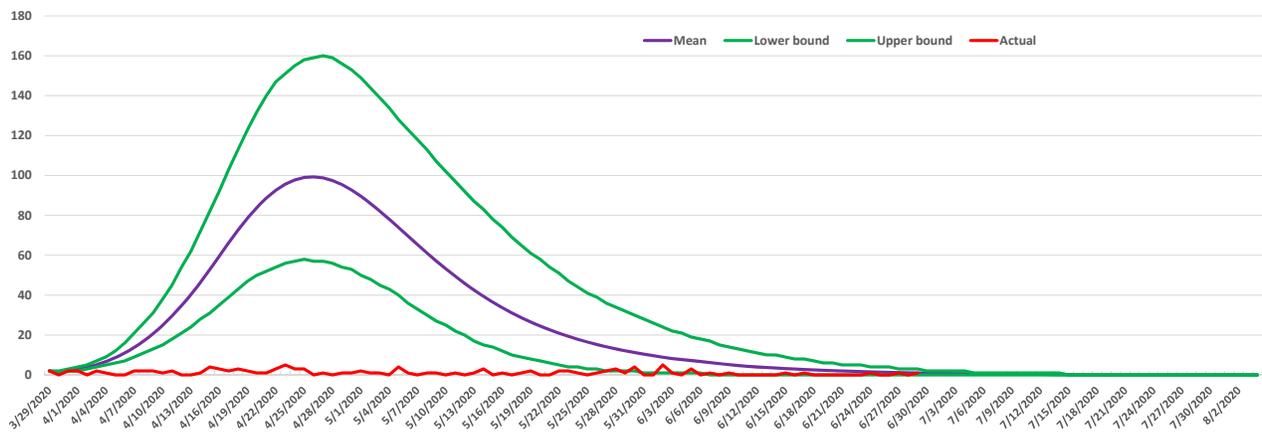
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Vermont COVID 19 Daily Death Projections March 26



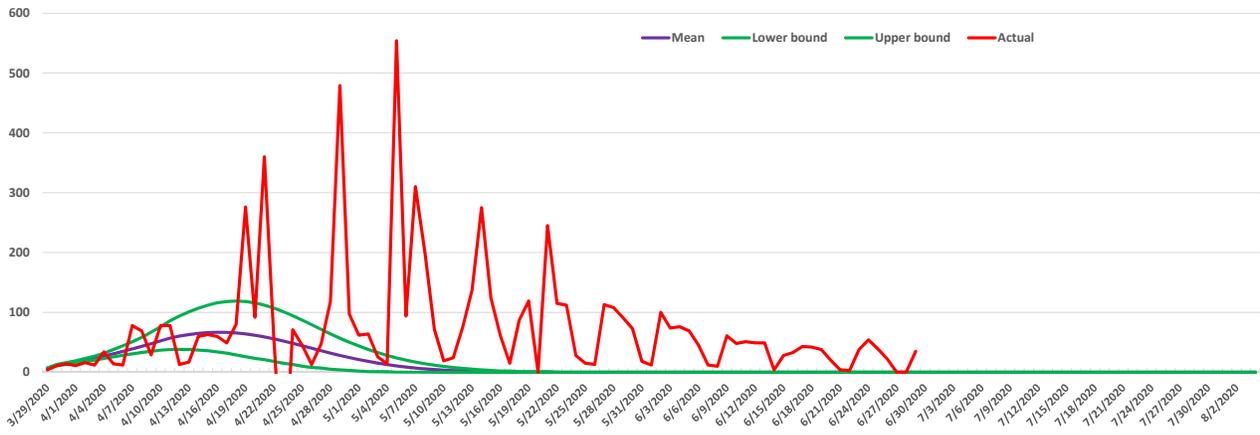
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Maine COVID 19 Daily Death Projections March 26



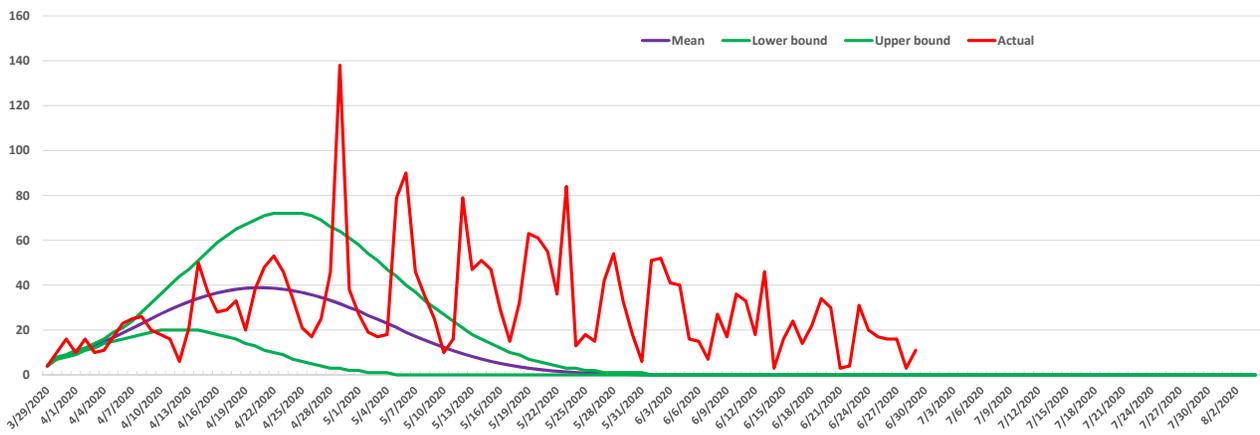
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Pennsylvania COVID 19 Daily Death Projections March 26



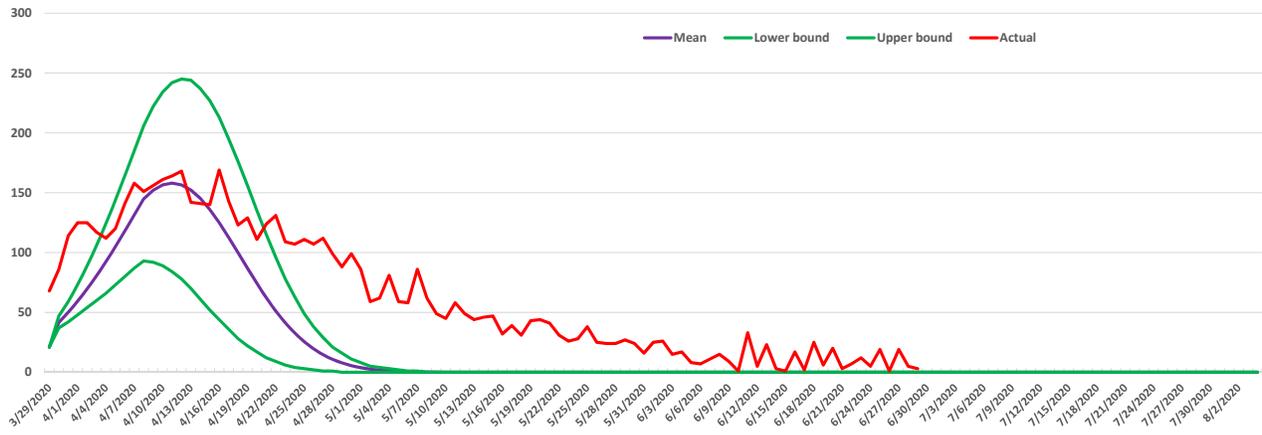
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Ohio COVID 19 Daily Death Projections March 26



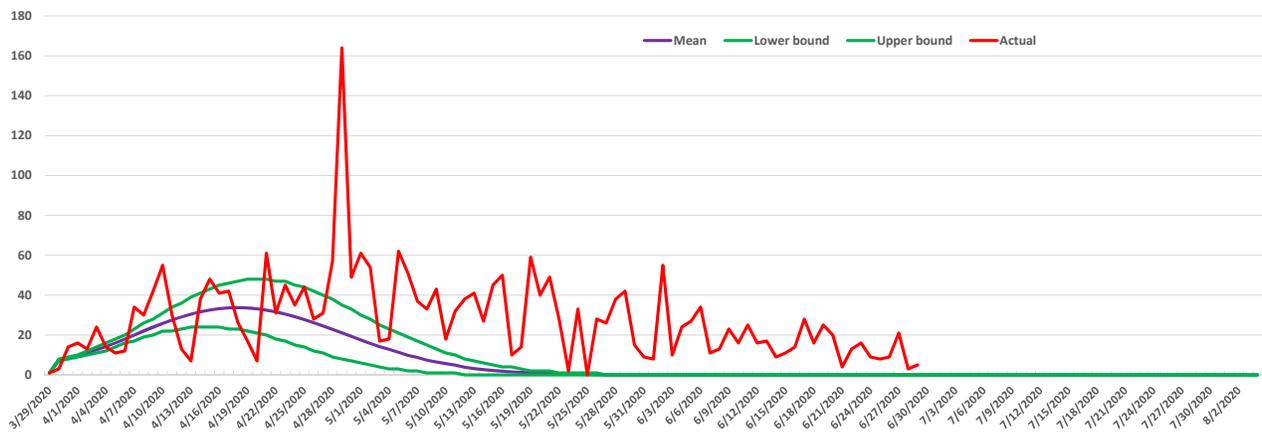
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Michigan COVID 19 Daily Death Projections March 26



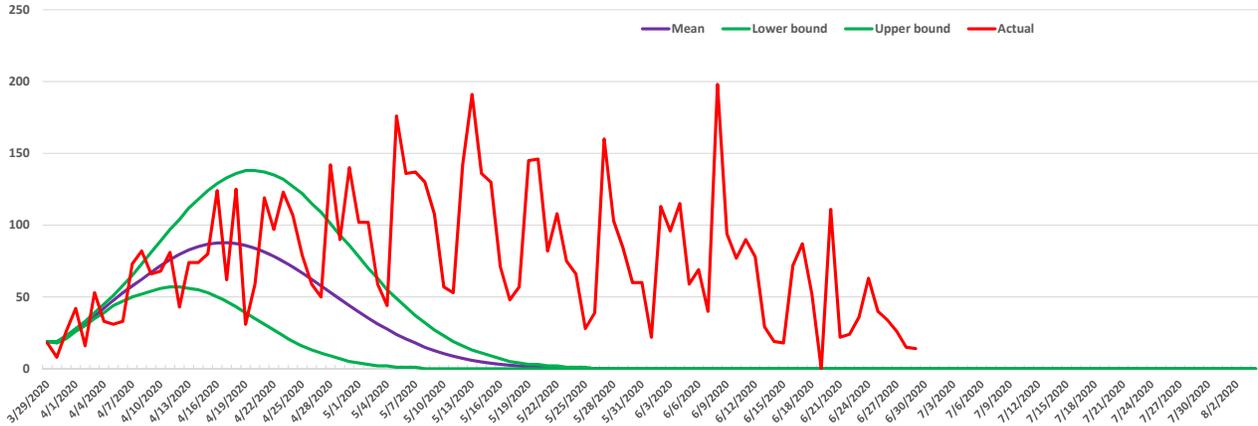
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Indiana COVID 19 Daily Death Projections March 26



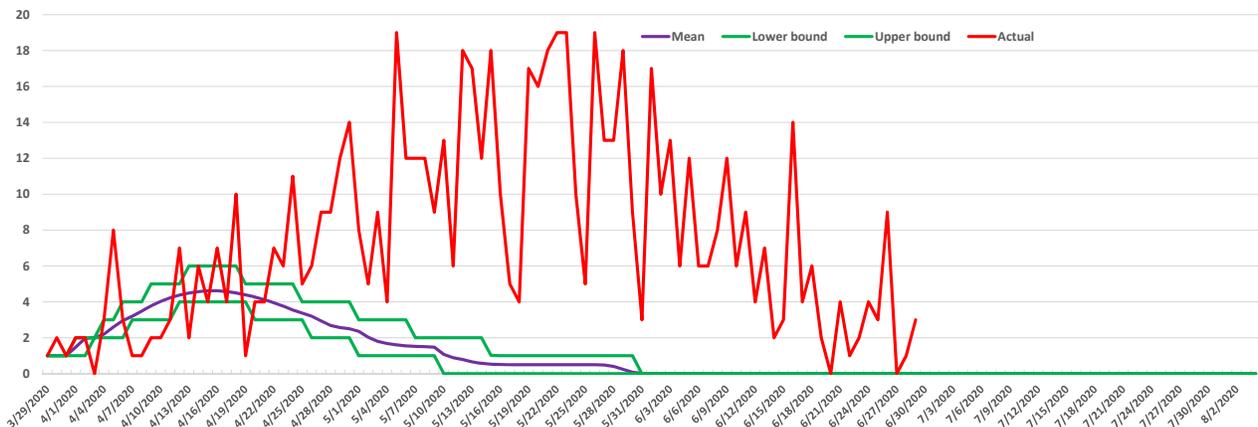
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Illinois COVID 19 Daily Death Projections March 26



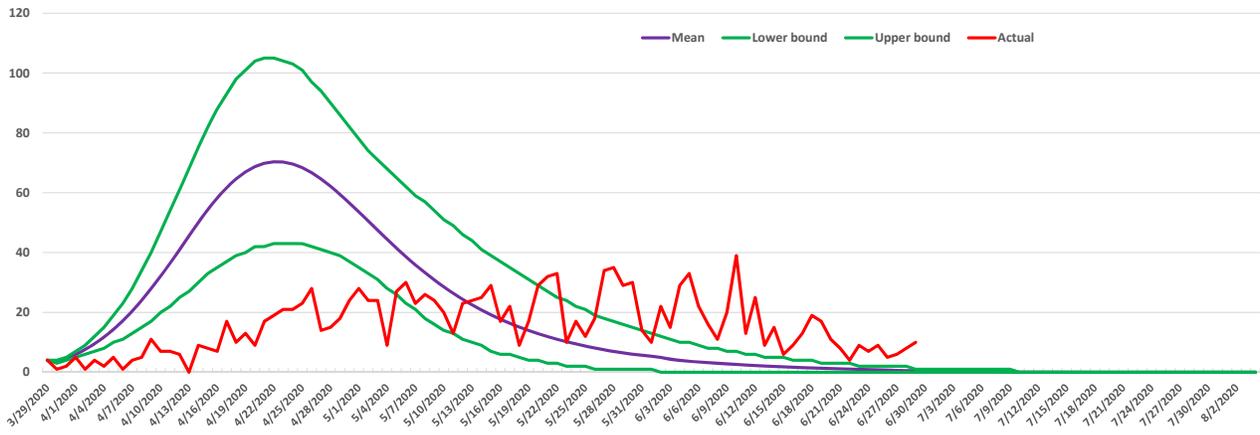
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Iowa COVID 19 Daily Death Projections March 26



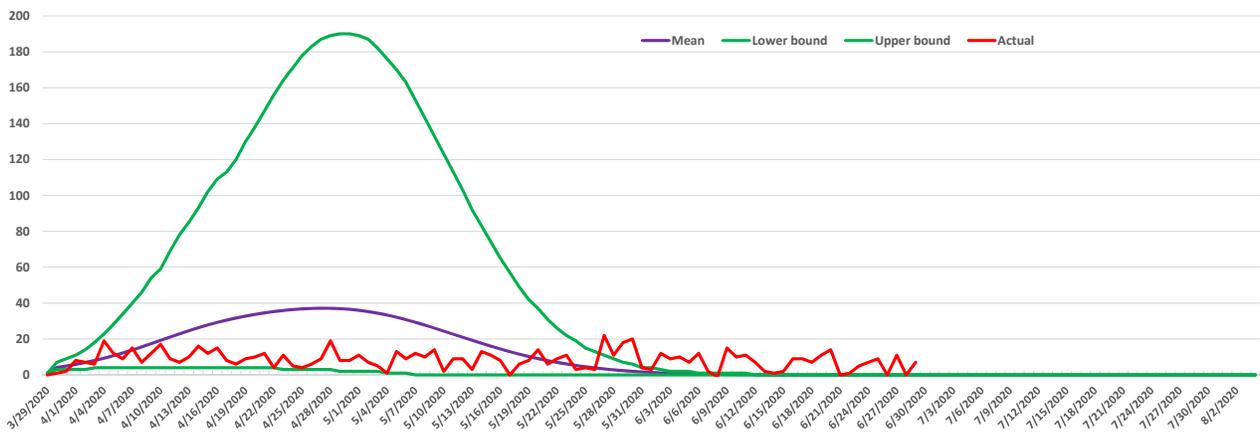
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Minnesota COVID 19 Daily Death Projections March 26



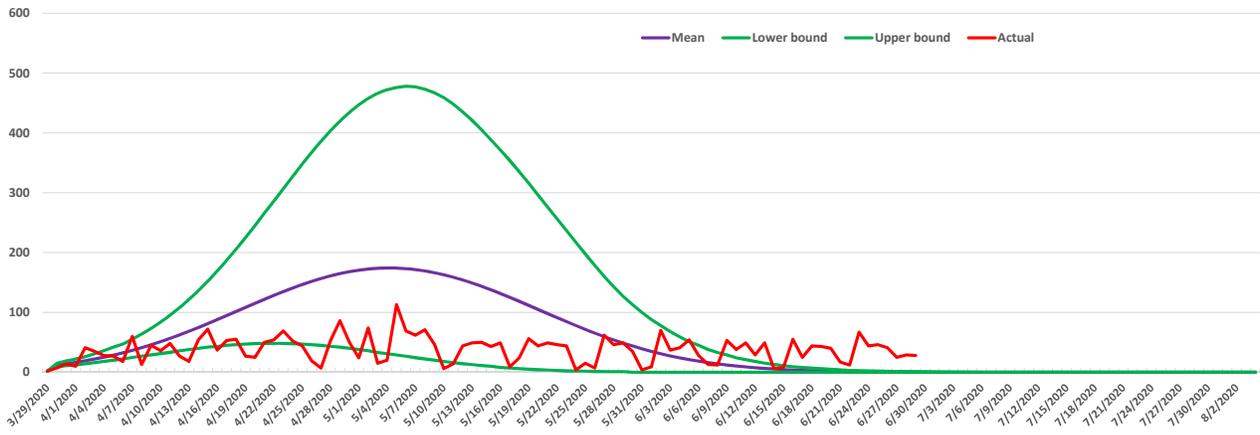
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Wisconsin COVID 19 Daily Death Projections March 26



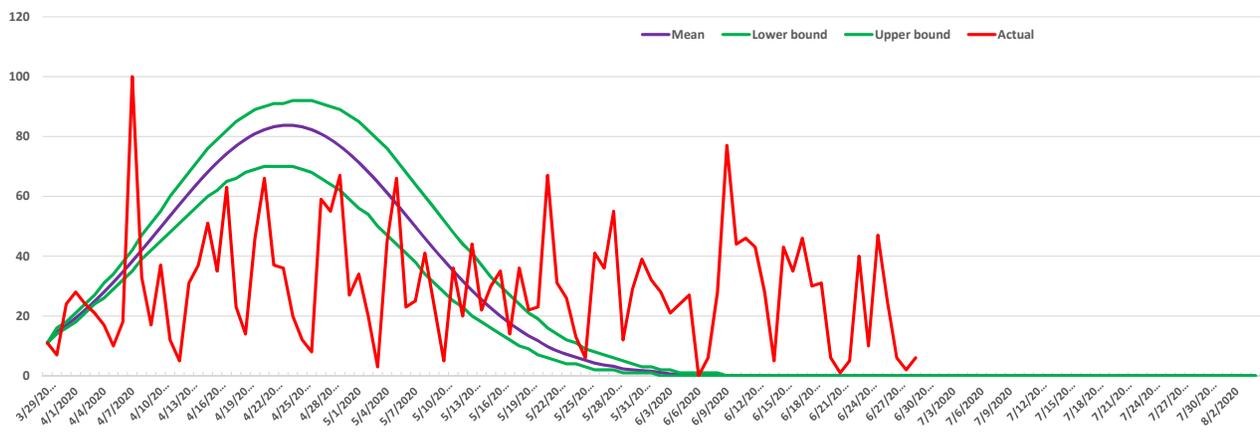
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Florida COVID 19 Daily Death Projections March 26



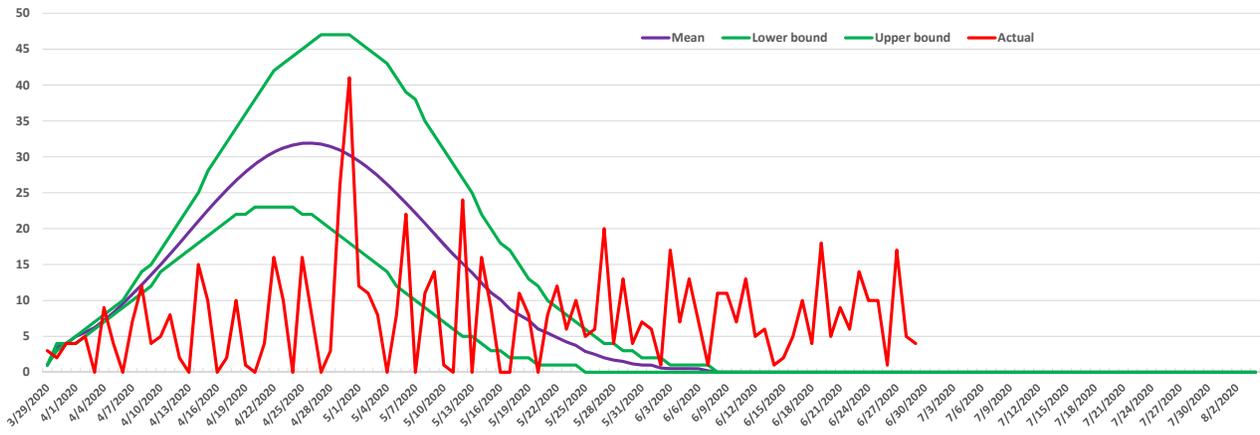
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Georgia COVID 19 Daily Death Projections March 26



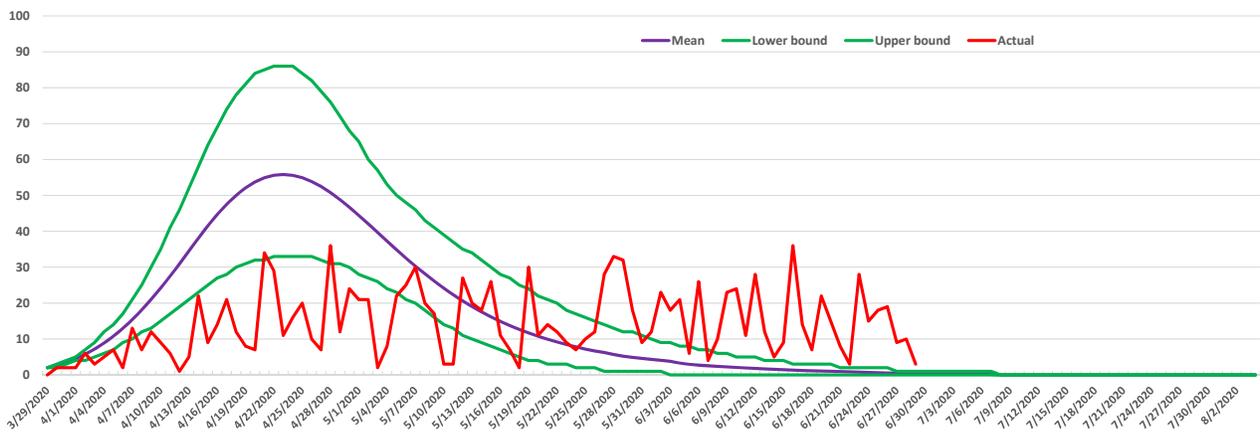
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South Carolina COVID 19 Daily Death Projections March 26



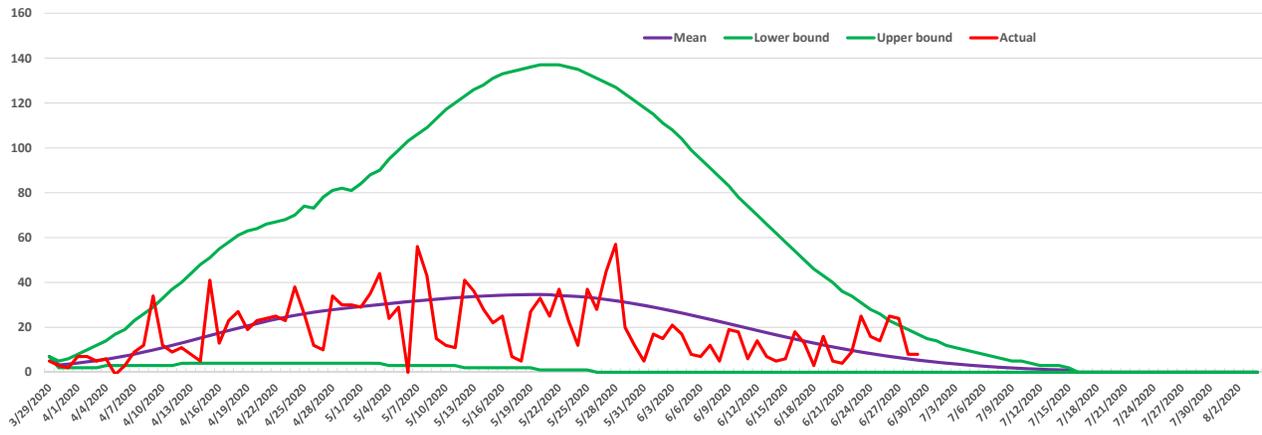
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North Carolina COVID 19 Daily Death Projections March 26



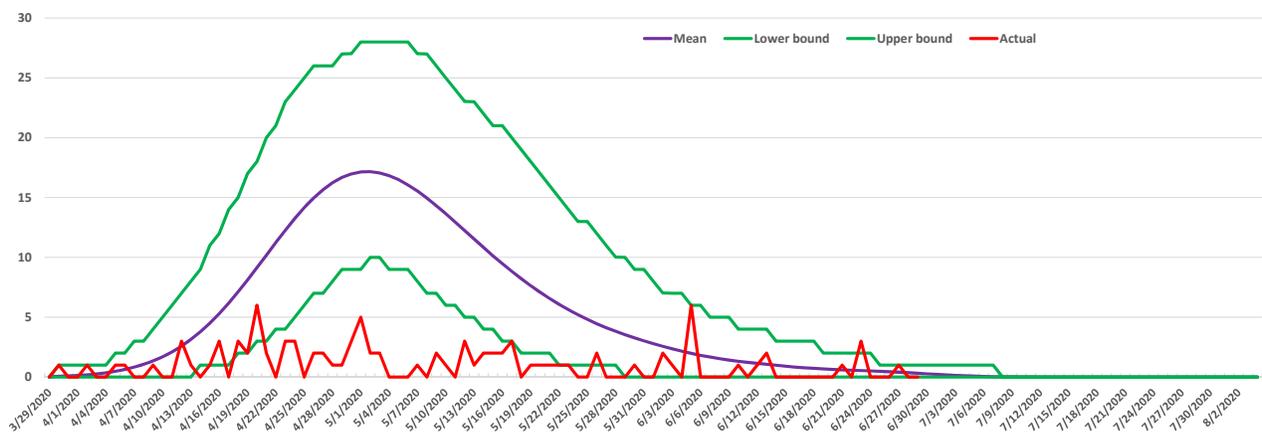
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Virginia COVID 19 Daily Death Projections March 26



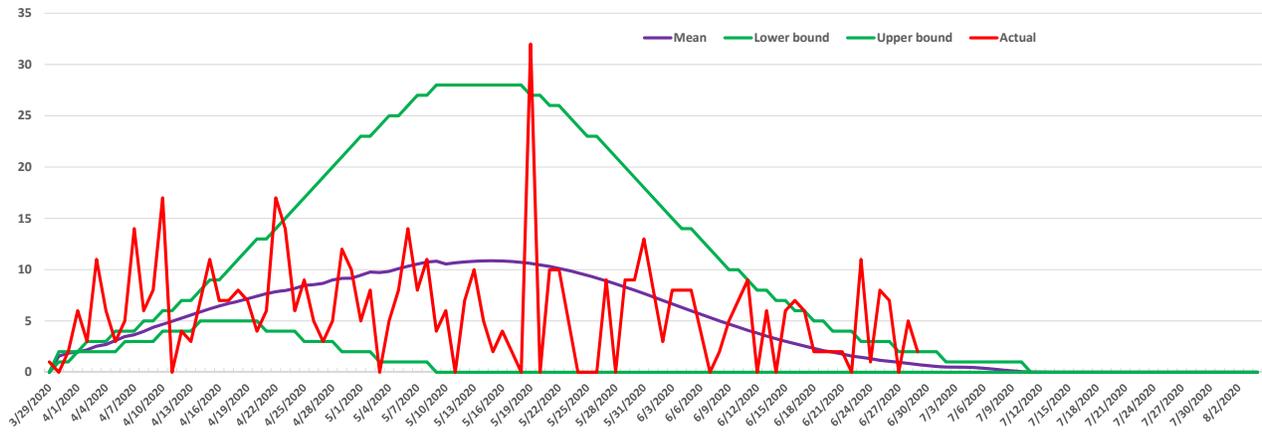
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West Virginia COVID 19 Daily Death Projections March 26



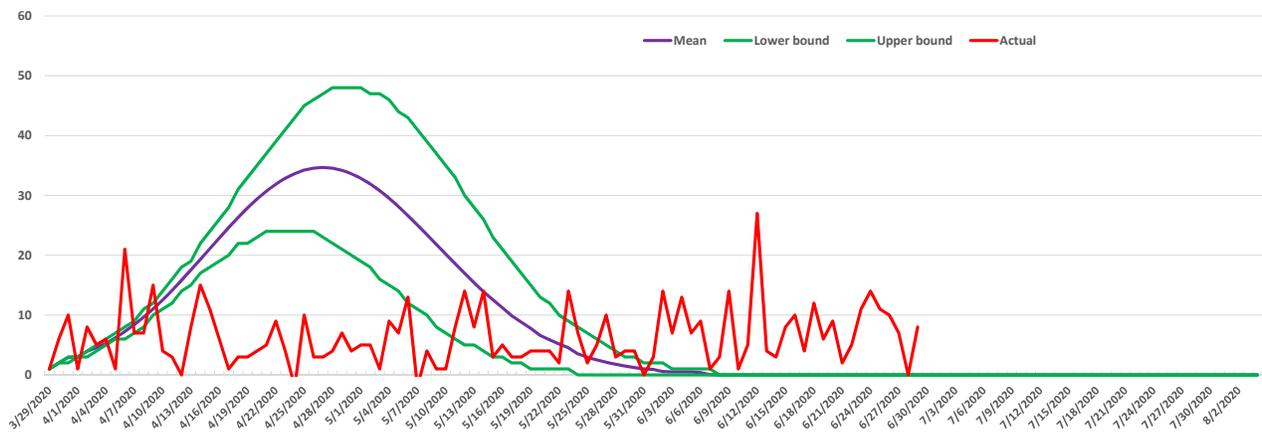
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Kentucky COVID 19 Daily Death Projections March 26



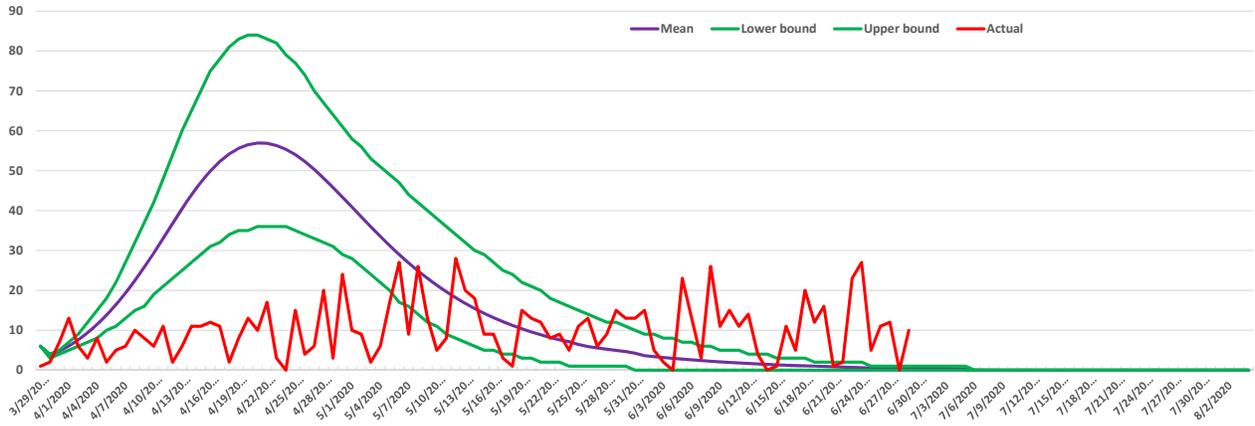
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Tennessee COVID 19 Daily Death Projections March 26



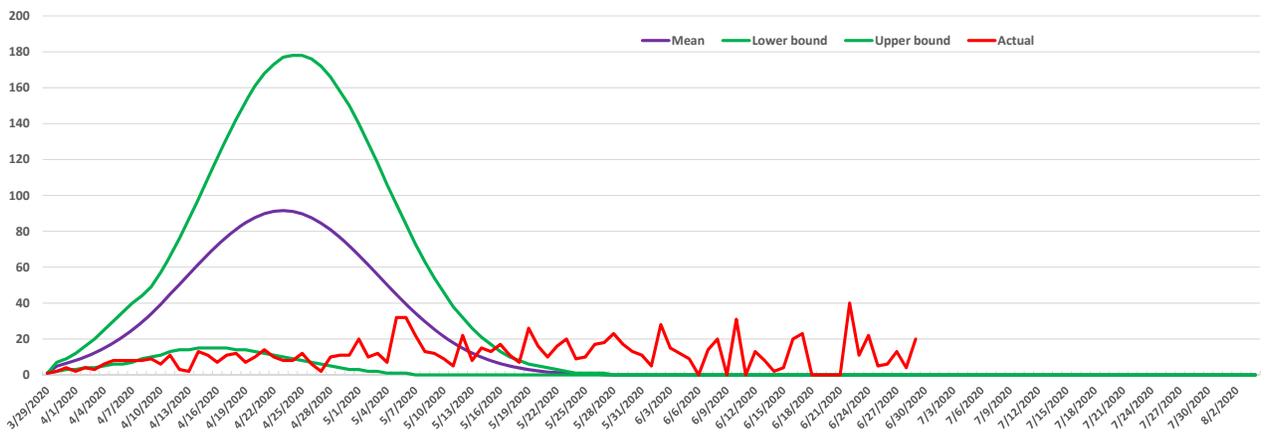
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Alabama COVID 19 Daily Death Projections March 26



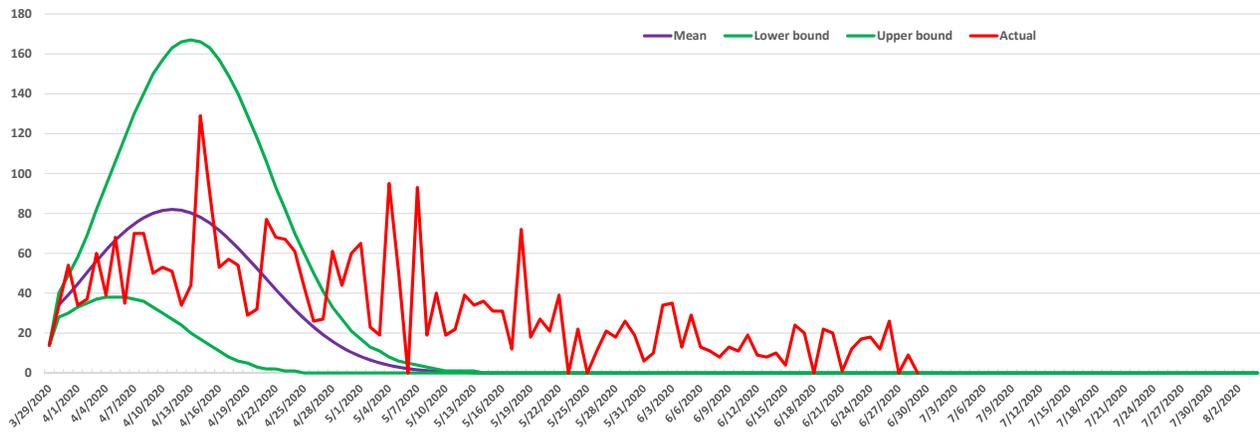
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Mississippi COVID 19 Daily Death Projections March 26



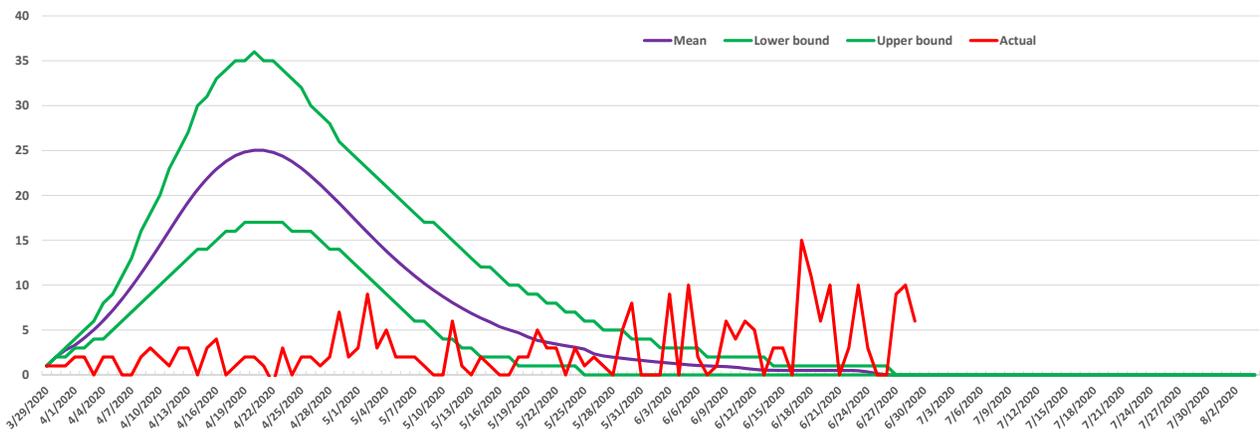
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Louisiana COVID 19 Daily Death Projections March 26



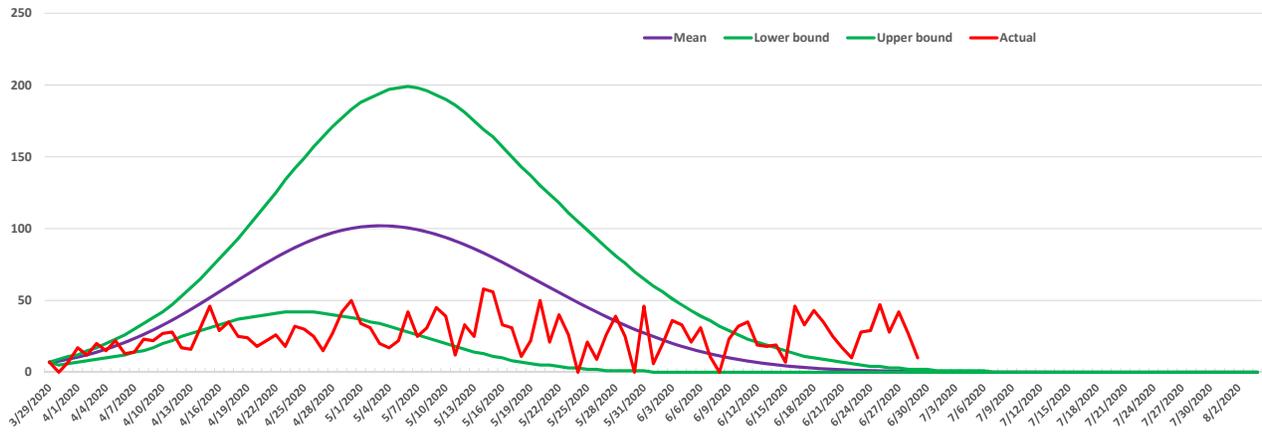
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Arkansas COVID 19 Daily Death Projections March 26



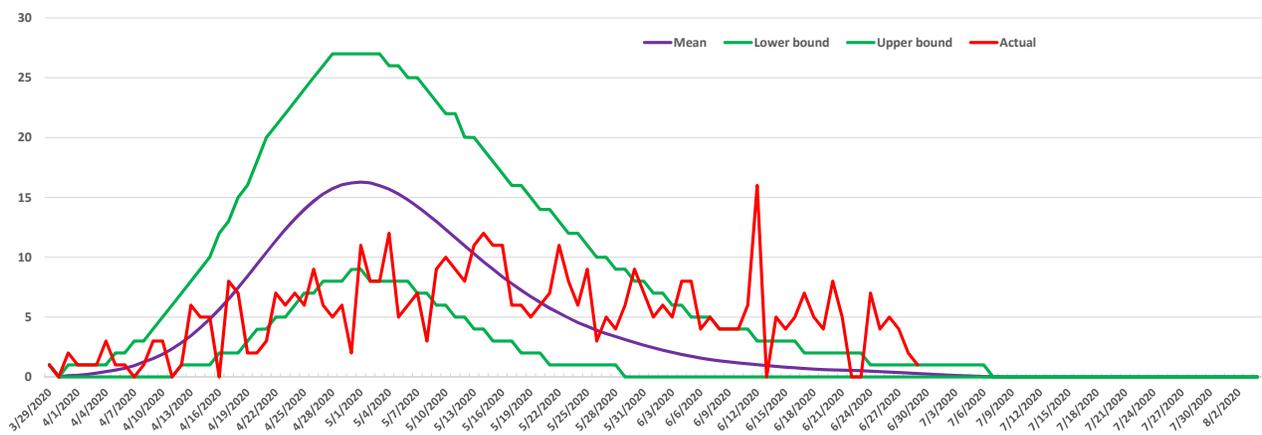
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Texas COVID 19 Daily Death Projections March 26



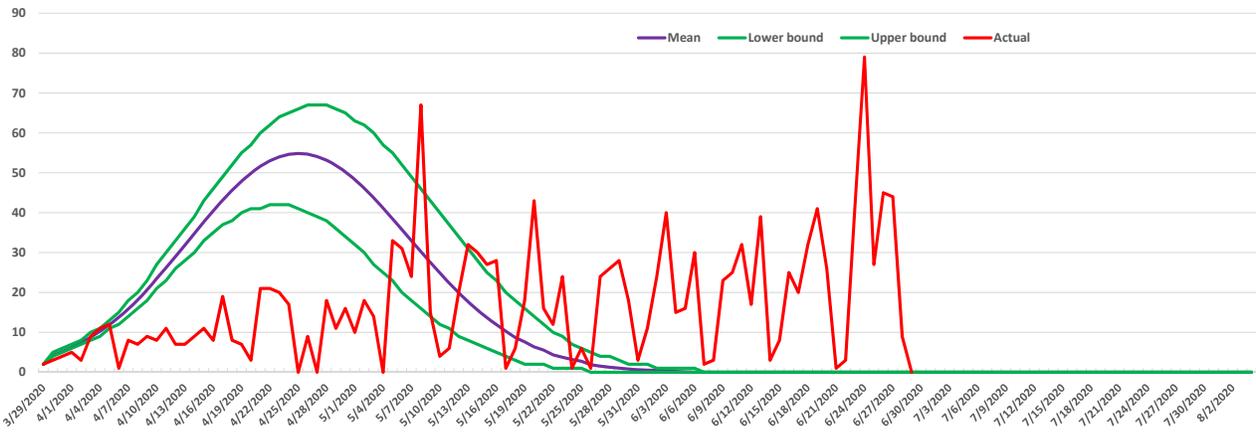
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New Mexico COVID 19 Daily Death Projections March 26



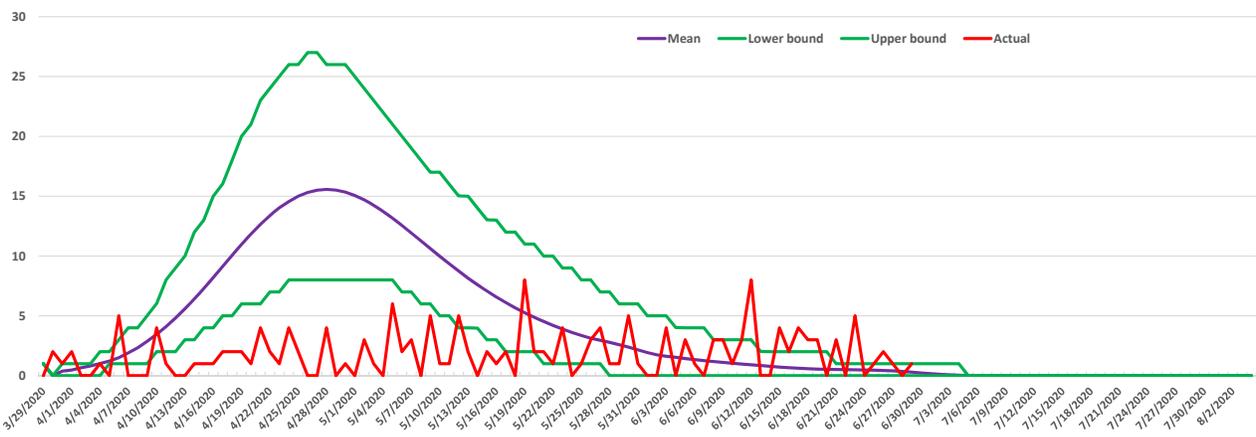
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Arizona COVID 19 Daily Death Projections March 26



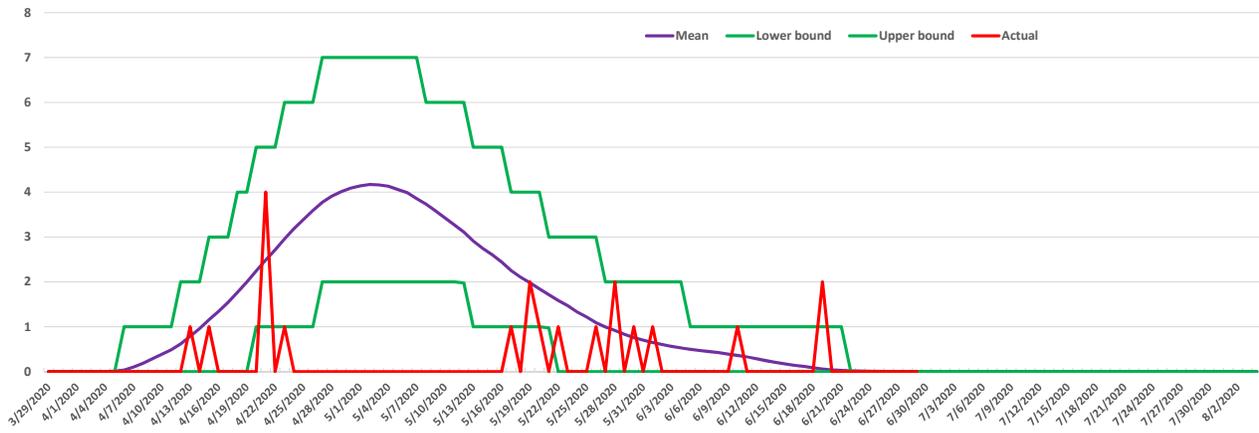
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Utah COVID 19 Daily Death Projections March 26



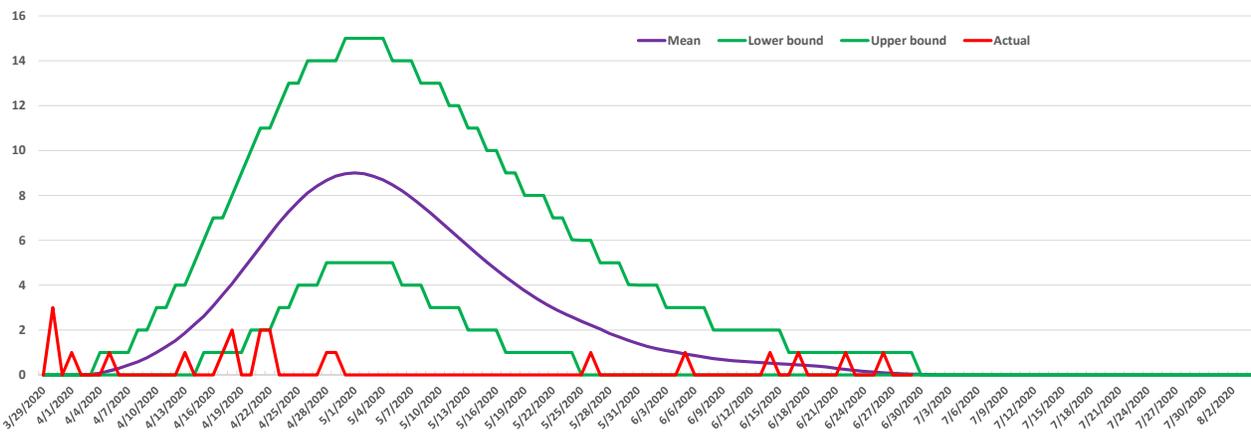
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Wyoming COVID 19 Daily Death Projections March 26



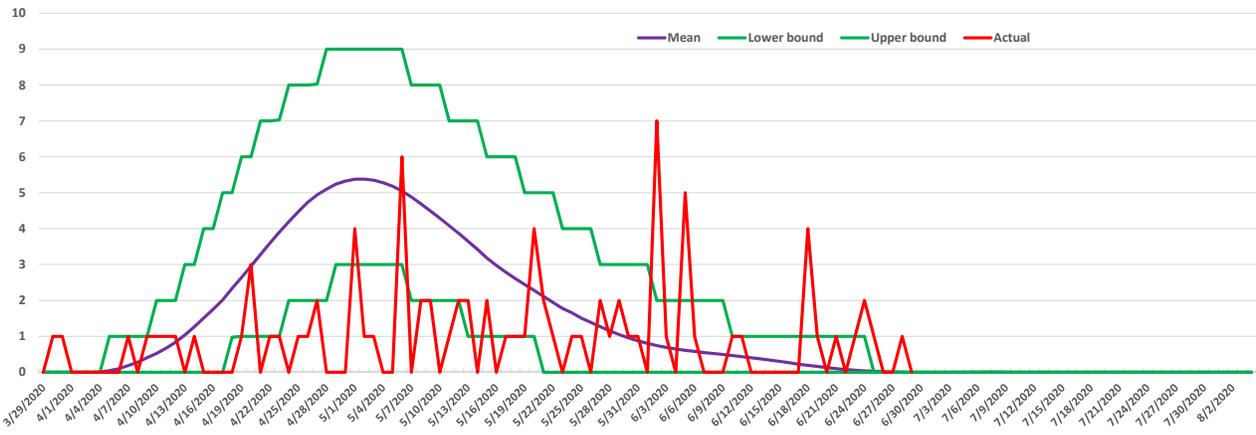
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Montana COVID 19 Daily Death Projections March 26



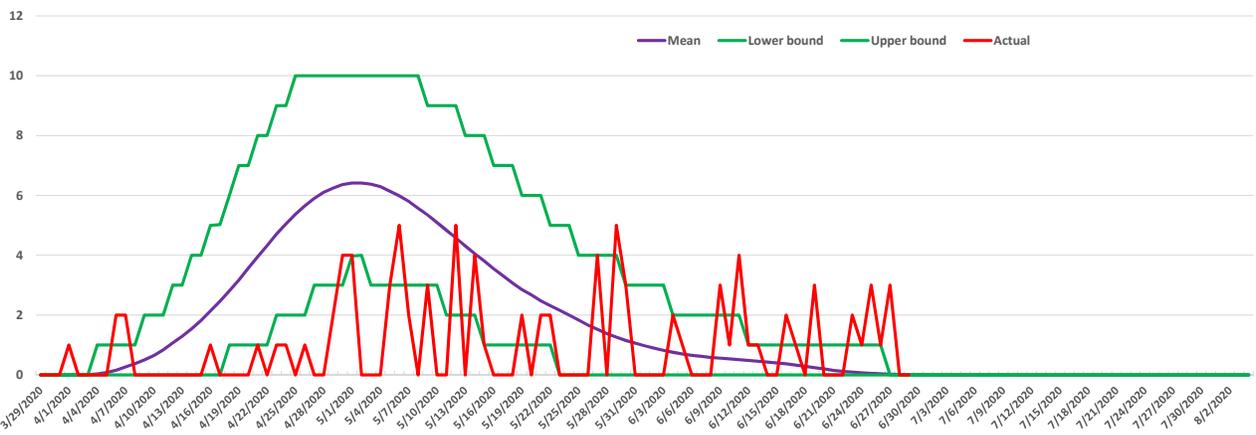
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North Dakota COVID 19 Daily Death Projections March 26



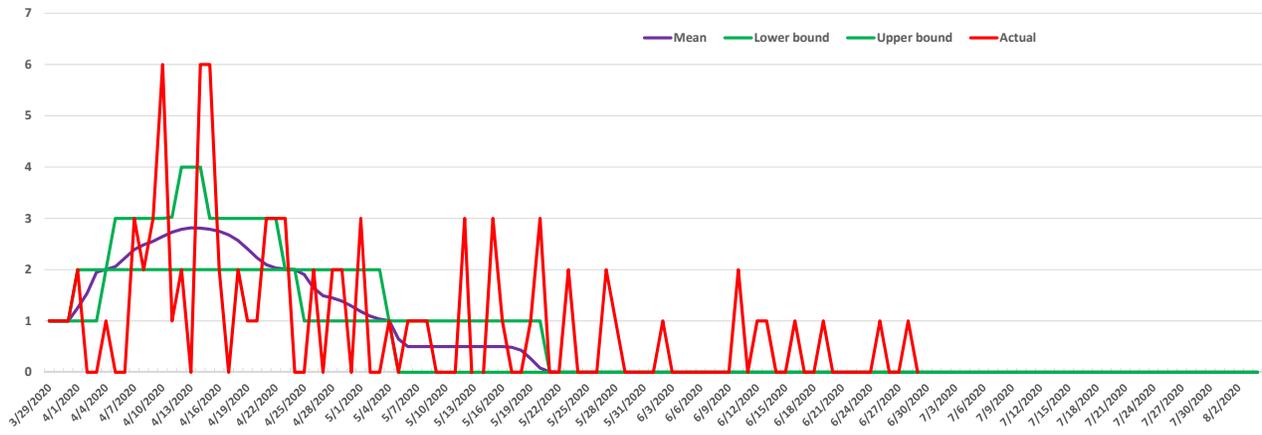
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South Dakota COVID 19 Daily Death Projections March 26



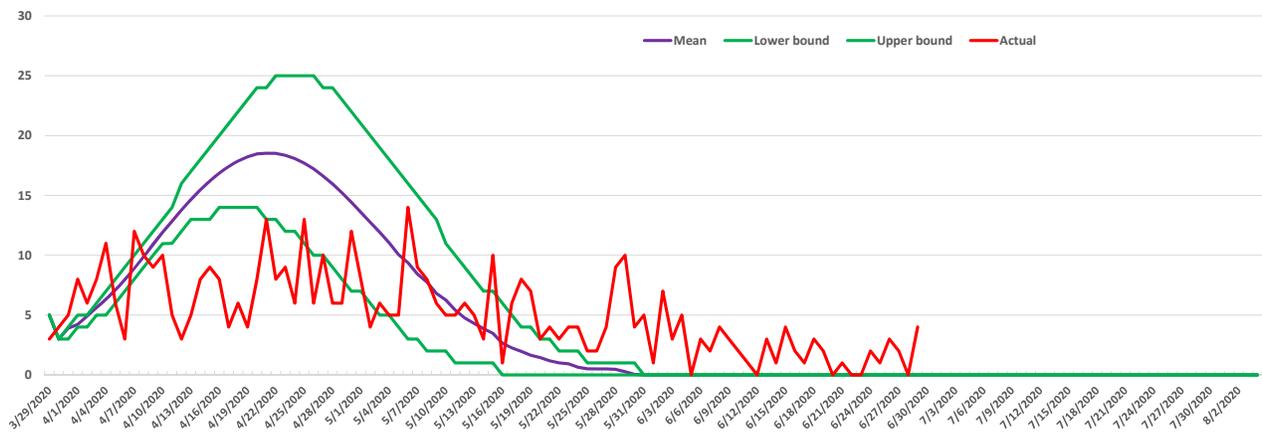
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Idaho COVID 19 Daily Death Projections March 26



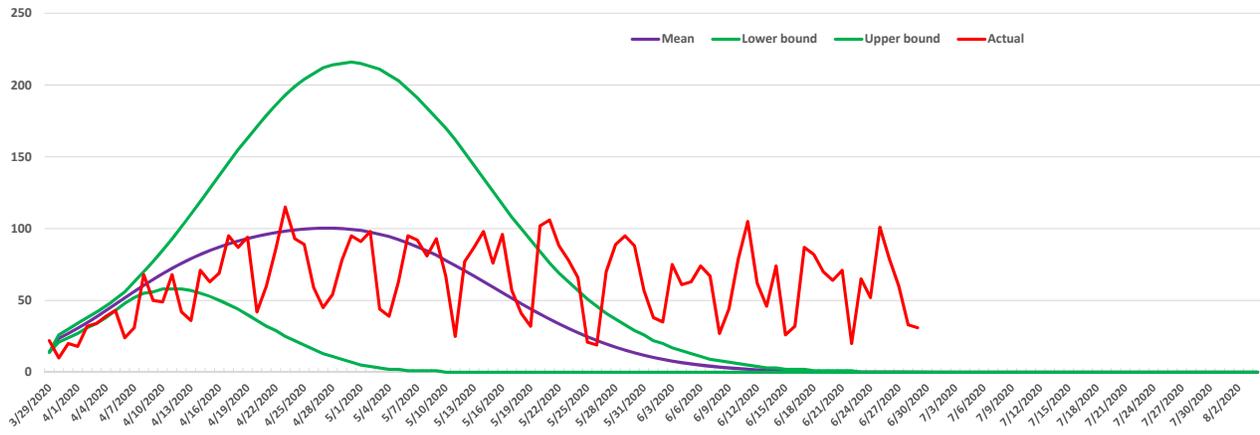
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Nevada COVID 19 Daily Death Projections March 26



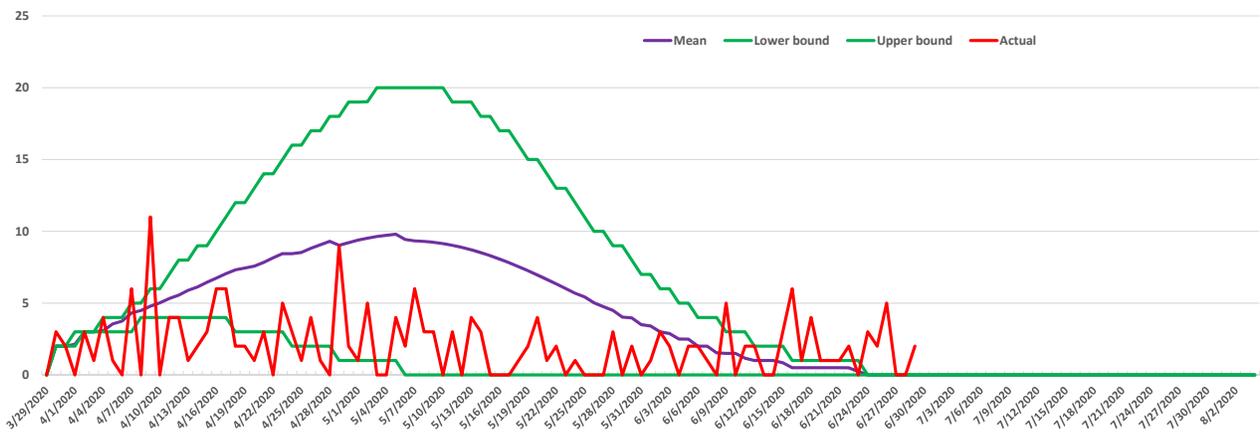
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California COVID 19 Daily Death Projections March 26



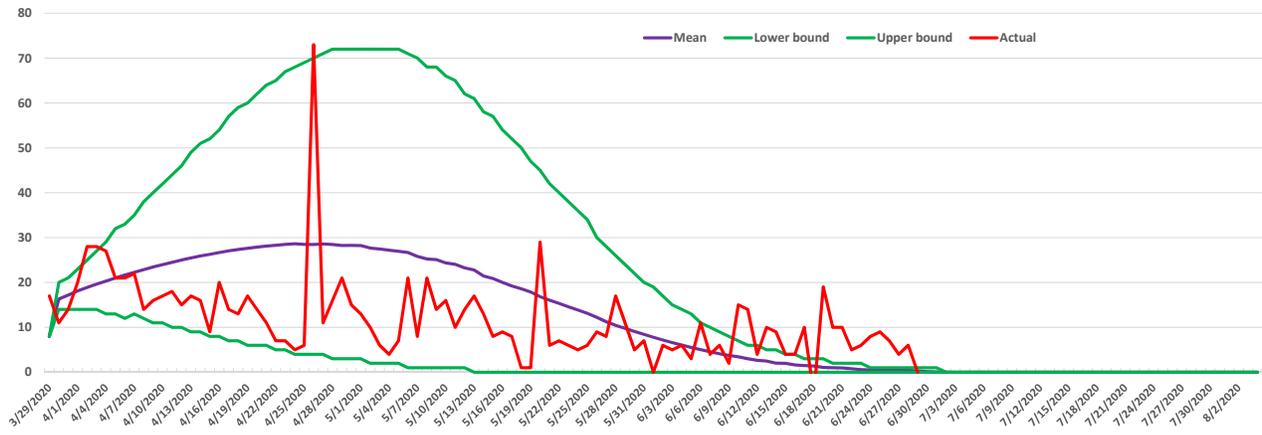
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Oregon COVID 19 Daily Death Projections March 26



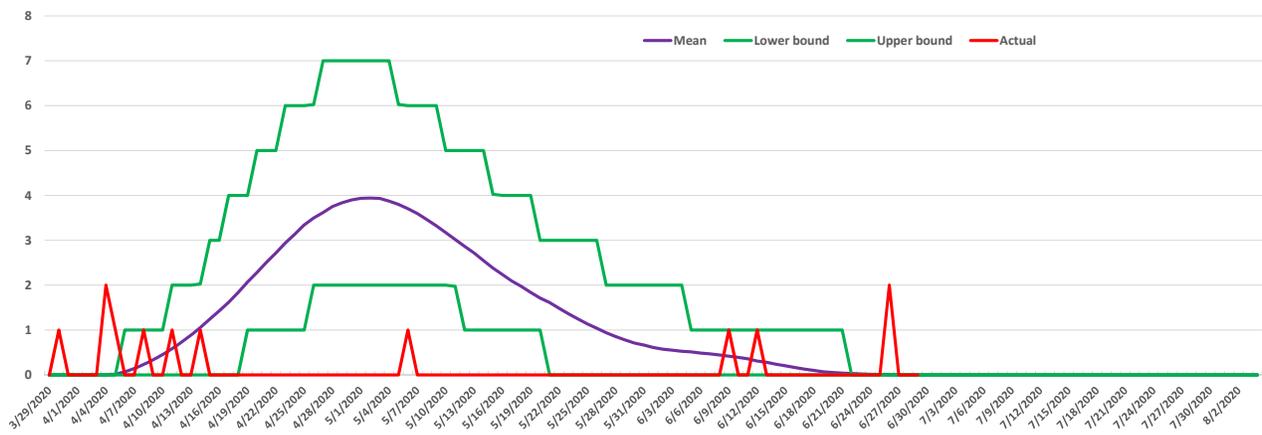
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Washington COVID 19 Daily Death Projections March 26



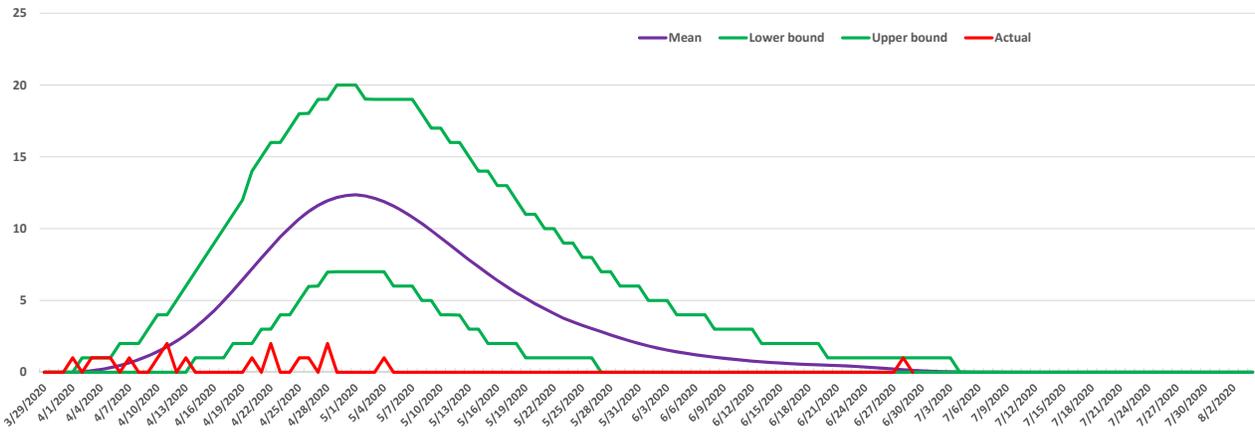
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Alaska COVID 19 Daily Death Projections March 26



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Hawaii COVID 19 Daily Death Projections March 26



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Cumulative Death Projections

- Comparing June 29th Cumulative deaths with the original IMHE projections
- Twelve states are above the mean and above the 95% confidence interval
 - Connecticut, Illinois, Indiana, Iowa, Maryland, Massachusetts, Michigan, New Jersey, New York, Ohio, Pennsylvania, Rhode Island
- Five states are above the mean but within the 95% confidence interval
 - California, Georgia, Idaho, Louisiana, New Hampshire
- Nineteen states are below the mean but within the 95% confidence interval
 - Arizona, Florida, Kentucky, Minnesota, Mississippi, Missouri, Nebraska, Nevada, New Mexico, North Carolina, North Dakota, Oregon, South Carolina, South Dakota, Texas, Vermont, Virginia, Washington, Wisconsin
- Fourteen states are below the mean and below the 95% confidence interval
 - Alabama, Alaska, Arkansas, Colorado, Delaware, Hawaii, Kansas, Maine, Montana, Oklahoma, Tennessee, Utah, West Virginia, Wyoming



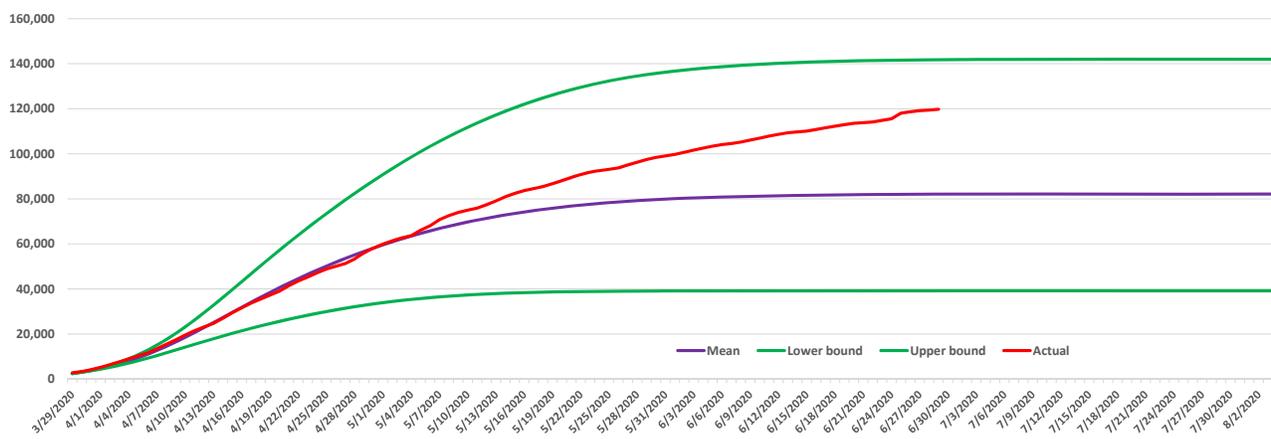
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Concluding Thoughts

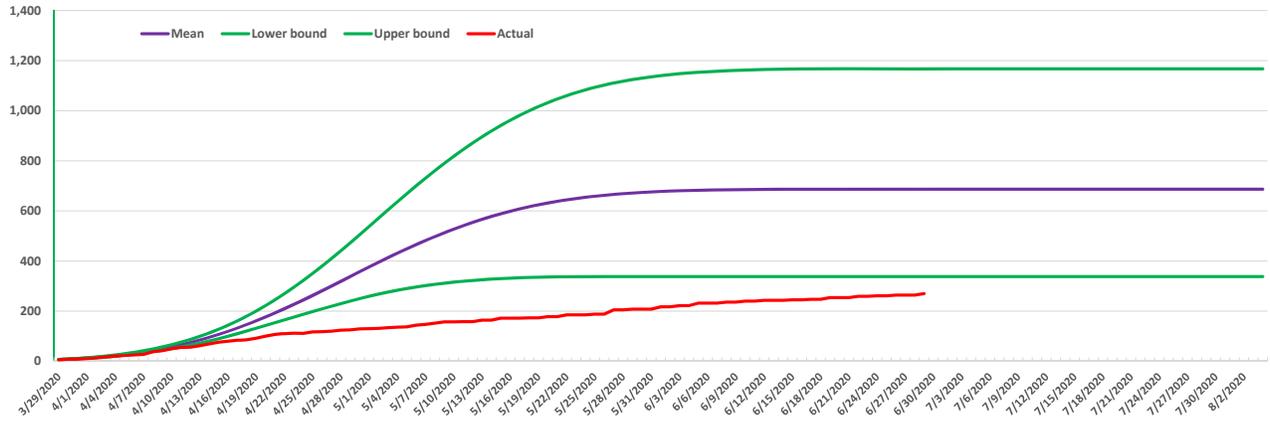
- The IMHE model continues to be revised
- In the last two weeks, the expected cumulative death statistics have been reduced in more states than increased
- The distribution of death by age group for COVID 19 continues to be similar to the distribution of death from all causes
- Since June 1, the trend analysis in daily death has been a reduction of 5.76 deaths
- Thirty five states have had a decreasing trend for daily deaths, thirteen have experienced an increasing trend
- The U.S. Cumulative Death Total through June 22nd is above the mean but within the 95% confidence band



U.S. COVID 19 Cumulative Death Projections

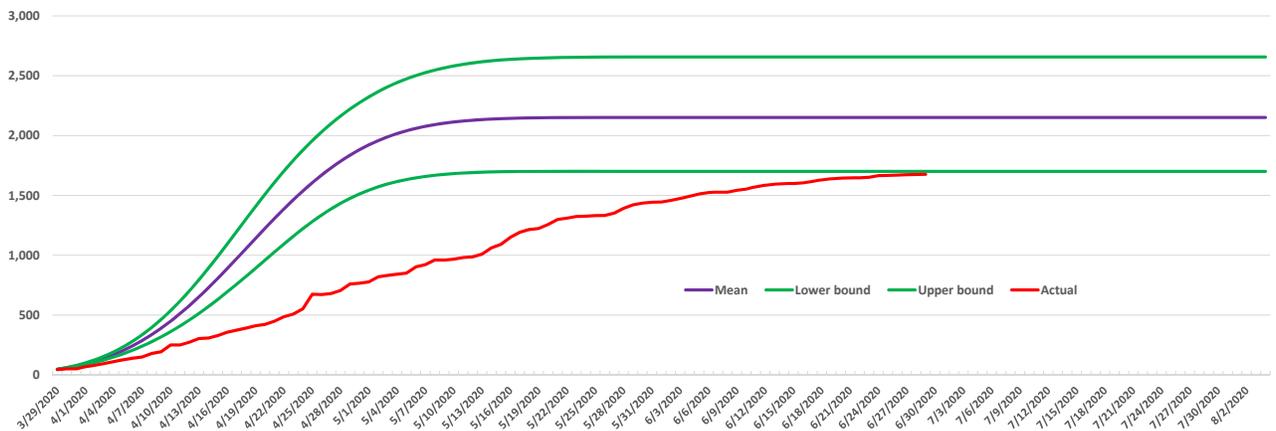


Kansas COVID 19 Cumulative Death Projections



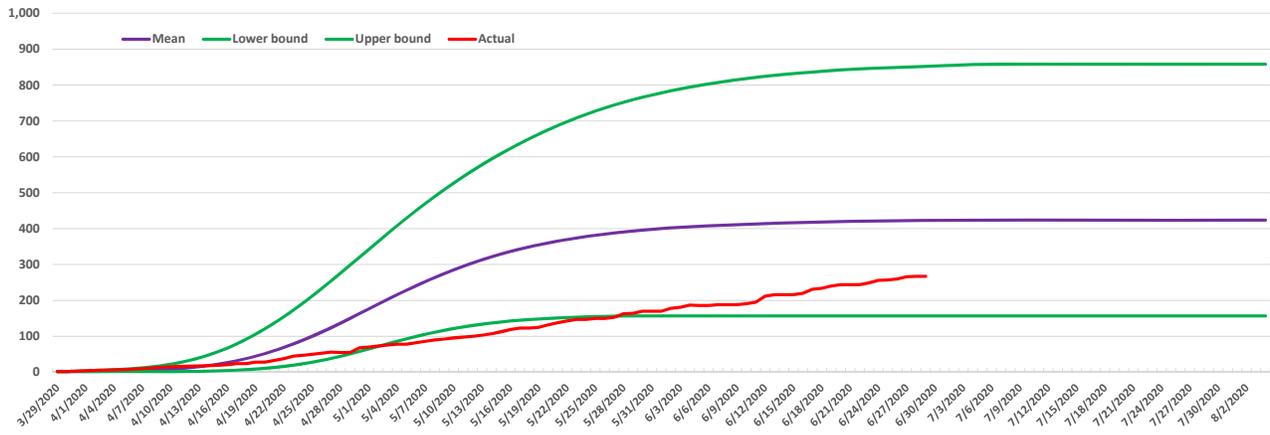
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Colorado COVID 19 Cumulative Death Projections March 26



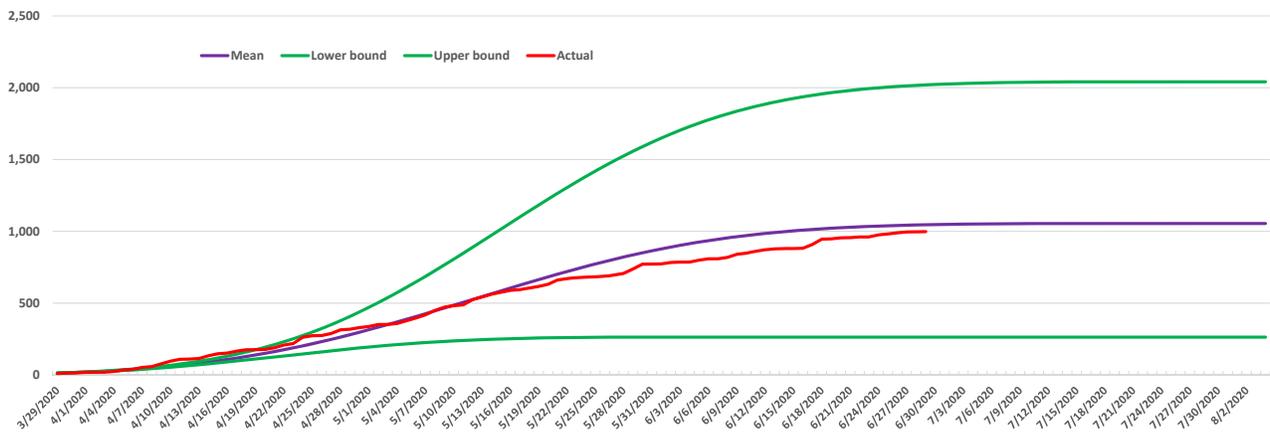
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Nebraska COVID 19 Daily Death Projections March 26



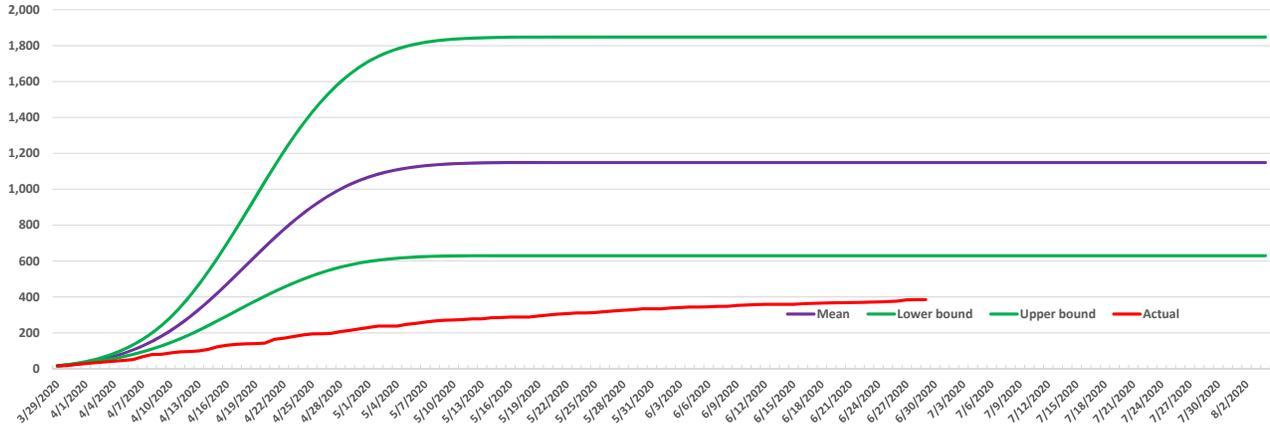
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Missouri COVID 19 Cumulative Death Projections March 26



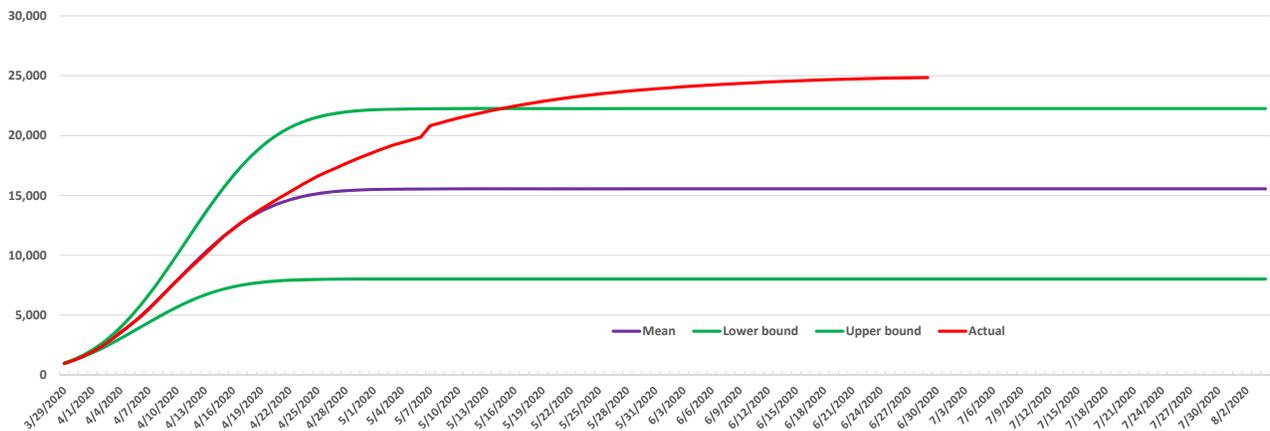
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Oklahoma COVID 19 Daily Death Projections March 26



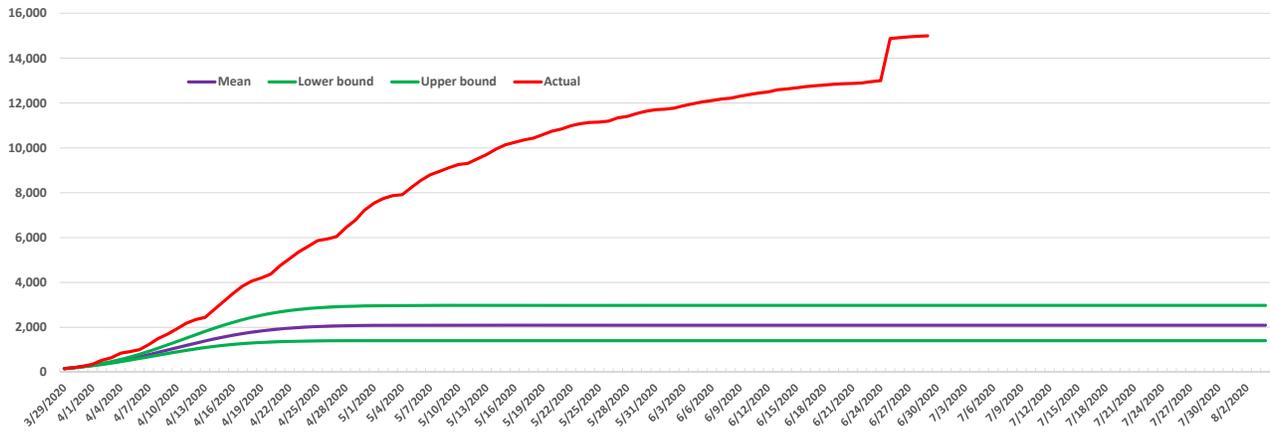
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New York COVID 19 Cumulative Death Projections



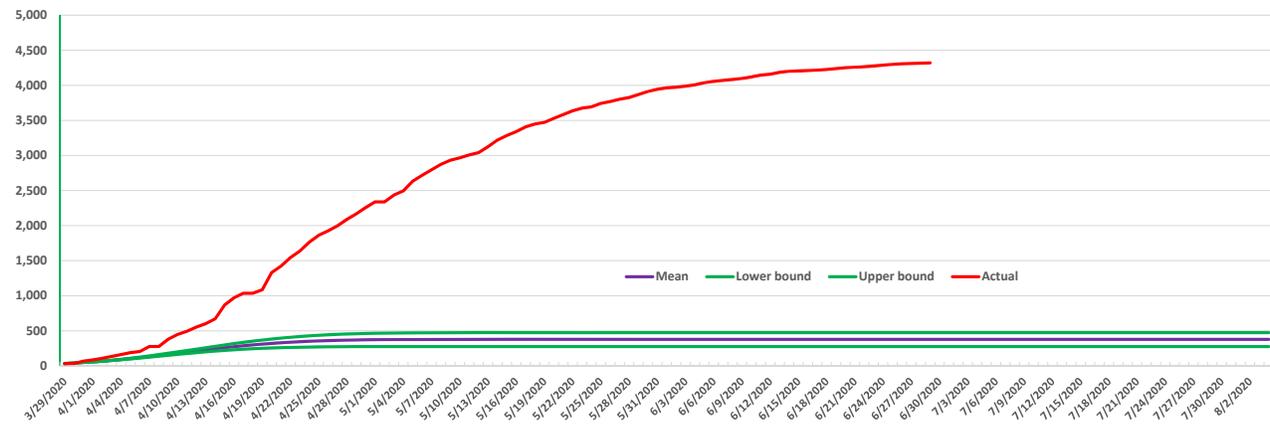
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New Jersey COVID 19 Cumulative Death Projections



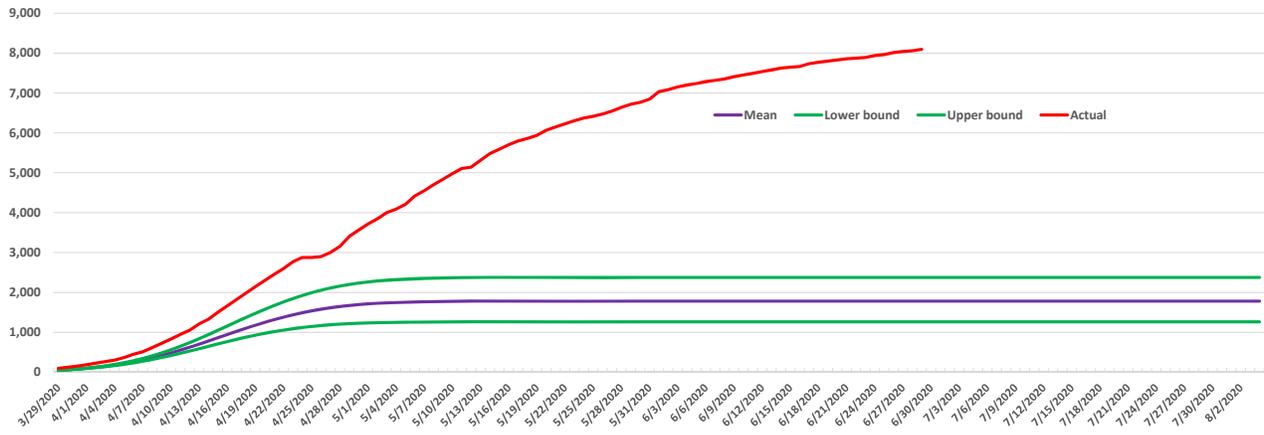
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Connecticut COVID 19 Cumulative Death Projections



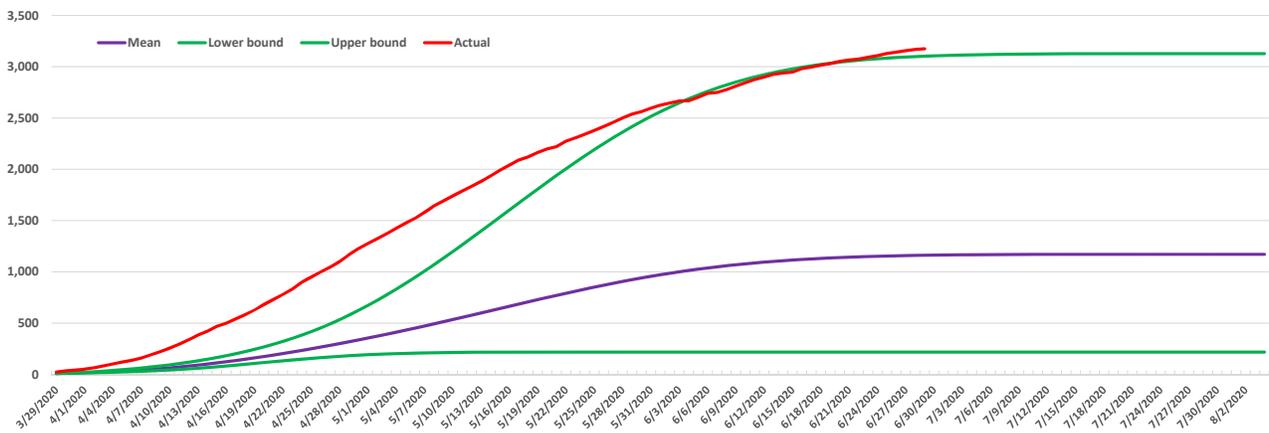
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Massachusetts COVID 19 Cumulative Death Projections



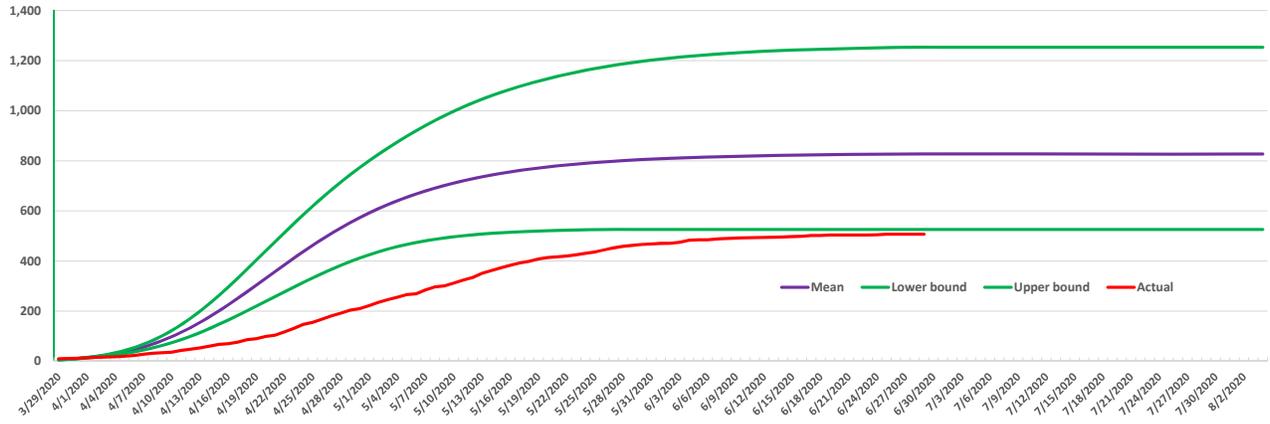
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Maryland COVID 19 Daily Death Projections March 26



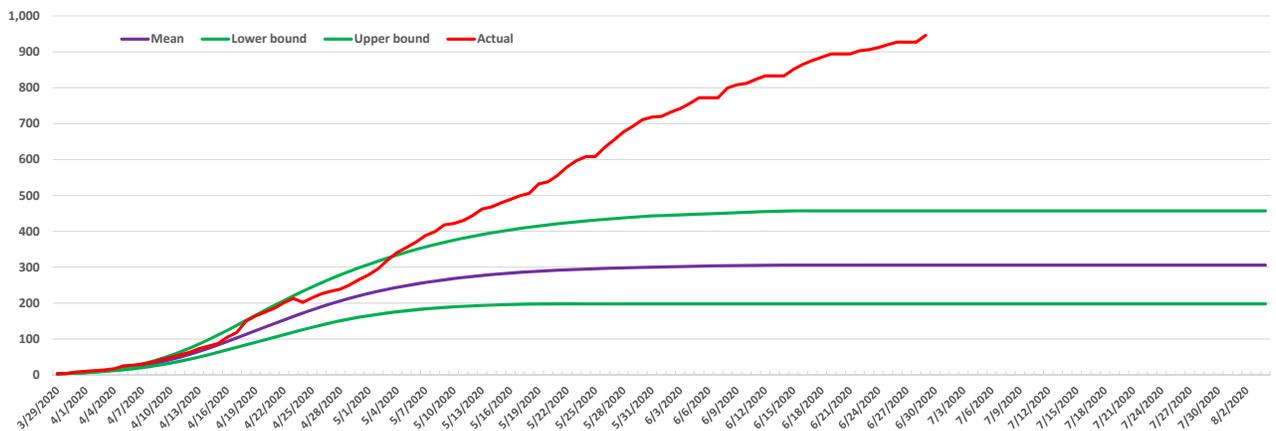
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Delaware COVID 19 Cumulative Death Projections



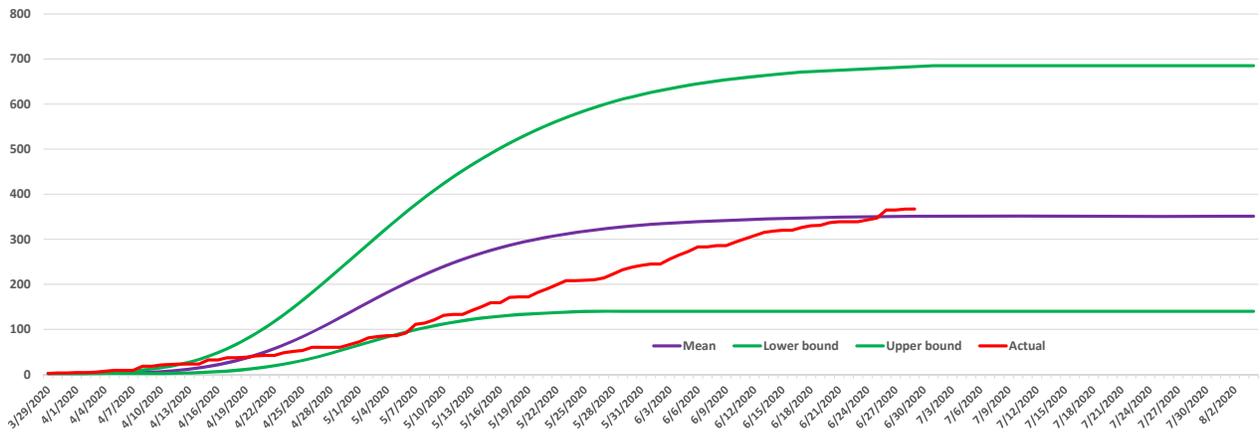
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Rhode Island COVID 19 Cumulative Death Projections March 26



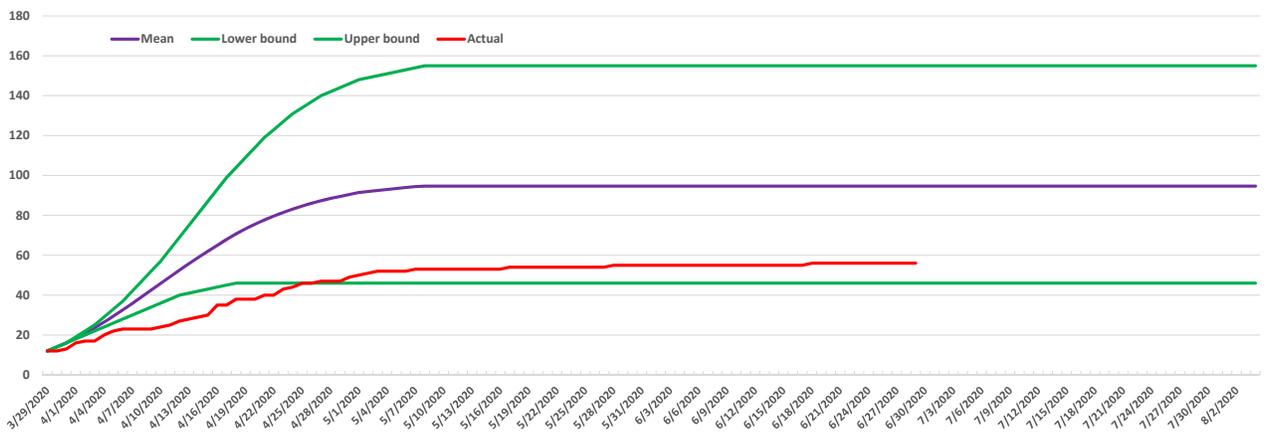
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New Hampshire COVID 19 Cumulative Death Projections



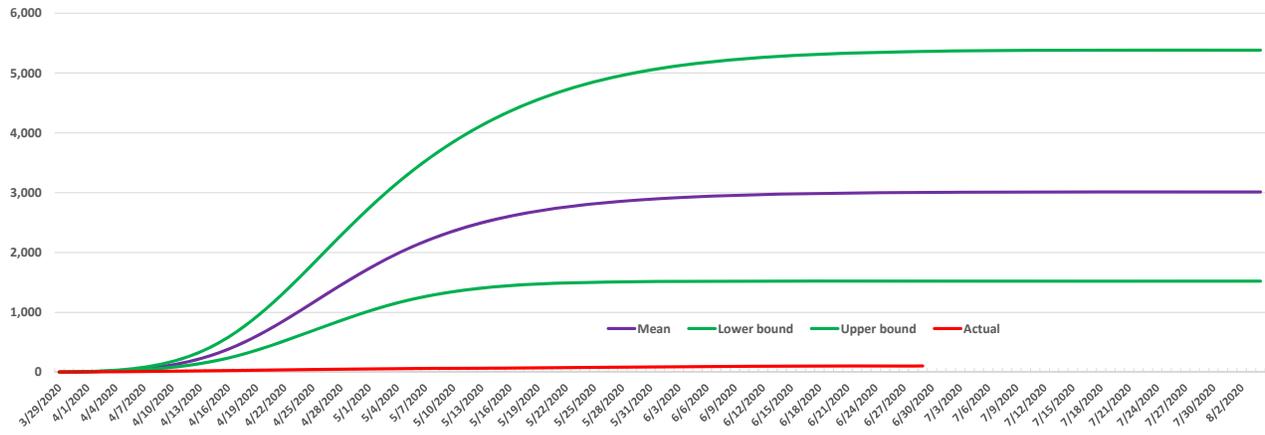
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Vermont COVID 19 Cumulative Death Projections March 26



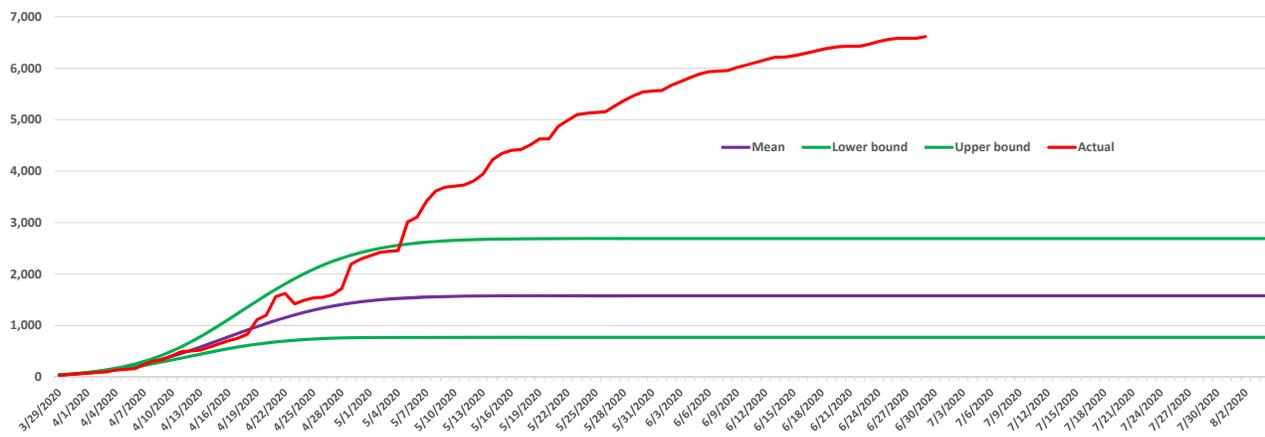
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Maine COVID 19 Cumulative Death Projections



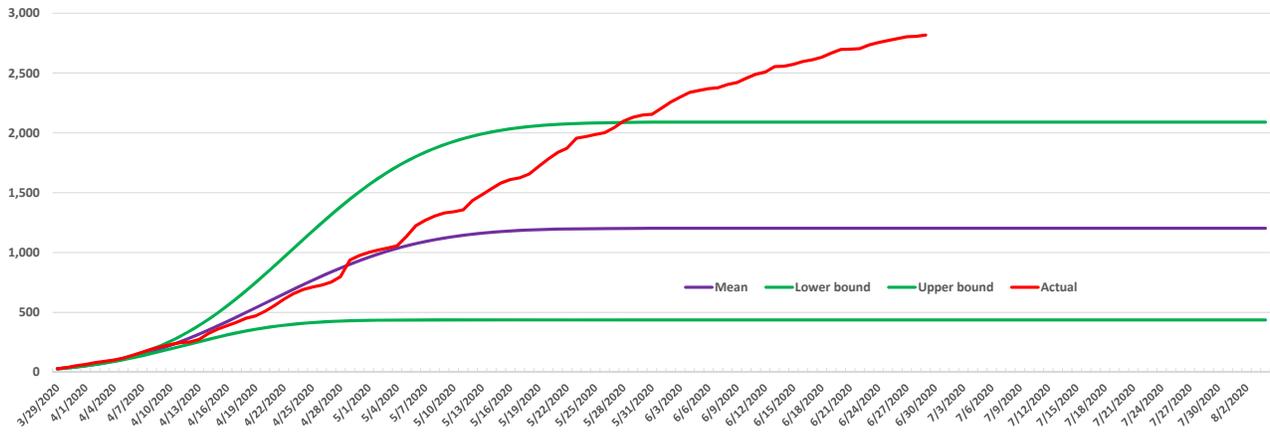
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Pennsylvania COVID 19 Cumulative Death Projections



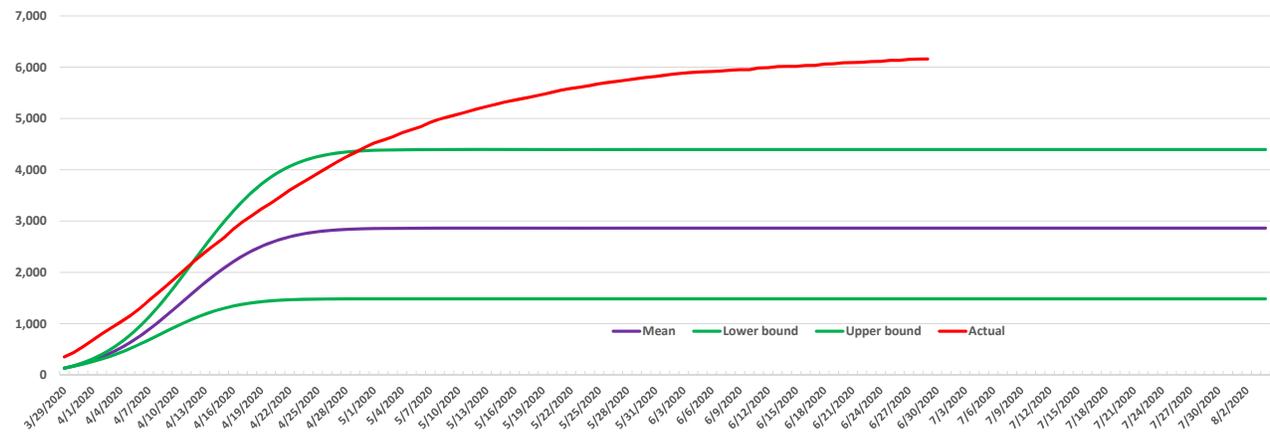
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Ohio COVID 19 Cumulative Death Projections March 26



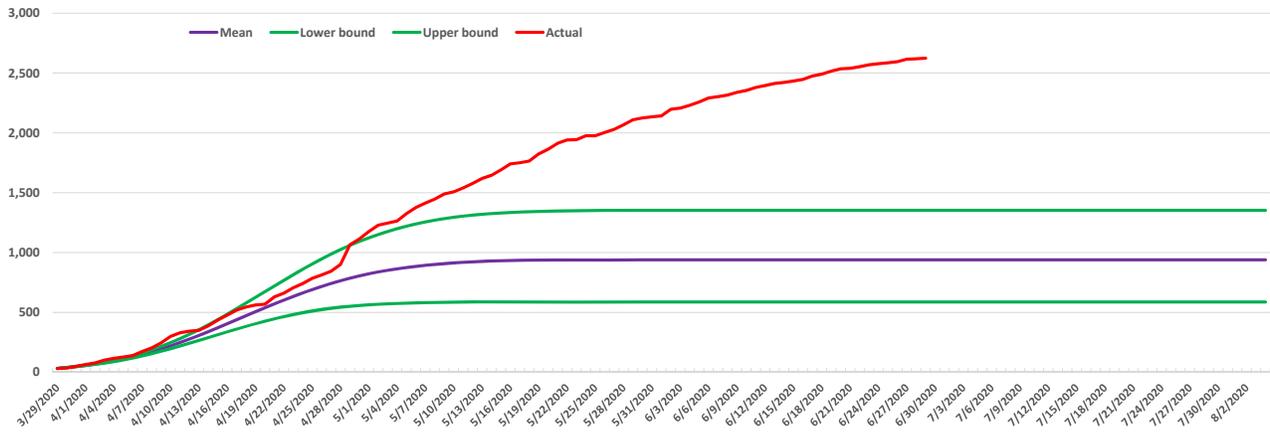
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Michigan COVID 19 Cumulative Death Projections



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Indiana COVID 19 Cumulative Death Projections March 26



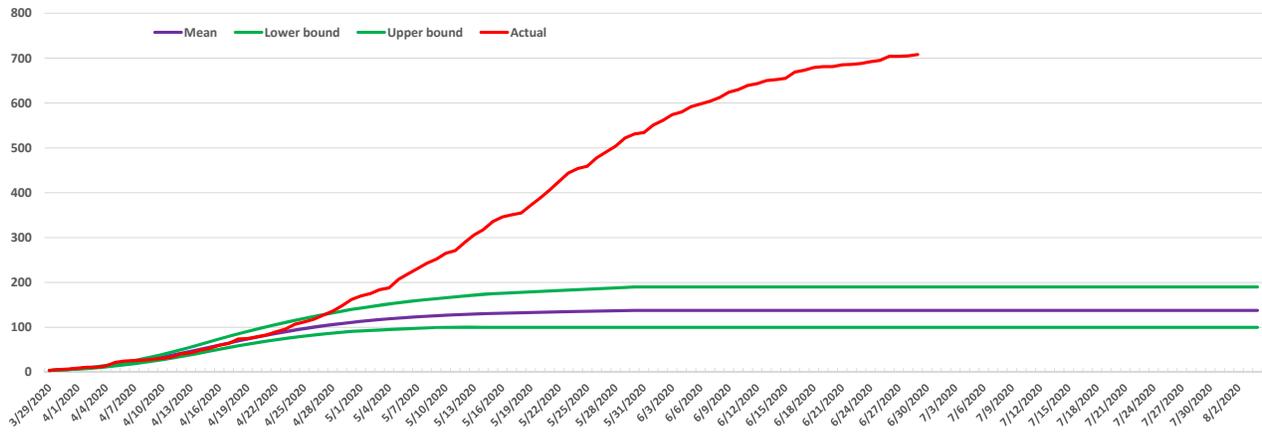
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Illinois COVID 19 Cumulative Death Projections March 26



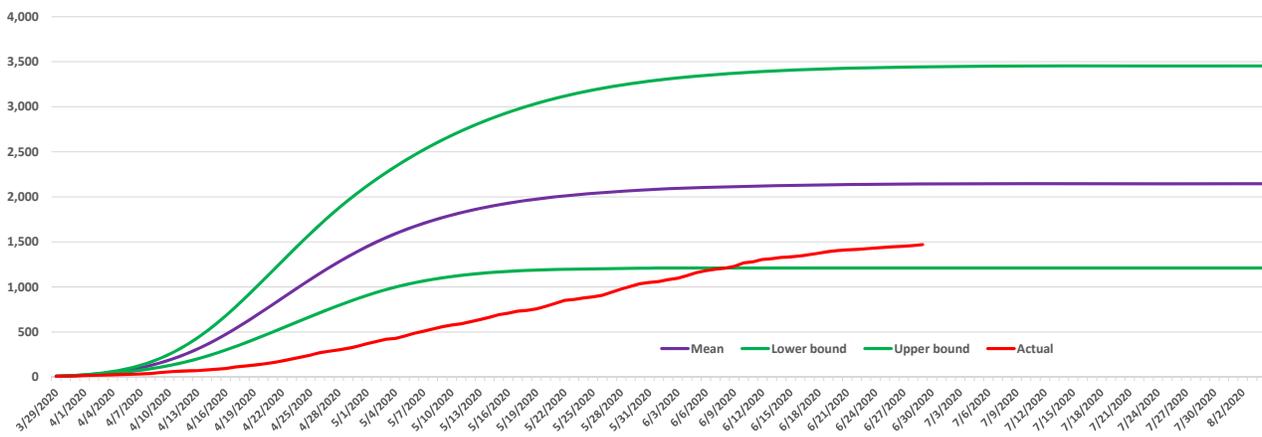
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Iowa COVID 19 Daily Death Projections March 26



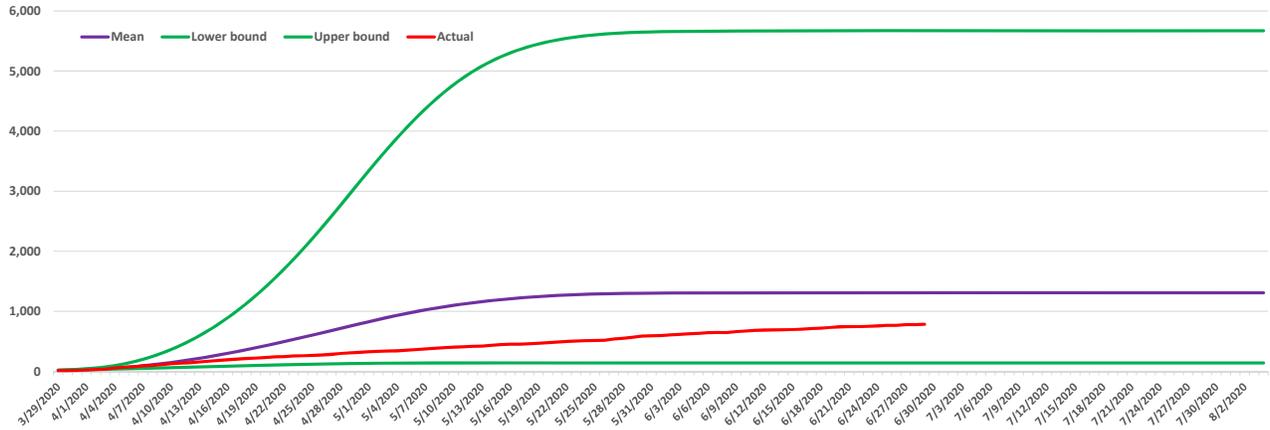
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Minnesota COVID 19 Cumulative Death Projections



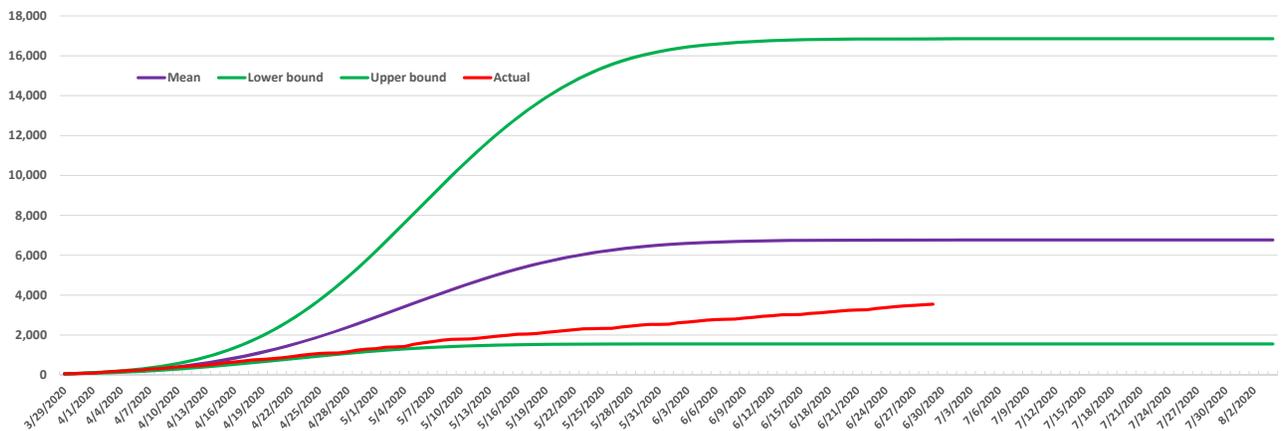
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Wisconsin COVID 19 Cumulative Death Projections



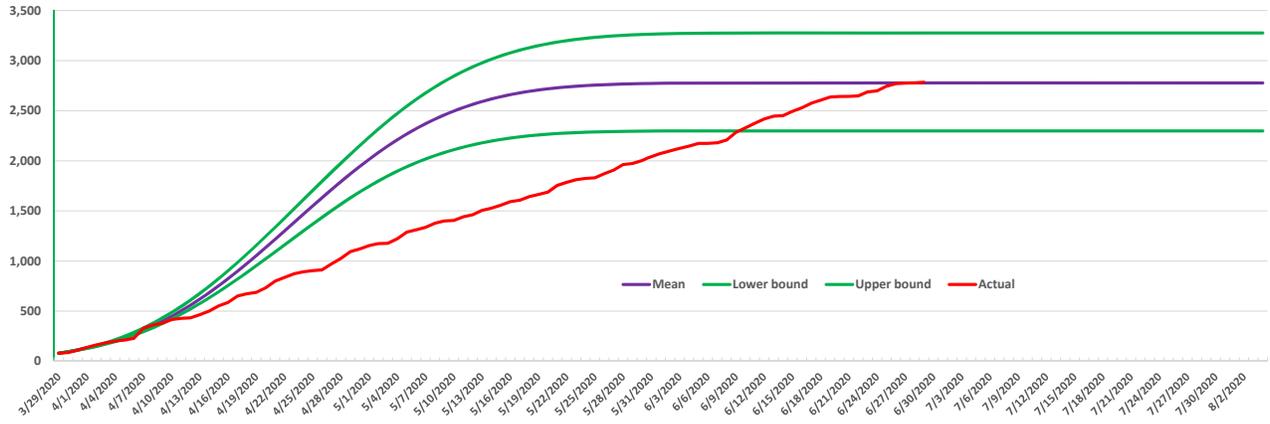
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Florida COVID 19 Cumulative Death Projections March 26



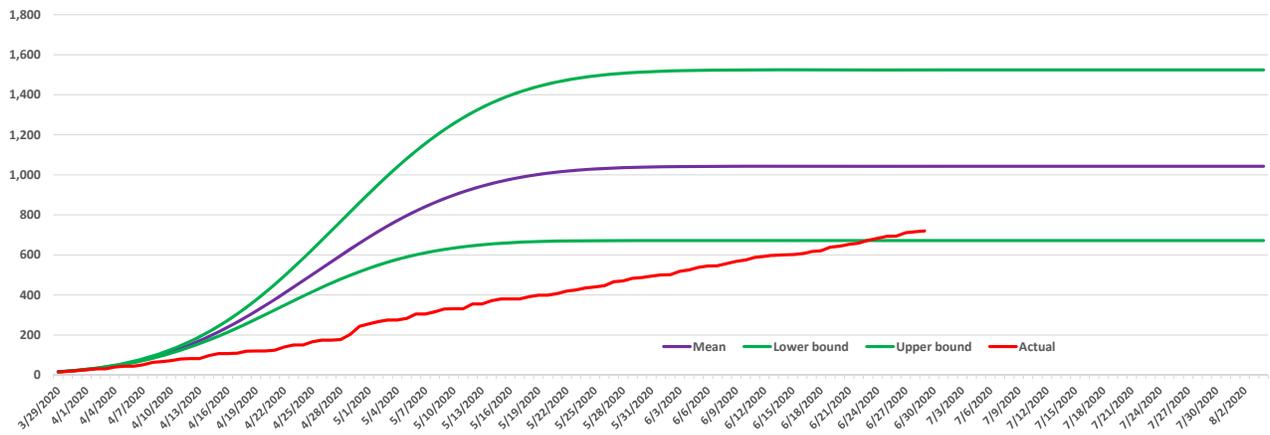
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Georgia COVID 19 Cumulative Death Projections



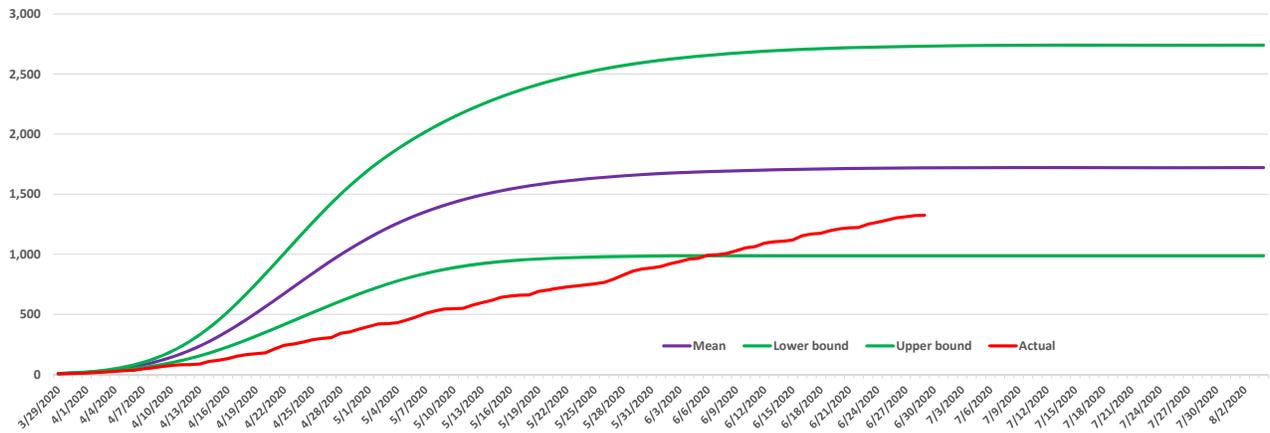
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South Carolina COVID 19 Cumulative Death Projections



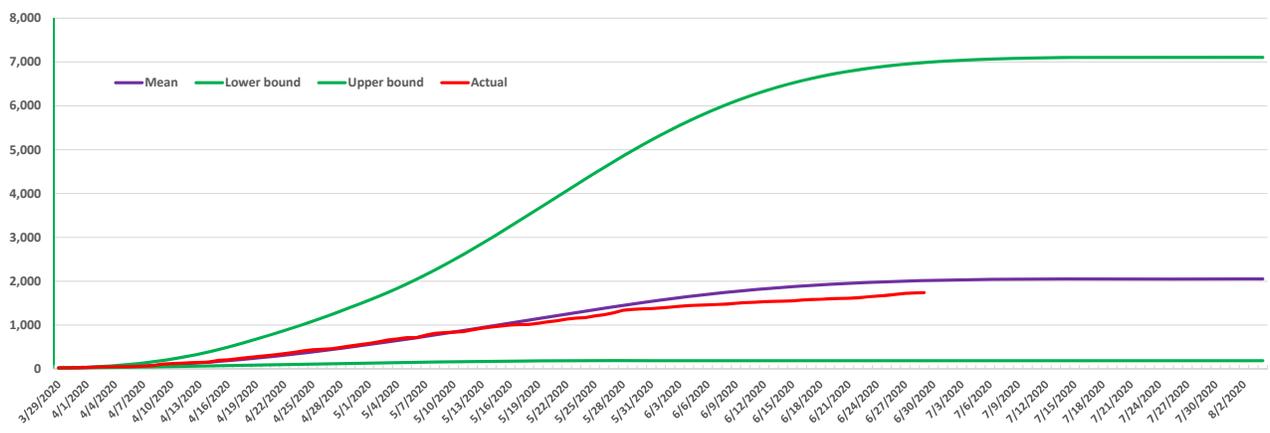
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North Carolina COVID 19 Cumulative Death Projections



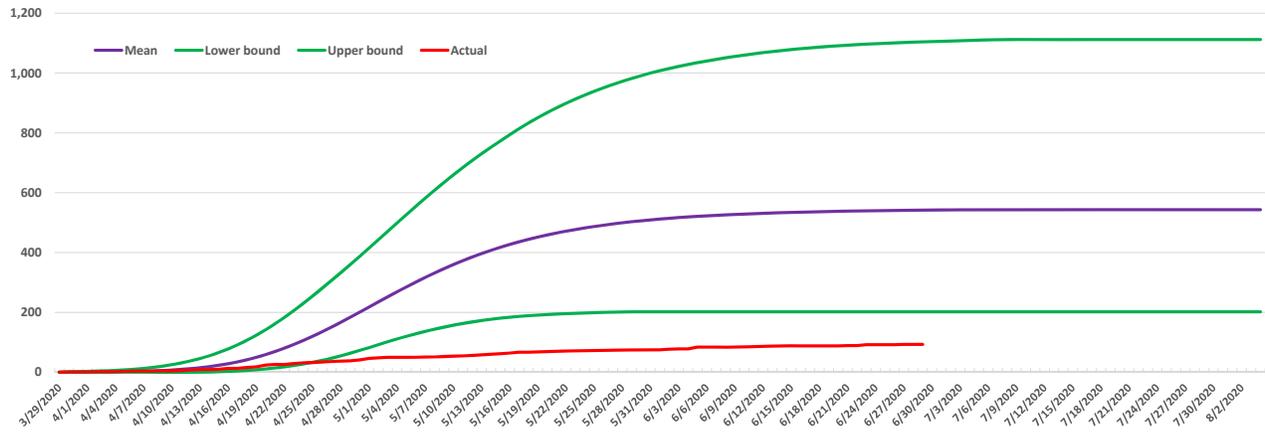
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Virginia COVID 19 Cumulative Death Projections



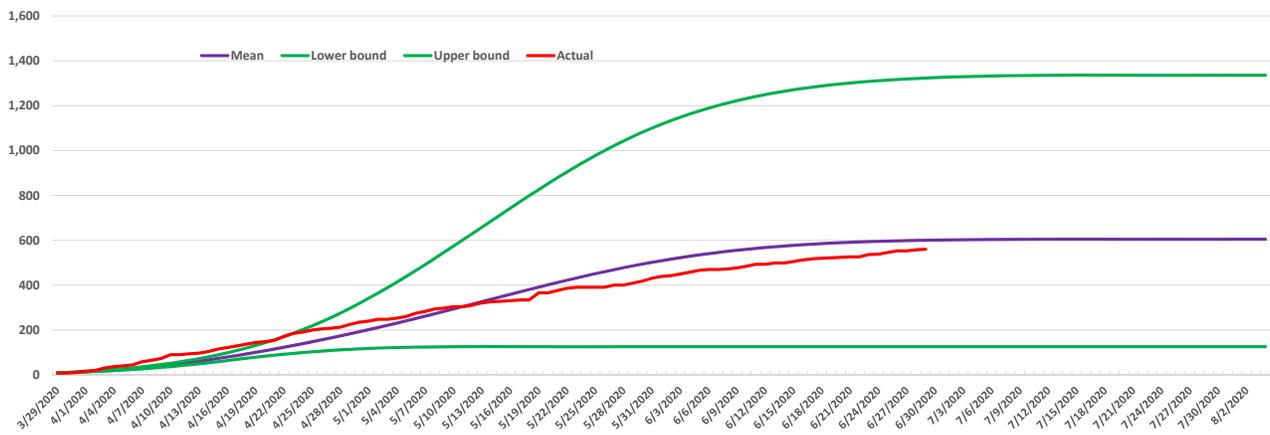
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West Virginia COVID 19 Cumulative Death Projections



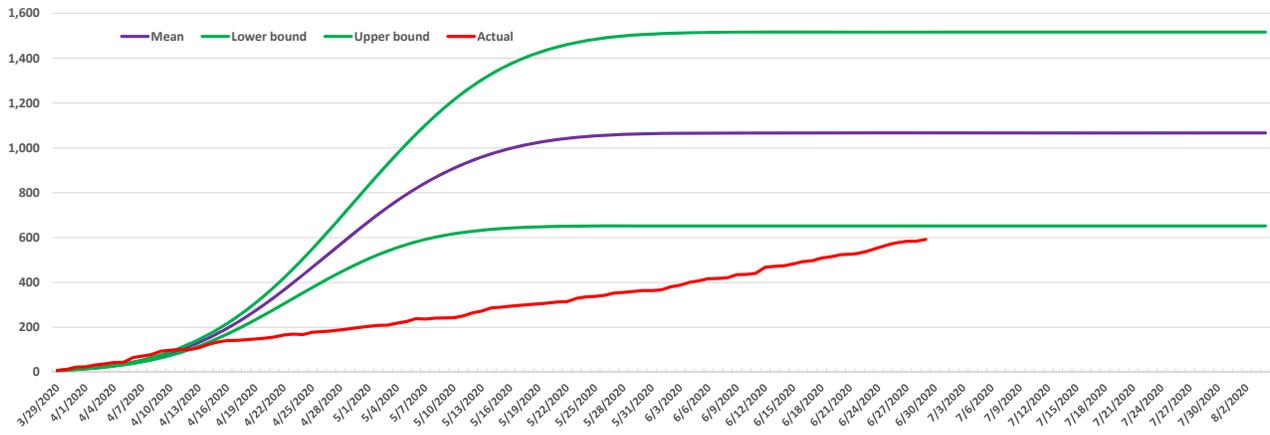
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Kentucky COVID 19 Cumulative Death Projections March 26



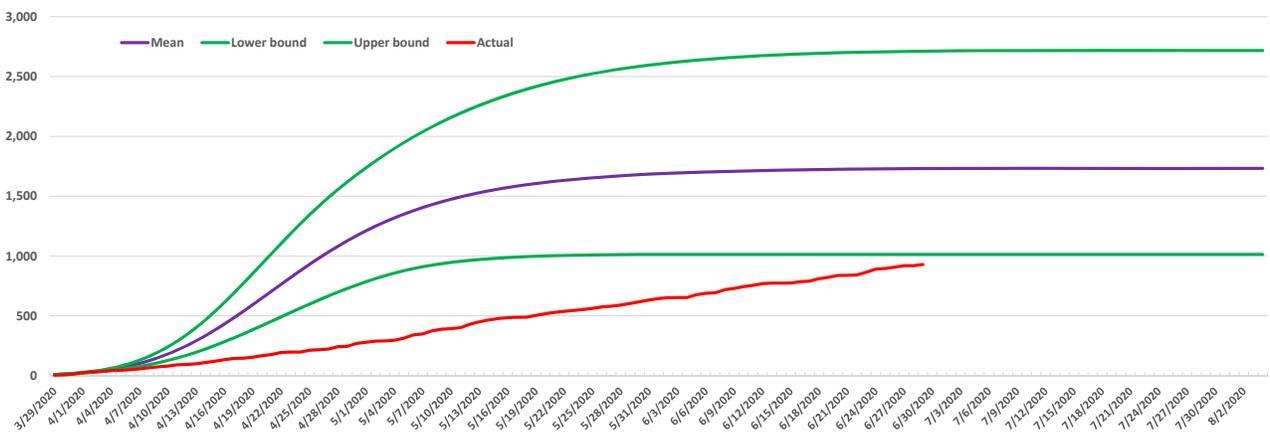
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Tennessee COVID 19 Cumulative Death Projections March 26



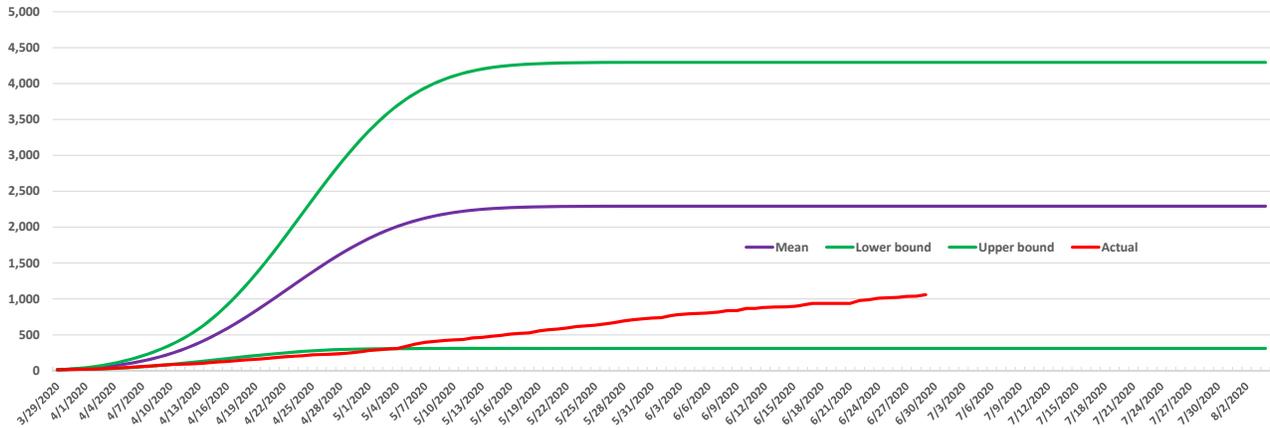
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Alabama COVID 19 Cumulative Death Projections March 26



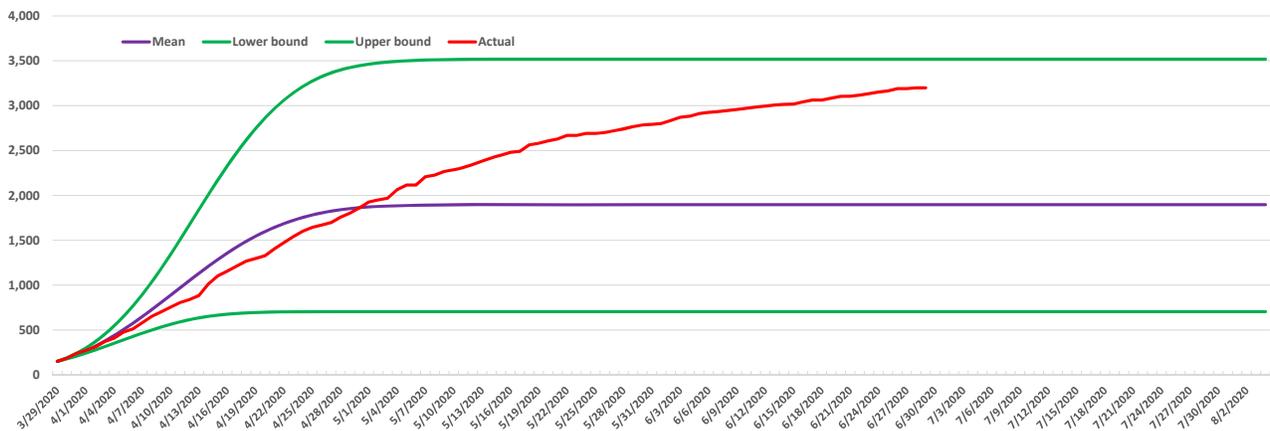
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Mississippi COVID 19 Daily Death Projections March 26



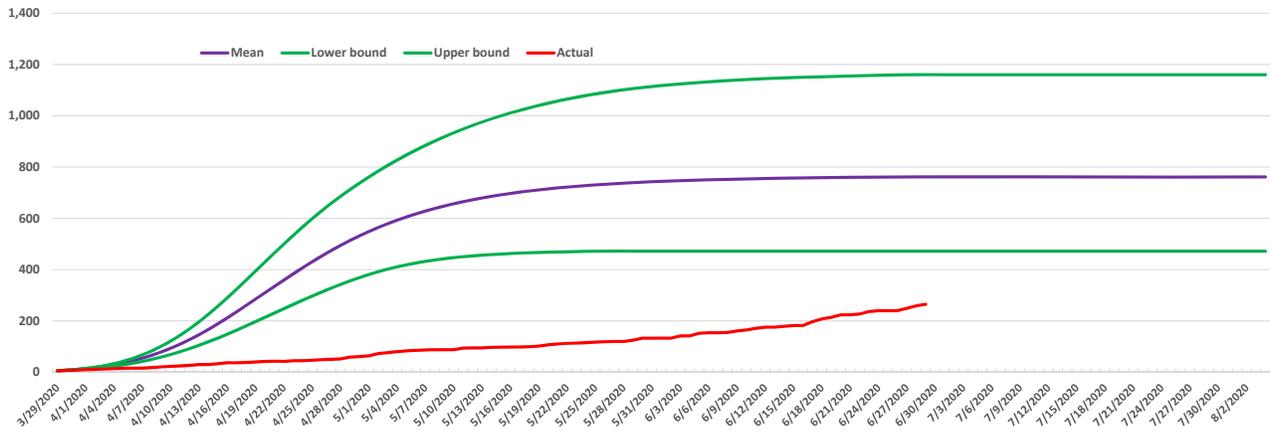
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Louisiana COVID 19 Daily Death Projections March 26



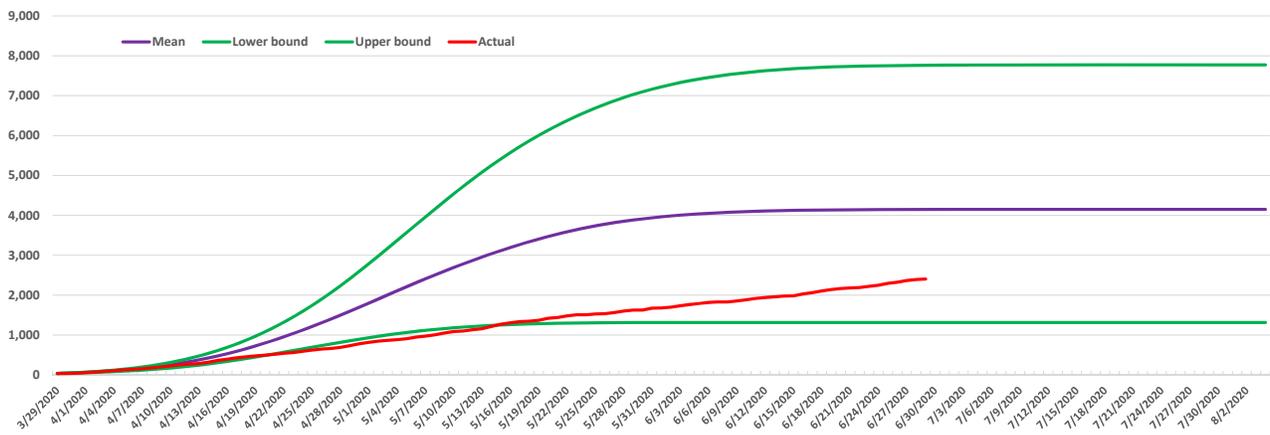
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Arkansas COVID 19 Cumulative Death Projections March 26



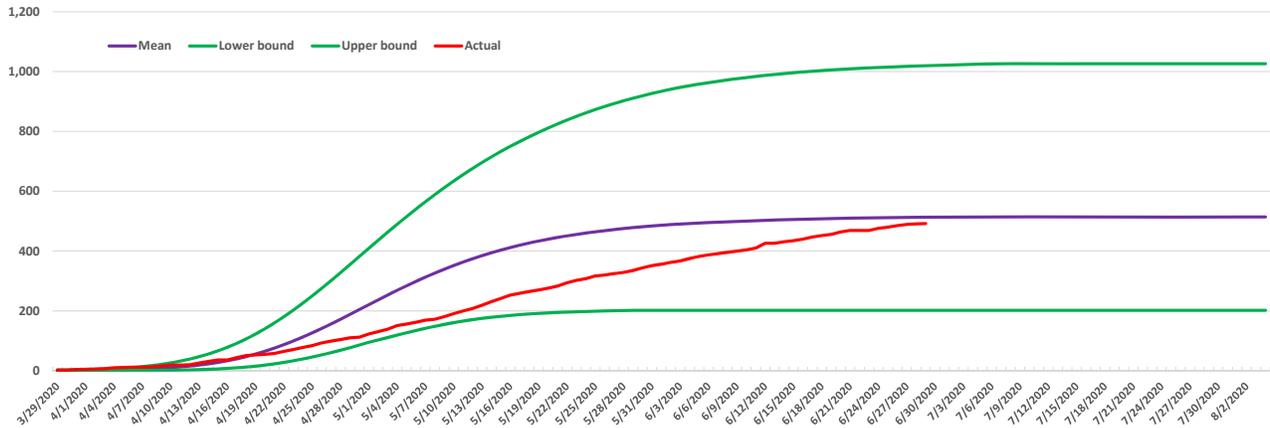
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Texas COVID 19 Daily Death Projections March 26



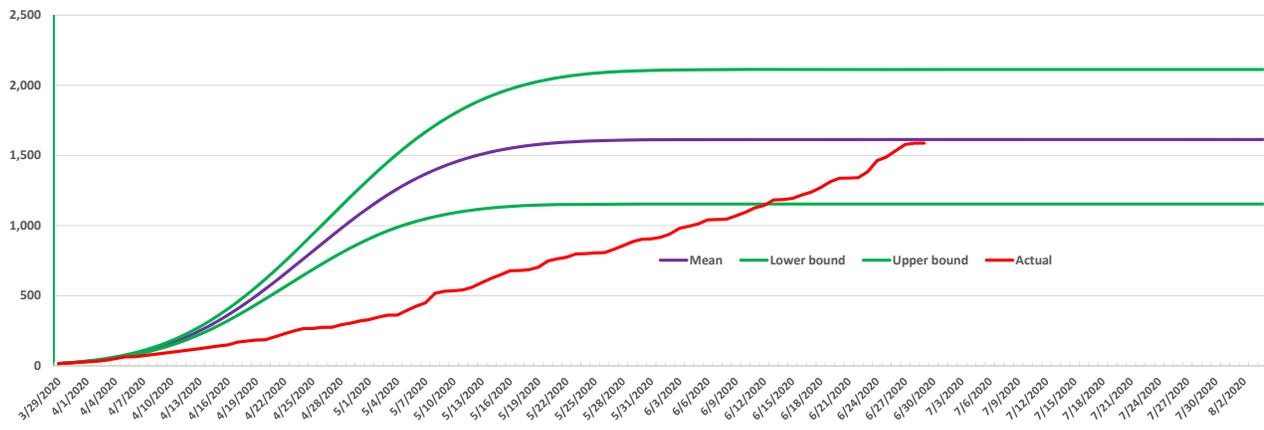
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New Mexico COVID 19 Daily Death Projections March 26



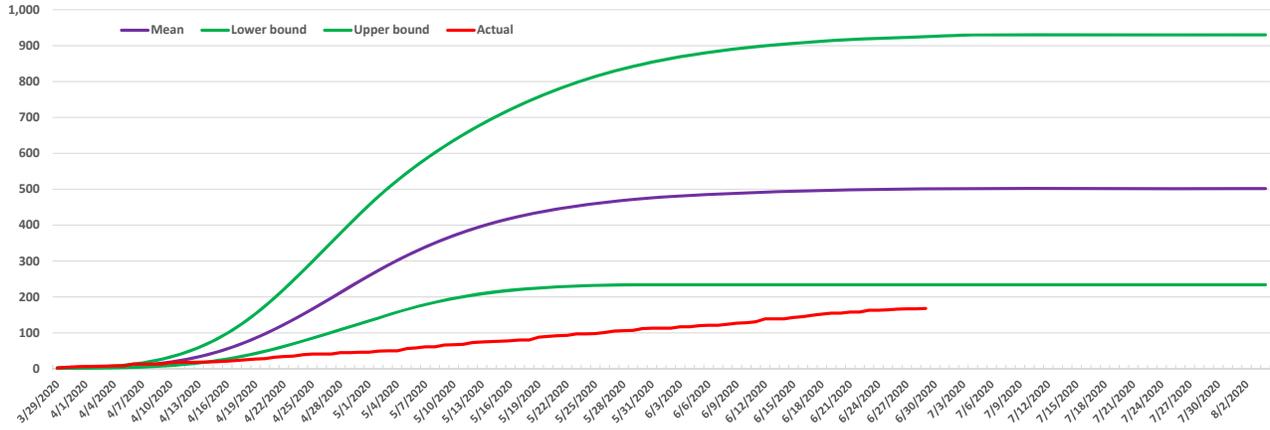
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Arizona COVID 19 Cumulative Death Projections



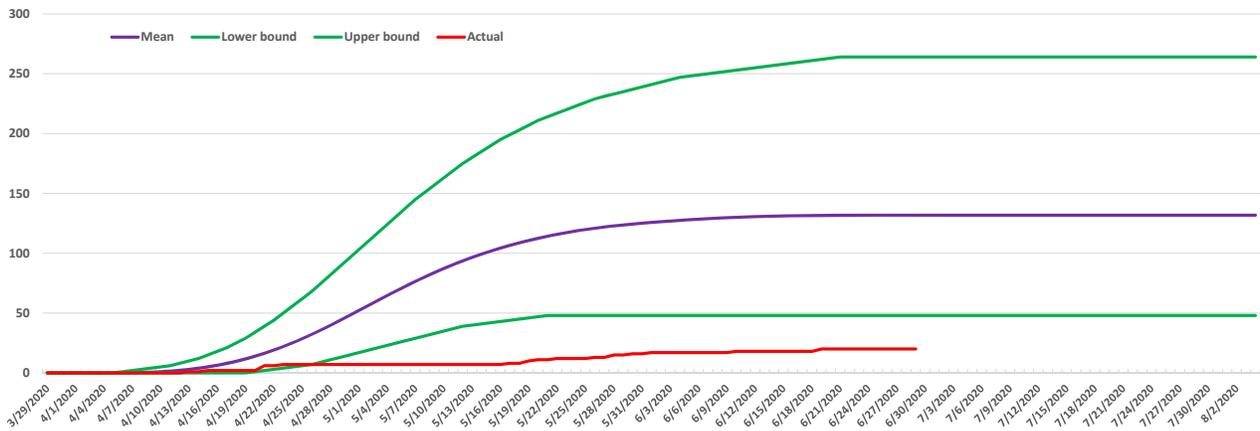
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Utah COVID 19 Daily Death Projections March 26



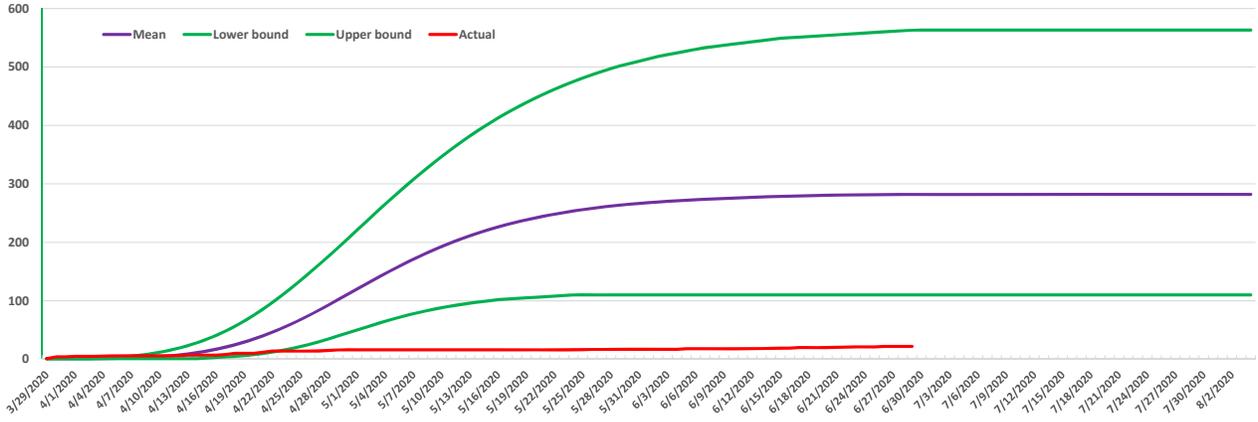
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Wyoming COVID 19 Cumulative Death Projections March 26



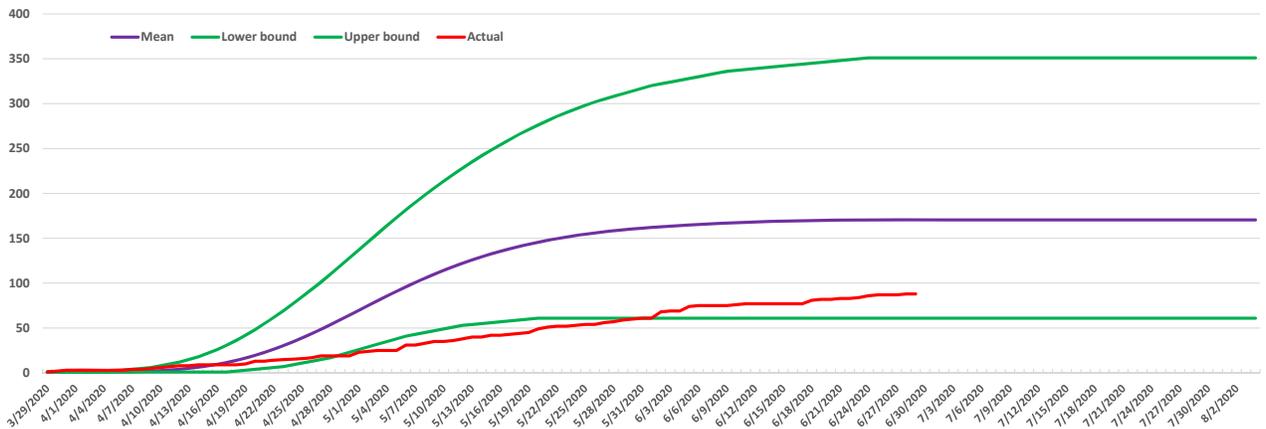
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Montana COVID 19 Cumulative Death Projections



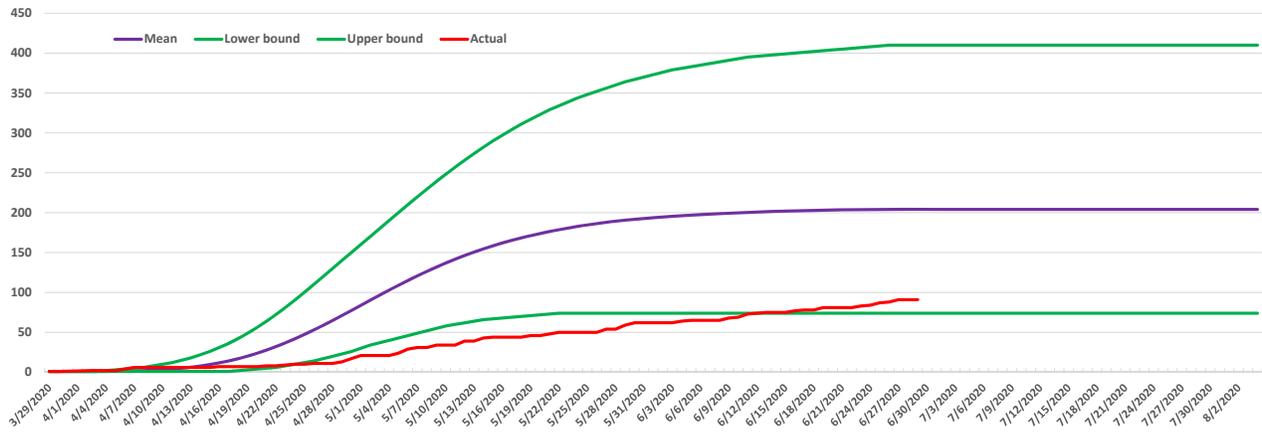
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North Dakota COVID 19 Cumulative Death Projections March 26



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South Dakota COVID 19 Daily Death Projections March 26



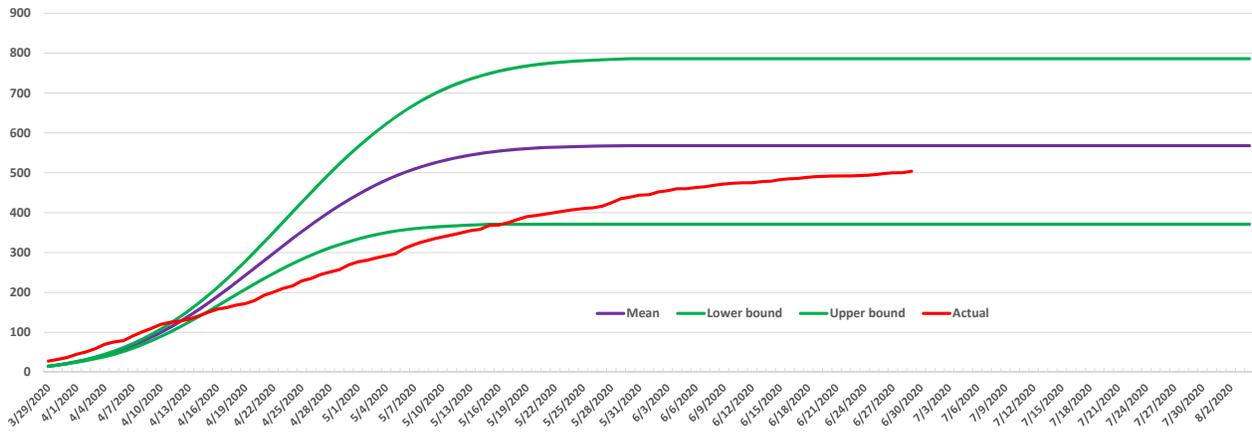
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Idaho COVID 19 Cumulative Death Projections March 26

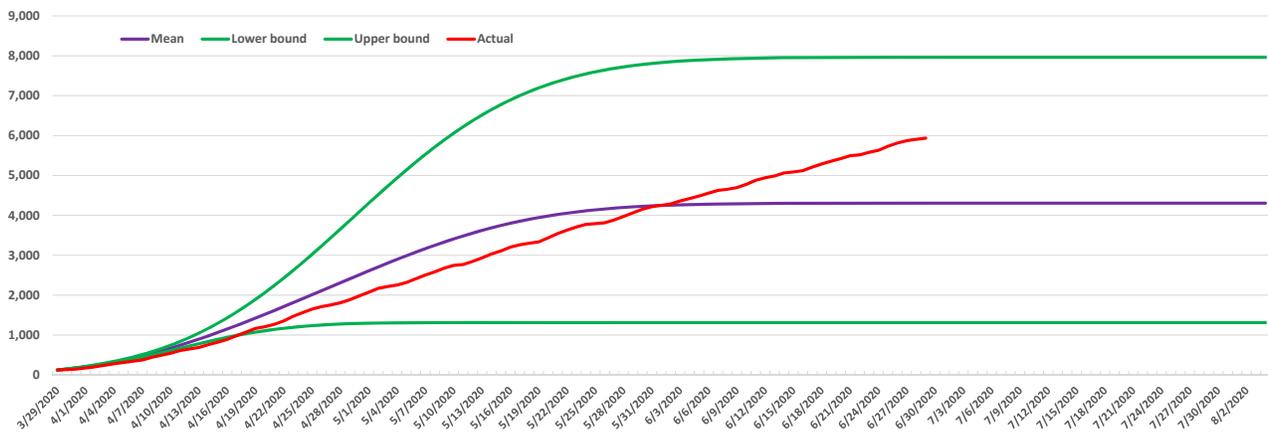


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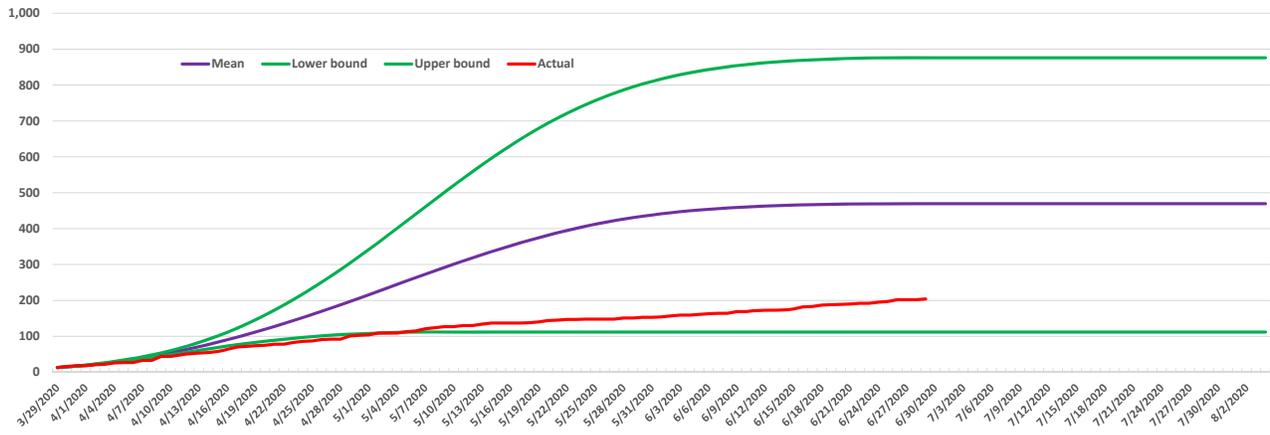
Nevada COVID 19 Cumulative Death Projections



California COVID 19 Cumulative Death Projections March 26

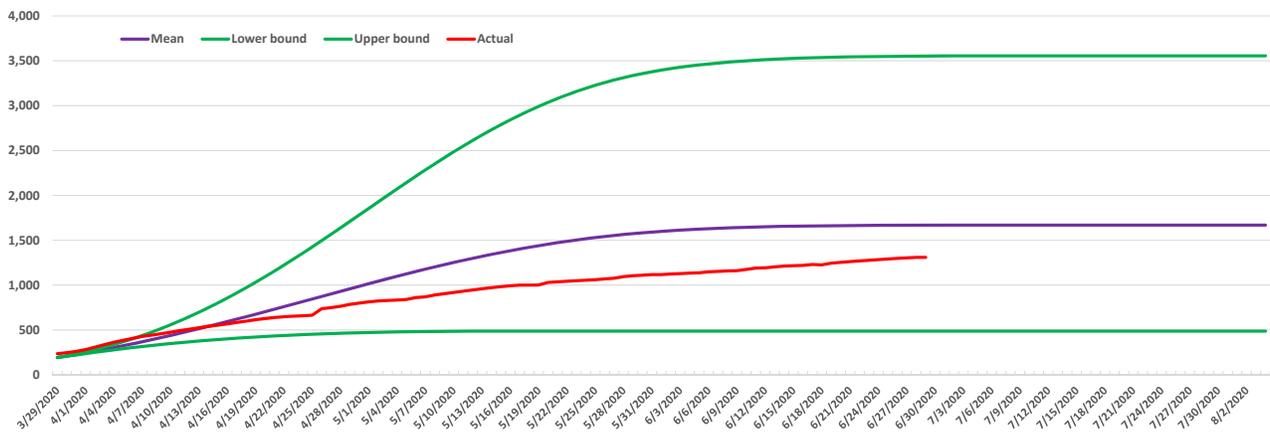


Oregon COVID 19 Cumulative Death Projections March 26



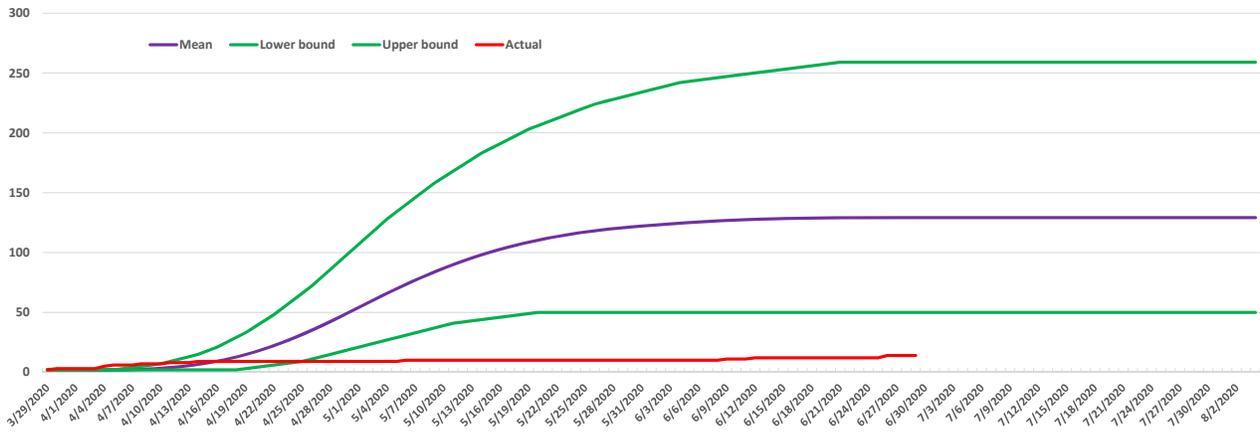
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Washington COVID 19 Cumulative Death Projections March 26



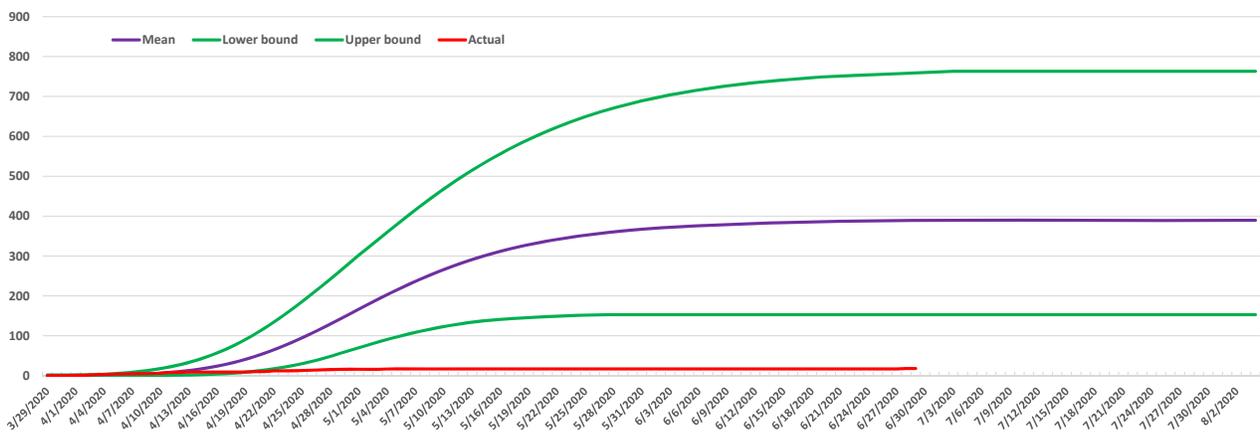
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Alaska COVID 19 Cumulative Death Projections March 26



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Hawaii COVID 19 Daily Death Projections March 26



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