Modeling & Forecasting COVID-19 in NM

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April 20, 2021

NNSA
National Nuclear Security Administration

20 Apr 2021: EpiGrid modeling

- NM daily incidence is flat, but model rises slowly
  - Model over-predicts incidence in a few counties (Eddy, Lea, Quay, Roosevelt) with low *State* vaccination levels
  - Rise is dominated by vaccination uncertainty.
- NM deaths are now slightly below the model.
  - Model does not yet account for vaccination of cohorts with higher death rates.
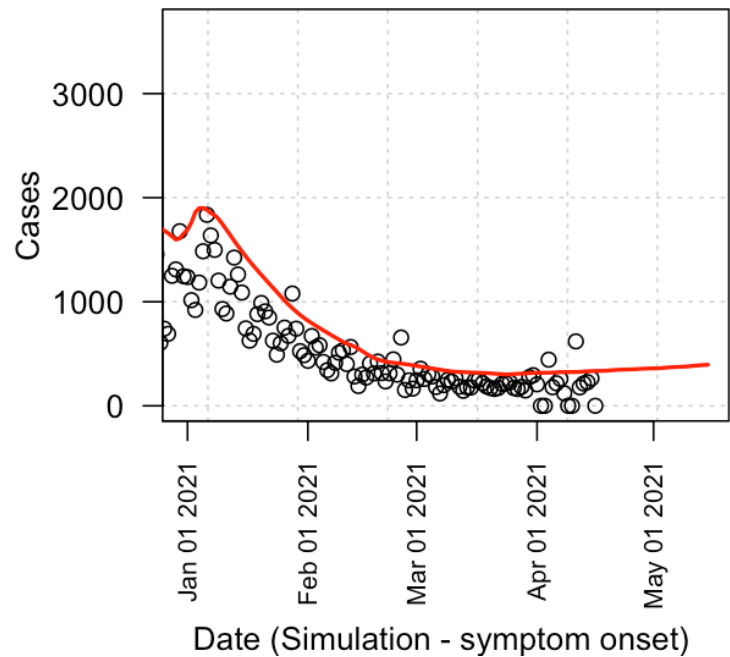
log10 Incidence, wk 64, 2021-05-16

United States__New Mexico

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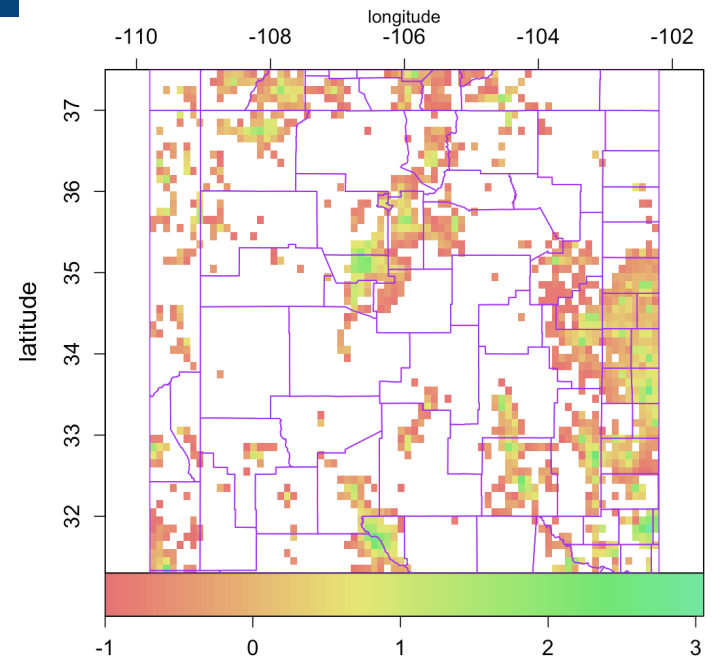
log10 Cumulative cases, wk 64, 2021-05-16
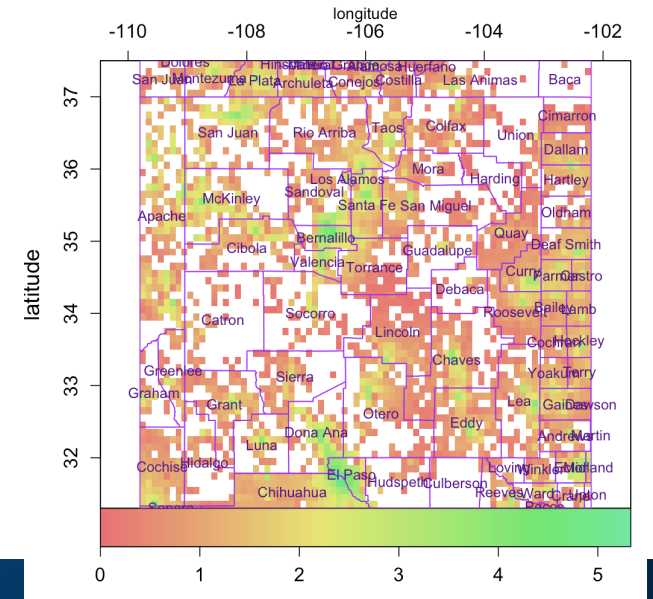
A look at the raw incidence data

- Sunday, Monday
- Tuesday
- Wednesday/Thursday
- Friday
- Saturday
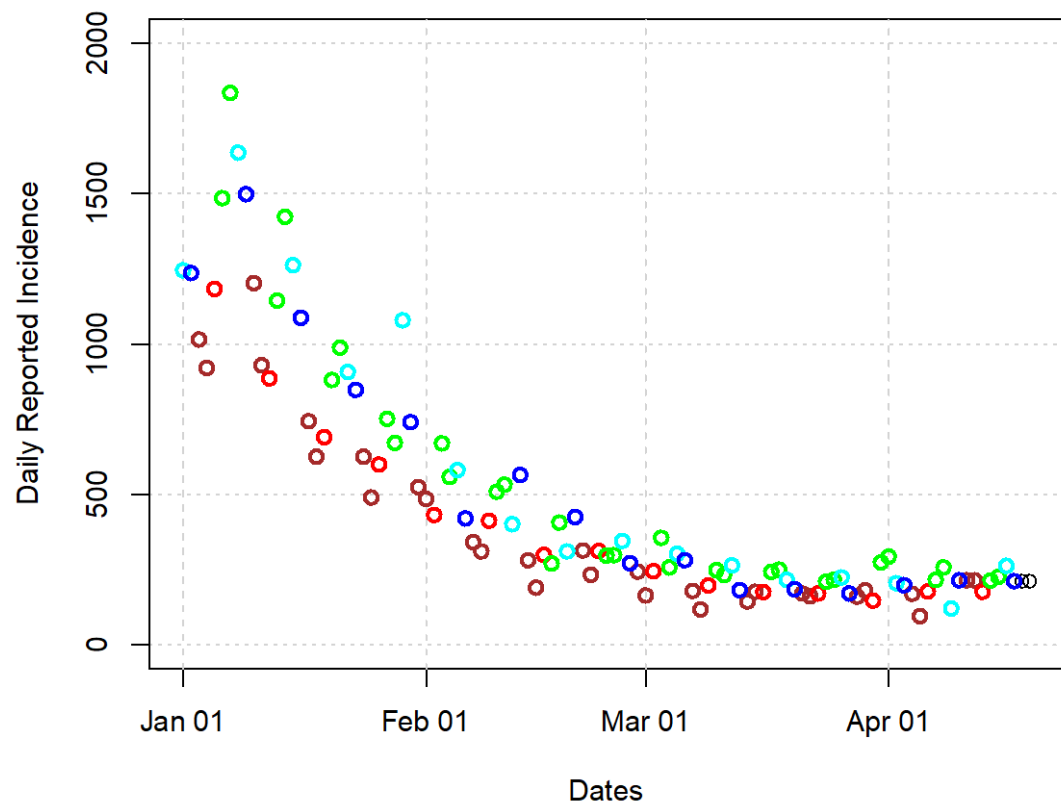
Cases appear to constant.

The 190 cases in the Lea county correctional facility are removed from data reported on March 26th. The 1/3 of reported cases that were > 2 weeks prior were removed from March 24th. Case reported for the 10-12th and 17th – 19th are each divided by 3 to estimate individual day counts.
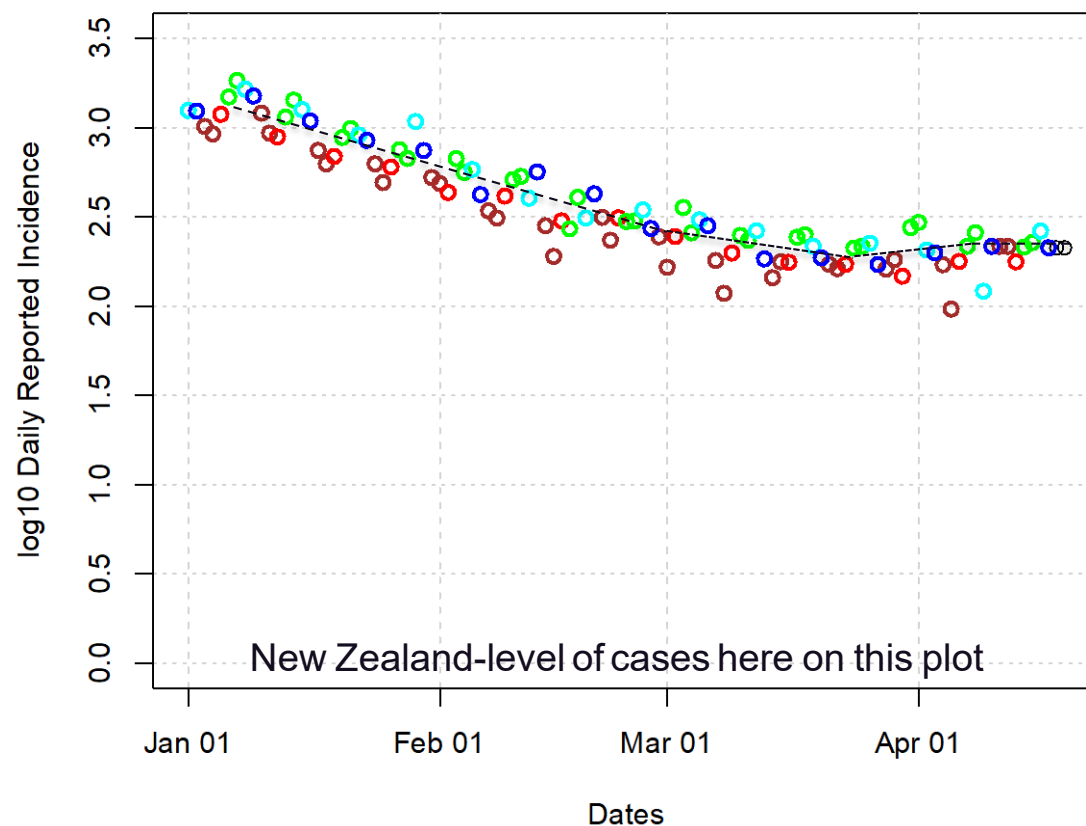
06 April 2021 Model (Mechanistic) – more details and information

- **Figure for historical *State* first-dose vaccinations.**
- **Most Federal doses are allocated to specific counties in this model.**
  - Some are allocated to McKinley, Cibola, and San Juan Counties (IHS).
  - Some are allocated to: Cannon (Curry), Holloman (Otero), and Kirtland AFBs (Bernalillo).
  - DOE doses distributed to Los Alamos, Rio Arriba and Santa Fe Counties.
- **947,701 first doses have been administered in NM (Federal and State).**
- **Transmission is based on mobility with modifications due to PHO's and the red/yellow/green/turquoise (RYGT) framework.**
  - Public health orders (PHO) and public behavior similar to previous models.
 - There are no extrapolations to RYGT assignments.
  - Currently modeling turquoise counties as a progressively increasing force-of-infection.
- **Daily reported cases in El Paso are flat, some ambiguity.**

- **Baseline results reflect novel variants of SARS-CoV-2**. **The effect may be detectable now.**
  - Potential for a 50% increase in contagion/force of infection.
  - Epidemiological evidence does not discount strain replacement in New Mexico.
  - Without vaccination and with the current state of PHO opening, an increased daily incidence would be occurring.

Circles are initial doses as reported by the State of NM. Line is first doses as modeled.
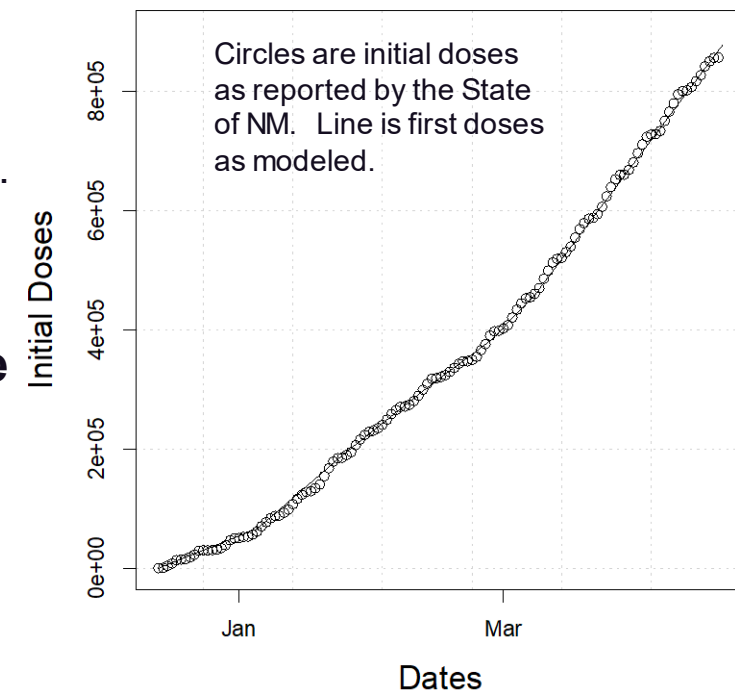
T-80 Mobility – northern counties (data only)

Mobility is the same or slightly lower than pre-covid-19 levels in most counties (Bernalillo, Los Alamos, McKinley, Rio Arriba, Sandoval, Santa Fe, Taos, Valencia) with the exception of San Juan which is slightly higher.

- Weekends not shown
- Monday
- Wednesday/Thursday
- Friday (usually higher)

McKinley
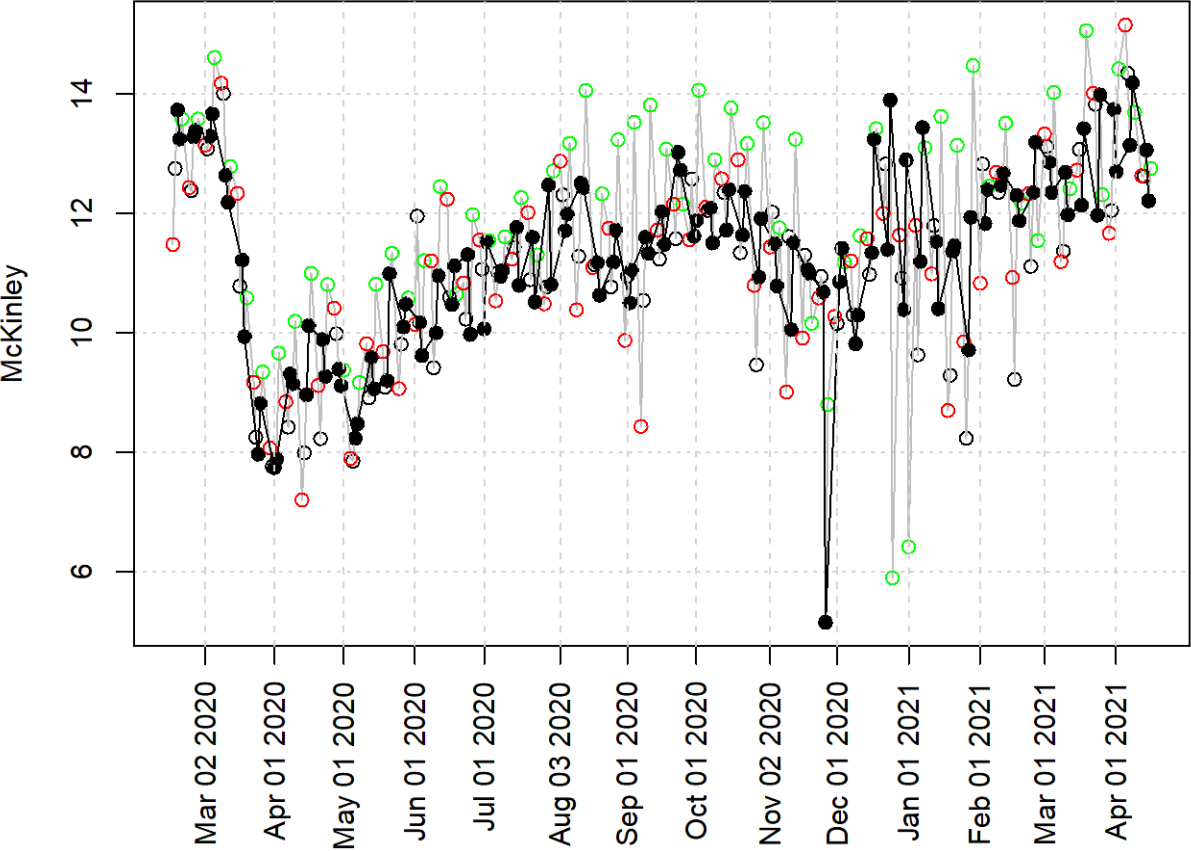
Bernalillo
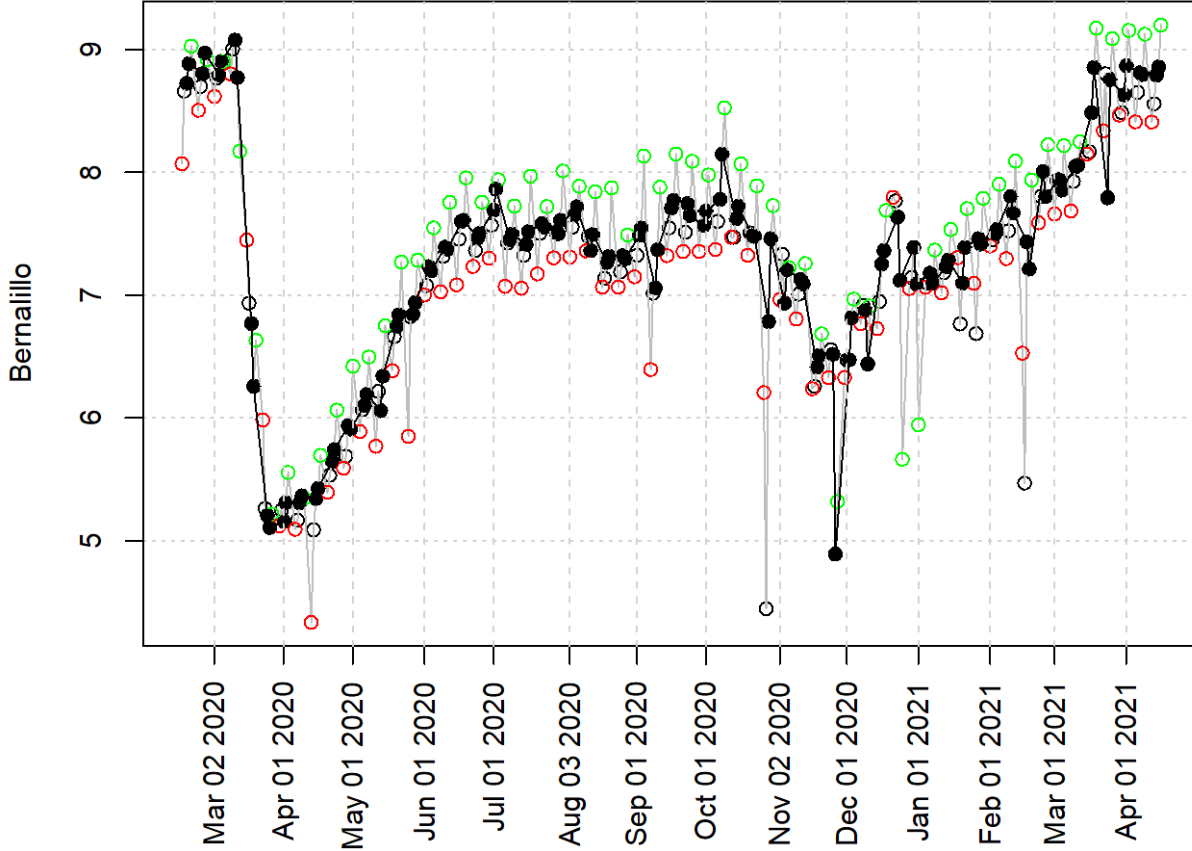
T-80 Mobility – southern counties and Curry (data only)

Mobility is similar to pre covid-19 (Chaves, Curry, Lincoln, Luna, Otero, Socorro) with some counties having higher mobility (Dona Ana, Grant, Roosevelt) and some possibly with lower mobility (Eddy, Lea).

Eddy

Dona Ana

Lea
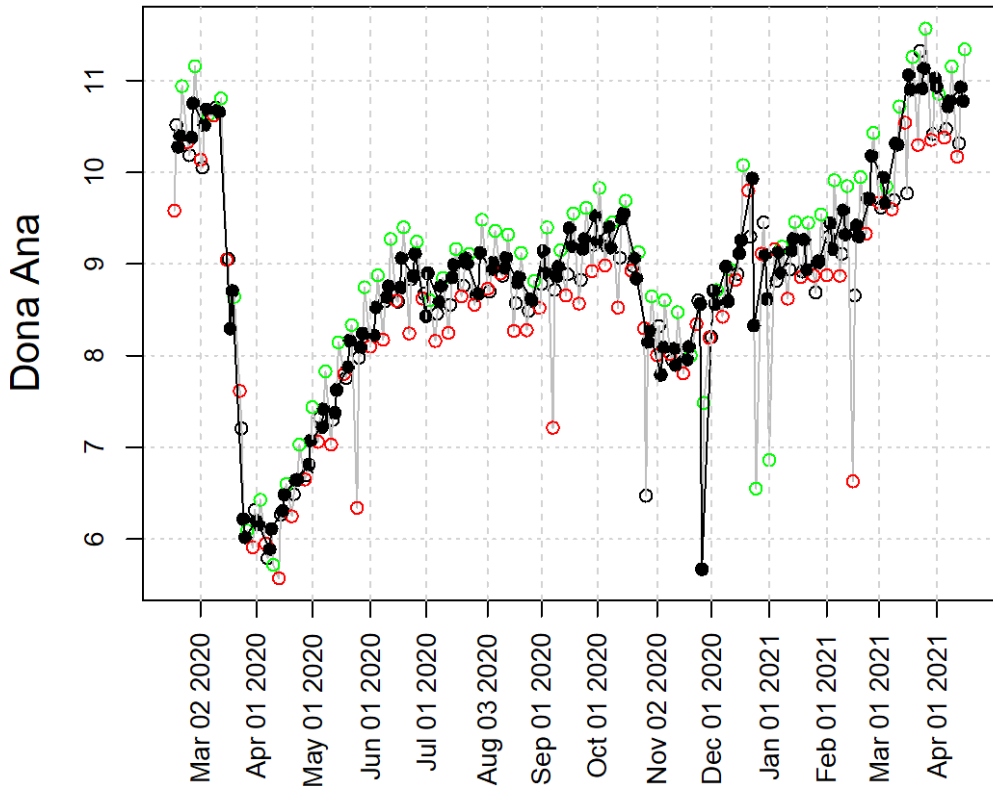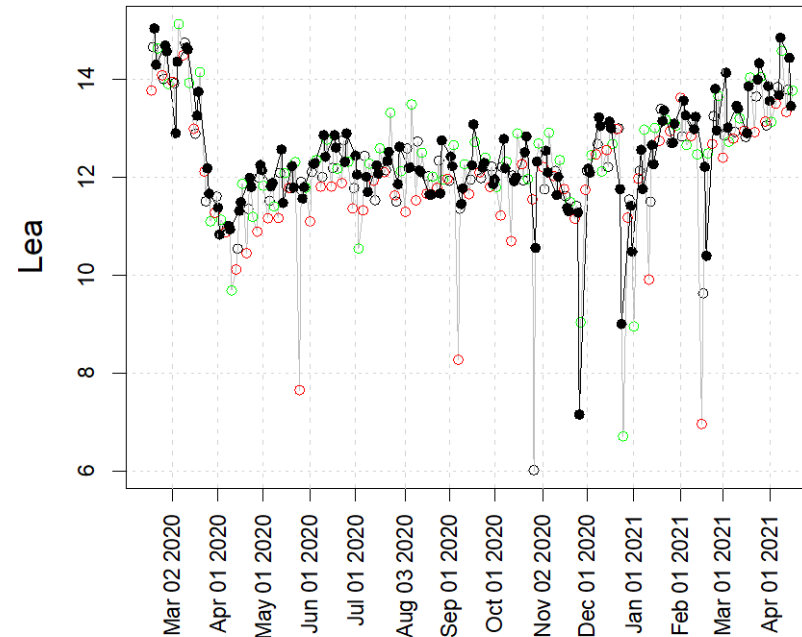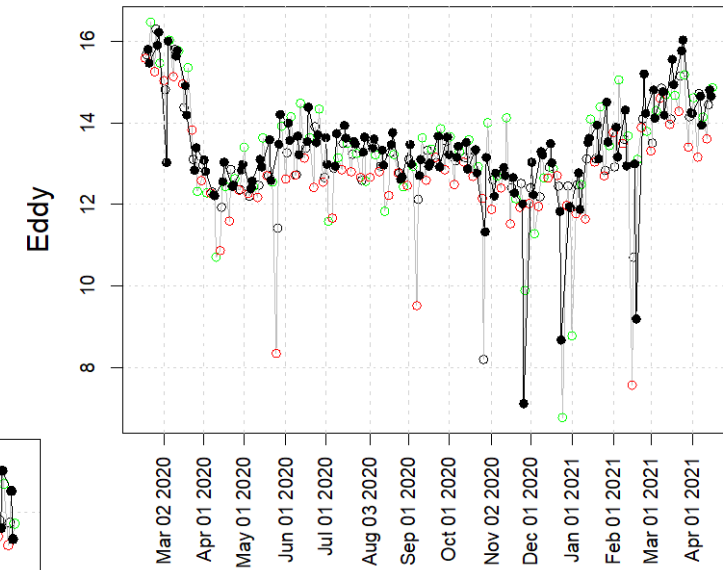
- Weekends NOT shown
- Monday
- Wednesday/Thursday
- Friday (usually higher)

Hospital bed concurrent usage by COVID-19 patients (Statewide)

- Left panel: Linear vs. time (y-scale=0:900) shows hospital beds.
- Right panel: Log vs. time, same data and models (y-scale = 90:900, 10x).
- Divergence between 15Dec2020 model, subsequent EMR data, and later EG models reflects the impact of vaccination.
- Hospital load is very unlikely to increase substantially in the next month due to COVID-19.

Hospital Bed Utilization (New Mexico)

EMR hospitalization data as circles
20Apr2021 model (purple, thick line)
16Feb2021 model (green)
12Jan2021 model (yellow, lower)
15Dec2020 model (orange, upper)

Tue Apr 20 14:56:25 2021

Hospital Bed Utilization (New Mexico)

EMR hospitalization data as circles
20Apr2021 model (purple, thick line)
16Feb2021 model (green)
12Jan2021 model (yellow, lower)
15Dec2020 model (orange, upper)

Tue Apr 20 14:54:56 2021
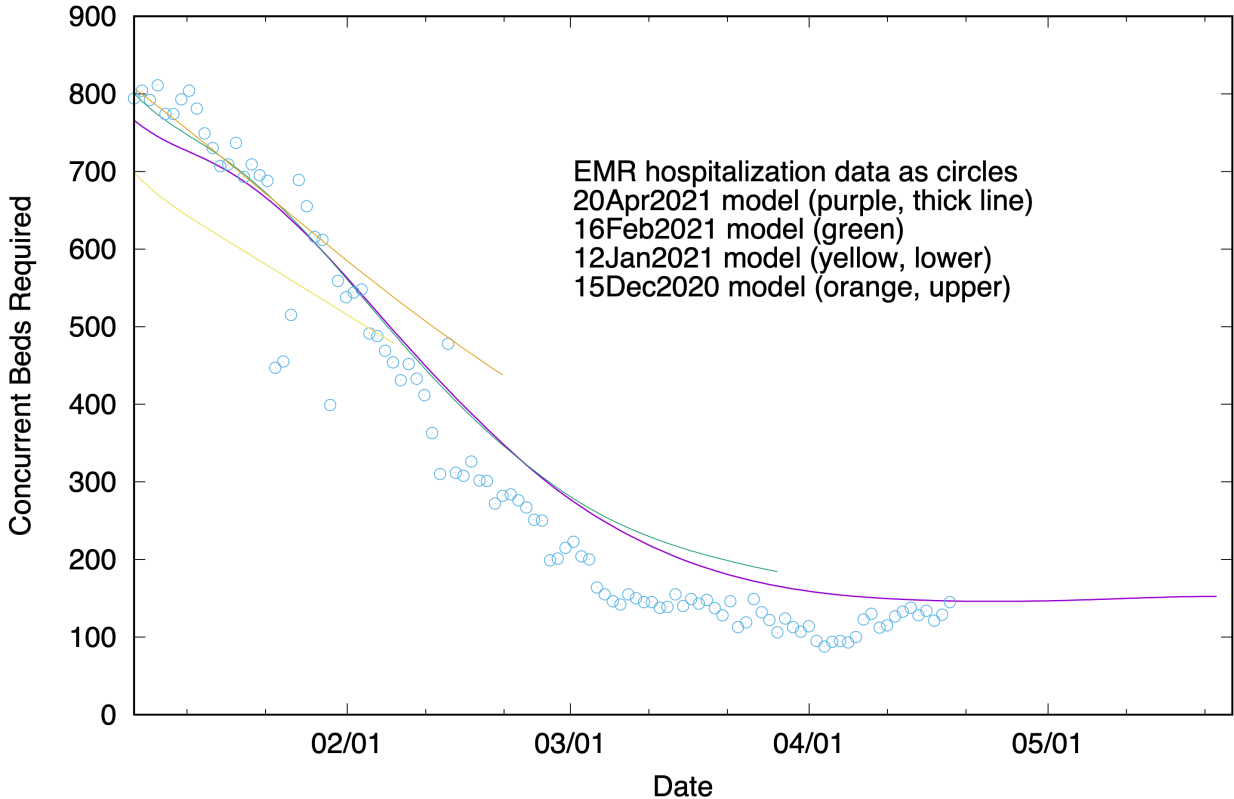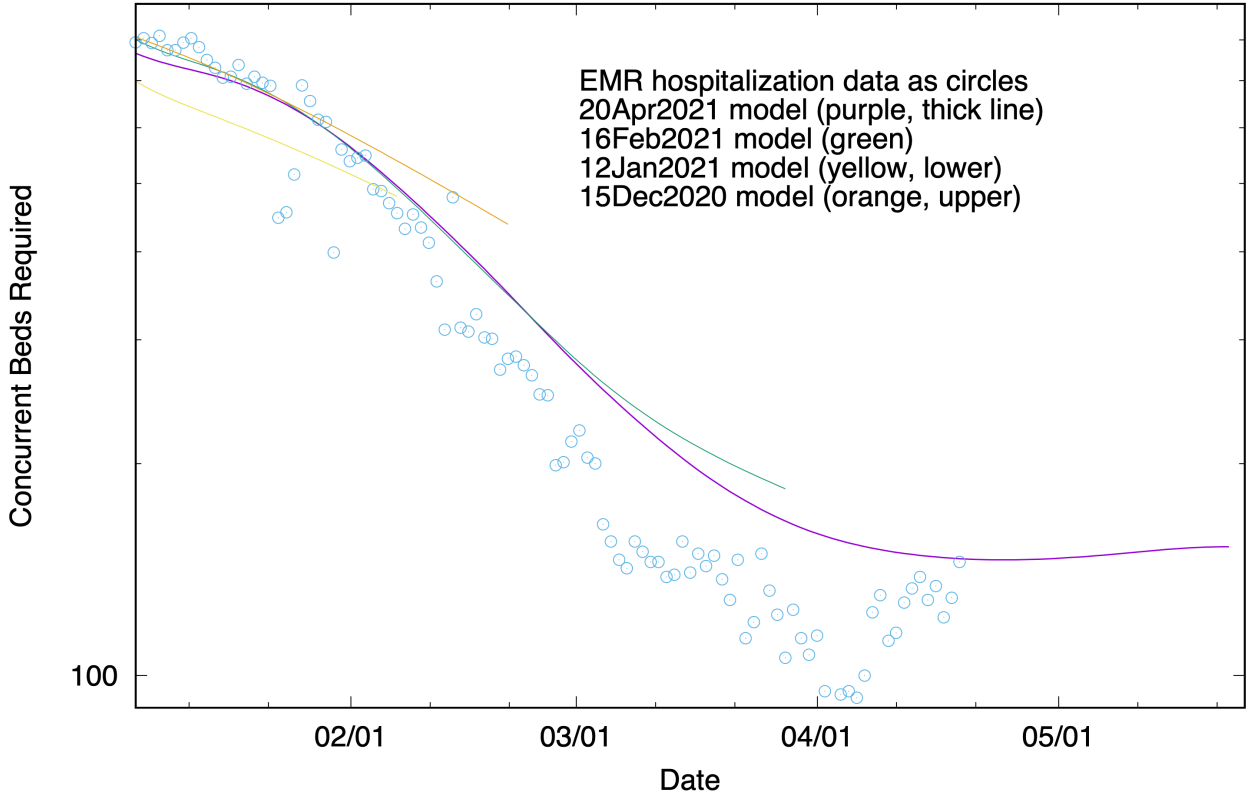
What is happening in the rest of the U.S.?

The 10 most populous states

Case are rising: Florida, Illinois, Pennsylvania, Texas

Flat or possibly rising: Georgia, Michigan, Ohio

Case are not rising: California, New York, North Carolina
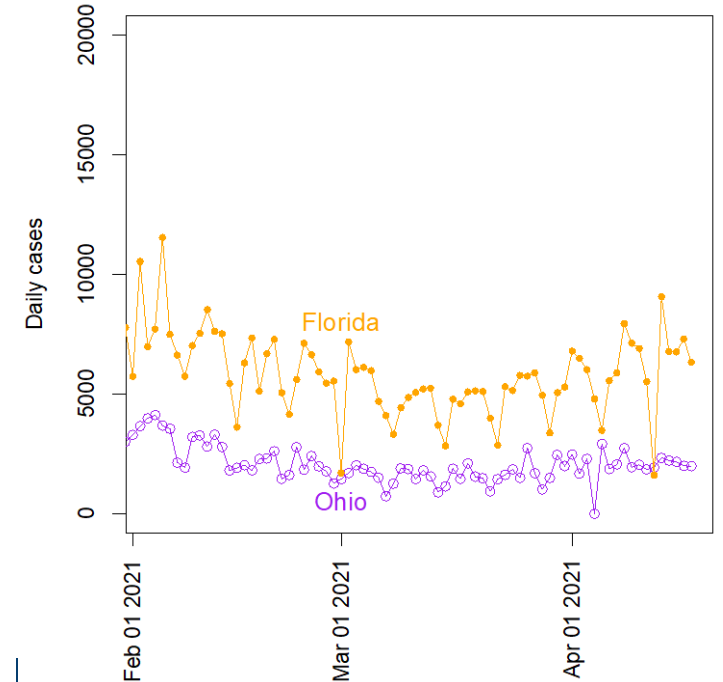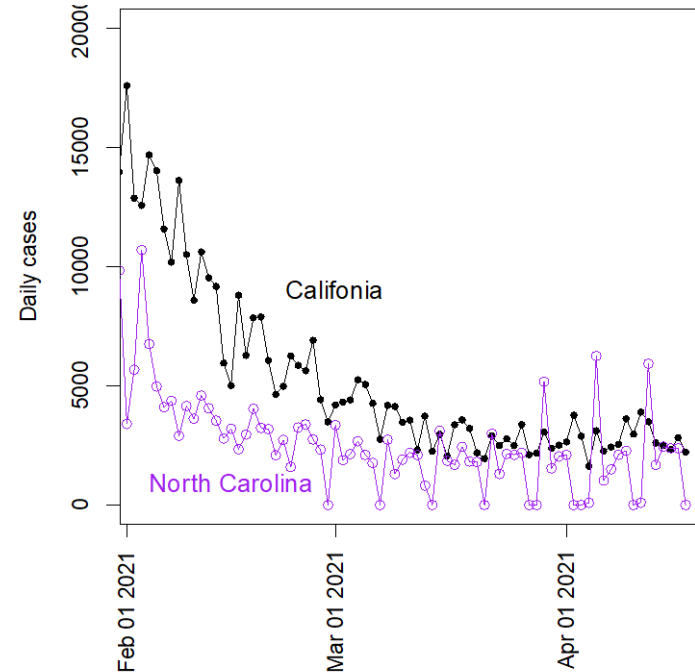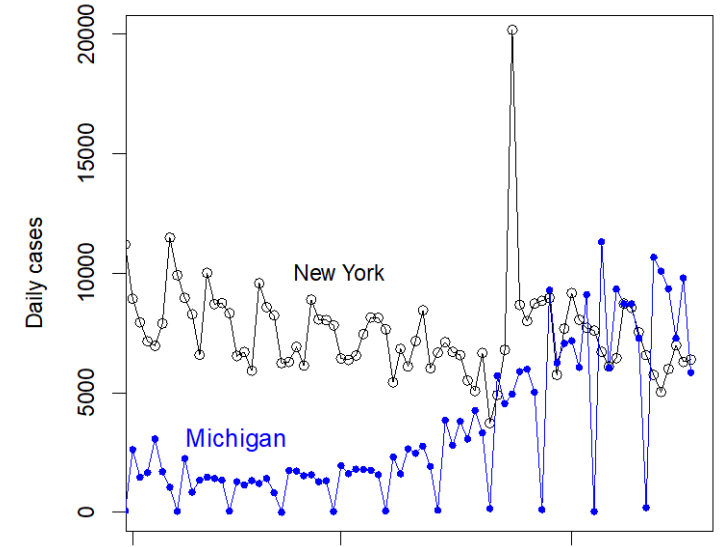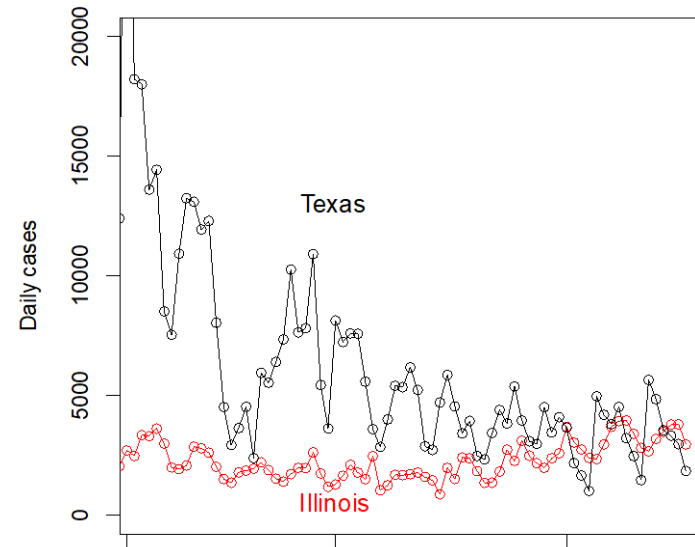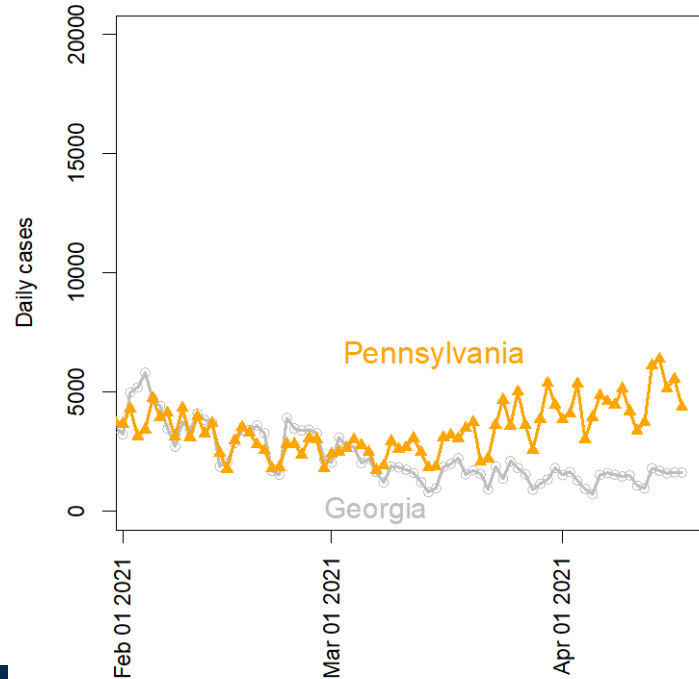
Outlook with Vaccination

- ~948k people vaccinated (1 or 2 doses).
- ~644k people with 2 doses.
- No later than end-of-June, NM will be at ~1.6M NM doses at the current rate.
- Expanded EUA for ages >= 12 likely before late June.
- Uncertainties in vaccination dominate uncertainties in predictions.
- Quarantine continues to play an important role in control.
- Infection control is important but may be playing a numerically less-dominant role at this time.
- Further loss of infection control would be detrimental.
- Currently modeling 90% vaccine effectiveness.
- Matching to some county's vaccination data.
- Curry, Eddy, Lea, Otero, Roosevelt, and Quay Counties cannot be easily explained with the reported vaccination data and observed cell phone T80 mobility data.
- Assuming only susceptible people are vaccinated.
- Unchanged quarantine effectiveness assumed in all cases.
- Interim vaccine hesitancy numbers are being implicitly account for, but end-state hesitancy is not being predicted.

New Mexico Model and Data (Incidence)

Lower, red curve is New Mexico's baseline model
Upper, blue curve is New Mexico with delayed second dose
Vaccinations match county-by-county and state
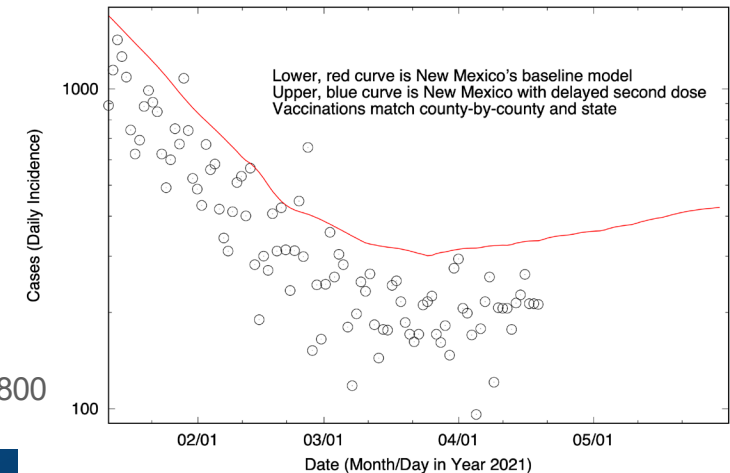
y-axis: 90:1800

Short- & Long-Term Forecast for NM: Cases

7-day Incidence Confirmed Cases Forecast for New Mexico Based on Data as of 2021-04-19

6–Week Forecast of Confirmed Cases for New Mexico Based on Data as of 2021-04-19

Week	Best Case (5th Percentile)	Middle Case (50th Percentile)	Worst Case (95th Percentile)^
2021–04–19		195,478*	
2021–04–26	195,849	196,480	197,572
2021–05–03	196,258	197,544	199,809
2021–05–10	196,665	198,666	202,233
2021–05–17	197,043	199,884	204,841
2021–05–24	197,420	201,156	207,692
2021–05–31	197,724	202,480	210,961

*Last reported confirmed cases count
^Closest–matching scenario

6–Week Forecast of Daily Average of Confirmed Cases for New Mexico Based on Data as of 2021-04-19

Week	Best Case (5th Percentile)	Middle Case (50th Percentile)	Worst Case (95th Percentile)^
2021–04–19		213*	
2021–04–26	53	143	299
2021–05–03	58	152	320
2021–05–10	58	160	346
2021–05–17	54	174	373
2021–05–24	54	182	407
2021–05–31	43	189	467

*Last reported confirmed cases count
^Closest–matching scenario

So what?
The _daily_ number of cases are expected to range between 53 and 346 in the next few weeks

Short- & Long-Term Forecast for NM: Deaths

7-day Deaths Forecast for New Mexico Based on Data as of 2021–04–19

Prediction Intervals: 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%

6-Week Forecast of Deaths for New Mexico Based on Data as of 2021–04–19

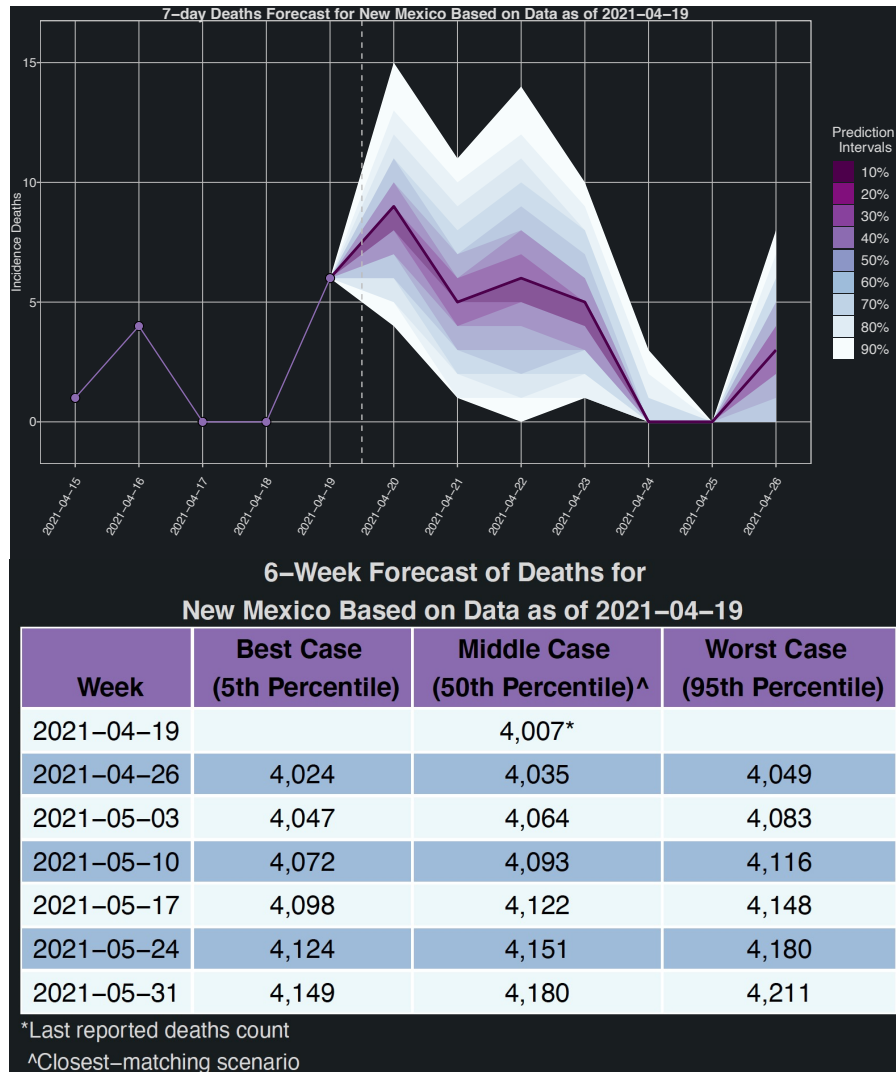| Week	Best Case (5th Percentile)	Middle Case (50th Percentile)^	Worst Case (95th Percentile)
2021–04–19		4,007*	
2021–04–26	4,024	4,035	4,049
2021–05–03	4,047	4,064	4,083
2021–05–10	4,072	4,093	4,116
2021–05–17	4,098	4,122	4,148
2021–05–24	4,124	4,151	4,180
2021–05–31	4,149	4,180	4,211

*Last reported deaths count
^Closest–matching scenario

6-Week Forecast of Daily Average of Deaths for New Mexico Based on Data as of 2021–04–19

Week	Best Case (5th Percentile)	Middle Case (50th Percentile)^	Worst Case (95th Percentile)
2021–04–19		4*	
2021–04–26	2	4	6
2021–05–03	3	4	5
2021–05–10	4	4	5
2021–05–17	4	4	5
2021–05–24	4	4	5
2021–05–31	4	4	4

*Last reported confirmed deaths
^Closest–matching scenario

So what?
The daily number of deaths are expected to range between 4 and 6 in the next few weeks

Growth Rate for NM

Daily Growth Rate for the Past Six Weeks in New Mexico as of 2021-04-19
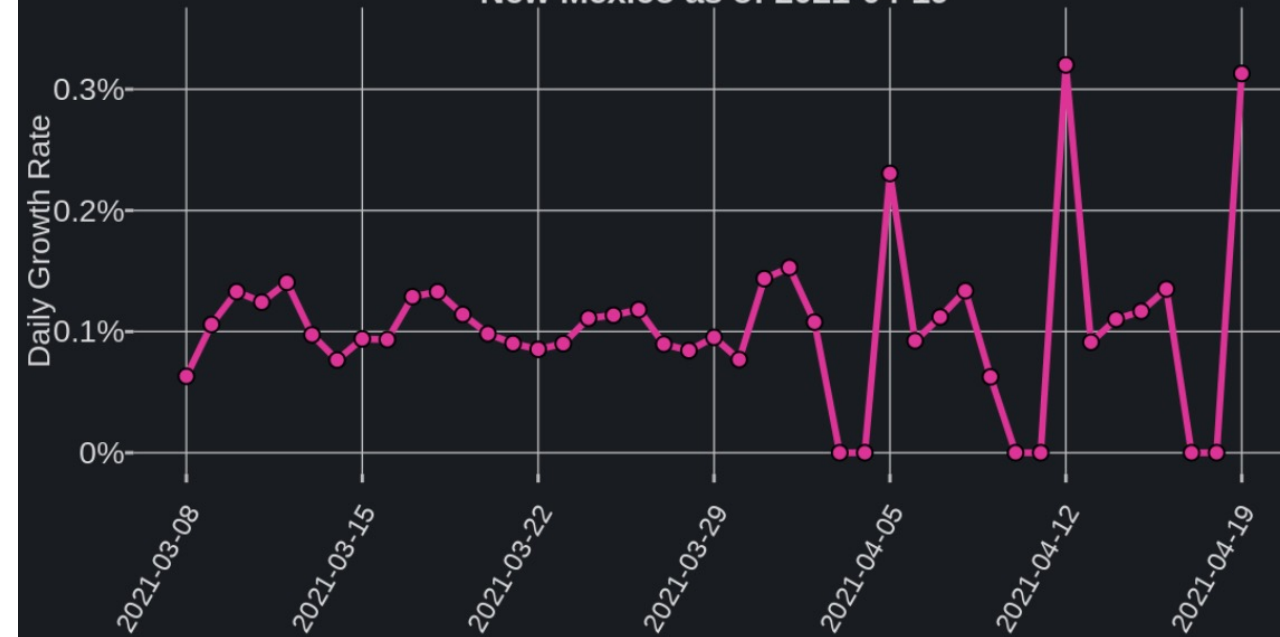
6-Week Forecast of the Average Weekly Growth Rate for New Mexico Based on Data as of 2021-04-19

| Week	Best Case (5th Percentile)	Middle Case (50th Percentile)	Worst Case (95th Percentile)^
2021-04-19		0.11%*	
2021-04-26	0.027%	0.073%	0.15%
2021-05-03	0.030%	0.077%	0.16%
2021-05-10	0.030%	0.081%	0.17%
2021-05-17	0.027%	0.087%	0.18%
2021-05-24	0.027%	0.091%	0.20%
2021-05-31	0.022%	0.094%	0.22%

*Last weekly mean daily growth rate
^Closest-matching scenario

So what?
As of April 19th, the average growth rate in NM is at 0.11% (up from two weeks ago 0.10%)
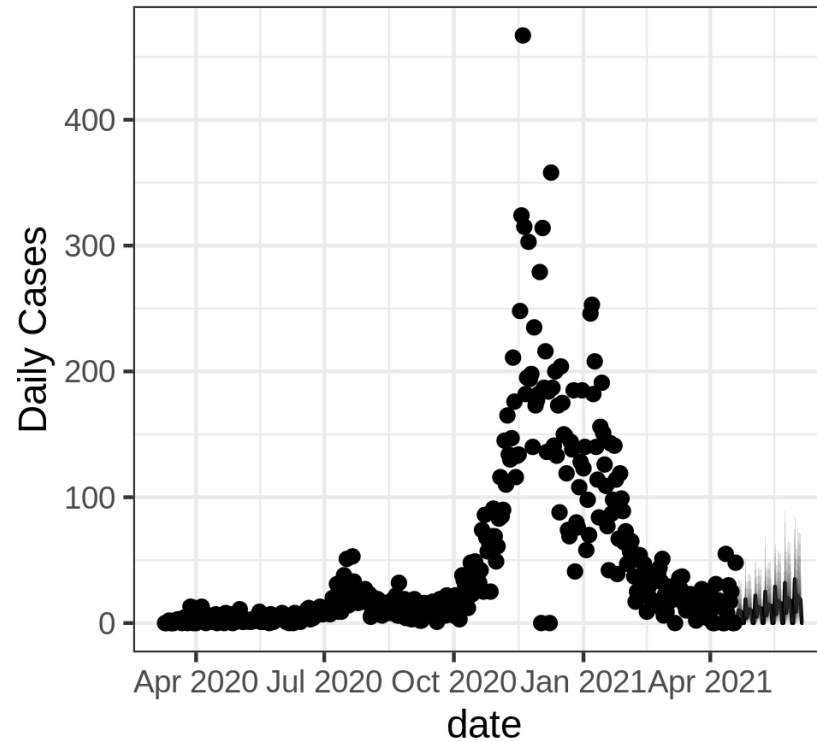
Regional Forecasts

Central Region
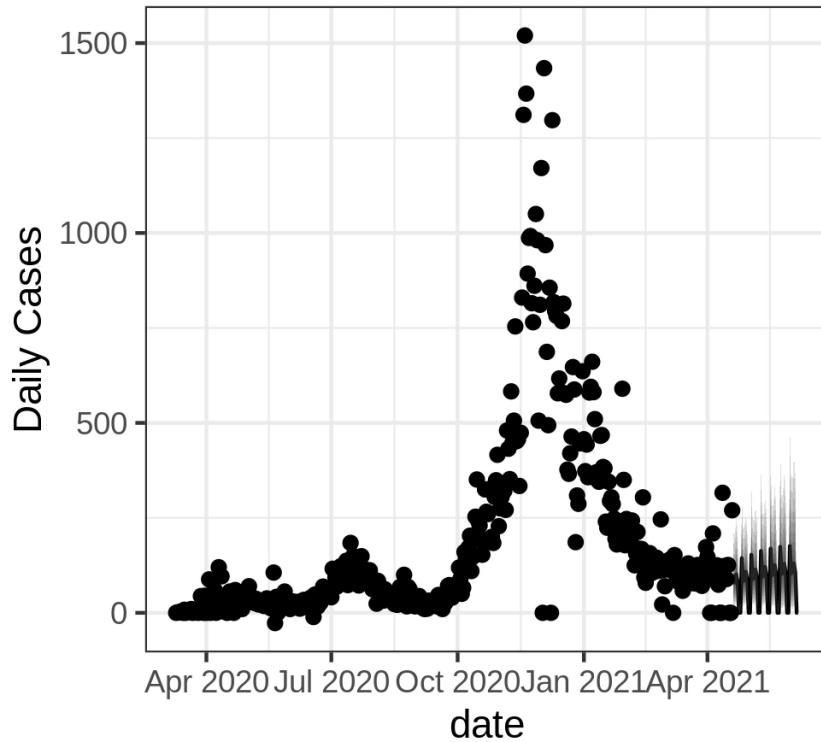
Weekly cases will range between **189-269** in the next few weeks

Northeast Region

Weekly cases will range between **14-28** in the next few weeks

Northwest Region

Weekly cases will range between **672-720** in the next few weeks
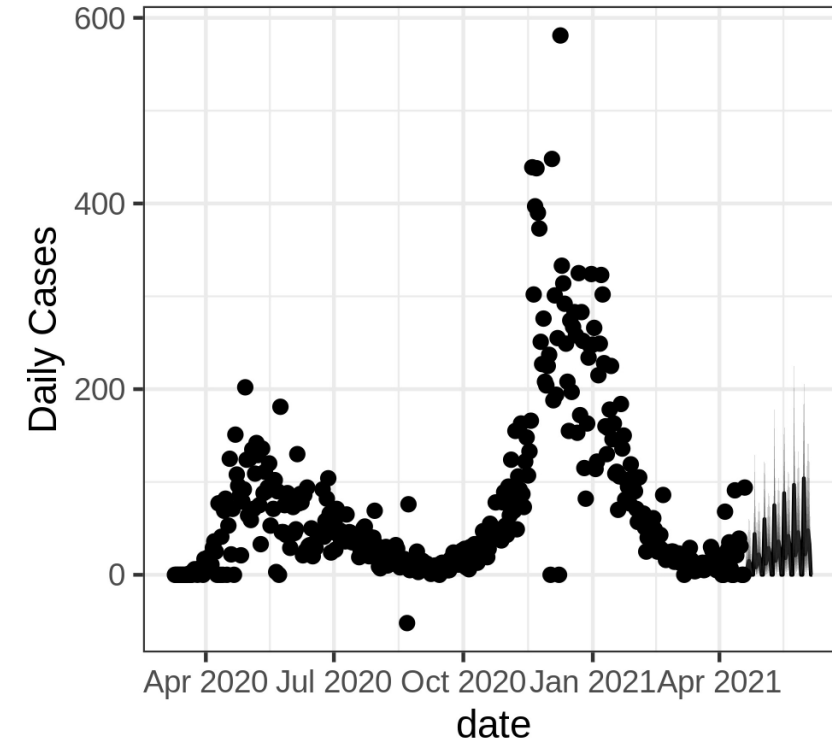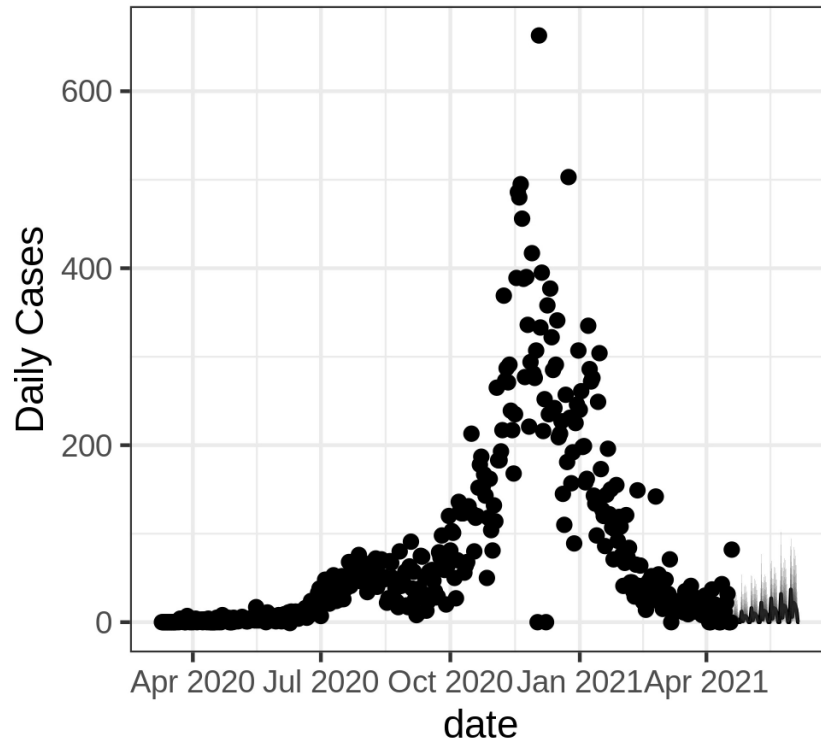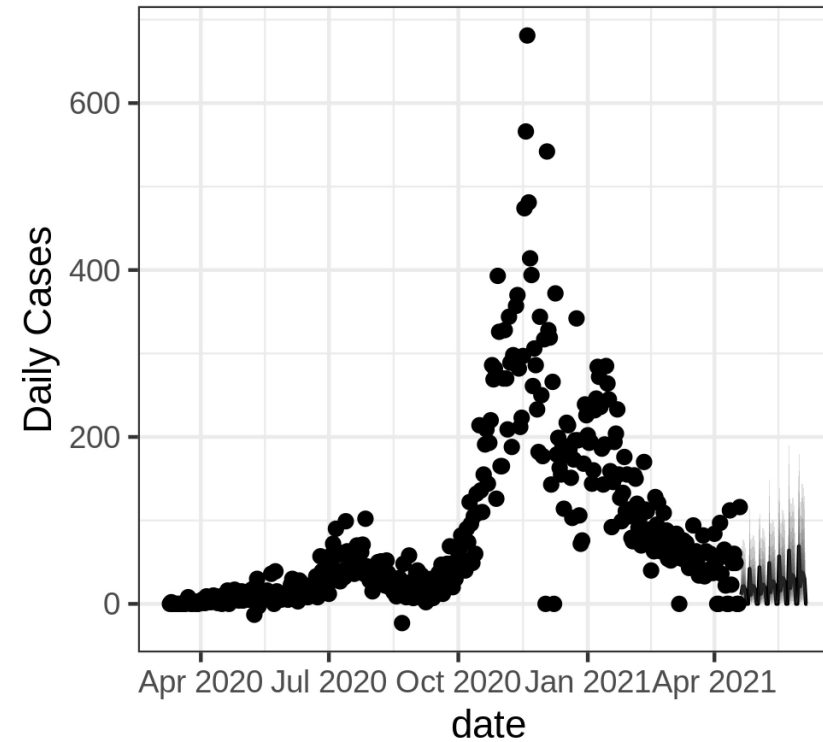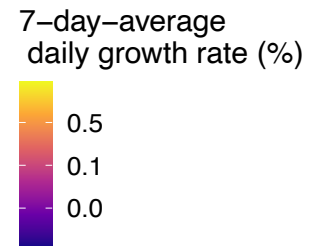
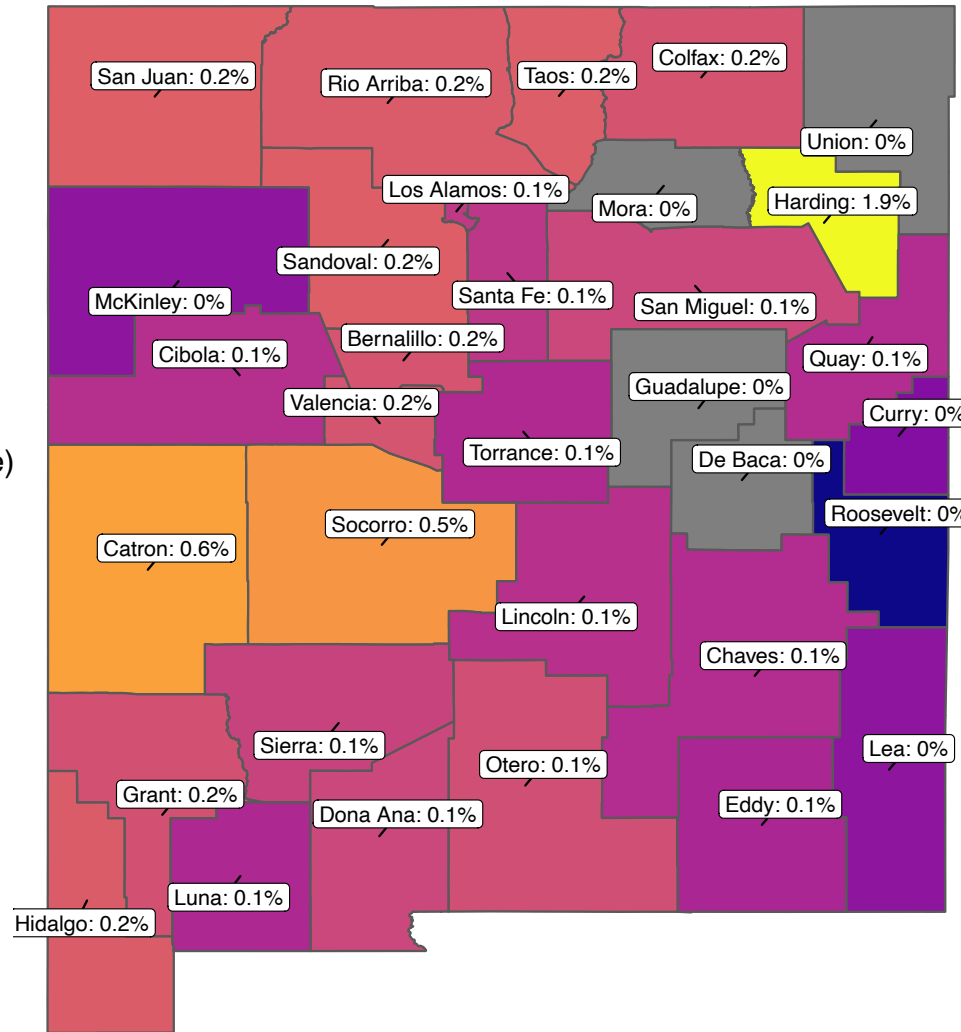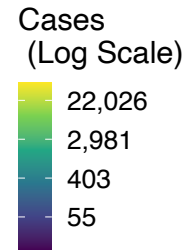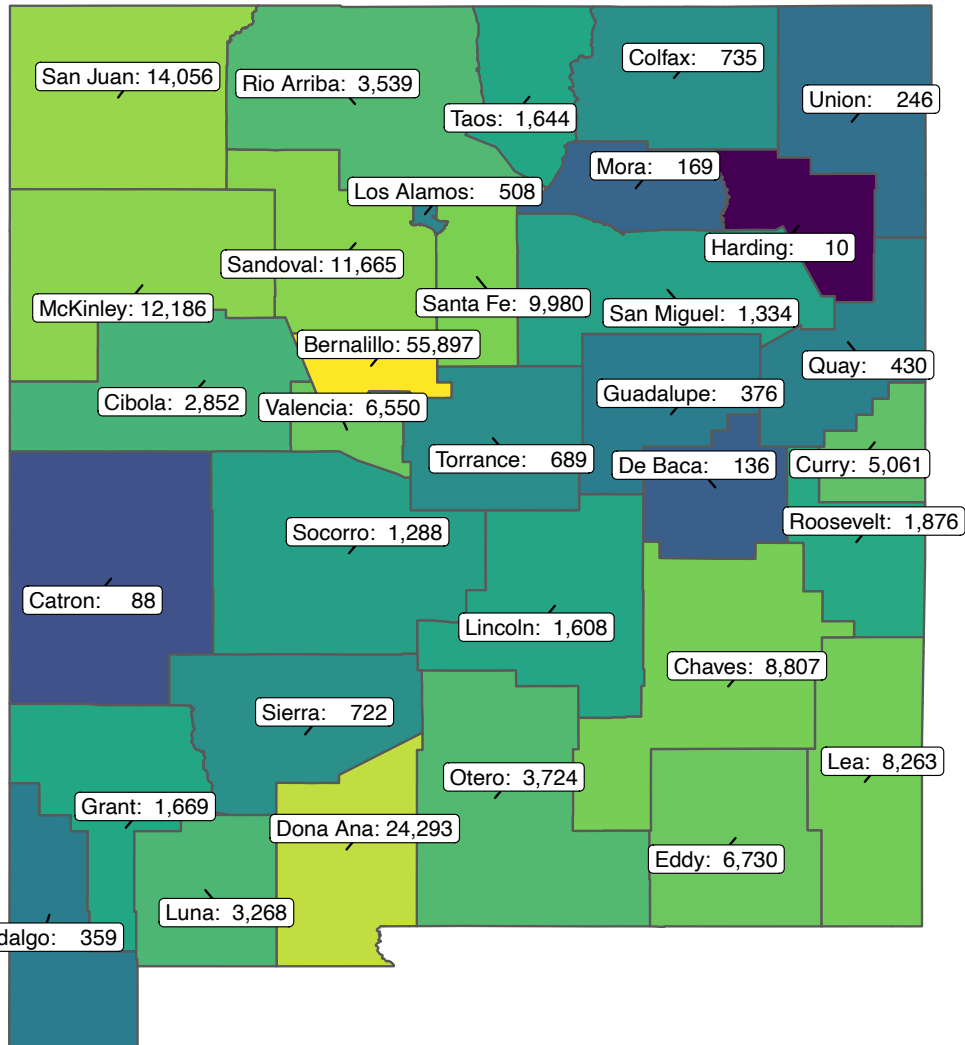# Regional Forecasts

Southeast Region

Weekly cases will range between **15-35** in the next few weeks

Southwest Region

Weekly cases will range between **53-65** in the next few weeks

Cumulative Cases & Daily Growth Rate for NM: April 19

Cases (Log Scale)
- 22,026
- 2,981
- 403
- 55

San Juan: 14,056
Rio Arriba: 3,539
Colfax: 735
Union: 246
Taos: 1,644
Mora: 169
Los Alamos: 508
Harding: 10
Sandoval: 11,665
McKinley: 12,186
Santa Fe: 9,980
San Miguel: 1,334
Bernalillo: 55,897
Cibola: 2,852
Valencia: 6,550
Guadalupe: 376
Quay: 430
Torrance: 689
De Baca: 136
Curry: 5,061
Socorro: 1,288
Roosevelt: 1,876
Catron: 88
Lincoln: 1,608
Chaves: 8,807
Sierra: 722
Lea: 8,263
Otero: 3,724
Grant: 1,669
Dona Ana: 24,293
Eddy: 6,730
Hidalgo: 359
Luna: 3,268

7-day-average daily growth rate (%)
- 0.5
- 0.1
- 0.0

San Juan: 0.2%
Rio Arriba: 0.2%
Taos: 0.2%
Colfax: 0.2%
Union: 0%
Los Alamos: 0.1%
Harding: 1.9%
Mora: 0%
Sandoval: 0.2%
McKinley: 0%
Santa Fe: 0.1%
San Miguel: 0.1%
Cibola: 0.1%
Bernalillo: 0.2%
Quay: 0.1%
Valencia: 0.2%
Guadalupe: 0%
Curry: 0%
Torrance: 0.1%
De Baca: 0%
Catron: 0.6%
Socorro: 0.5%
Roosevelt: 0%
Lincoln: 0.1%
Chaves: 0.1%
Sierra: 0.1%
Lea: 0%
Otero: 0.1%
Grant: 0.2%
Eddy: 0.1%
Dona Ana: 0.1%
Luna: 0.1%
Hidalgo: 0.2%

*Growth rate is in cumulative cases

Daily Growth Rate for NM April 19

7–day–average
daily growth rate (%)

0.5
0.1
0.0

Socorro 0.5% =
Roosevelt 0.0% =
DeBaca 0.0% =
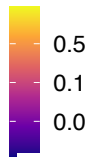Los Alamos 0.1% =
Quay 0.1% =
Colfax 0.2% =
Harding 1.9%
Hidalgo 0.2% =
Guadalupe 0.0% =
Catron 0.6% =
Union 0.0% =
Mora 0.0%=

*arrows indicate more than 0.5% difference in growth rate from last week's analysis; growth rate is in cumulative cases

Los Alamos National Laboratory

County	Daily Growth Rate	Change
San Juan	0.2%	=
Rio Arriba	0.2%	=
Sierra	0.1%	=
McKinley	0.0%	=
Sandoval	0.2%	=
Santa Fe	0.1%	=
Cibola	0.1%	=
Bernalillo	0.2%	=
Valencia	0.2%	=
Torrance	0.1%	=
Lincoln	0.1%	=
San Miguel	0.1%	=
Chaves	0.1%	=
Dona Ana	0.1%	=
Otero	0.1%	=
Lea	0.0%	=
Eddy	0.1%	=
Curry	0.0%	=
Grant	0.2%	=
Luna	0.1%	=
Taos	0.2%	=

COVID-19 across New Mexico

A 7-day moving window comparison
April 19, 2021

Impacted New Mexicans

Counties with New Cases This Week

Growth Rate / Cases Per Capita

	Low	Med	High
Accelerating	0k	1.1M	17k
Constant	37k	660k	459
Decelerating	0k	270k	0k

Counties With No New Cases In ...

| Last Week	Two Weeks	3+ Weeks
6k	9k	0k
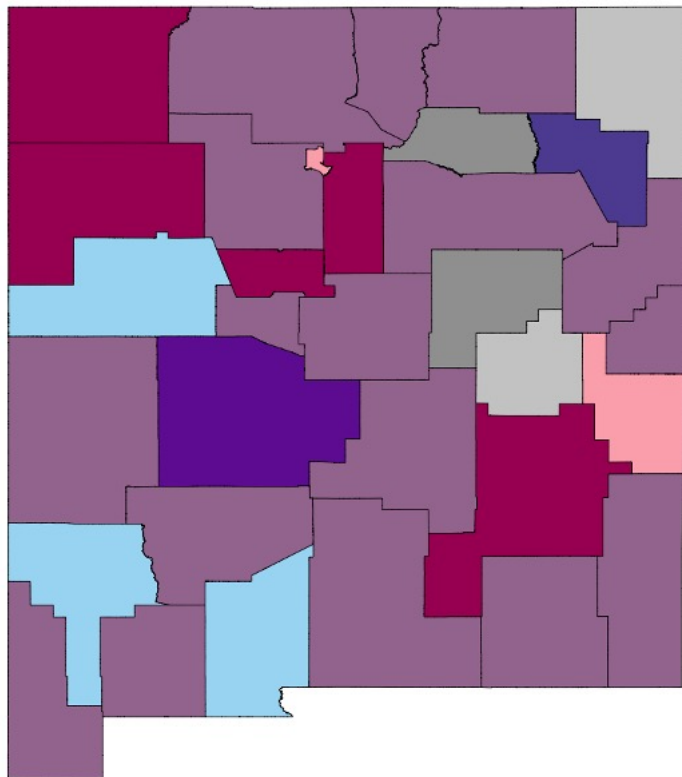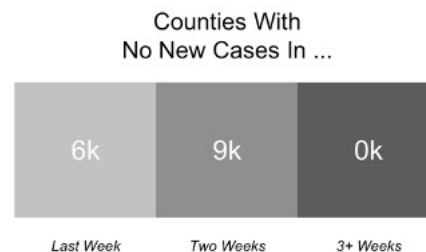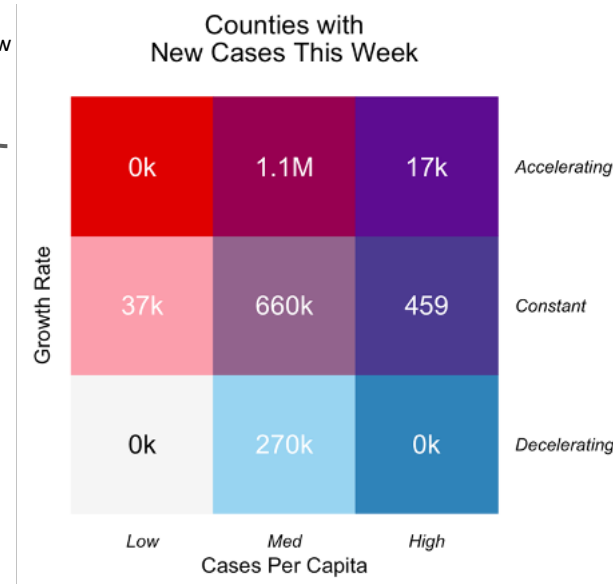
So what?

- Most people in New Mexico are living in a county that is **medium per-capita case counts with a mixture of accelerating and constant**

- **Chaves, Curry, McKinley, and Socorro** are accelerating; Bernalillo was classified as accelerating but is more likely constant; Taos was classified constant but may be accelerating

Number of New Mexicans living in regions with particular combinations of per capita case counts and 7-day growth rates

Low <10 cases/100k per week
Med   10-99 cases/100k per week
High >100   cases/100k per week

Concurrent Hosp & ICU Beds Based on Forecasts – Average Stay of 8 Hosp, 15 Days for ICU/vent & 25% ICU rate
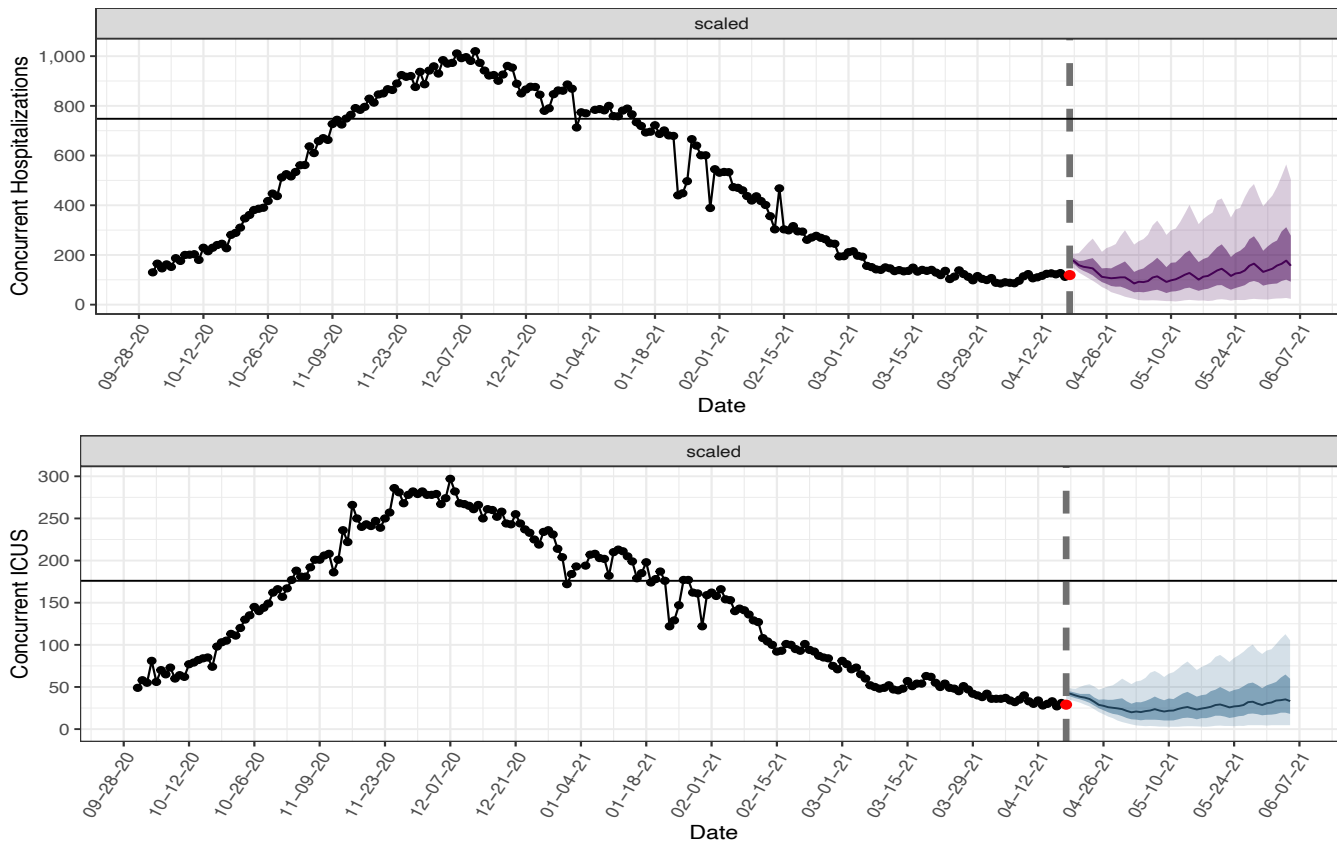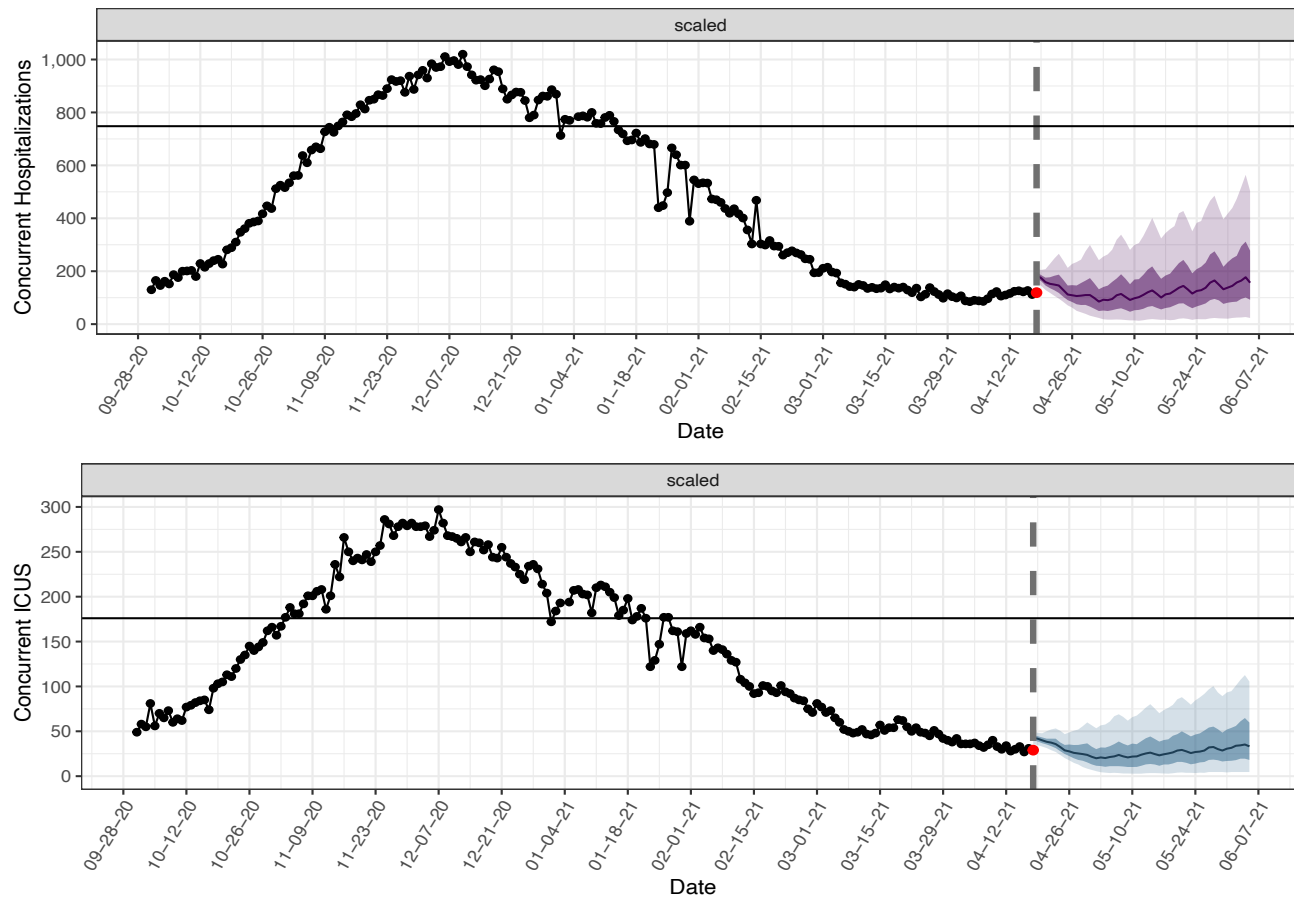

Concurrent COVID-19 ICU beds

Week	Qu. 5% (best case)	Qu. 50% (median)	Qu. 95% (worst case)
4/25	20	29	47
5/2	6	20	53
5/9	3	21	62
5/16	3	23	70
5/23	4	26	80
5/30	5	29	89

"Scaled" Scenario

next 3 weeks.

Concurrent Hosp & ICU Beds Based on Forecasts – Average Stay of 8 Hosp, 15 Days for ICU/vent & 25% ICU rate

Concurrent COVID-19 <u>non-ICU "med-surge"</u> beds

Week	Qu. 5% (best case)	Qu. 50% (median)	Qu. 95% (worst case)
4/25	51	83	166
5/2	18	65	188
5/9	11	71	219
5/16	13	77	254
5/23	13	90	271
5/30	17	103	307

"Scaled" Scenario

...at?

...<u>stay the same</u> over the next 3 weeks.