

Analysis of the IHME COVID 19 Forecasting Model – July 7th Update

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Outline

- ❖ No revisions to IHME model since June 30th
- ❖ A look at projected death through August 4th
- ❖ A look at infections
- ❖ A look at Kansas and United States mortality statistics
- ❖ Distribution of daily deaths compared to the March 26th model
 - ❖ Focus on the 8 persons per million switch point
 - ❖ 90th percentile for governments taking action
- ❖ 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 11%
- 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 30th discussion



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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 draws 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
- Paper is still in the peer review process



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COVID-19 Cases Percent of Population

	Trend		Trend		Trend		Trend		Trend
Alabama	0.93%	Hawaii	0.08%	Massachusetts	1.60%	New Mexico	0.65%	South Dakota	0.81%
Alaska	0.16%	Idaho	0.48%	Michigan	0.74%	New York	2.18%	Tennessee	0.78%
Arizona	1.44%	Illinois	1.18%	Minnesota	0.69%	North Carolina	0.73%	Texas	0.76%
Arkansas	0.81%	Indiana	0.72%	Mississippi	1.08%	North Dakota	0.51%	Utah	0.81%
California	0.72%	Iowa	1.02%	Missouri	0.42%	Ohio	0.50%	Vermont	0.20%
Colorado	0.60%	Kansas	0.58%	Montana	0.12%	Oklahoma	0.44%	Virginia	0.78%
Connecticut	1.32%	Kentucky	0.39%	Nebraska	1.04%	Oregon	0.25%	Washington	0.50%
Delaware	1.27%	Louisiana	1.47%	Nevada	0.77%	Pennsylvania	0.75%	West Virginia	0.20%
Florida	1.00%	Maine	0.26%	New Hampshire	0.44%	Rhode Island	1.62%	Wisconsin	0.56%
Georgia	0.95%	Maryland	1.16%	New Jersey	2.00%	South Carolina	0.92%	Wyoming	0.30%

U.S. average is 0.93%, Data from <https://www.worldometers.info/coronavirus/country/us/> July 7, 2020



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COVID-19 Case Summary

- The U.S. average infection rate is 0.93%, less than 1%
- The state range of infection rates is 2.18% for New York to 0.08% for Hawaii
- Fourteen states have had an infection rate greater than 1%
- Thirty-six states have had an infection rate of less than 1%



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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	0.7%	1.8%
35-44 years	6	2.1%	2.5%
45-54 years	13	4.6%	4.8%
55-64 years	39	13.9%	12.8%
65-74 years	55	19.6%	18.2%
75-84 years	64	22.9%	23.4%
85+ years	101	36.1%	34.2%
Total	280	100%	97.6%

<https://www.coronavirus.kdheks.gov/160/COVID-19-in-Kansas>, July 6, 2020

https://www.kdheks.gov/phi/AS_Tables/AS_2018_Tables_and_Figures/general_mortality/Table_E4.pdf, July 6, 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	142	0.1%	0.2%
25-34 years	770	0.7%	1.1%
35-44 years	1,972	1.8%	2.1%
45-54 years	5,488	4.9%	6.0%
55-64 years	13,465	12.0%	13.2%
65-74 years	23,333	20.8%	18.9%
75-84 years	29,780	26.5%	23.4%
85+ years	37,247	33.2%	31.2%
Total	112,226	99.97%	98.87%

<https://data.cdc.gov/NCHS/Provisional-COVID-19-Death-Counts-by-Sex-Age-and-S/9bhg-hcku>, July 6, 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	39	0.10	9.3
65-74 years	55	0.21	18.9
75-84 years	64	0.48	47.5
85+ years	101	1.54	142.1

<https://www.coronavirus.kdheks.gov/160/COVID-19-in-Kansas>, July 6, 2020

https://www.kdheks.gov/phi/AS_Tables/AS_2018_Tables_and_Figures/general_mortality/, July 6, 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	20	0.00	0.17
15-24 years	142	0.00	0.74
25-34 years	770	0.02	1.33
35-44 years	1,972	0.05	1.95
45-54 years	5,488	0.13	4.02
55-64 years	13,465	0.32	8.86
65-74 years	23,333	0.79	17.91
75-84 years	29,780	2.02	44.73
85+ years	37,247	5.76	135.74

<https://data.cdc.gov/NCHS/Provisional-COVID-19-Death-Counts-by-Sex-Age-and-S/9bhg-hcku>, July 6, 2020



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Trend Analysis in Daily Death

	6/1 – 6/29	6/1 – 7/6		6/1 – 6/29	6/1 – 7/6		6/1 – 6/29	6/1 – 7/6
Alabama	0.01	0.00	Hawaii	0.01	0.01	Massachusetts	-1.81	-1.66
Alaska	0.01	0.01	Idaho	0.00	0.00	Michigan	-0.34	-0.29
Arizona	0.41	0.35	Illinois	-2.53	-2.40	Minnesota	-0.61	-0.55
Arkansas	0.13	0.05	Indiana	-0.59	-0.48	Mississippi	-0.03	-0.11
California	0.03	-0.12	Iowa	-0.35	-0.29	Missouri	-0.05	-0.13
Colorado	-0.38	-0.31	Kansas	-0.07	-0.05	Montana	0.00	0.00
Connecticut	-0.52	-0.55	Kentucky	-0.09	-0.04	Nebraska	0.00	-0.03
Delaware	-0.11	-0.07	Louisiana	-0.39	-0.23	Nevada	-0.07	0.03
Florida	-0.05	0.28	Maine	-0.04	-0.02	New Hampshire	-0.10	-0.11
Georgia	-0.57	-0.63	Maryland	-0.51	-0.53	New Jersey	7.32	1.71



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Trend Analysis in Daily Death for June

	6/1 – 6/29	6/1 – 7/6		6/1 – 6/29	6/1 – 7/6
New Mexico	-0.12	-0.11	South Dakota	0.02	0.01
New York	-1.78	-1.51	Tennessee	-0.02	0.01
North Carolina	-0.19	-0.25	Texas	0.33	0.43
North Dakota	-0.05	-0.01	Utah	-0.01	0.03
Ohio	-0.89	-0.68	Vermont	0.00	0.00
Oklahoma	0.00	0.00	Virginia	0.03	0.07
Oregon	0.01	0.00	Washington	0.03	0.02
Pennsylvania	-1.51	-1.26	West Virginia	-0.03	-0.03
Rhode Island	-0.14	-0.24	Wisconsin	-0.11	-0.17
South Carolina	0.02	0.18	Wyoming	-0.01	-0.01



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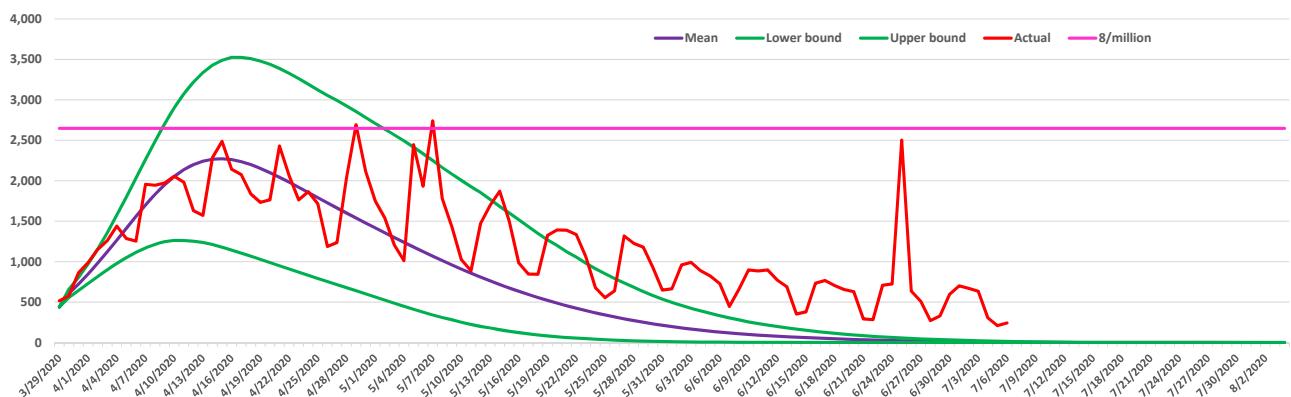
Trend Analysis Summary

- Since June 1, 30 States have had a decrease in daily death of greater than 0.01 per day
- Since June 1, 14 States have had an increase in daily death of greater than 0.01 per day
- Since June 1, 6 States have had a 0.00 increase/decrease in death per day
- The U.S. has experienced a -9.77 decrease per day since June 1.



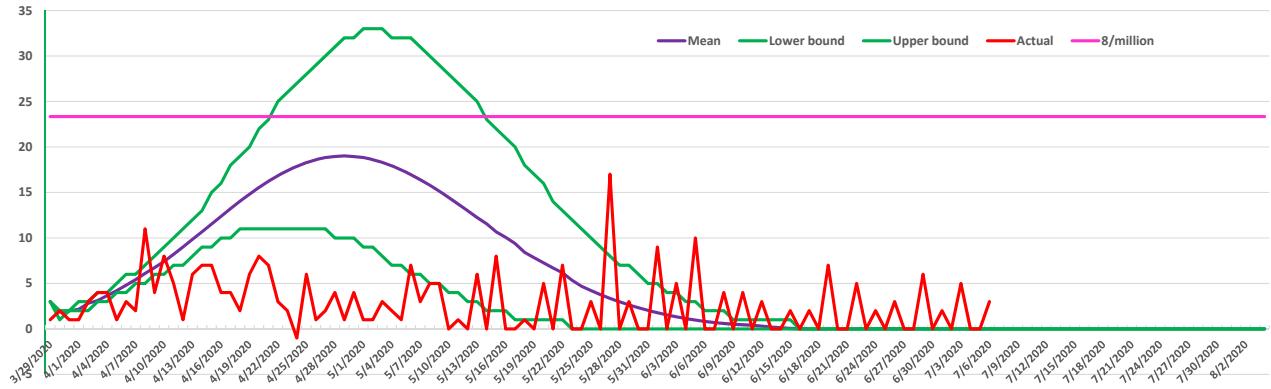
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U.S. COVID 19 Daily Death Projections March 26



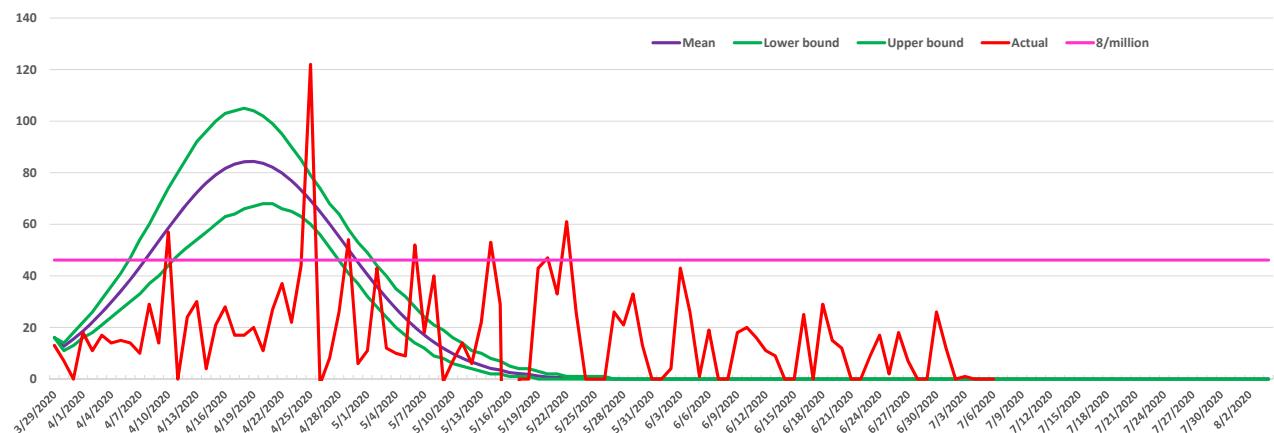
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Kansas COVID 19 Daily Death Projections March 26



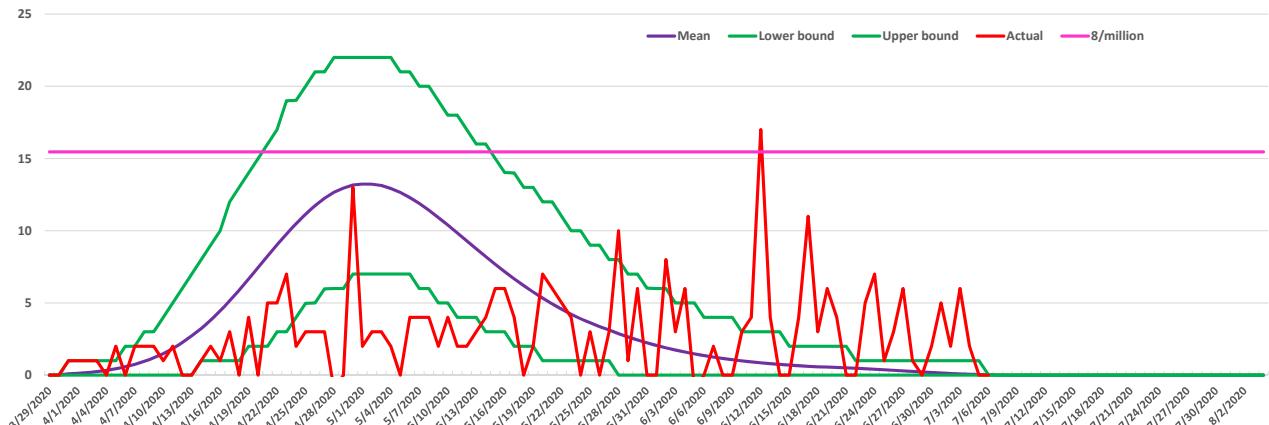
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Colorado COVID 19 Daily Death Projections March 26



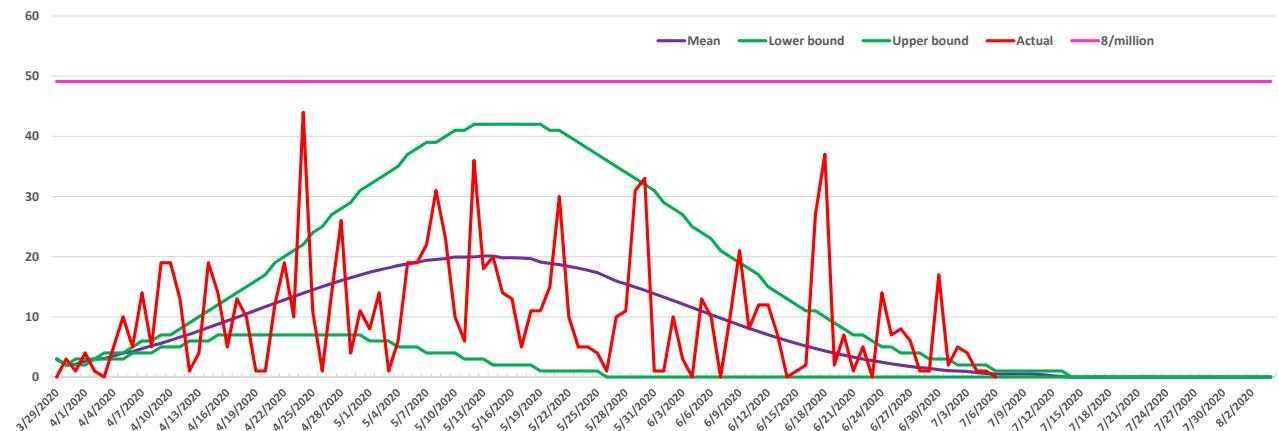
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Nebraska COVID 19 Daily Death Projections March 26



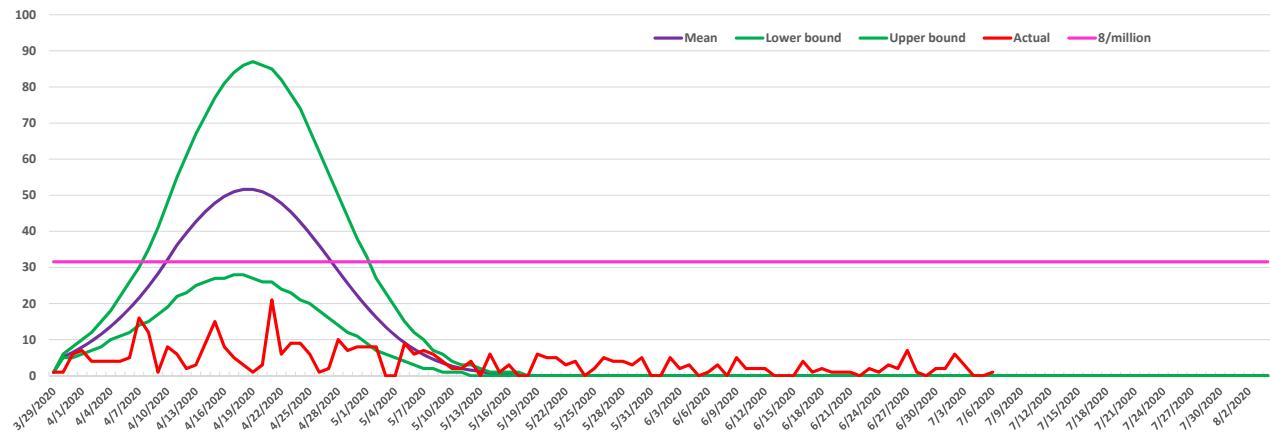
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Missouri COVID 19 Daily Death Projections March 26



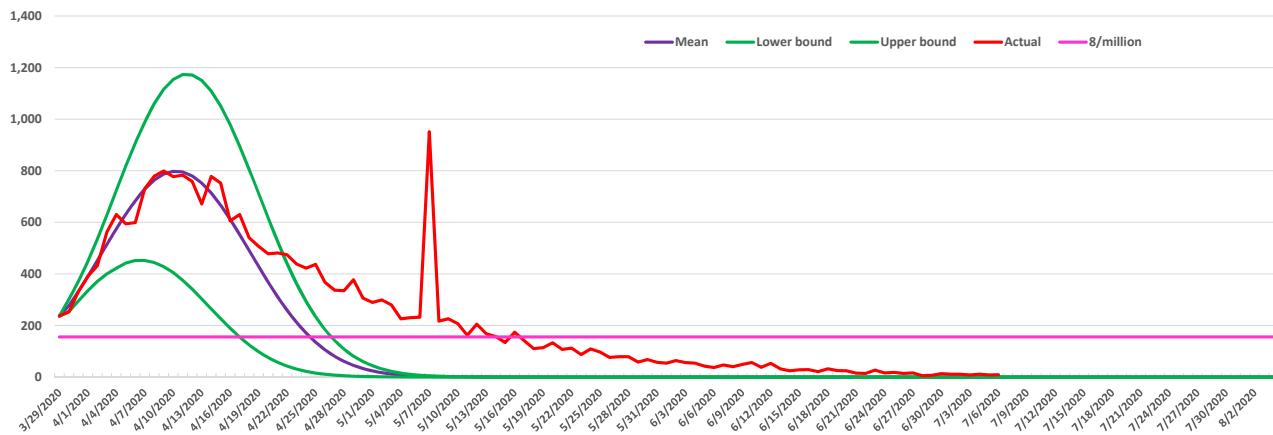
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Oklahoma COVID 19 Daily Death Projections March 26



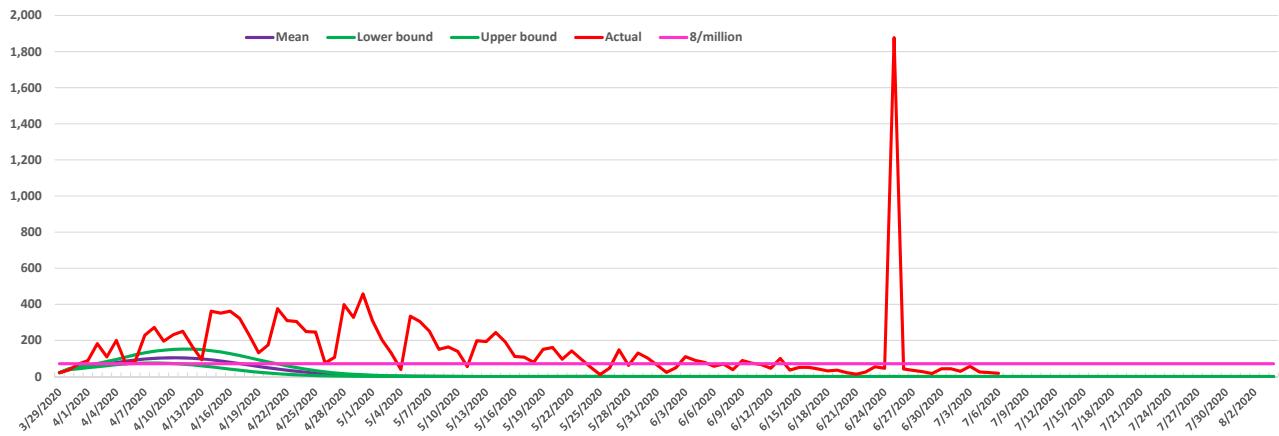
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New York COVID 19 Daily Death Projections March 26



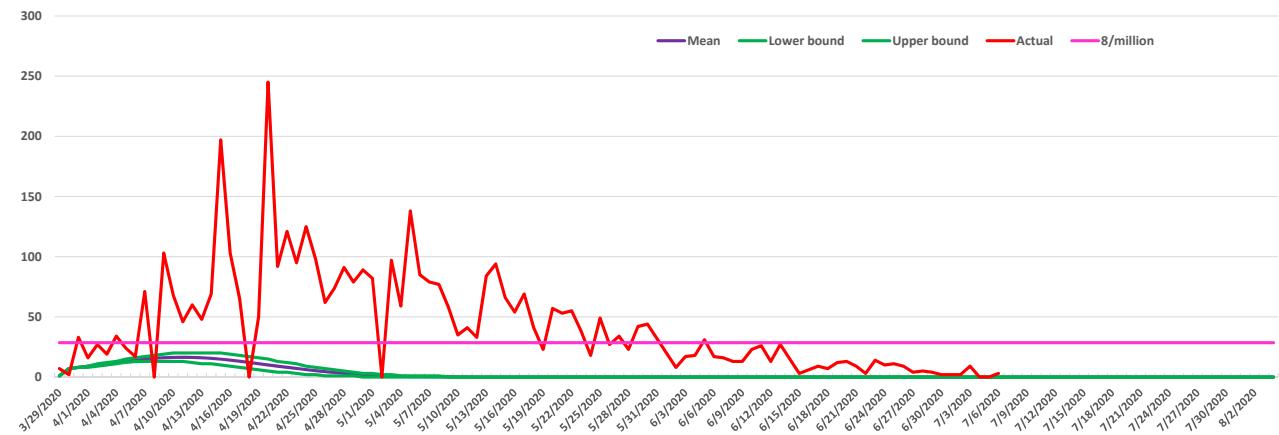
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New Jersey COVID 19 Daily Death Projections March 26



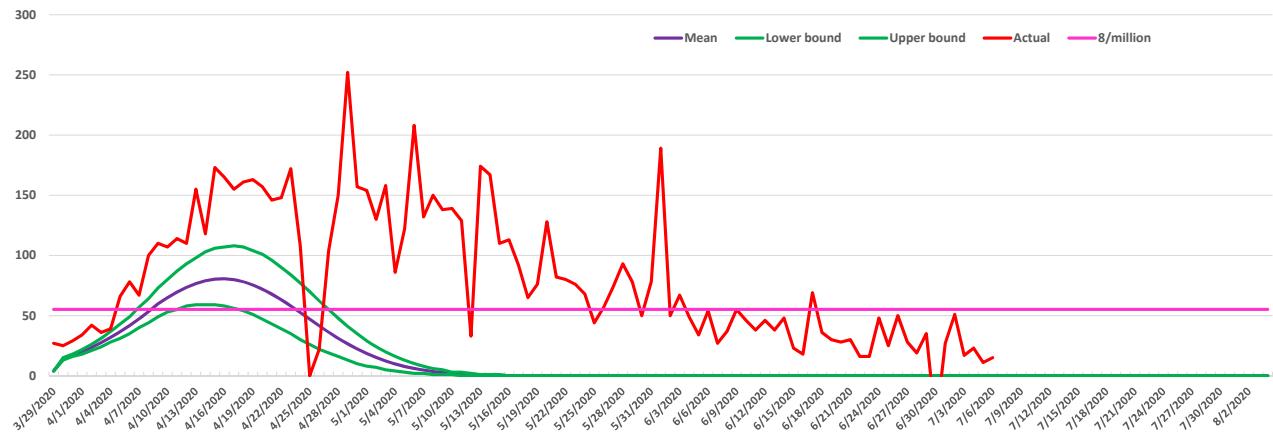
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Connecticut COVID 19 Daily Death Projections March 26



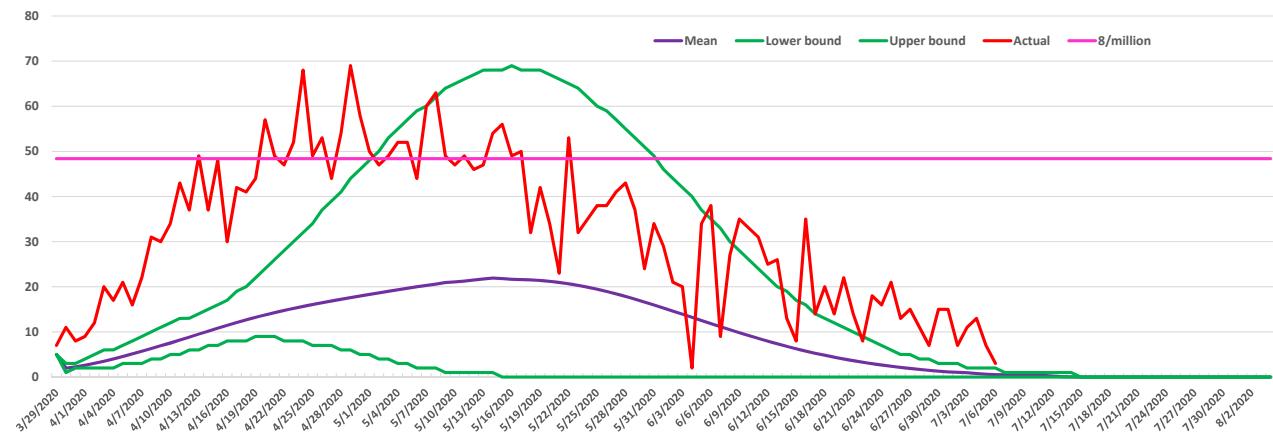
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Massachusetts COVID 19 Daily Death Projections March 26



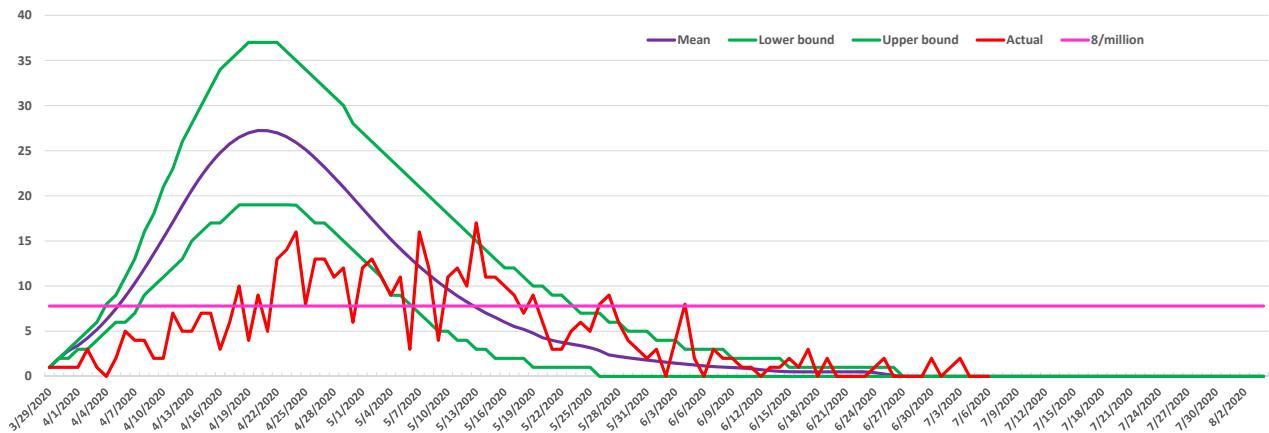
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Maryland COVID 19 Daily Death Projections March 26



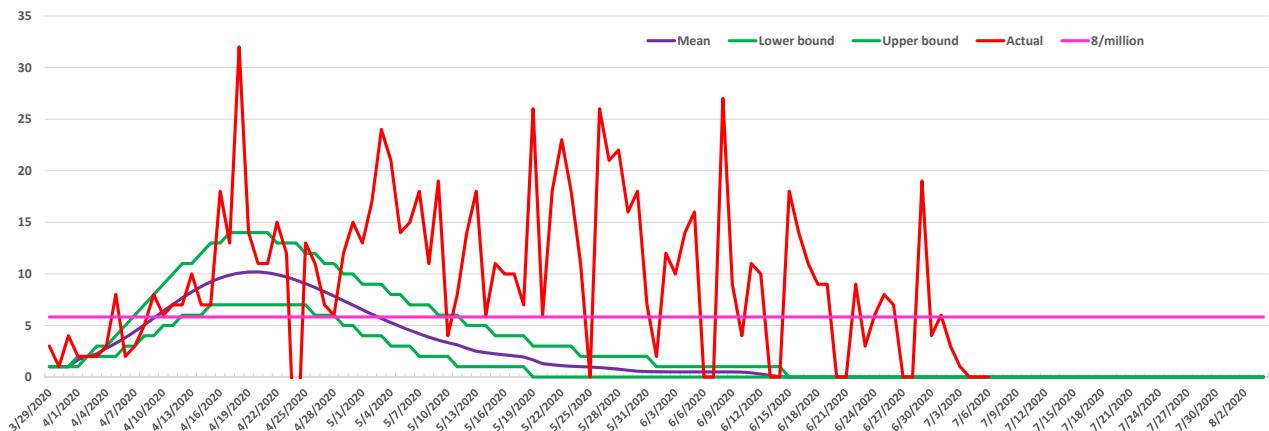
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Delaware COVID 19 Daily Death Projections March 26



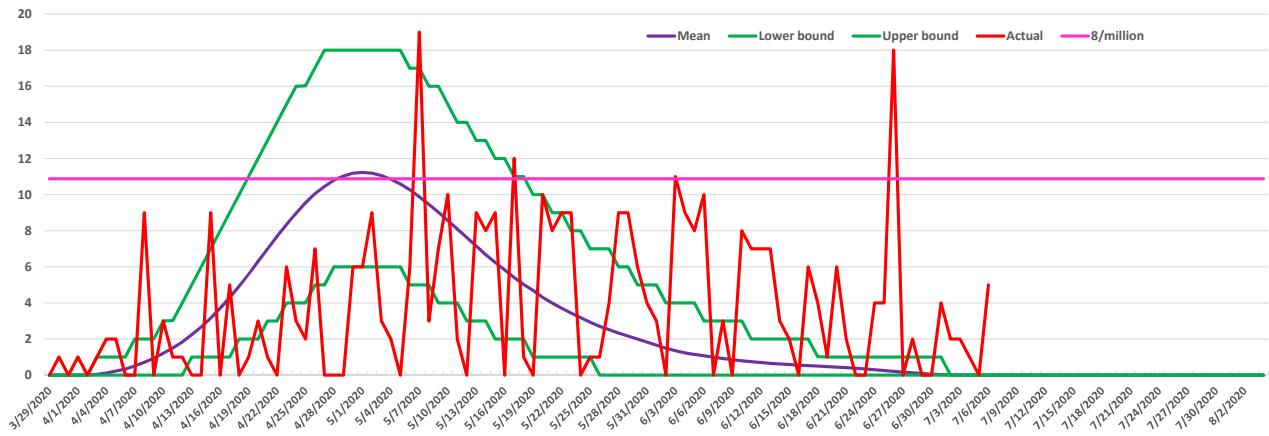
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Rhode Island COVID 19 Daily Death Projections March 26



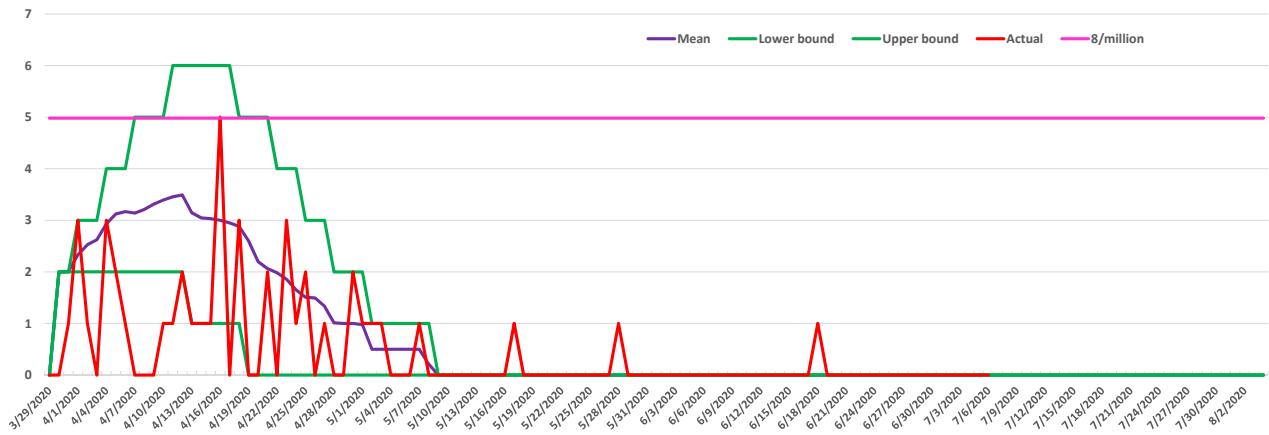
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New Hampshire COVID 19 Daily Death Projections March 26



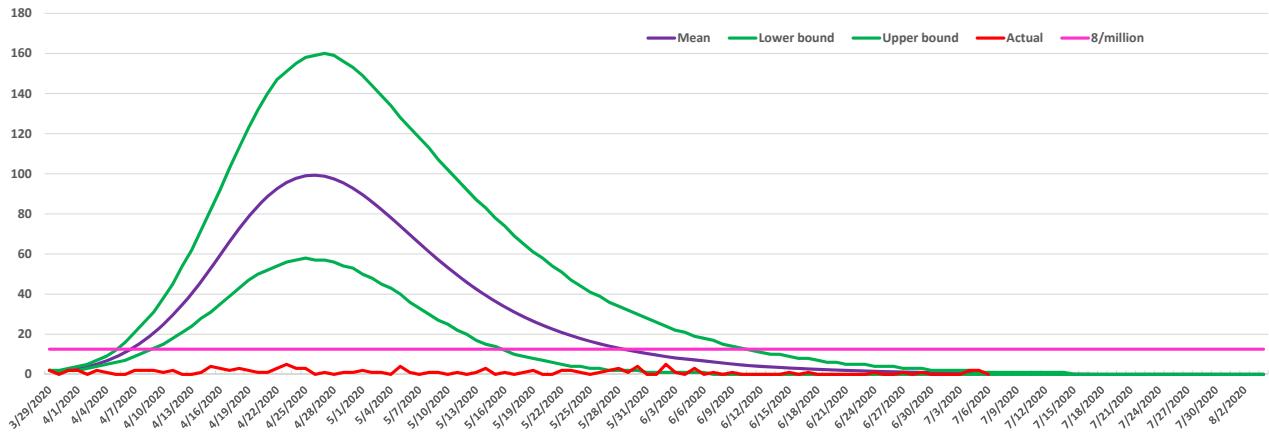
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Vermont COVID 19 Daily Death Projections March 26



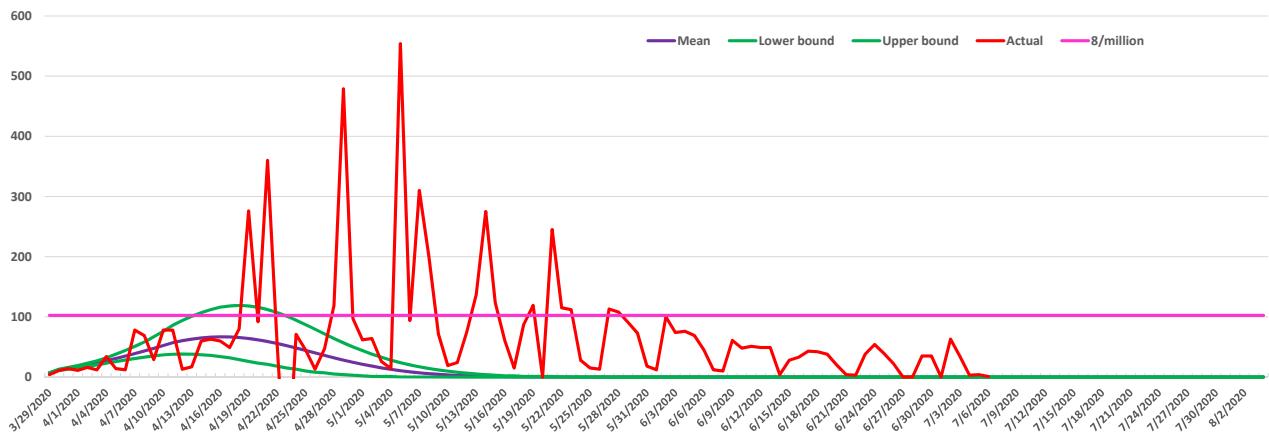
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Maine COVID 19 Daily Death Projections March 26



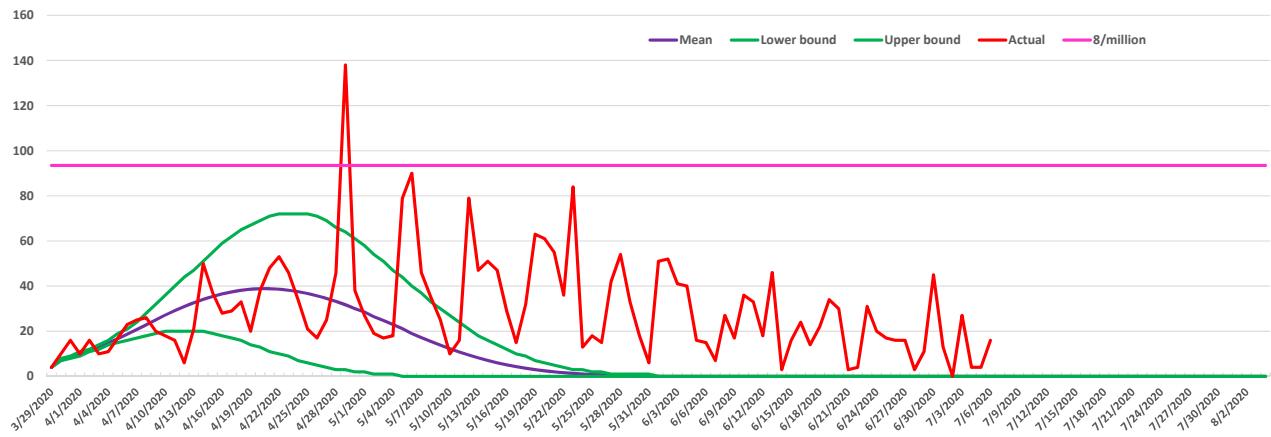
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Pennsylvania COVID 19 Daily Death Projections March 26



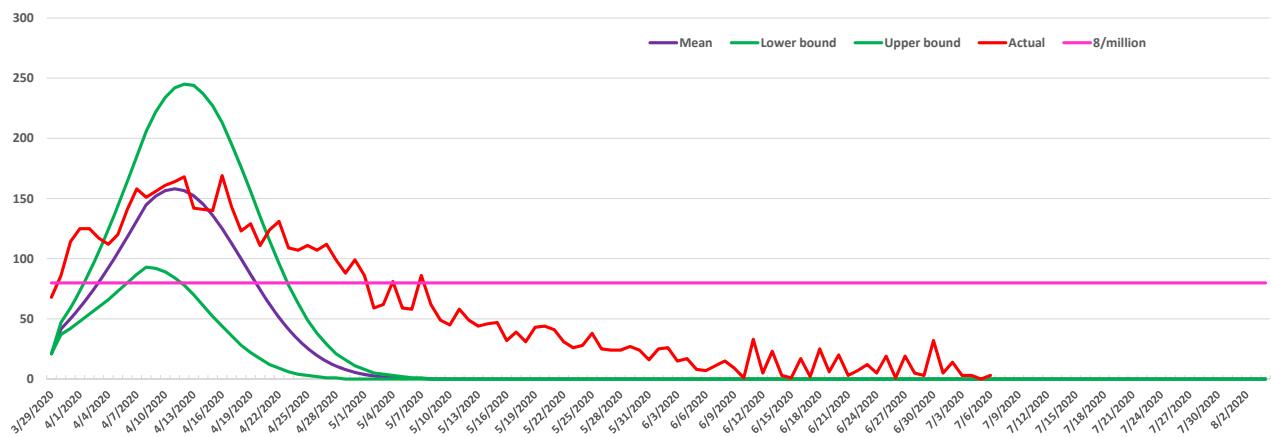
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Ohio COVID 19 Daily Death Projections March 26



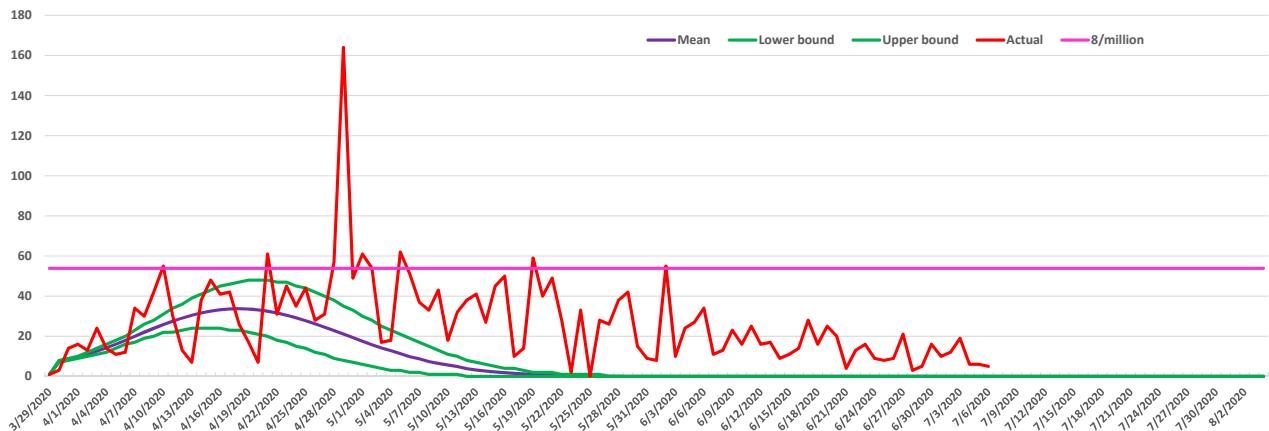
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Michigan COVID 19 Daily Death Projections March 26



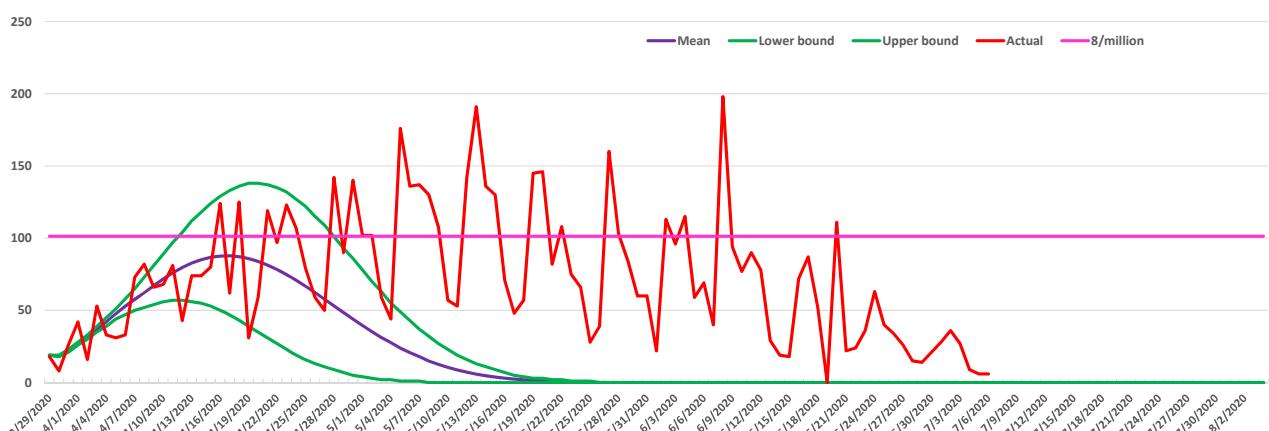
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Indiana COVID 19 Daily Death Projections March 26



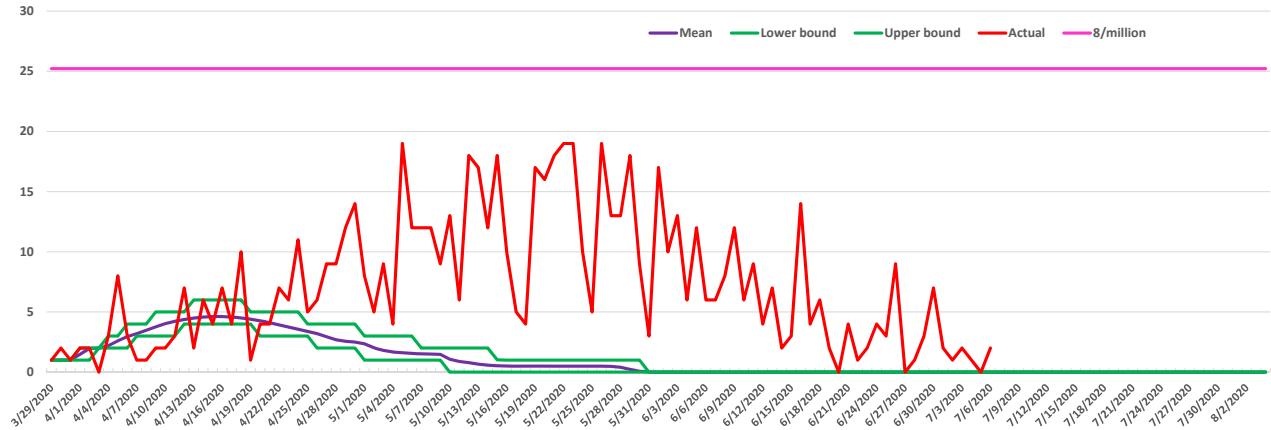
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Illinois COVID 19 Daily Death Projections March 26



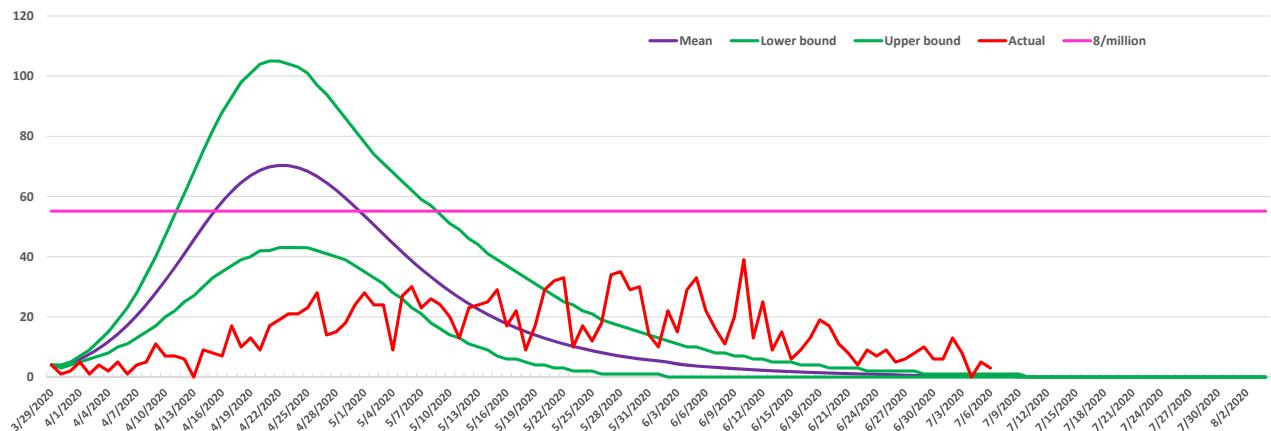
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Iowa COVID 19 Daily Death Projections March 26



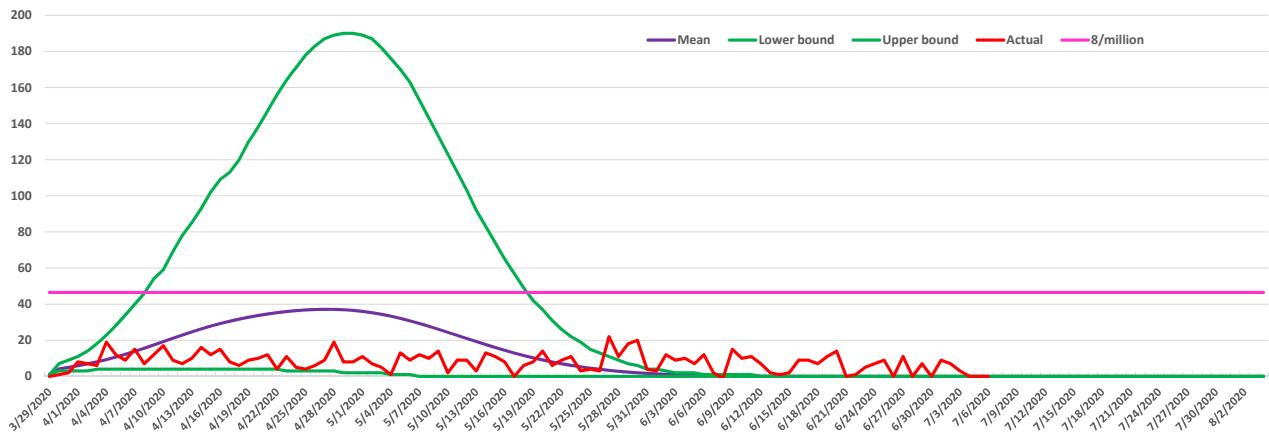
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Minnesota COVID 19 Daily Death Projections March 26



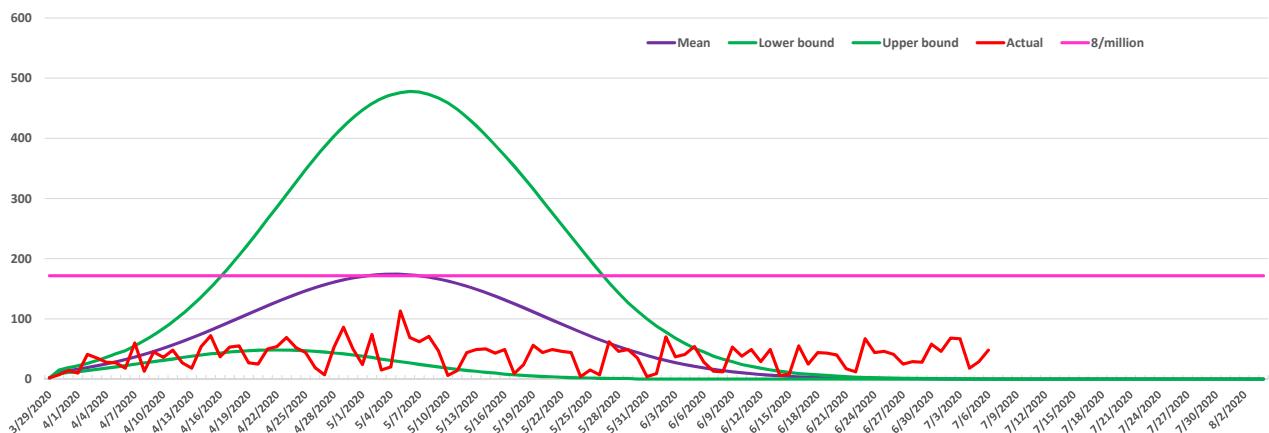
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Wisconsin COVID 19 Daily Death Projections March 26



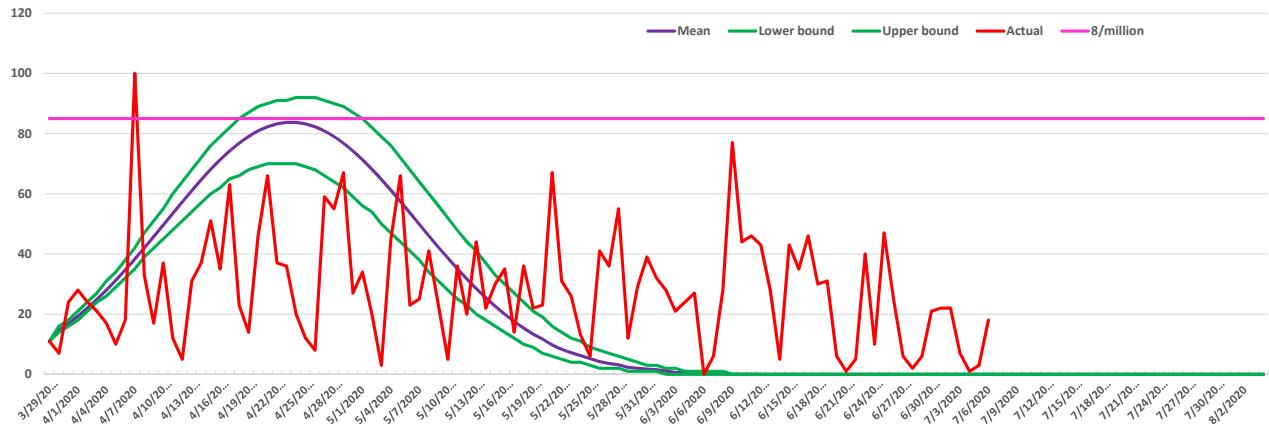
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Florida COVID 19 Daily Death Projections March 26



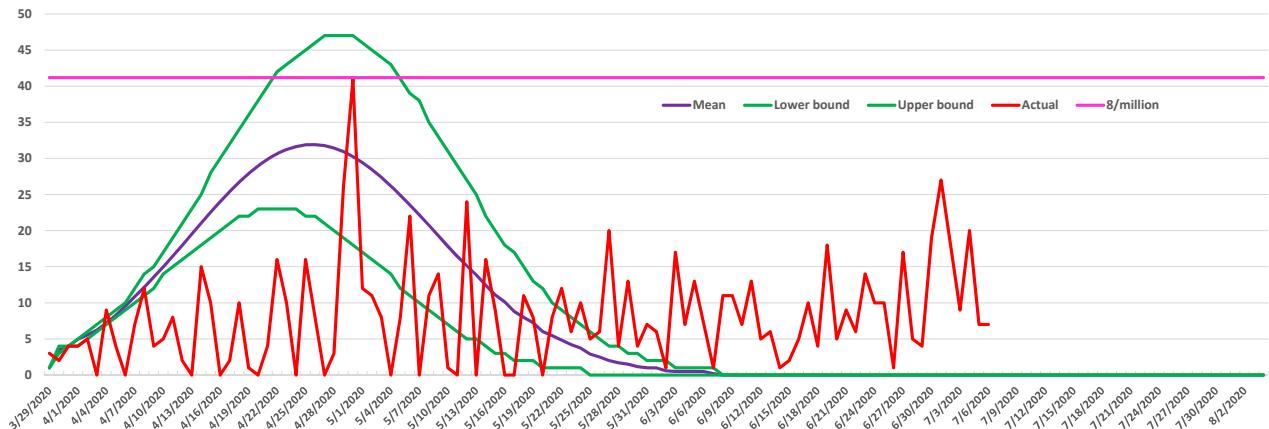
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Georgia COVID 19 Daily Death Projections March 26



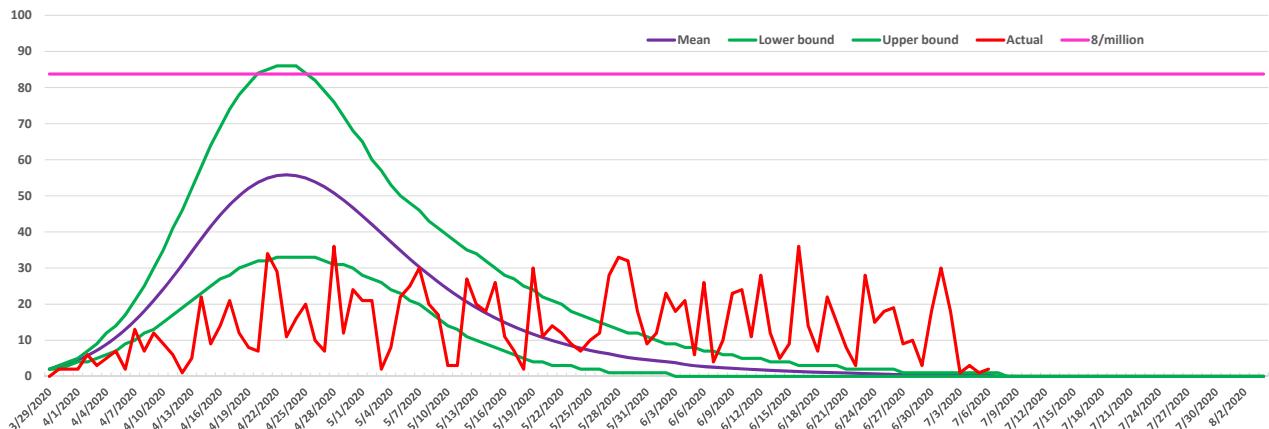
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South Carolina COVID 19 Daily Death Projections March 26



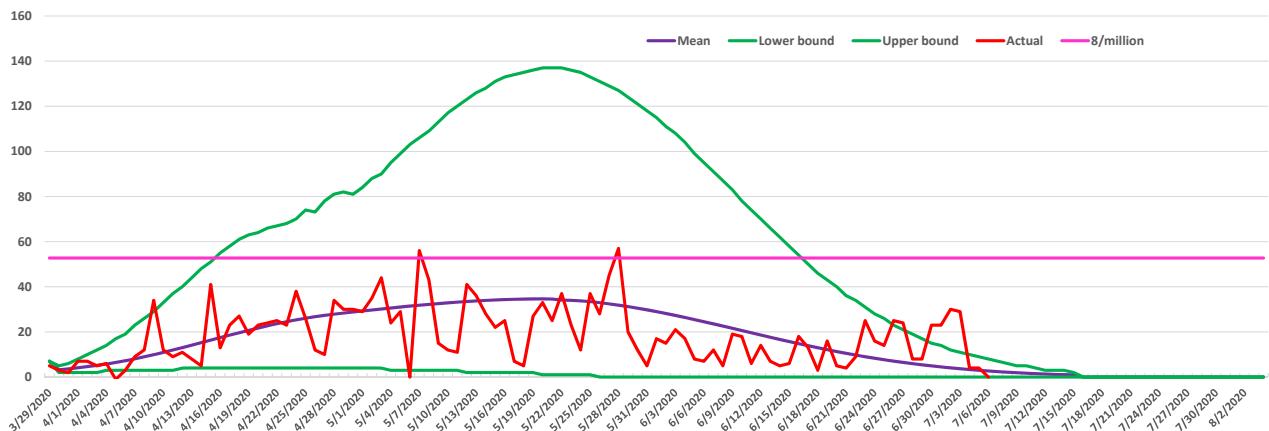
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North Carolina COVID 19 Daily Death Projections March 26



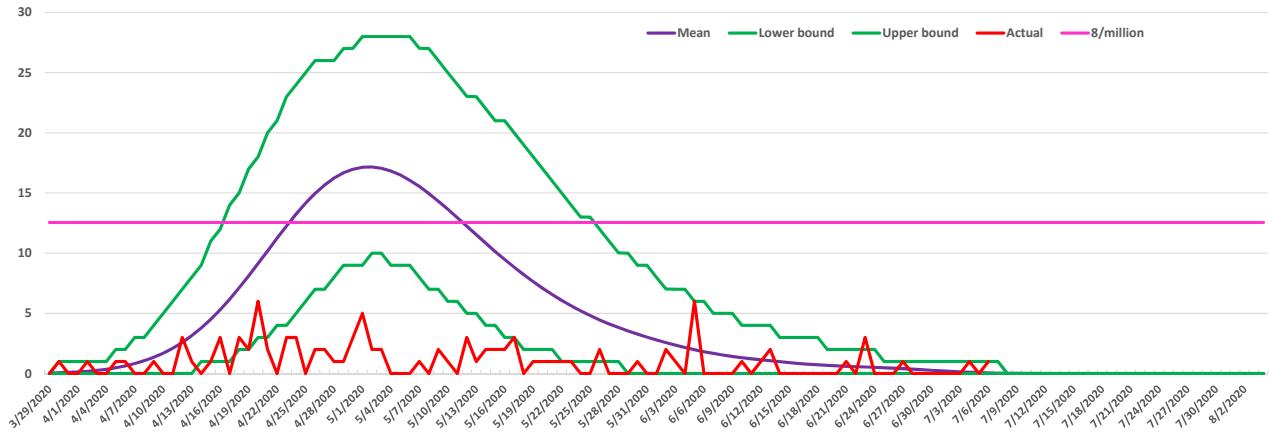
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Virginia COVID 19 Daily Death Projections March 26



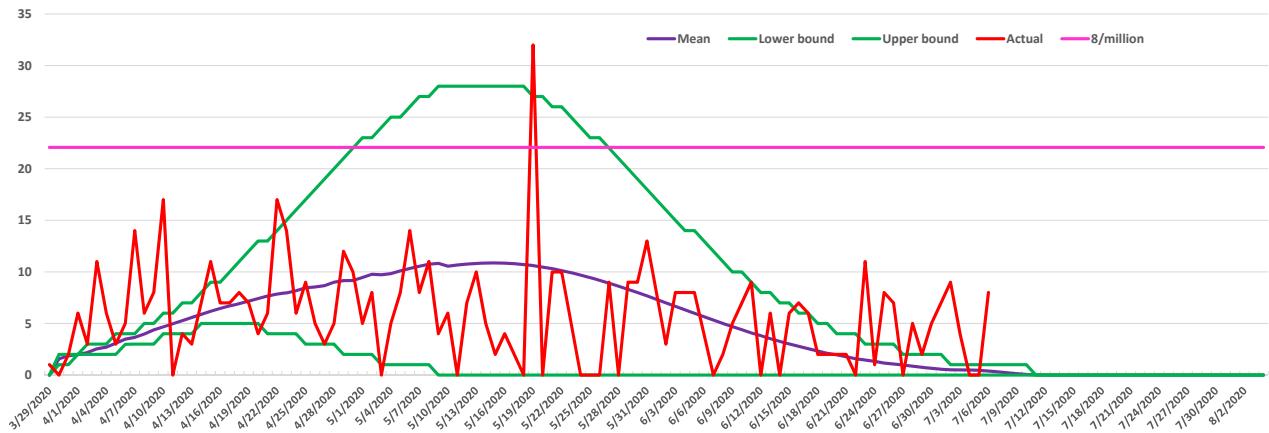
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West Virginia COVID 19 Daily Death Projections March 26



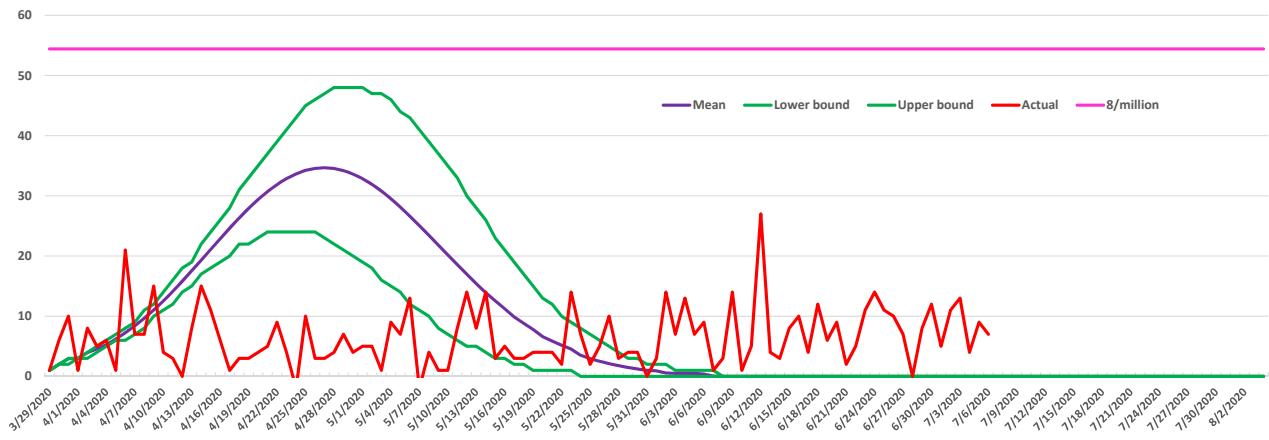
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Kentucky COVID 19 Daily Death Projections March 26



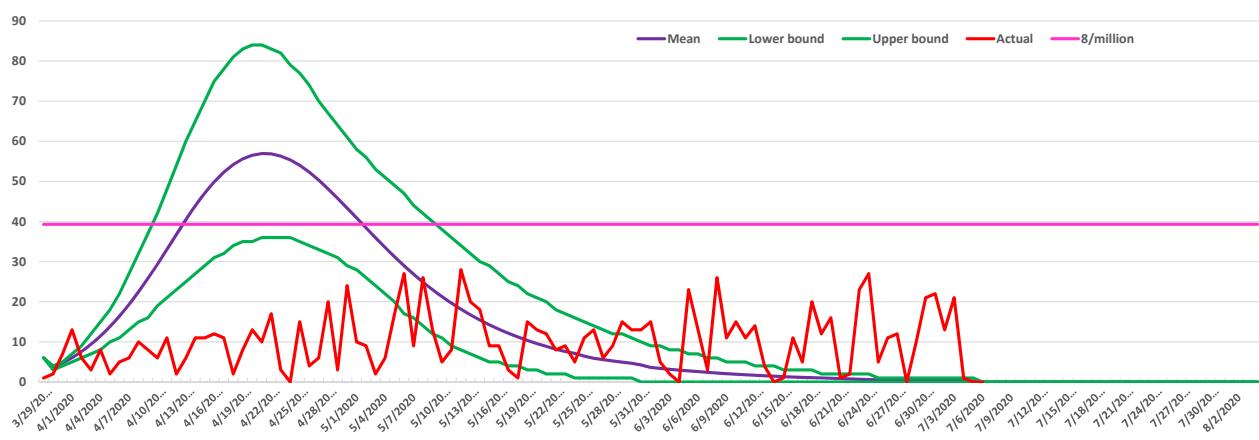
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Tennessee COVID 19 Daily Death Projections March 26



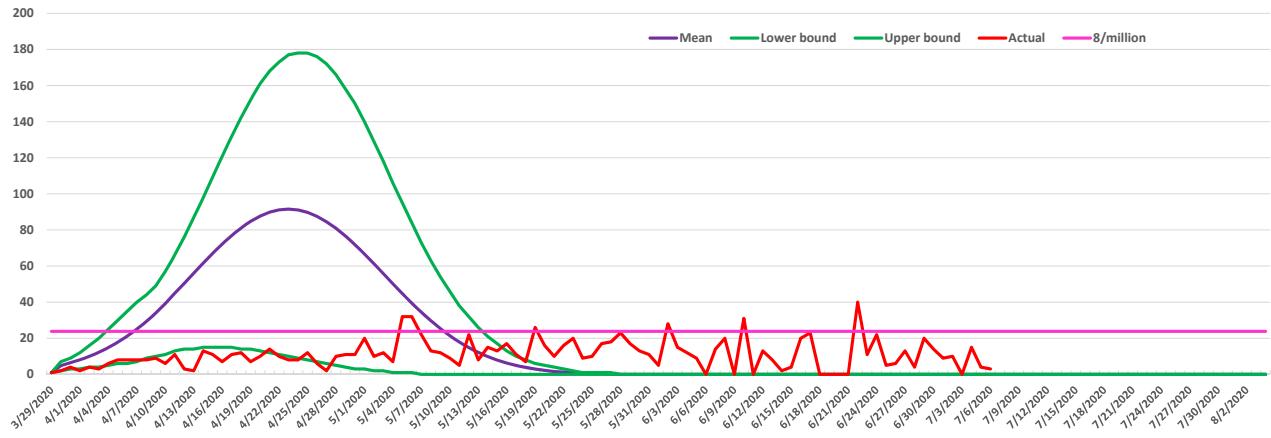
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Alabama COVID 19 Daily Death Projections March 26



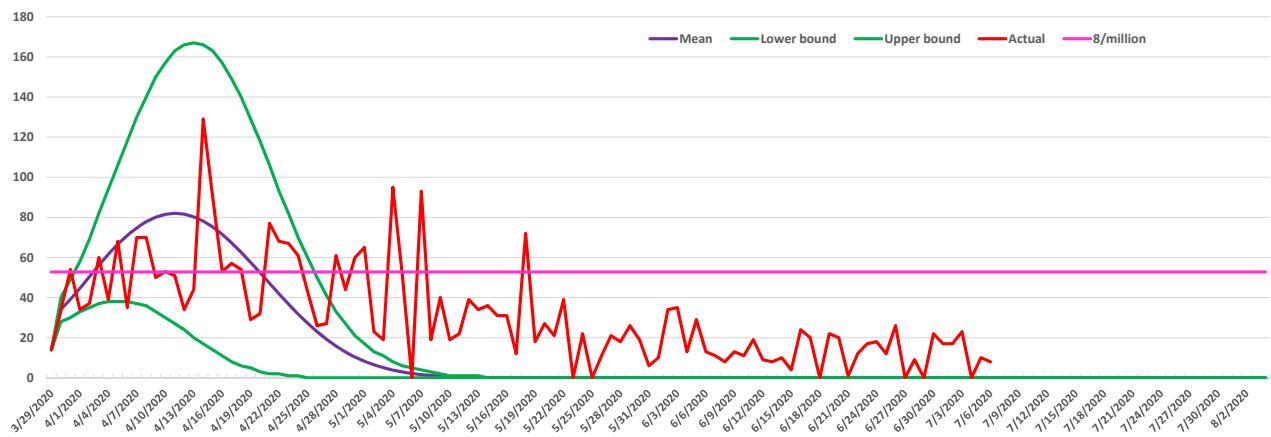
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Mississippi COVID 19 Daily Death Projections March 26



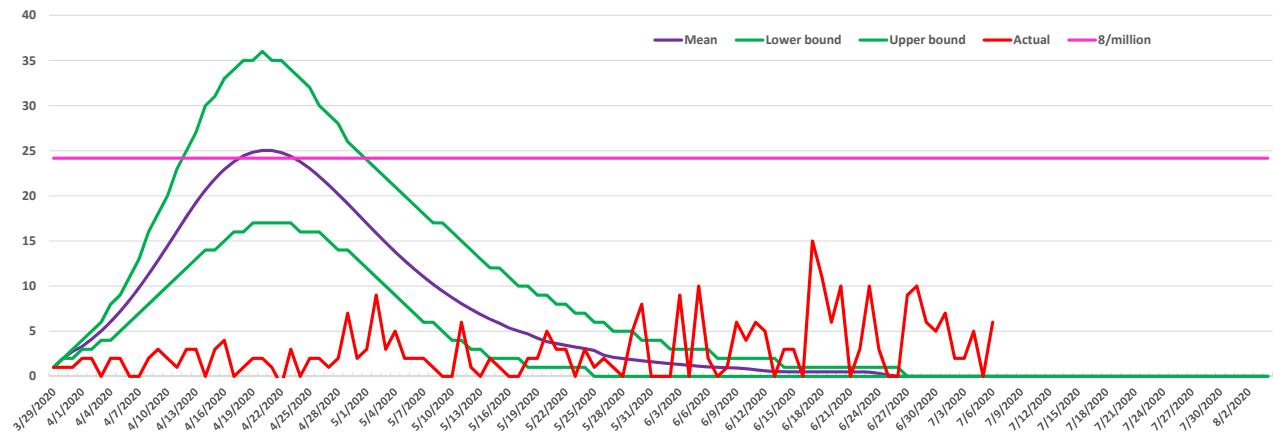
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Louisiana COVID 19 Daily Death Projections March 26



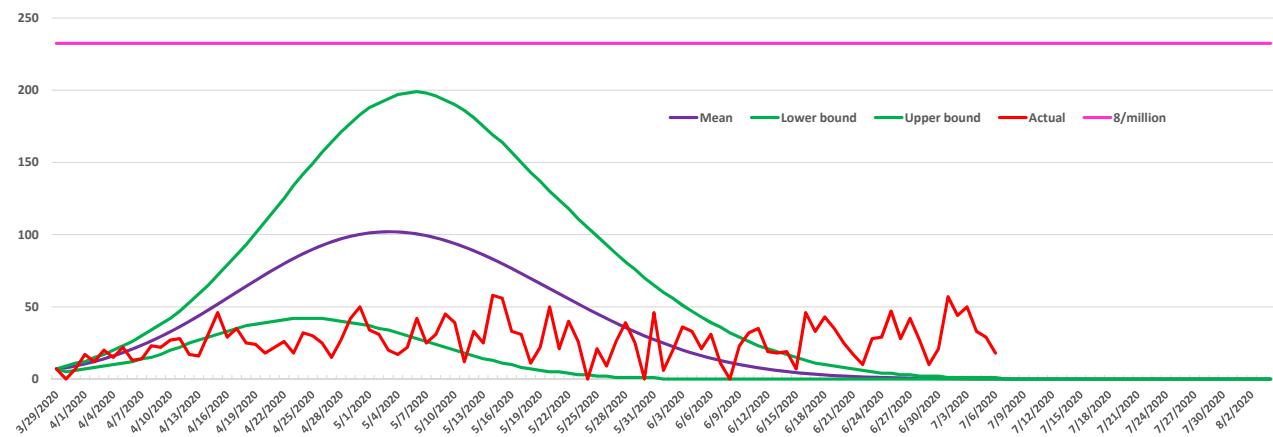
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Arkansas COVID 19 Daily Death Projections March 26



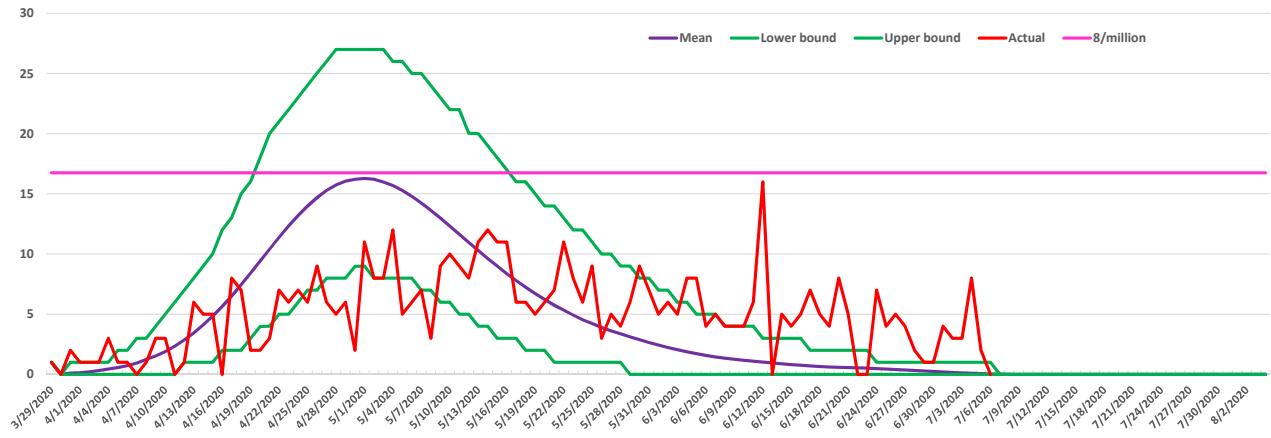
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Texas COVID 19 Daily Death Projections March 26



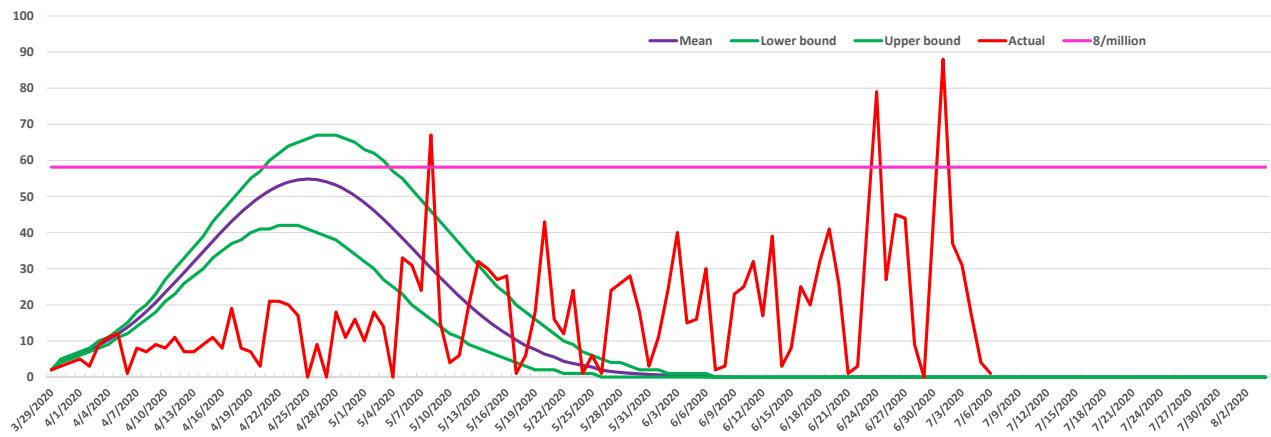
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New Mexico COVID 19 Daily Death Projections March 26



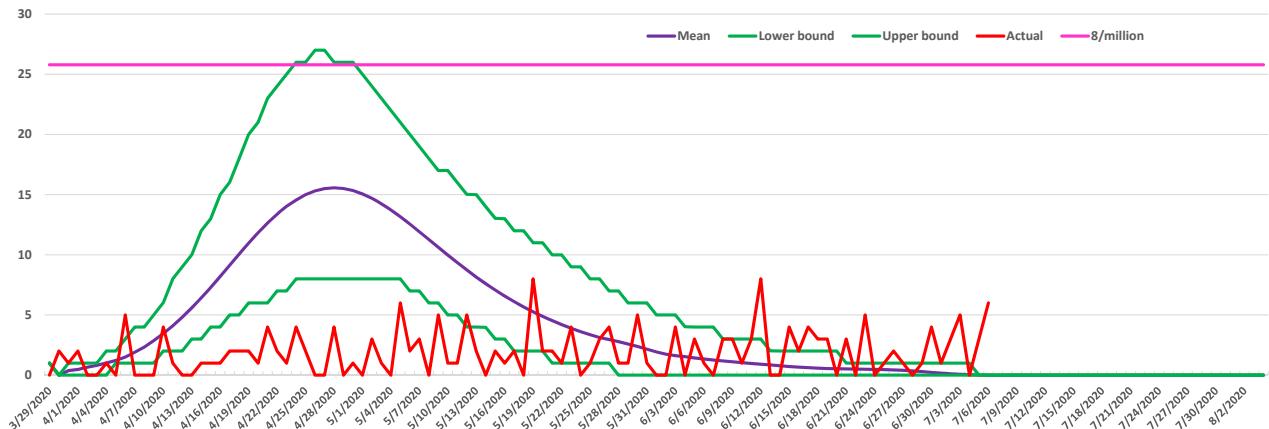
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Arizona COVID 19 Daily Death Projections March 26



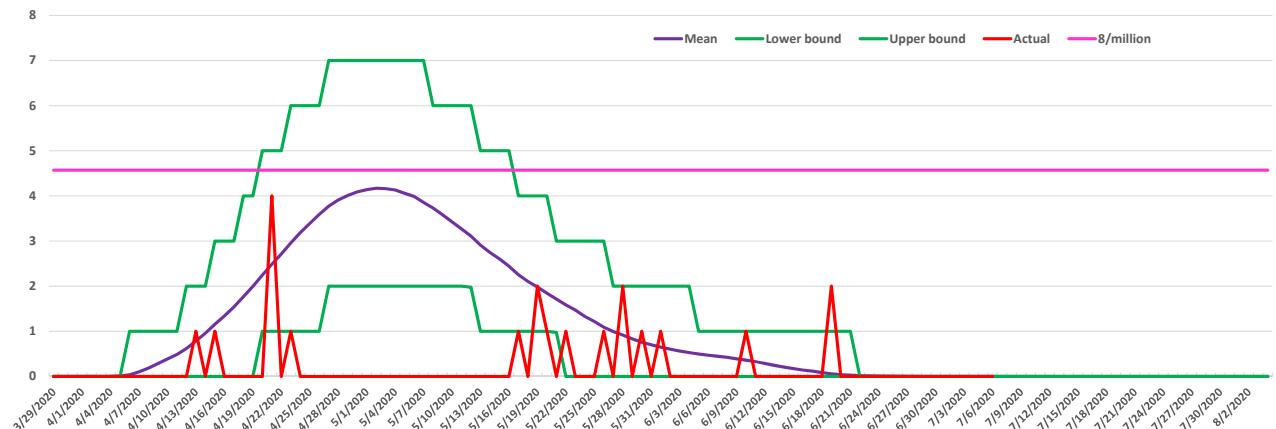
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Utah COVID 19 Daily Death Projections March 26



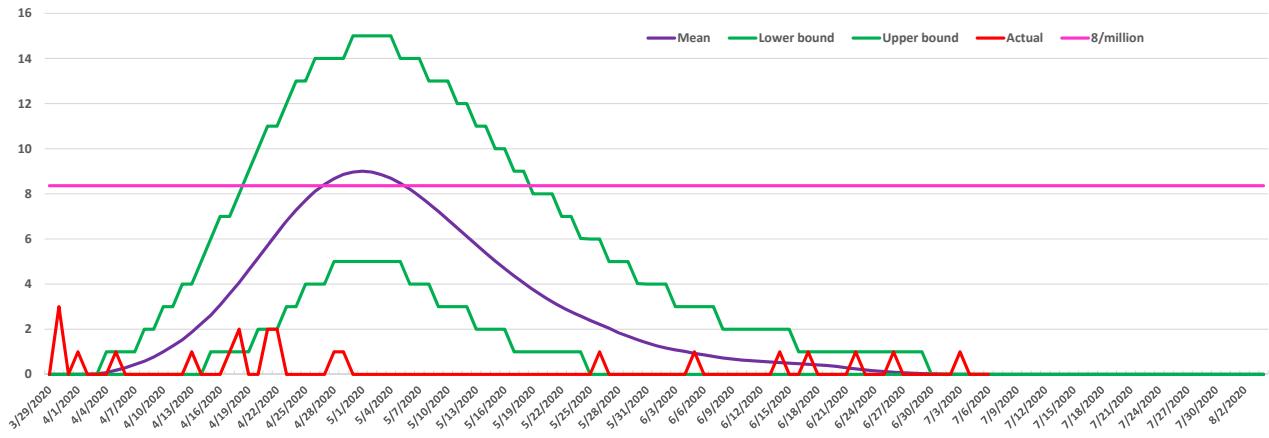
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Wyoming COVID 19 Daily Death Projections March 26



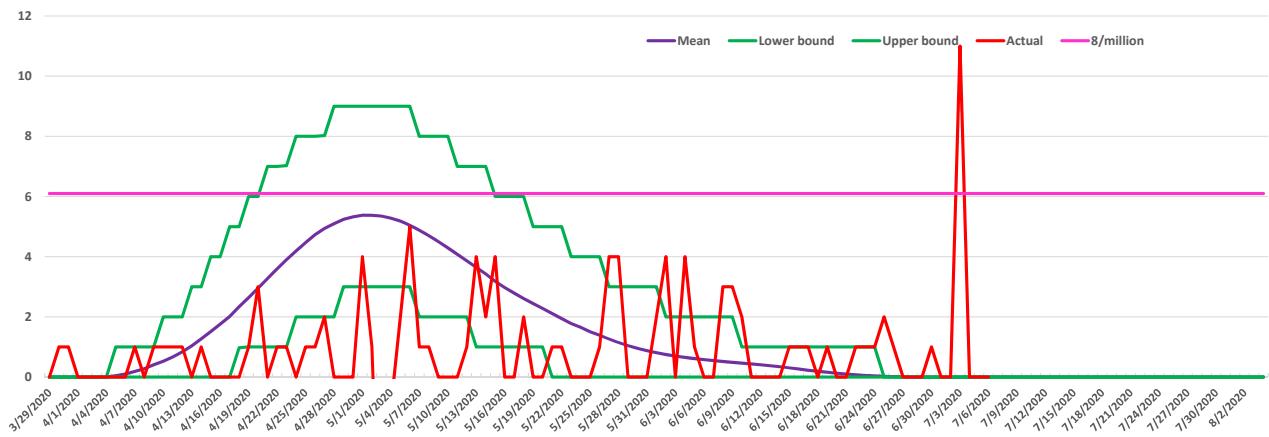
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Montana COVID 19 Daily Death Projections March 26



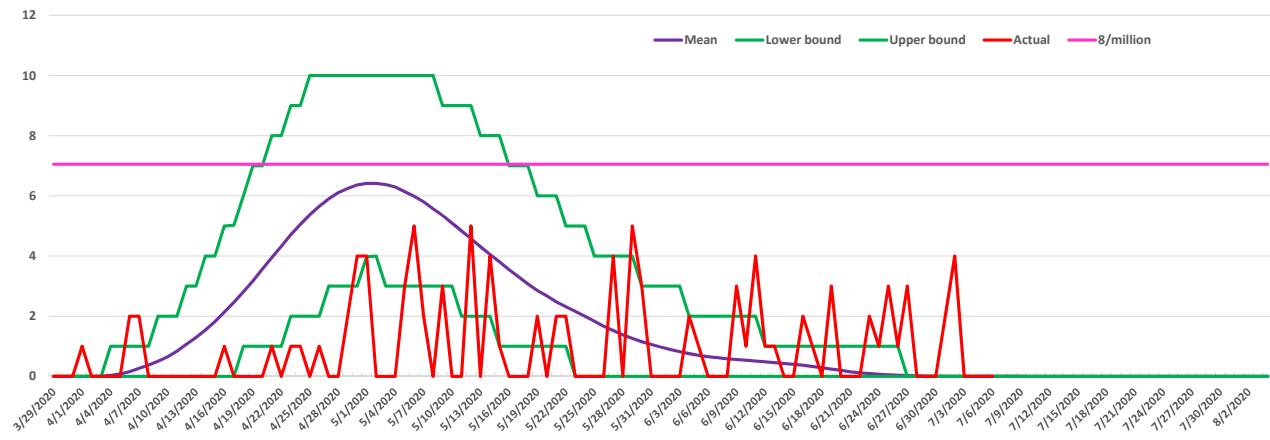
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North Dakota COVID 19 Daily Death Projections March 26



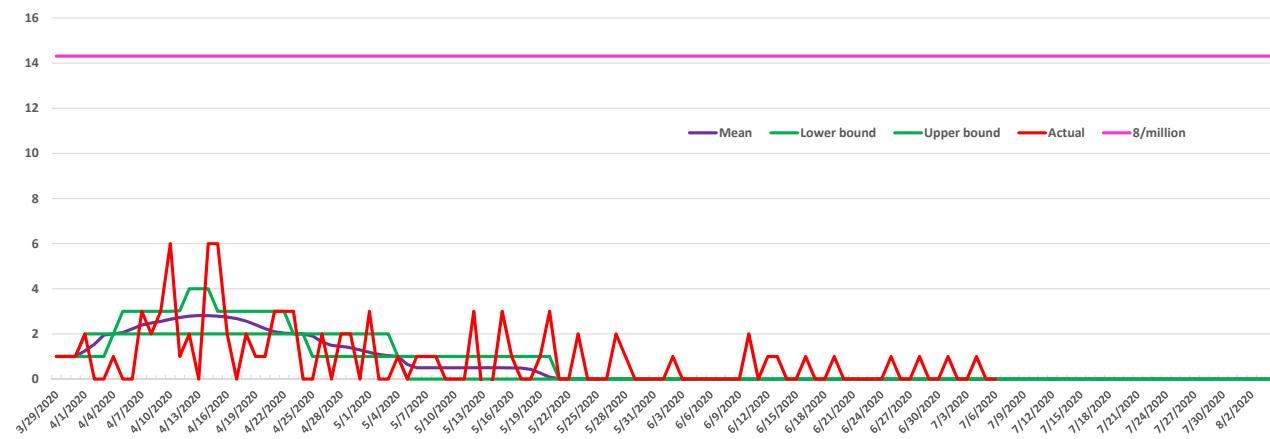
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South Dakota COVID 19 Daily Death Projections March 26



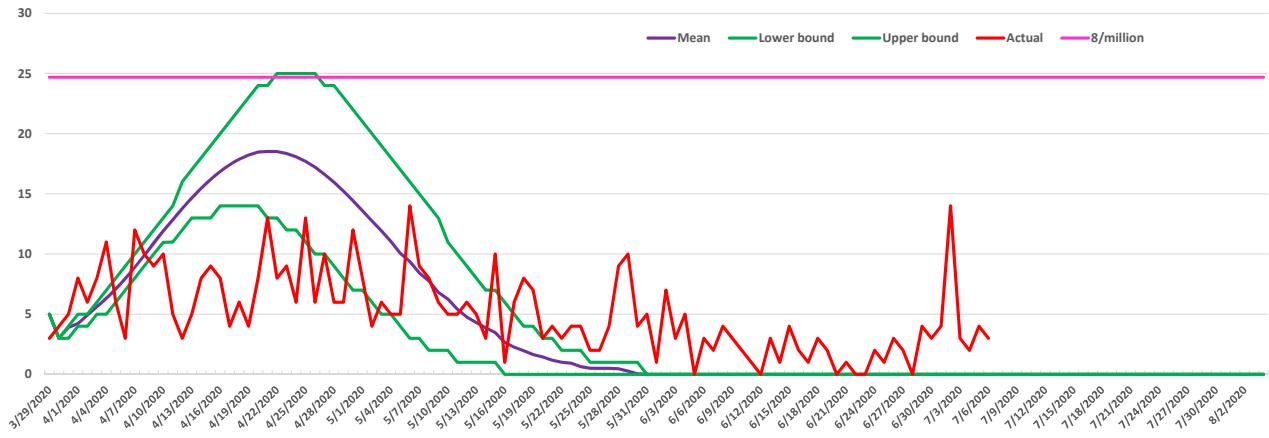
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Idaho COVID 19 Daily Death Projections March 26



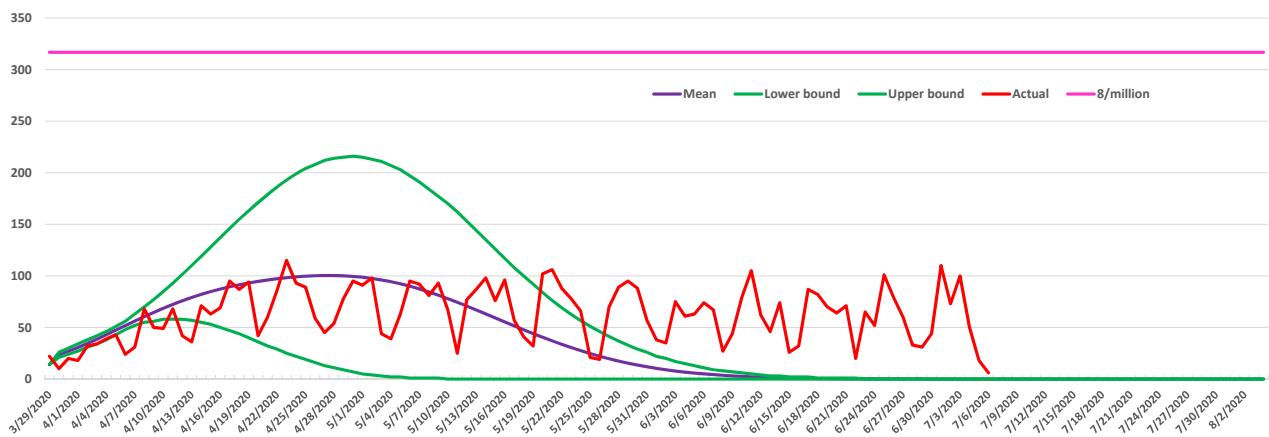
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Nevada COVID 19 Daily Death Projections March 26



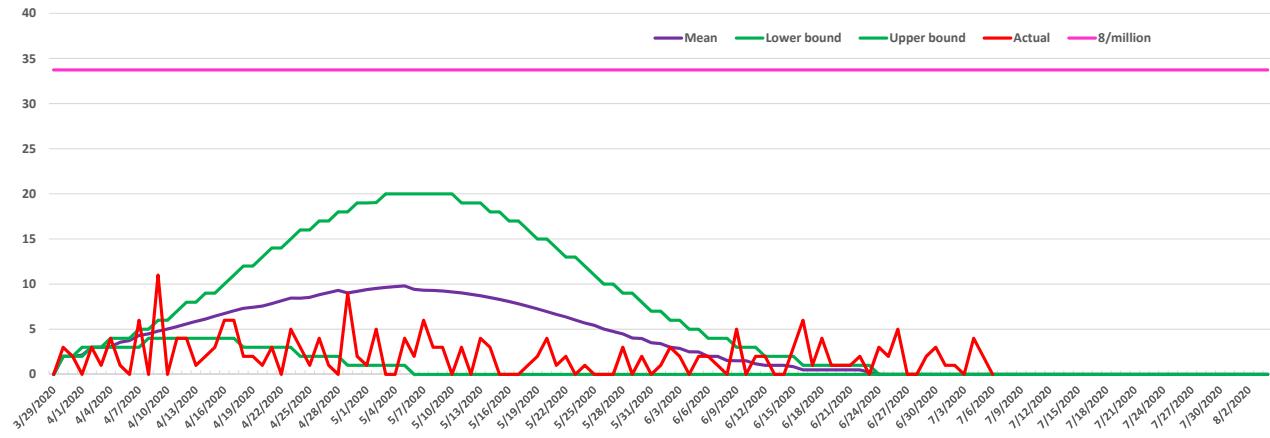
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California COVID 19 Daily Death Projections March 26



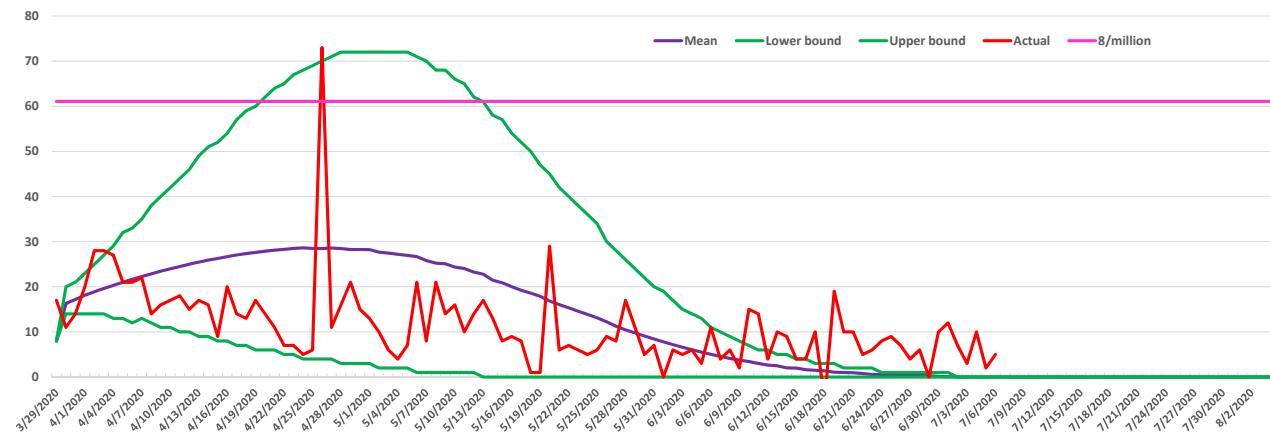
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Oregon COVID 19 Daily Death Projections March 26



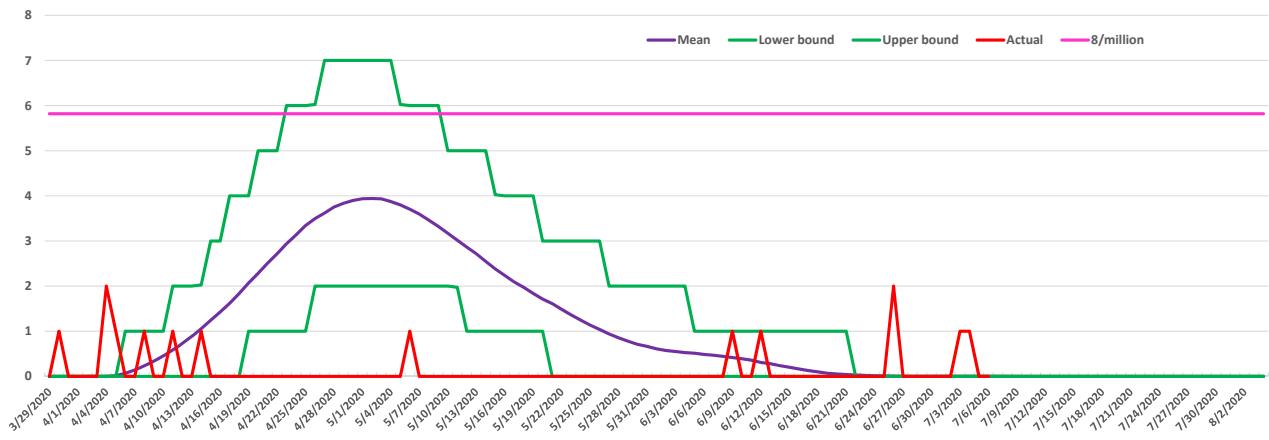
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Washington COVID 19 Daily Death Projections March 26



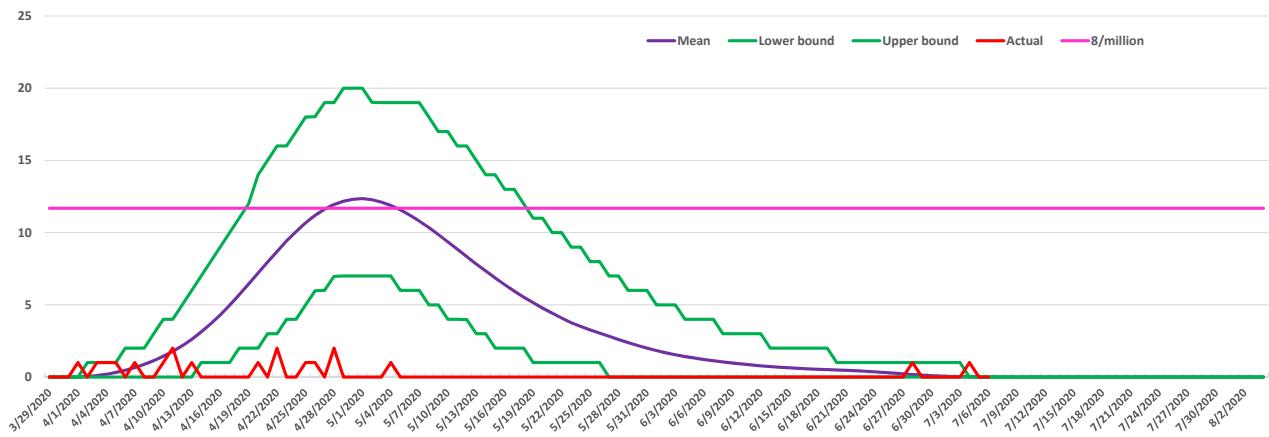
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Alaska COVID 19 Daily Death Projections March 26



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Hawaii COVID 19 Daily Death Projections March 26



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Cumulative Death Projections

- Comparing July 6th 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
- Six states are above the mean but within the 95% confidence interval
 - Arizona, California, Georgia, Idaho, Louisiana, New Hampshire
- Nineteen states are below the mean but within the 95% confidence interval
 - Florida, Kentucky, Minnesota, Mississippi, Missouri, Nebraska, Nevada, New Mexico, North Carolina, North Dakota, Oregon, South Carolina, South Dakota, Tennessee, Texas, Vermont, Virginia, Washington, Wisconsin
- Thirteen states are below the mean and below the 95% confidence interval
 - Alabama, Alaska, Arkansas, Colorado, Delaware, Hawaii, Kansas, Maine, Montana, Oklahoma, Utah, West Virginia, Wyoming



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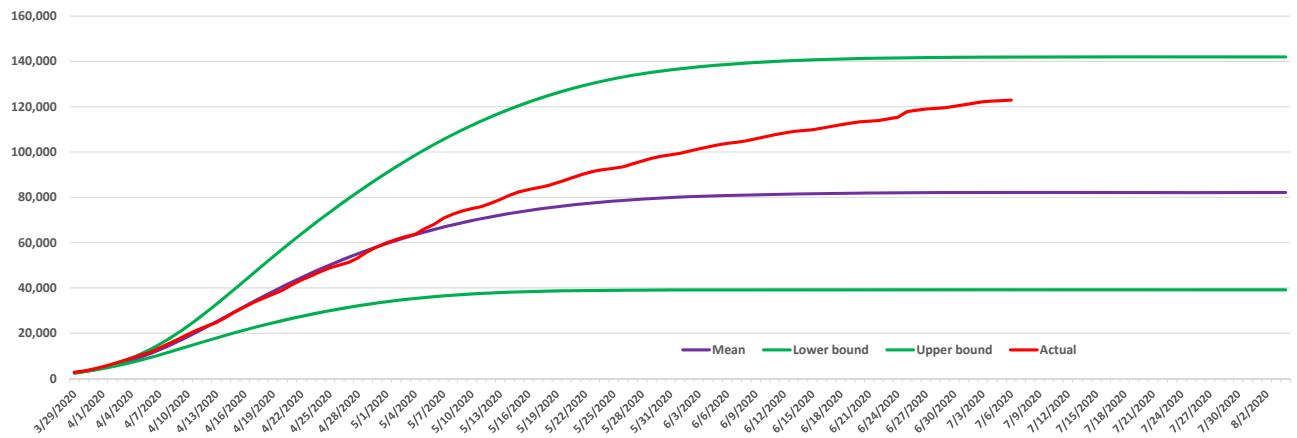
Concluding Thoughts

- The distribution of death by age group for COVID 19 continues to be similar to the distribution of death from all causes
- The U.S. infection rate is 0.93%
- Since June 1, the trend analysis in daily death has been a reduction of 9.77 deaths
- Using IHME's metric of 8 deaths per million as a indicator for economic shutdown, only seven states are relatively close or above that metric
- Thirty states have had a decreasing trend for daily deaths, fourteen have experienced an increasing trend
- The U.S. Cumulative Death Total through July 6th is above the mean but within the 95% confidence band



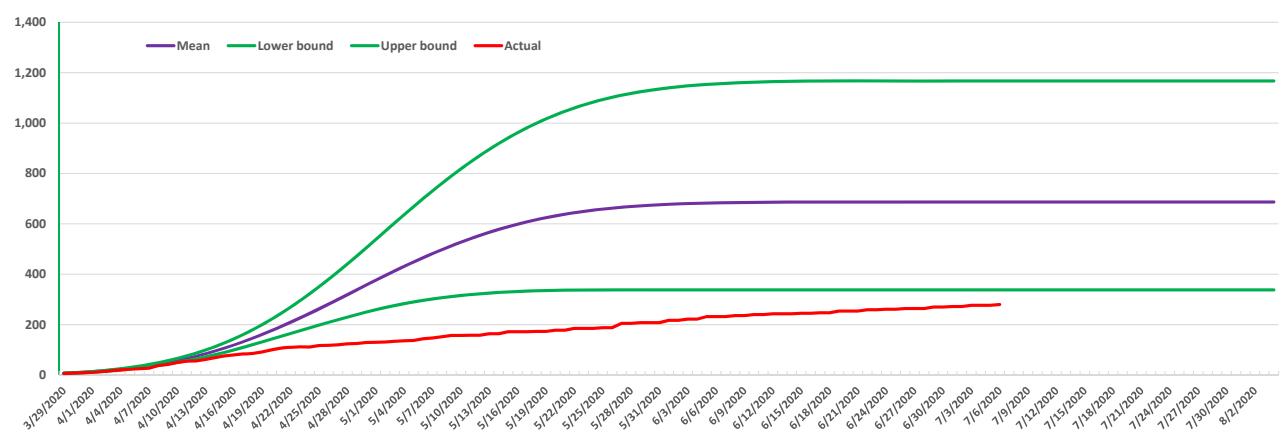
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U.S. COVID 19 Cumulative Death Projections



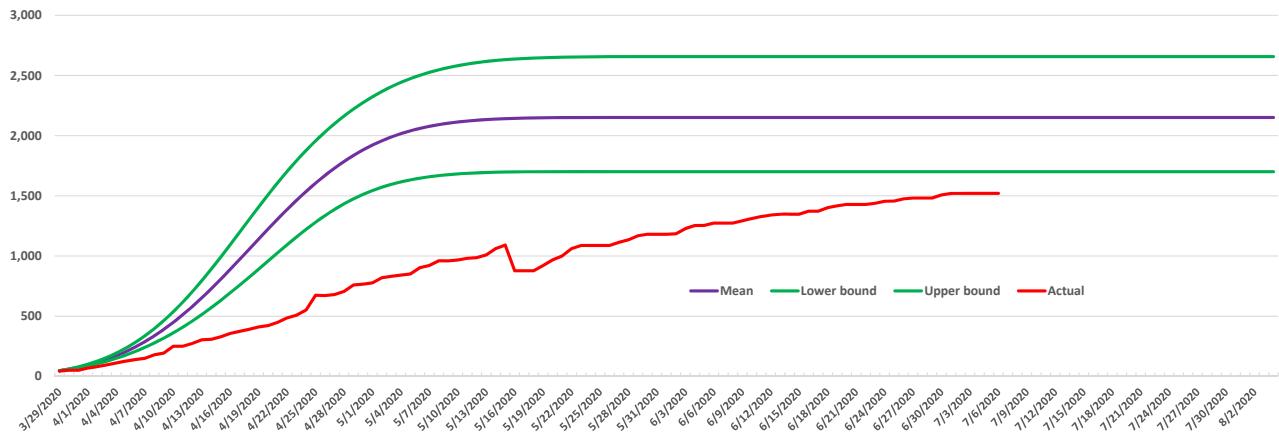
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Kansas COVID 19 Cumulative Death Projections



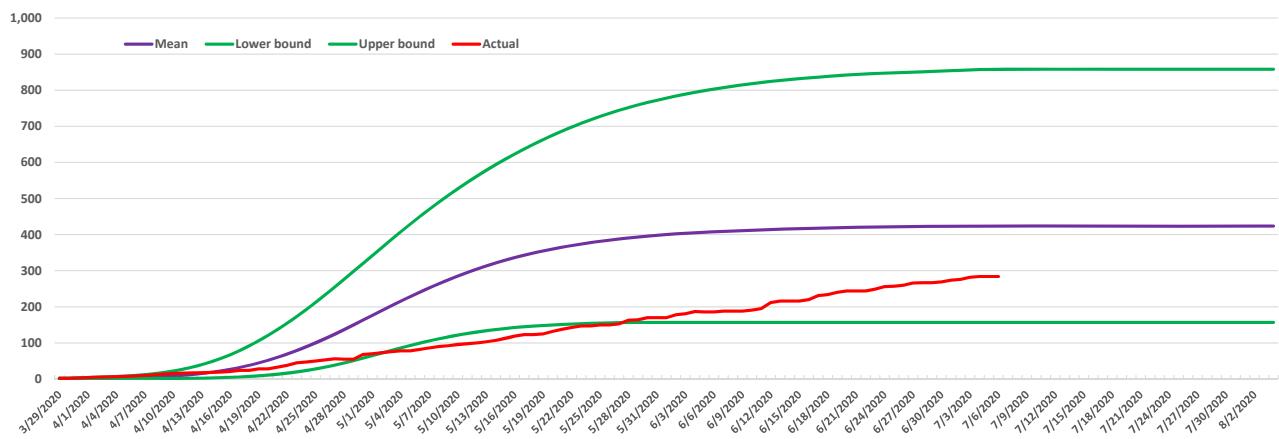
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Colorado COVID 19 Cumulative Death Projections March 26



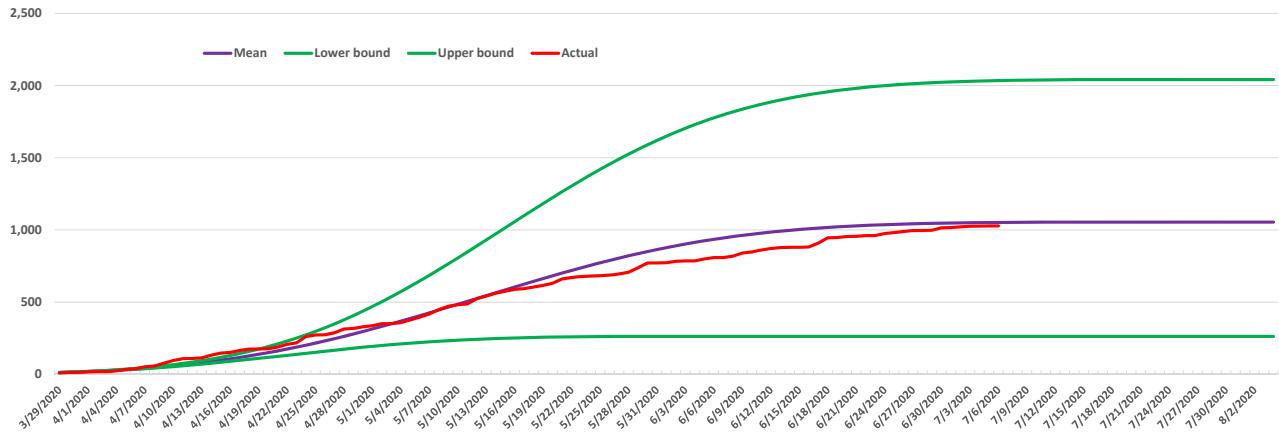
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Nebraska COVID 19 Daily Death Projections March 26



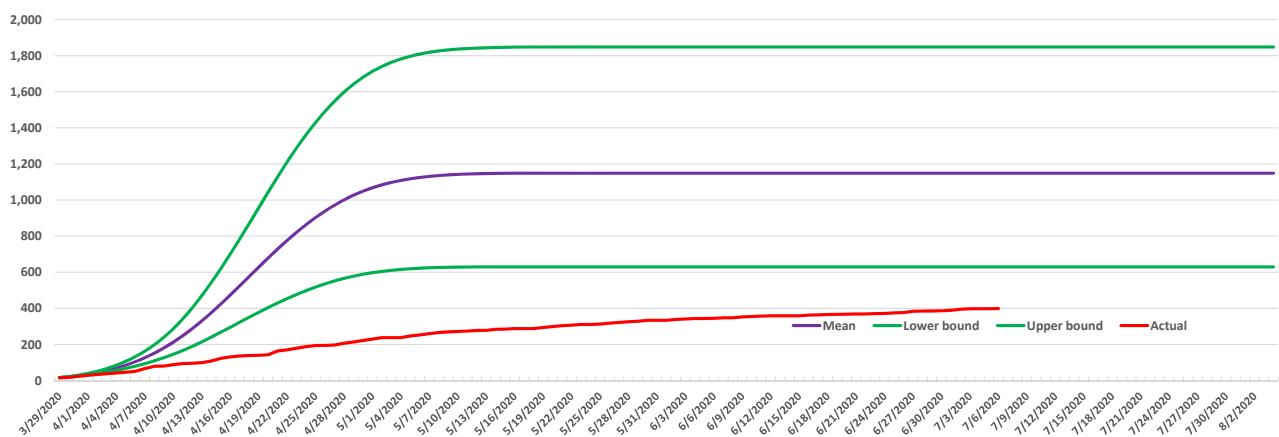
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Missouri COVID 19 Cumulative Death Projections March 26



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Oklahoma COVID 19 Daily Death Projections March 26



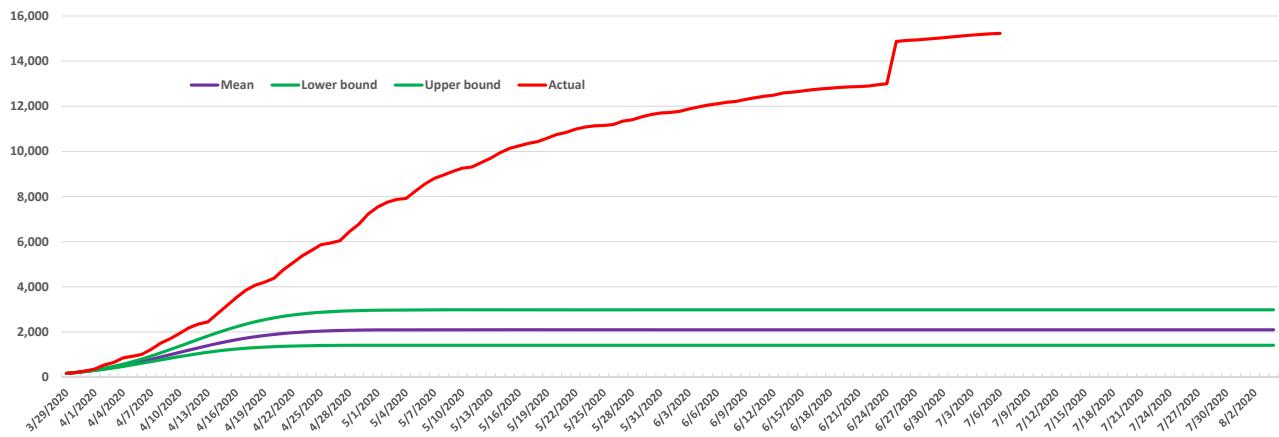
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New York COVID 19 Cumulative Death Projections



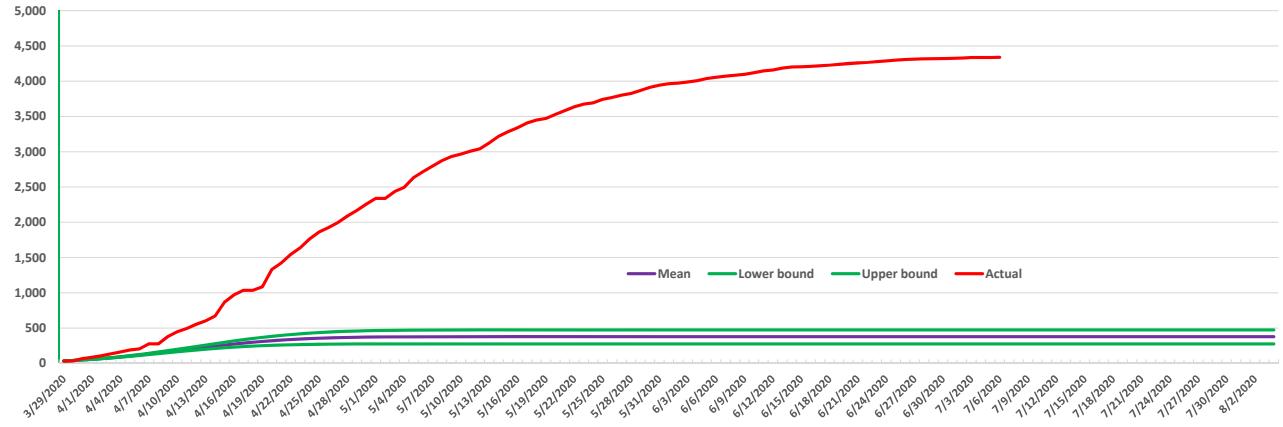
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New Jersey COVID 19 Cumulative Death Projections



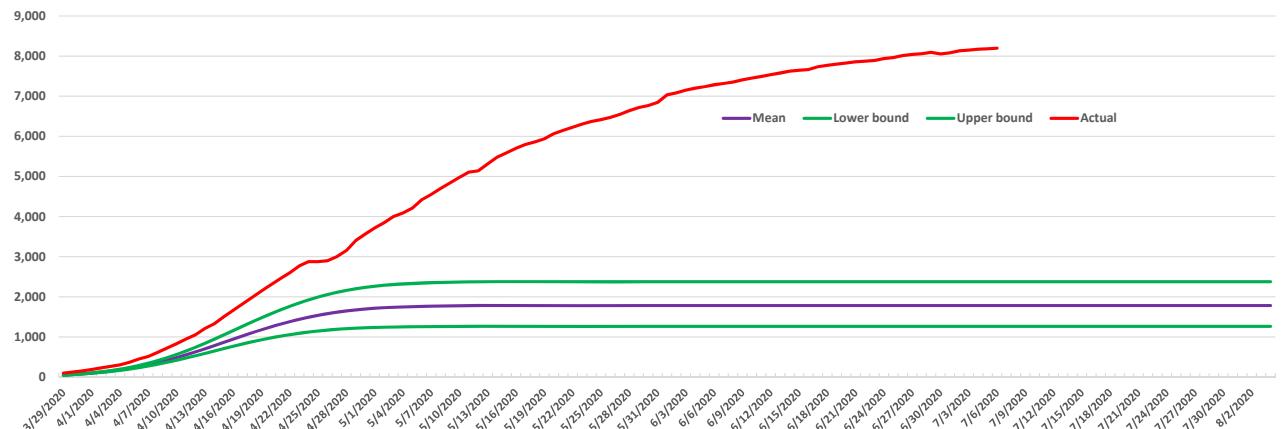
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Connecticut COVID 19 Cumulative Death Projections



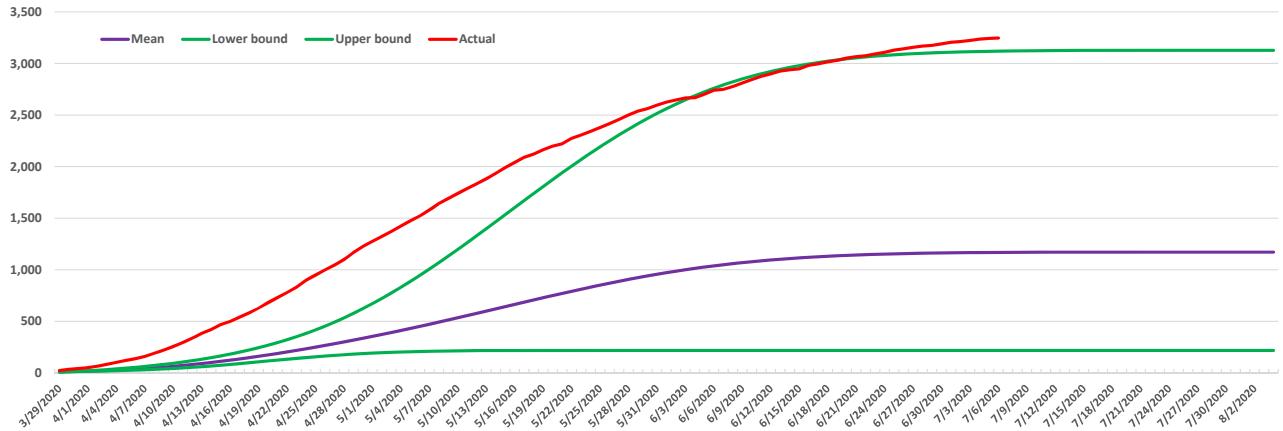
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Massachusetts COVID 19 Cumulative Death Projections



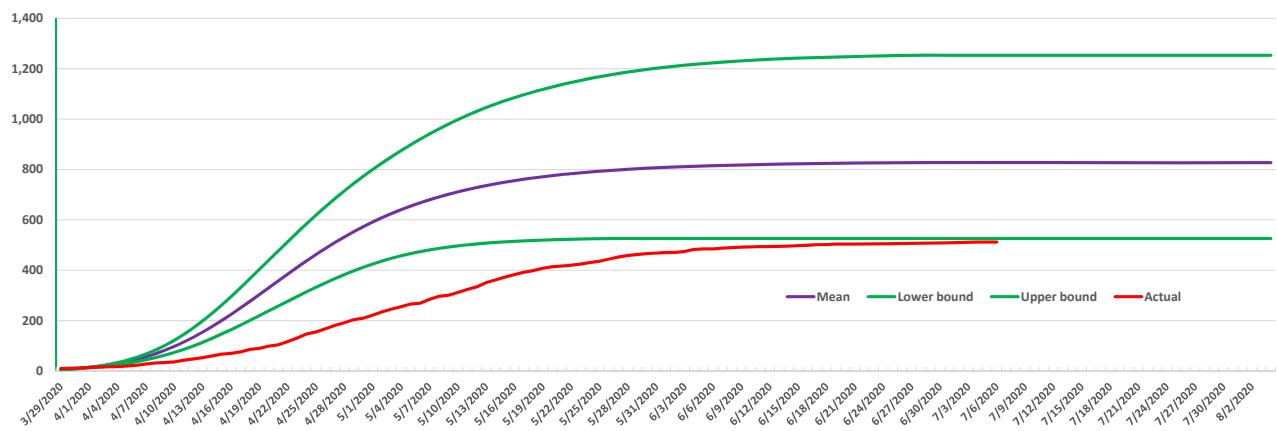
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Maryland COVID 19 Daily Death Projections March 26



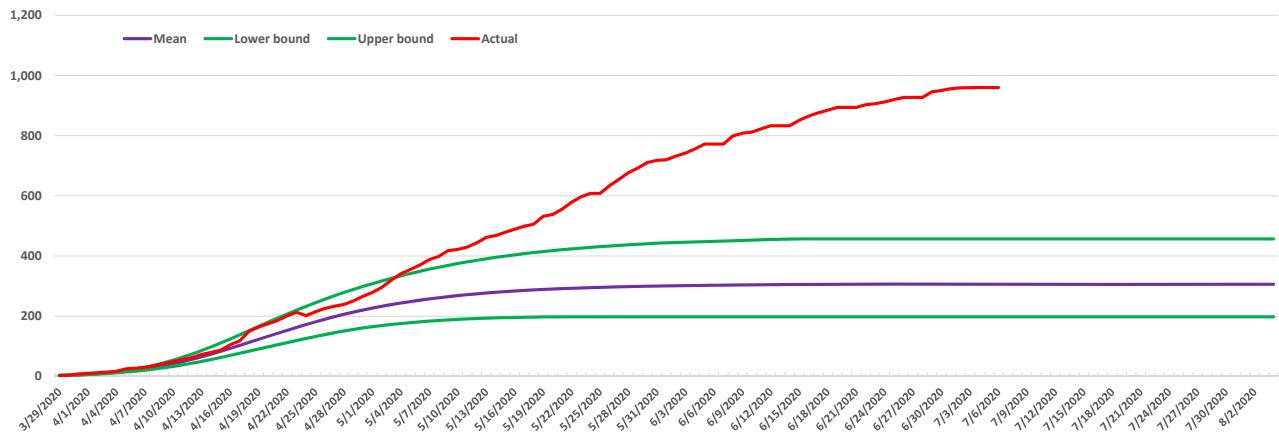
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Delaware COVID 19 Cumulative Death Projections



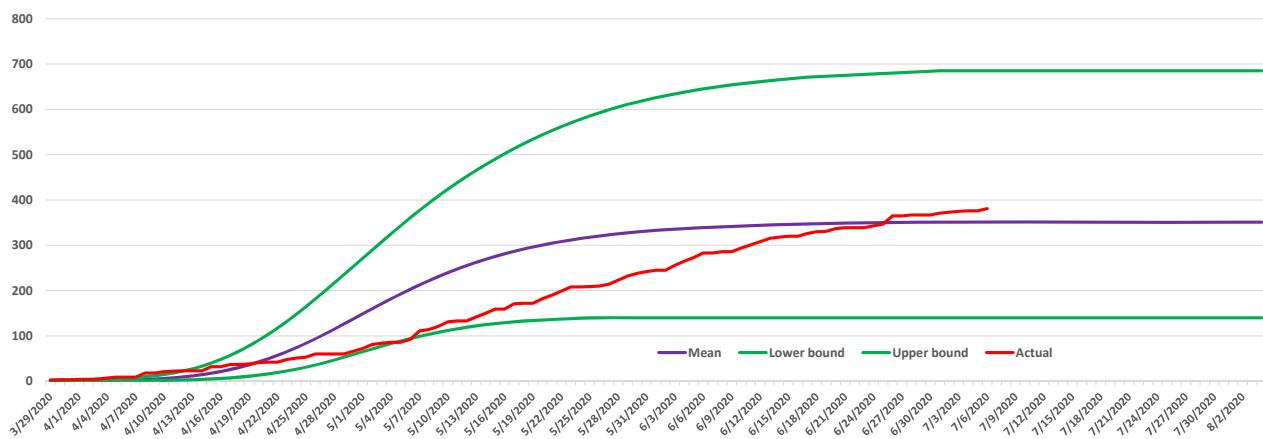
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Rhode Island COVID 19 Cumulative Death Projections March 26



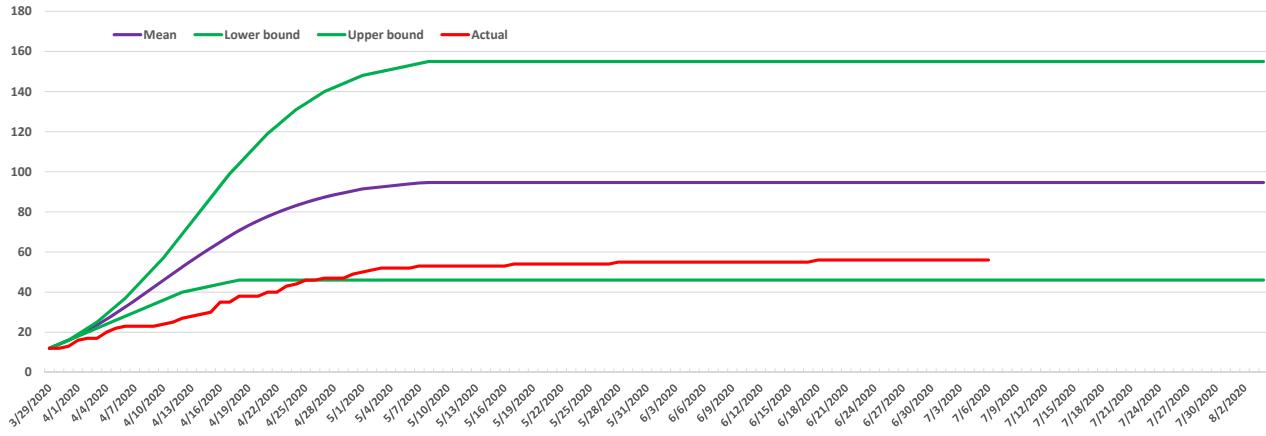
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New Hampshire COVID 19 Cumulative Death Projections



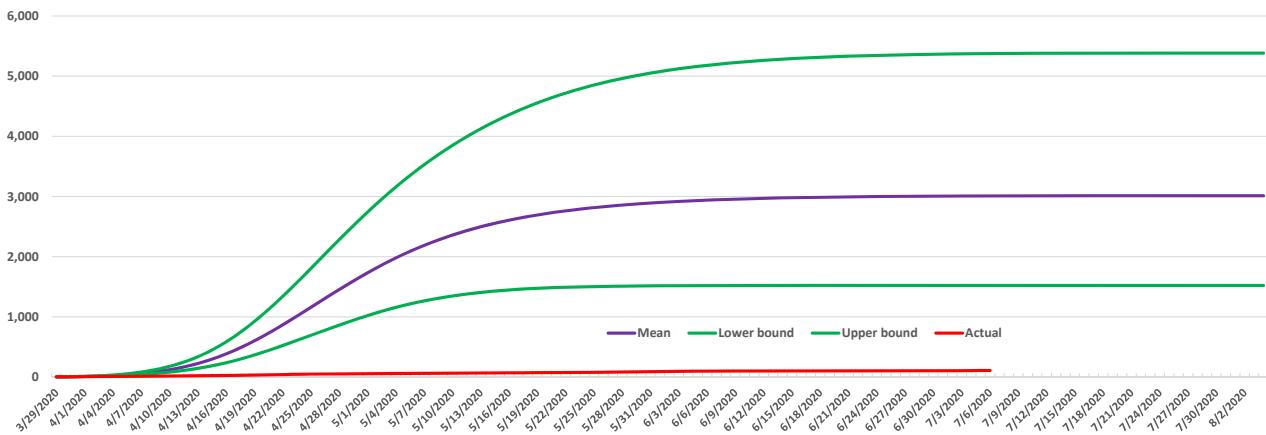
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Vermont COVID 19 Cumulative Death Projections March 26



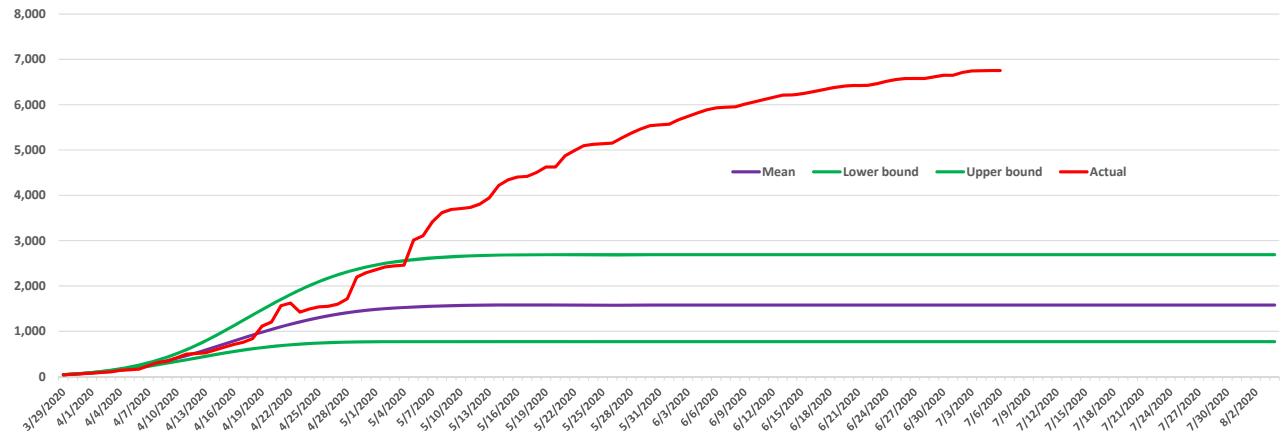
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Maine COVID 19 Cumulative Death Projections



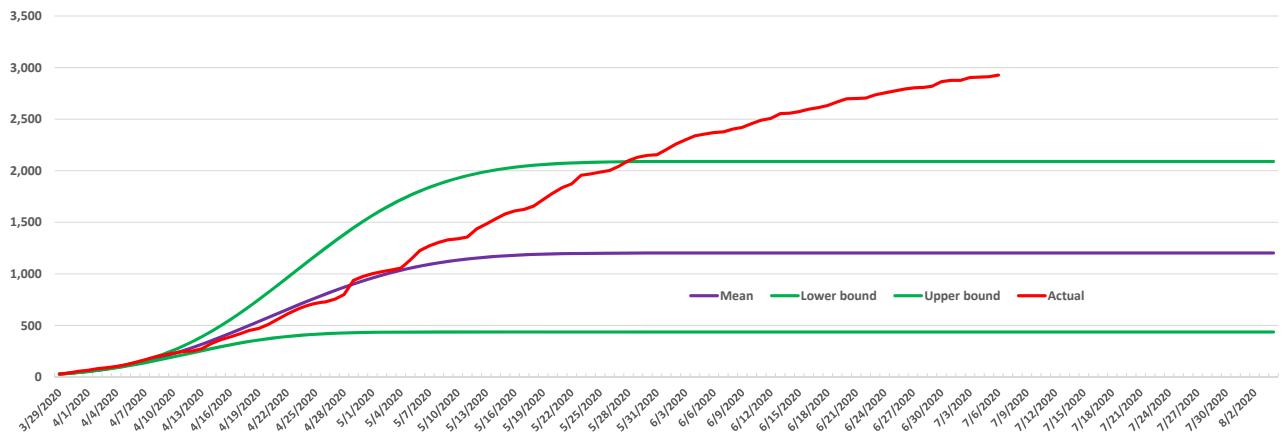
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Pennsylvania COVID 19 Cumulative Death Projections



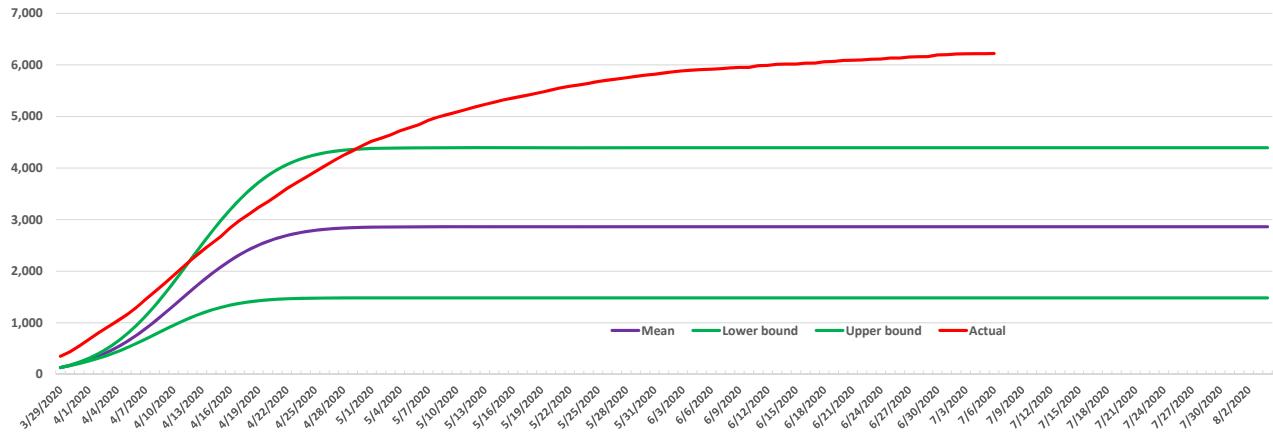
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Ohio COVID 19 Cumulative Death Projections March 26



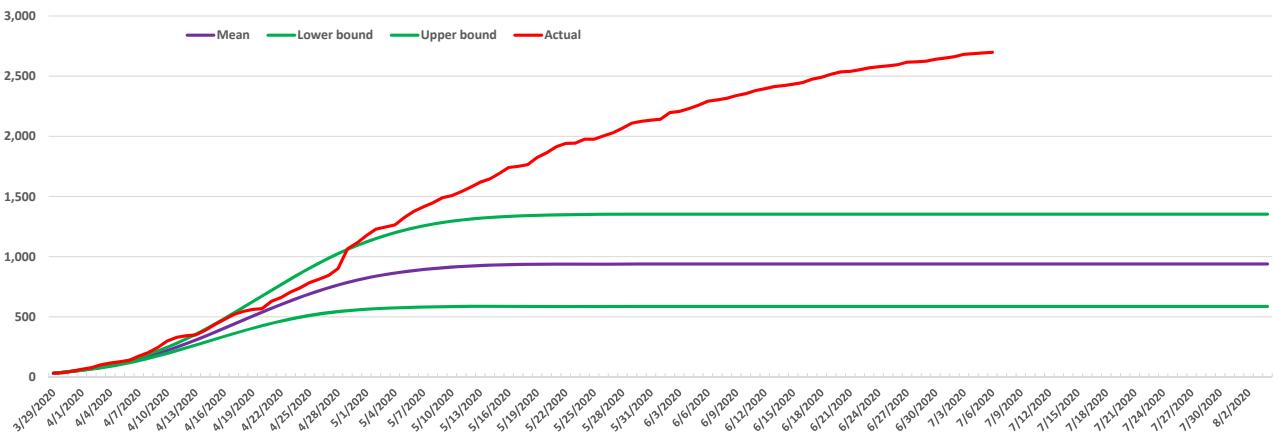
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Michigan COVID 19 Cumulative Death Projections



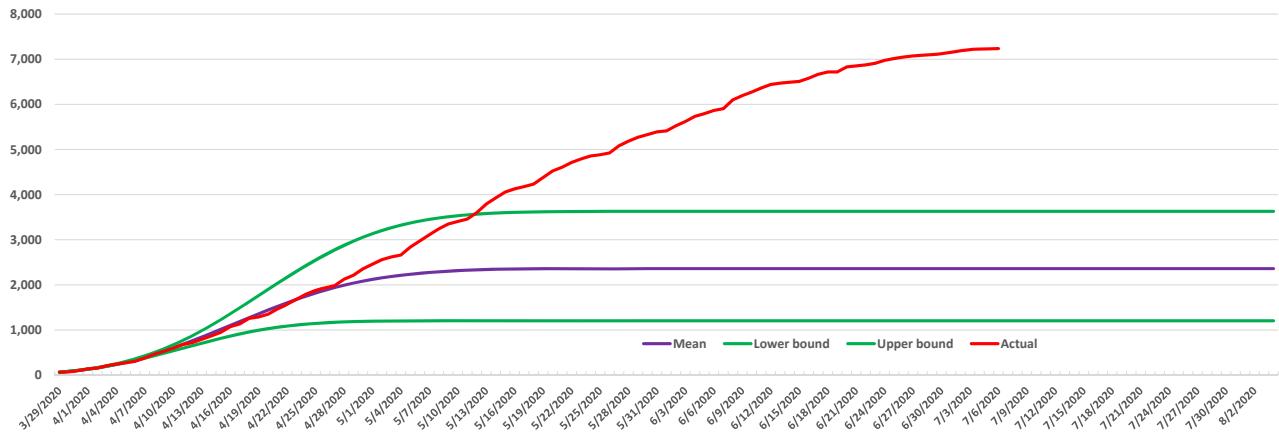
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Indiana COVID 19 Cumulative Death Projections March 26



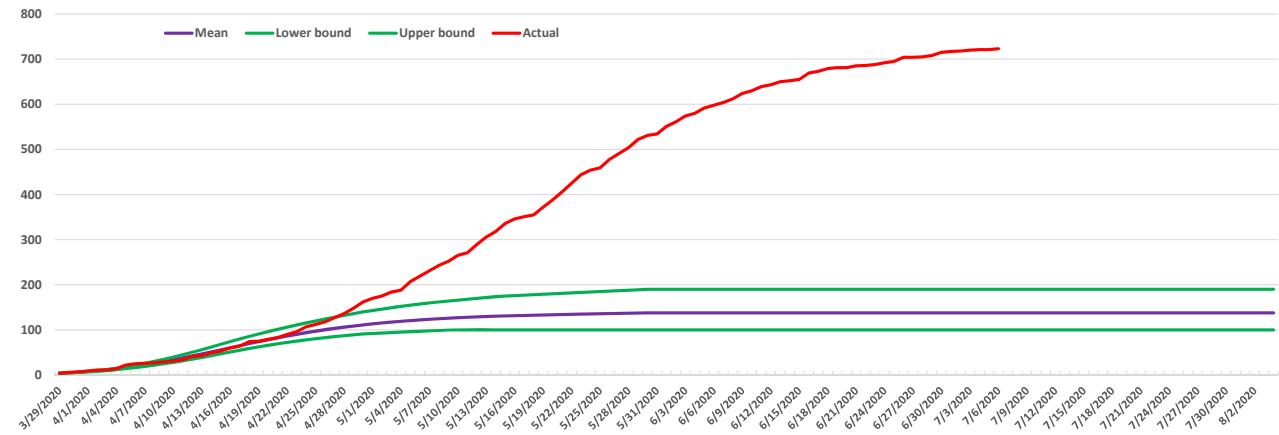
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Illinois COVID 19 Cumulative Death Projections March 26



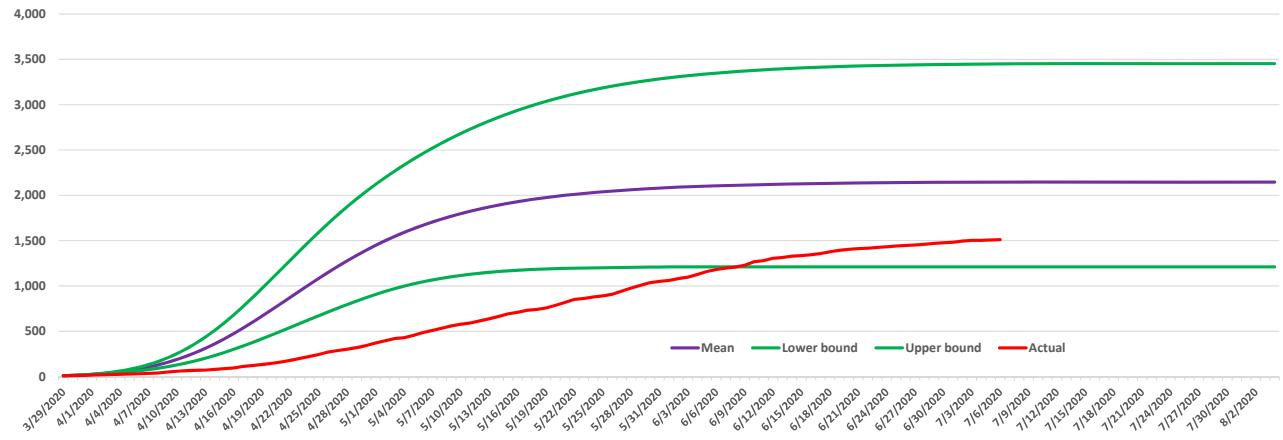
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Iowa COVID 19 Daily Death Projections March 26



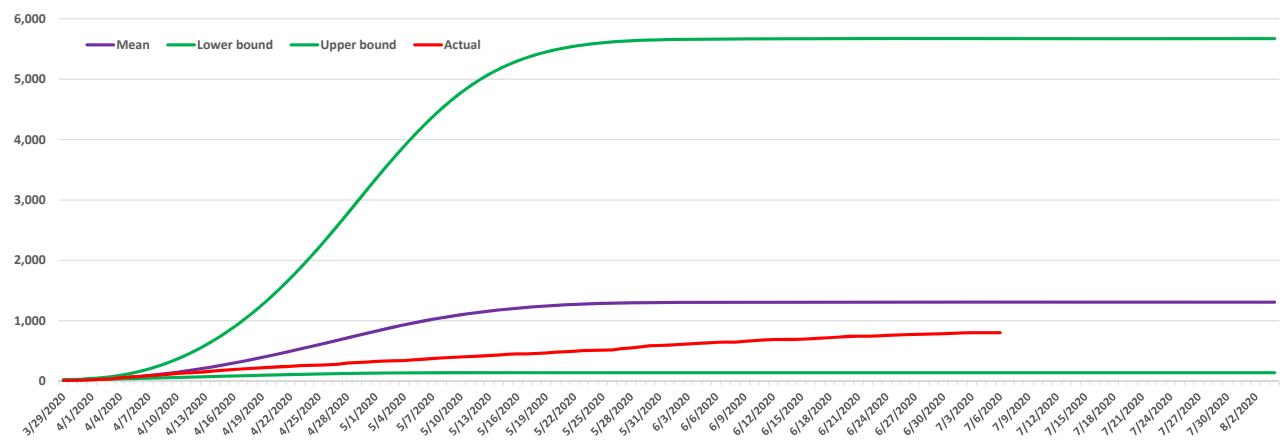
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Minnesota COVID 19 Cumulative Death Projections



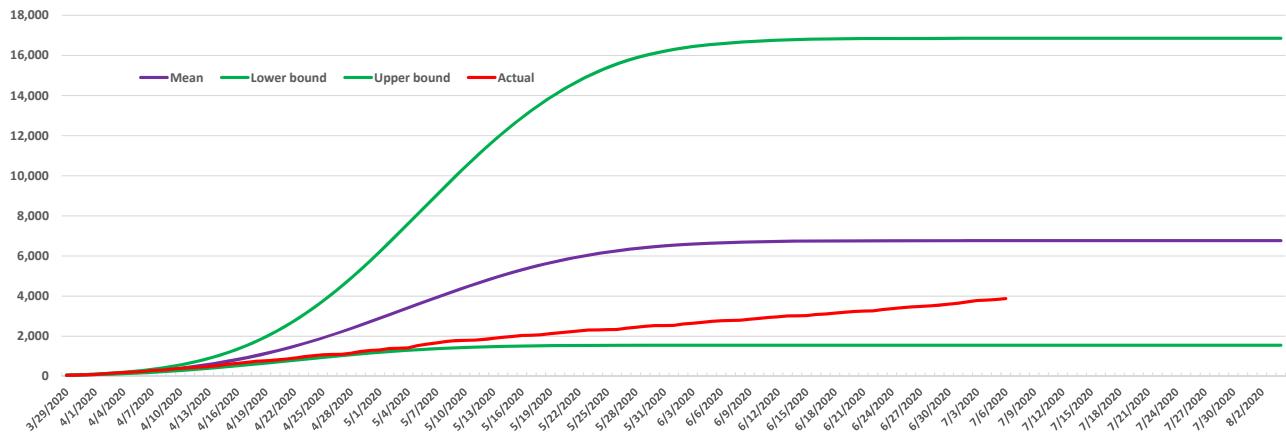
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Wisconsin COVID 19 Cumulative Death Projections



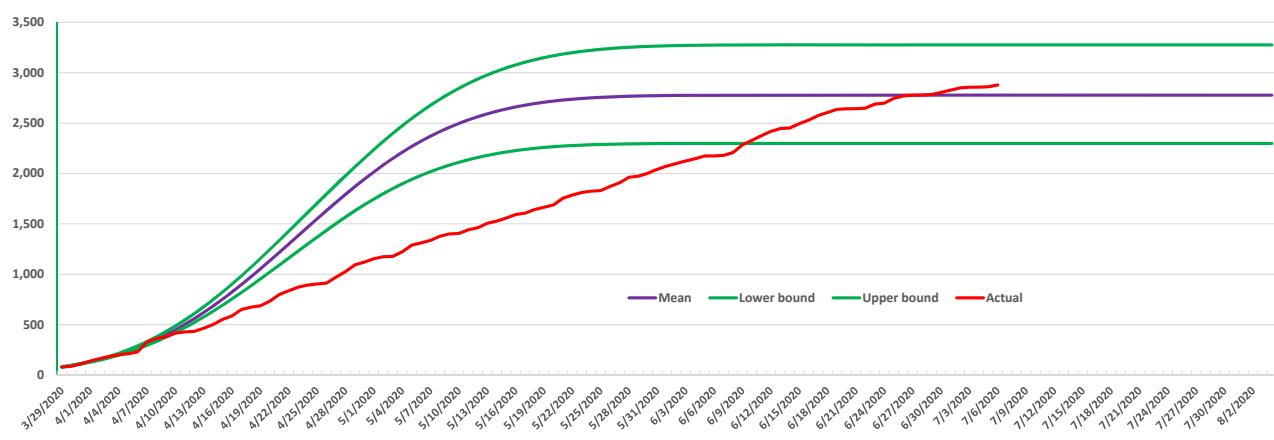
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Florida COVID 19 Cumulative Death Projections March 26



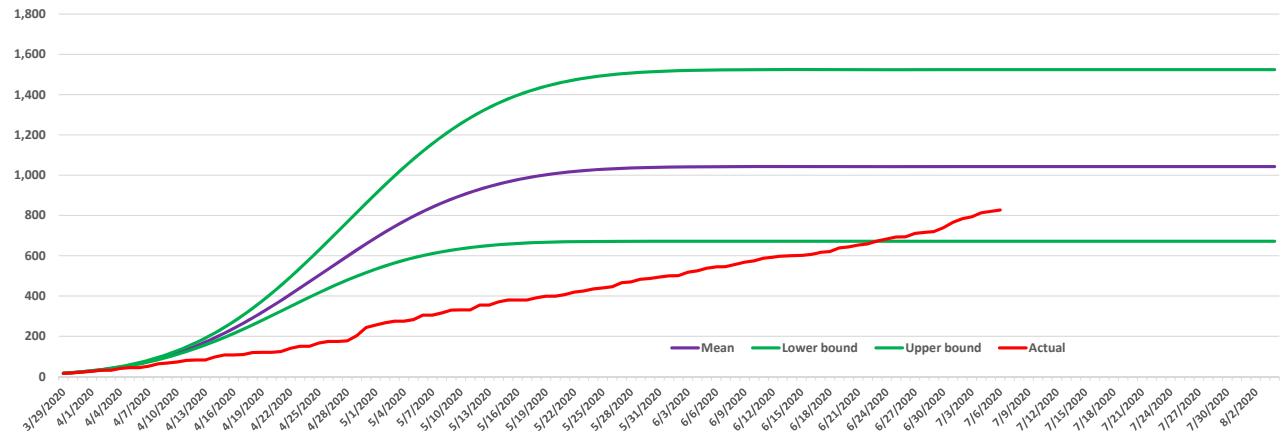
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Georgia COVID 19 Cumulative Death Projections



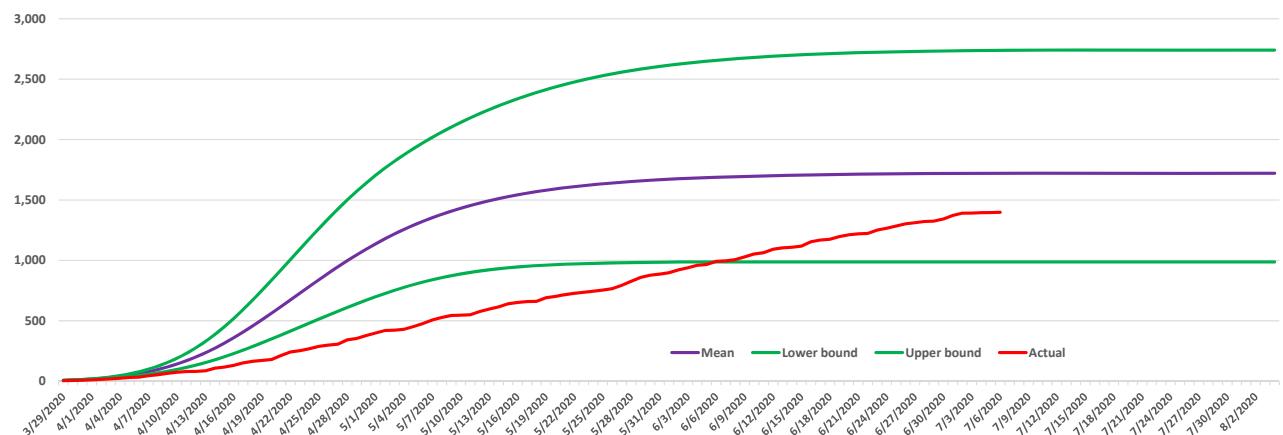
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South Carolina COVID 19 Cumulative Death Projections



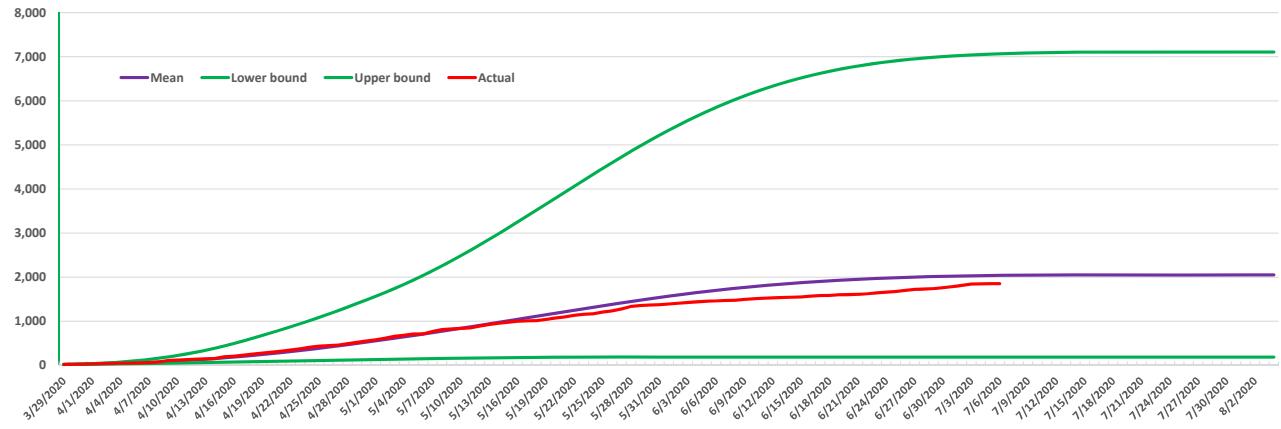
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North Carolina COVID 19 Cumulative Death Projections



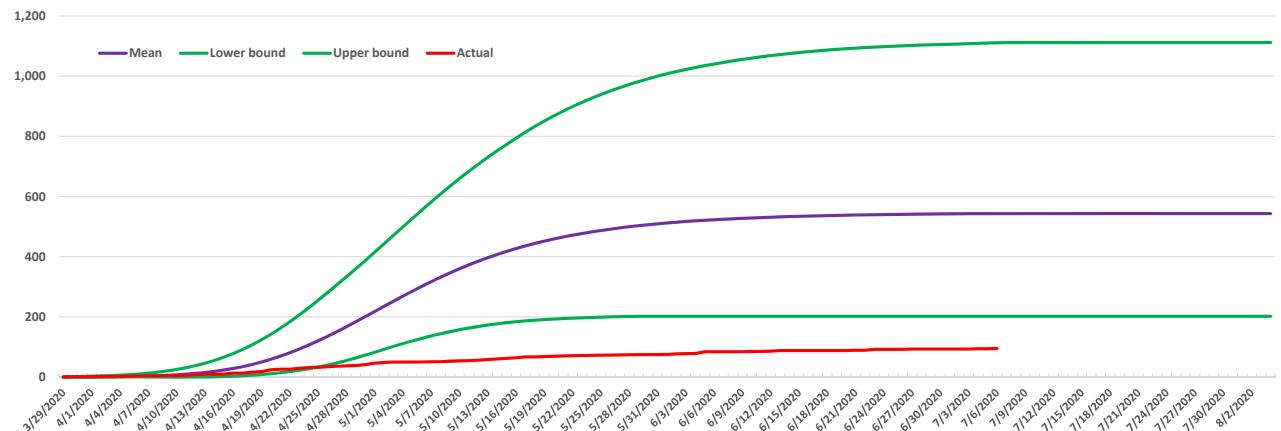
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Virginia COVID 19 Cumulative Death Projections



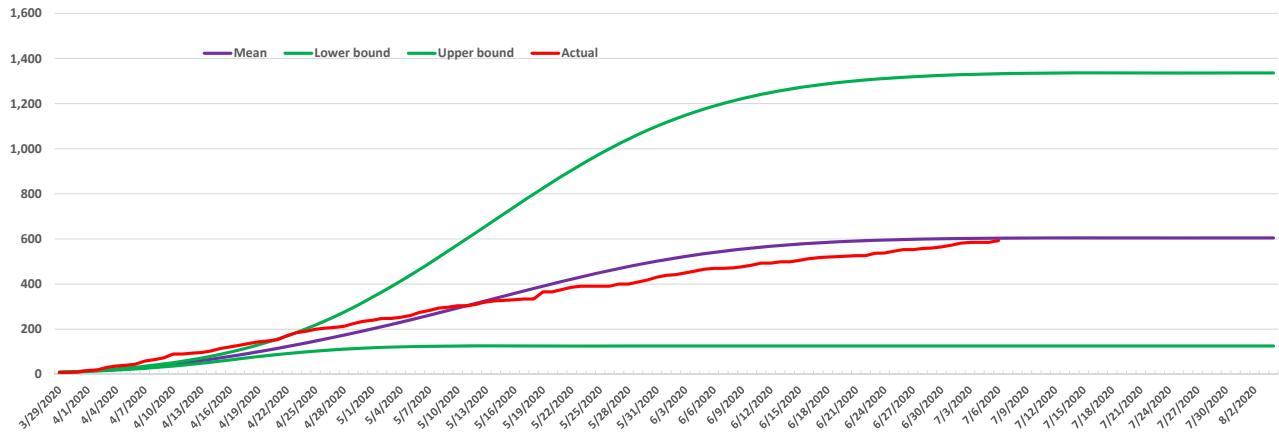
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West Virginia COVID 19 Cumulative Death Projections



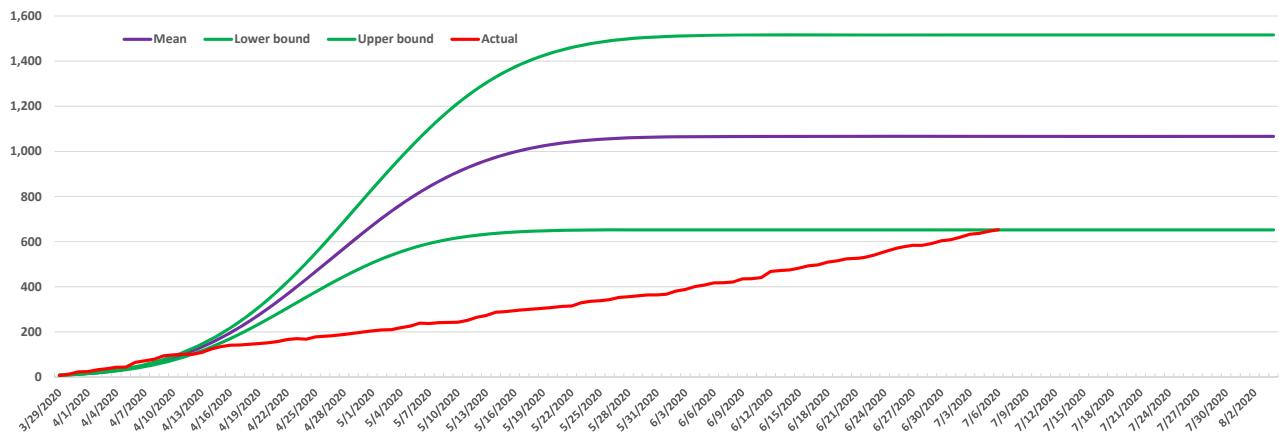
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Kentucky COVID 19 Cumulative Death Projections March 26



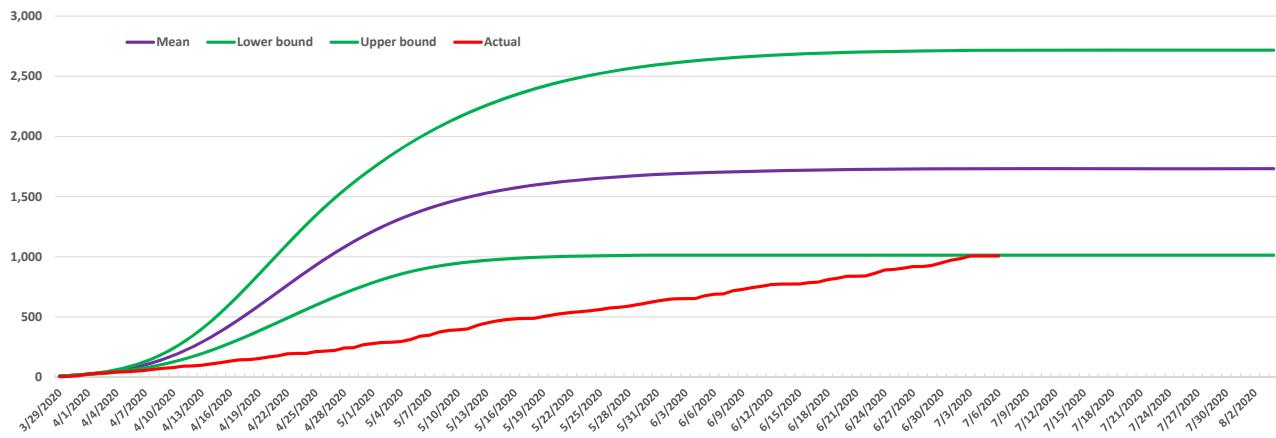
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Tennessee COVID 19 Cumulative Death Projections March 26



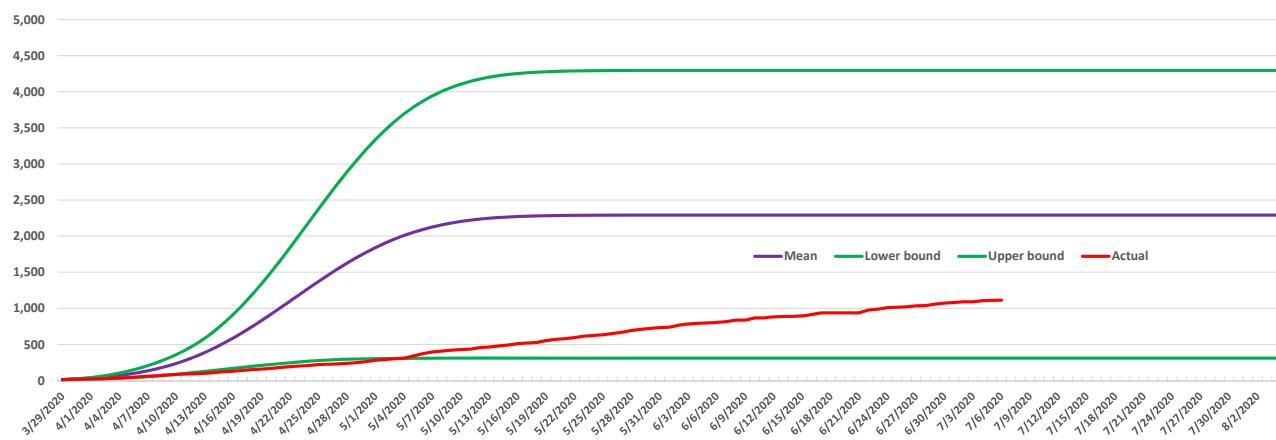
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Alabama COVID 19 Cumulative Death Projections March 26



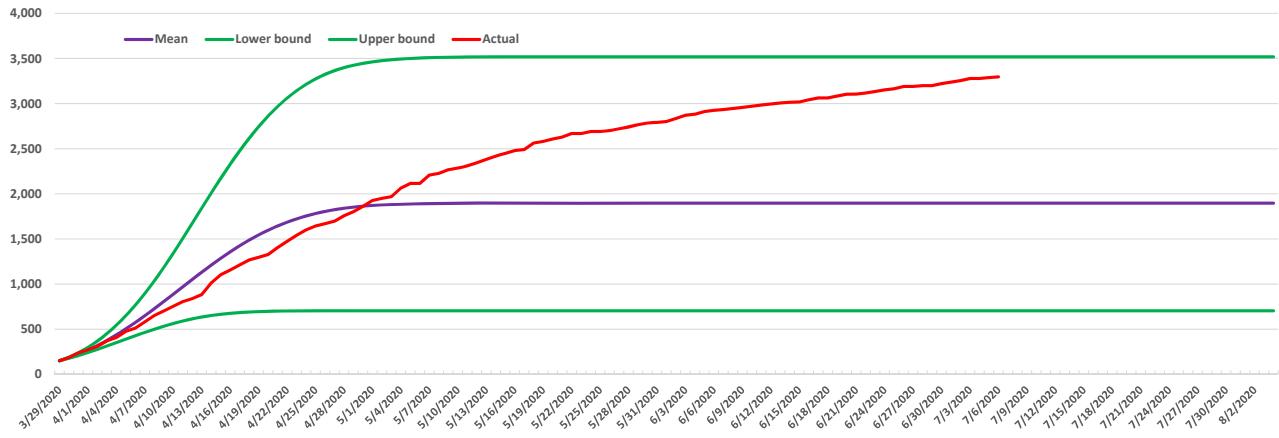
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Mississippi COVID 19 Daily Death Projections March 26



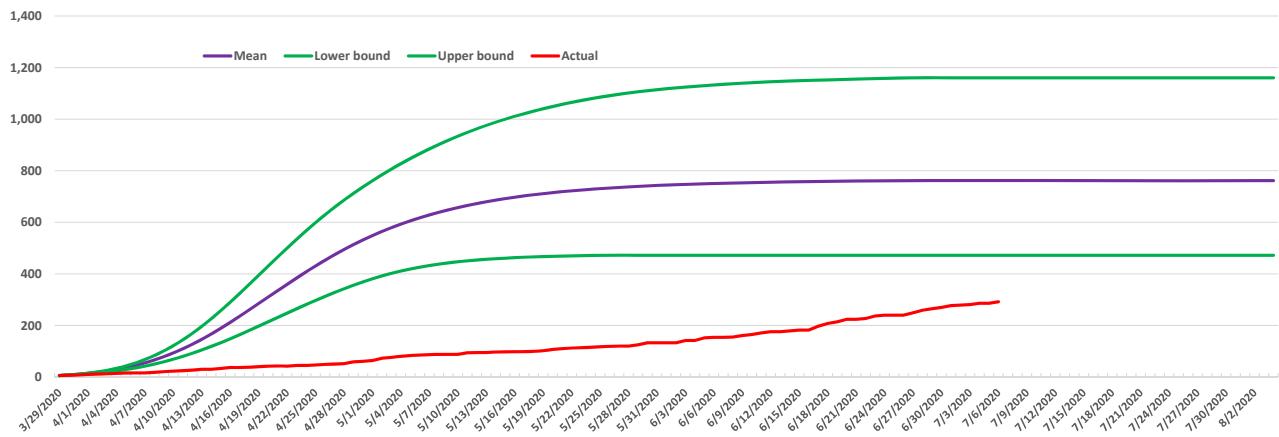
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Louisiana COVID 19 Daily Death Projections March 26



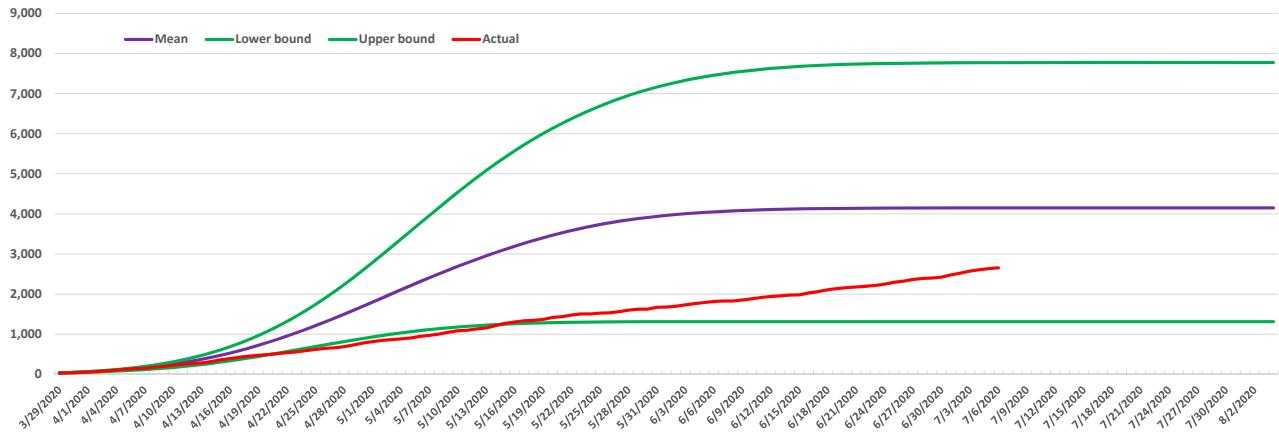
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Arkansas COVID 19 Cumulative Death Projections March 26



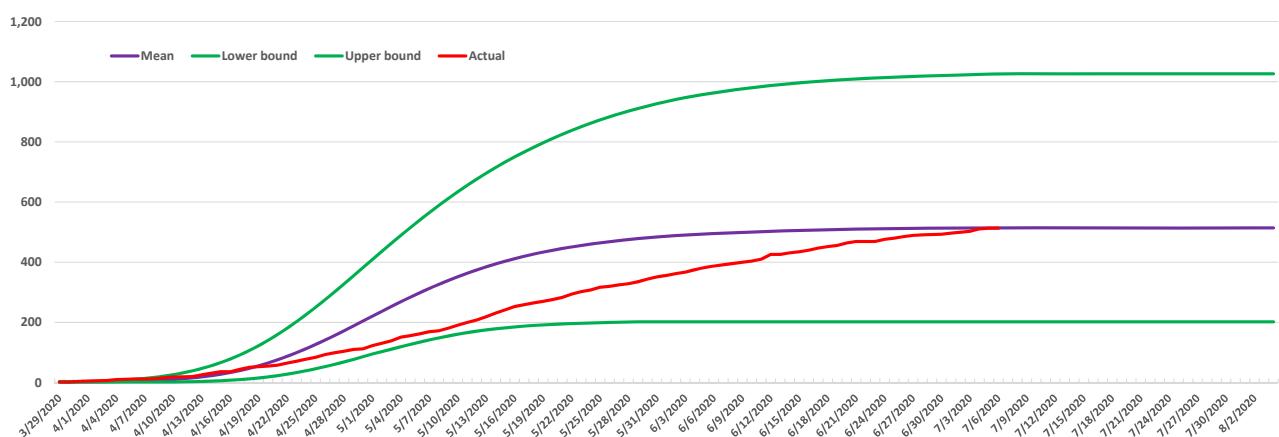
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Texas COVID 19 Daily Death Projections March 26



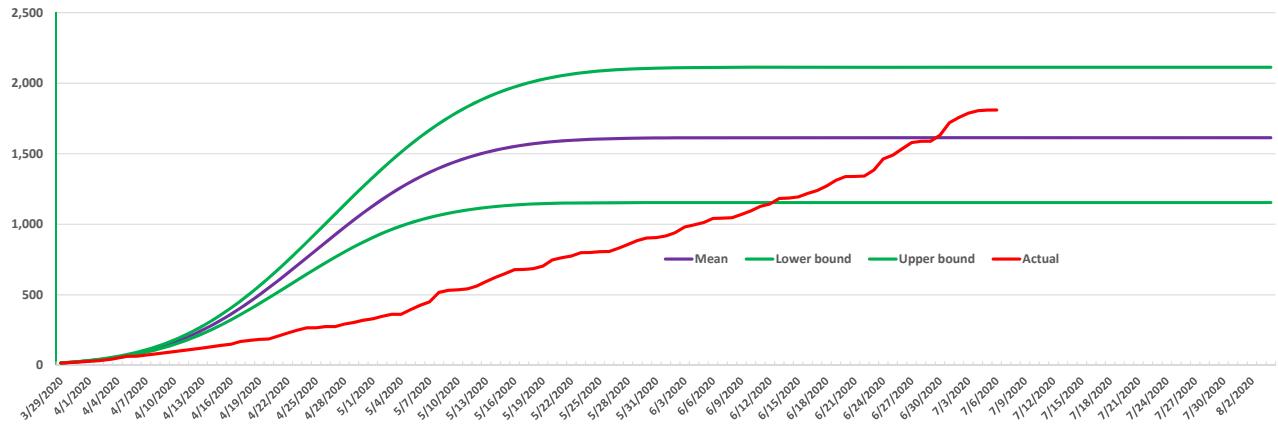
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New Mexico COVID 19 Daily Death Projections March 26



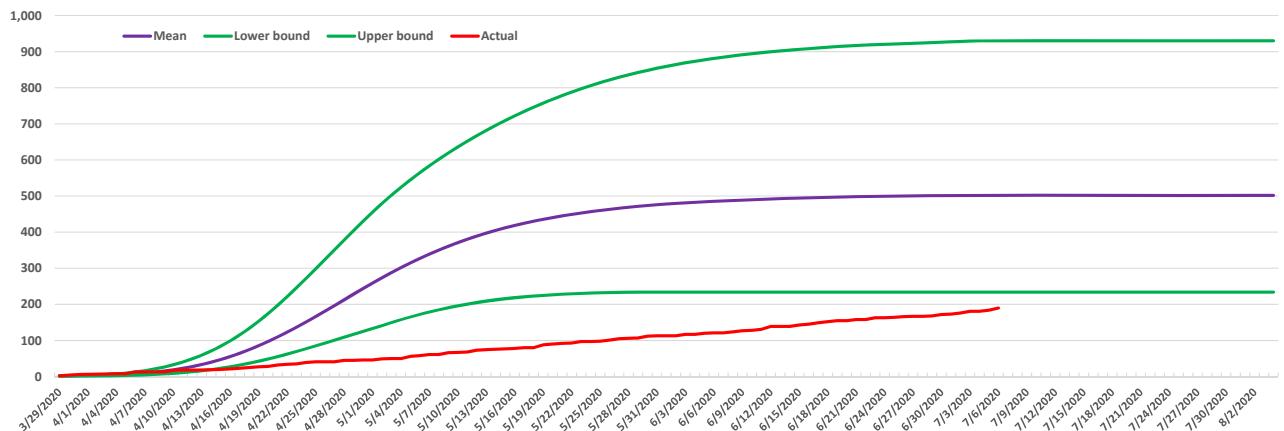
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Arizona COVID 19 Cumulative Death Projections



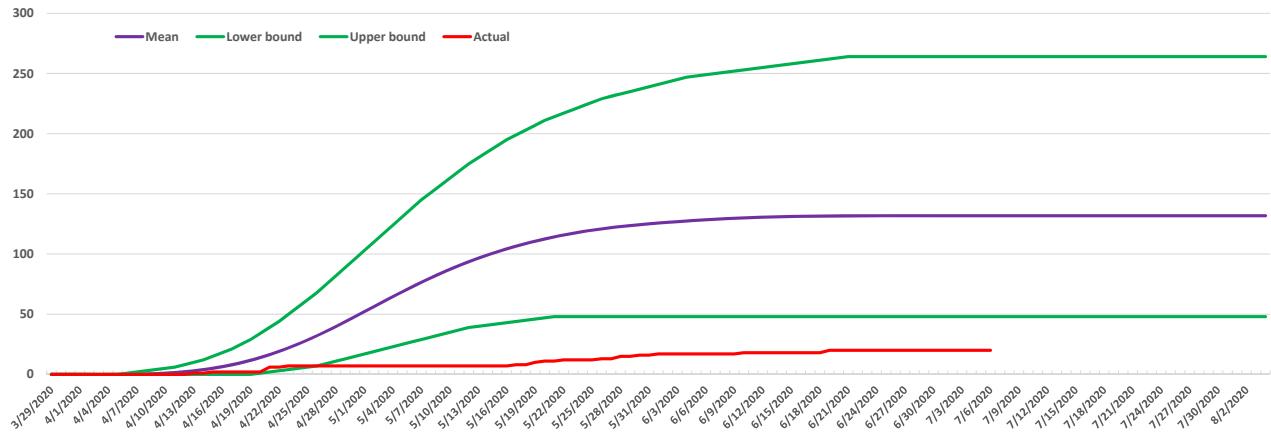
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Utah COVID 19 Daily Death Projections March 26



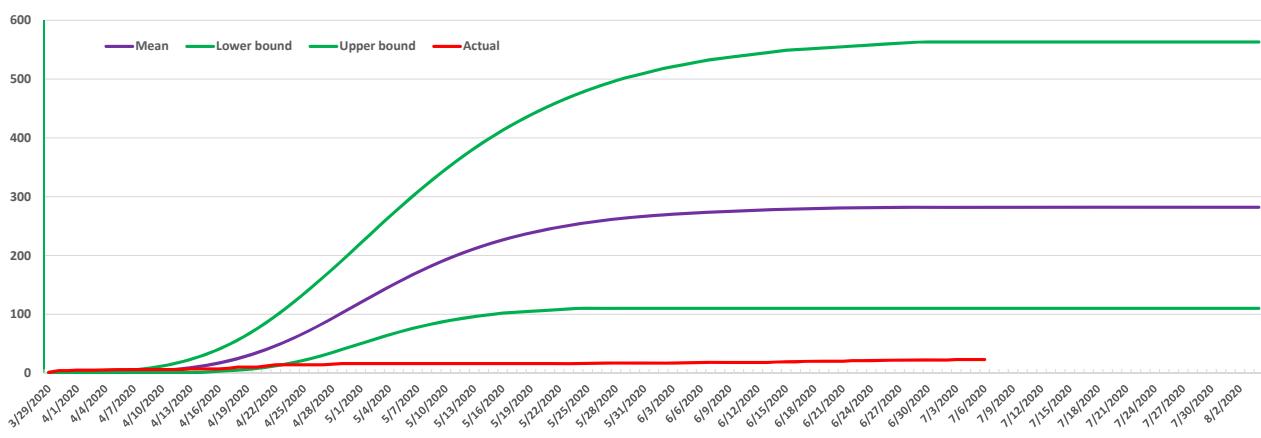
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Wyoming COVID 19 Cumulative Death Projections March 26



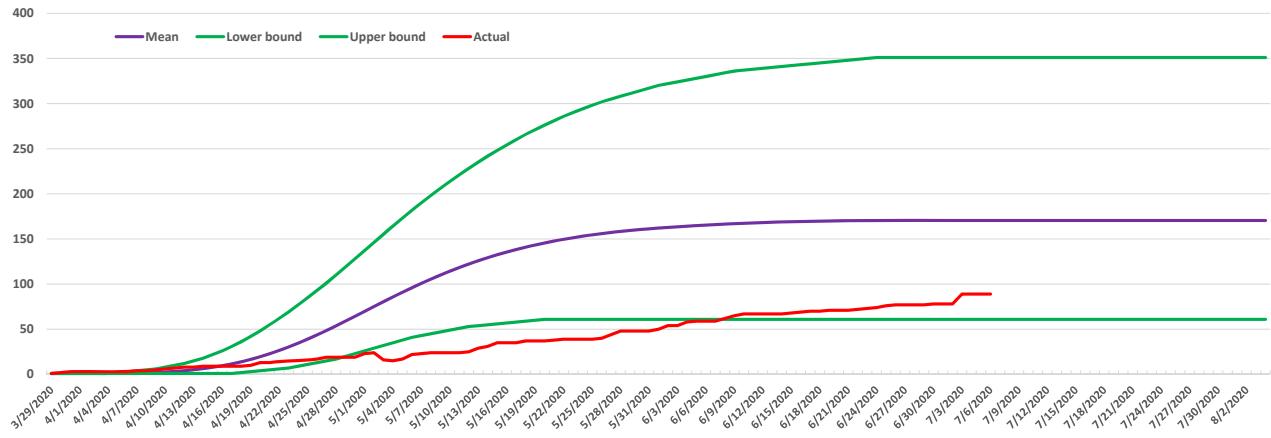
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Montana COVID 19 Cumulative Death Projections



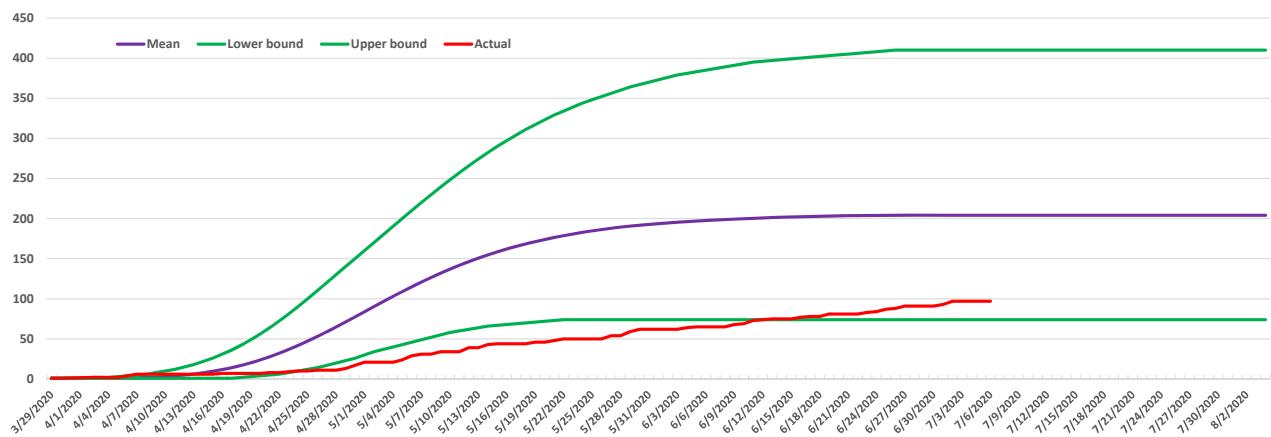
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North Dakota COVID 19 Cumulative Death Projections March 26



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South Dakota COVID 19 Daily Death Projections March 26



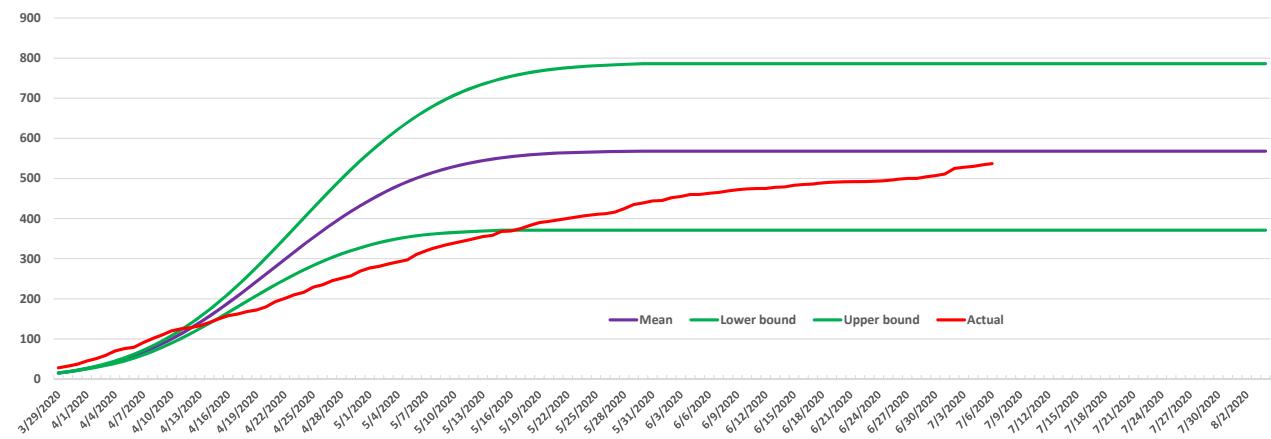
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Idaho COVID 19 Cumulative Death Projections March 26



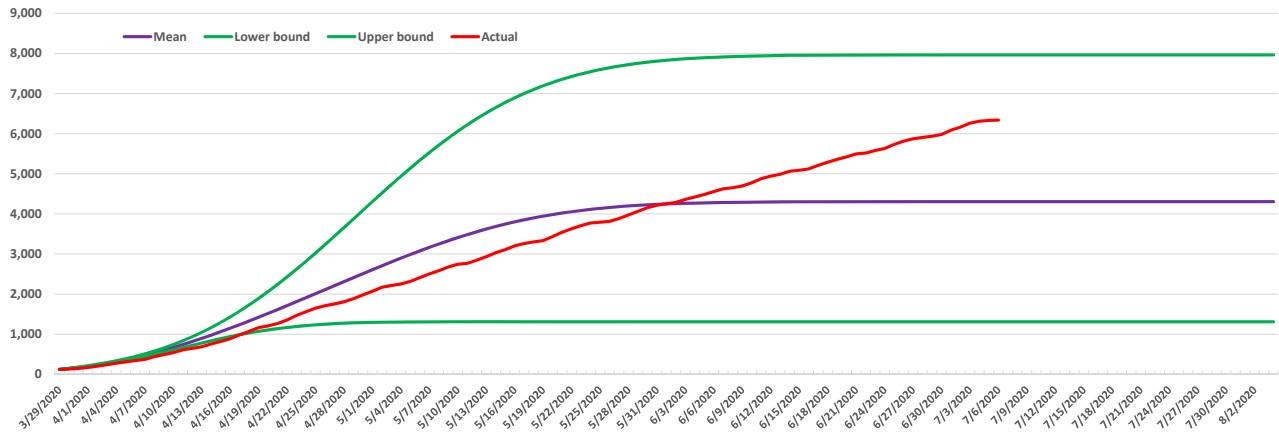
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Nevada COVID 19 Cumulative Death Projections



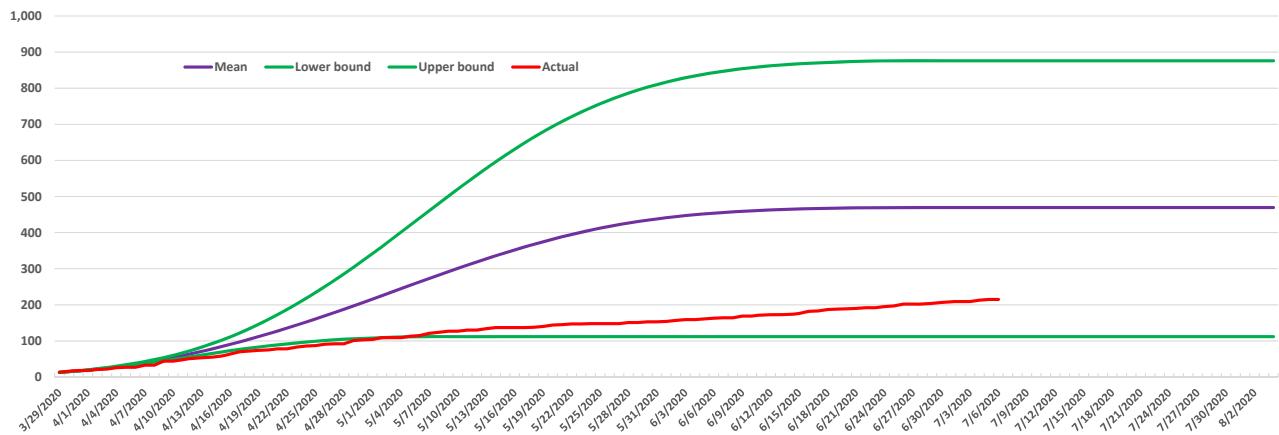
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California COVID 19 Cumulative Death Projections March 26



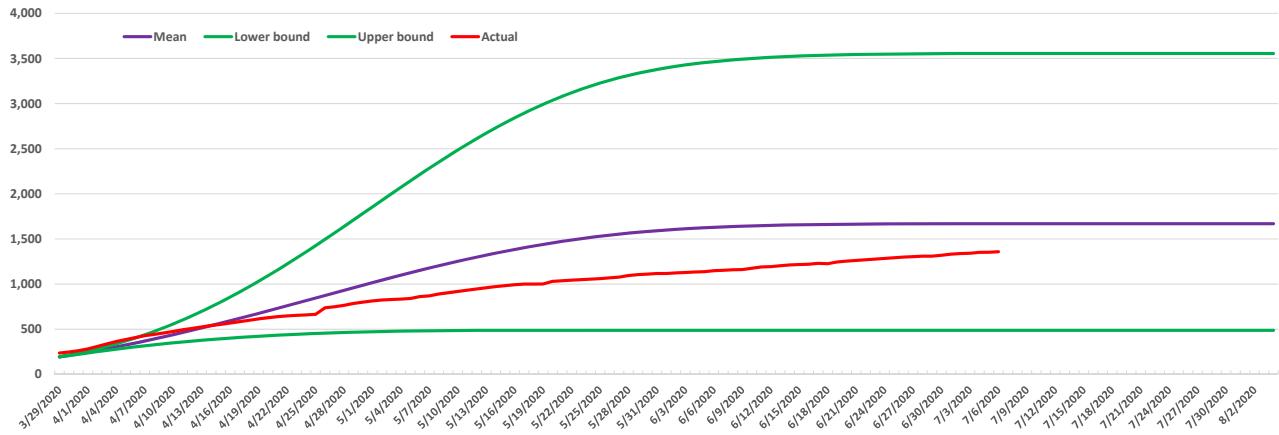
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Oregon COVID 19 Cumulative Death Projections March 26



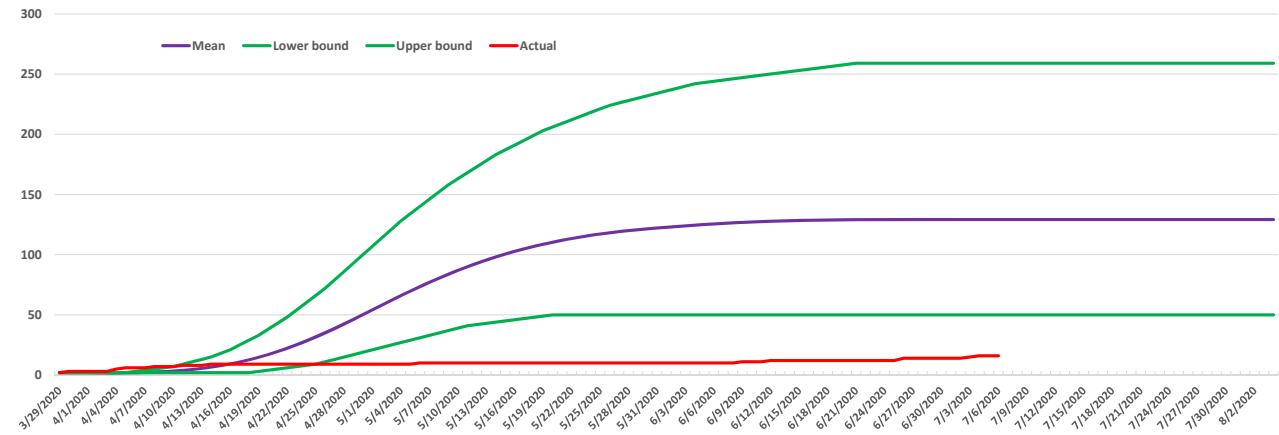
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Washington COVID 19 Cumulative Death Projections March 26



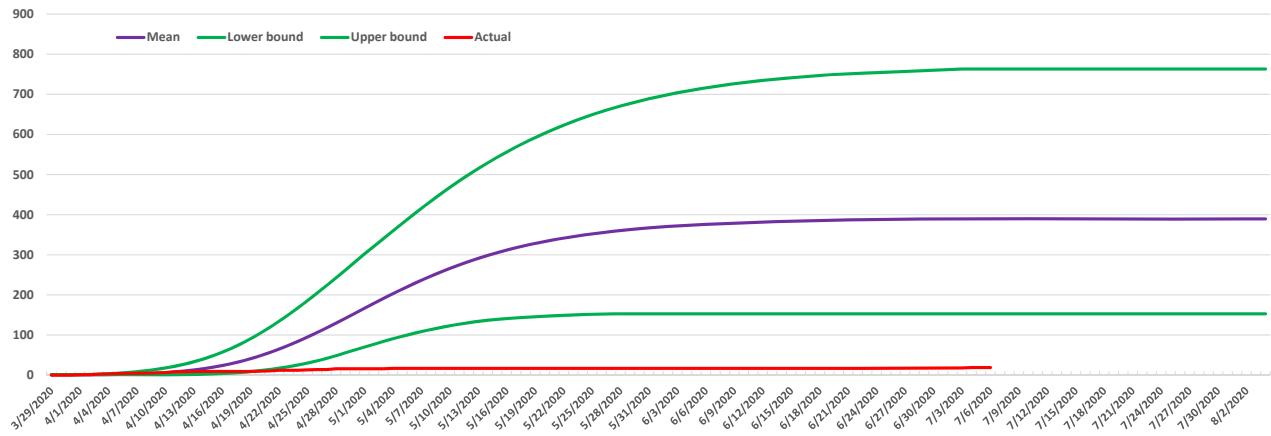
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Alaska COVID 19 Cumulative Death Projections March 26



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Hawaii COVID 19 Daily Death Projections March 26



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