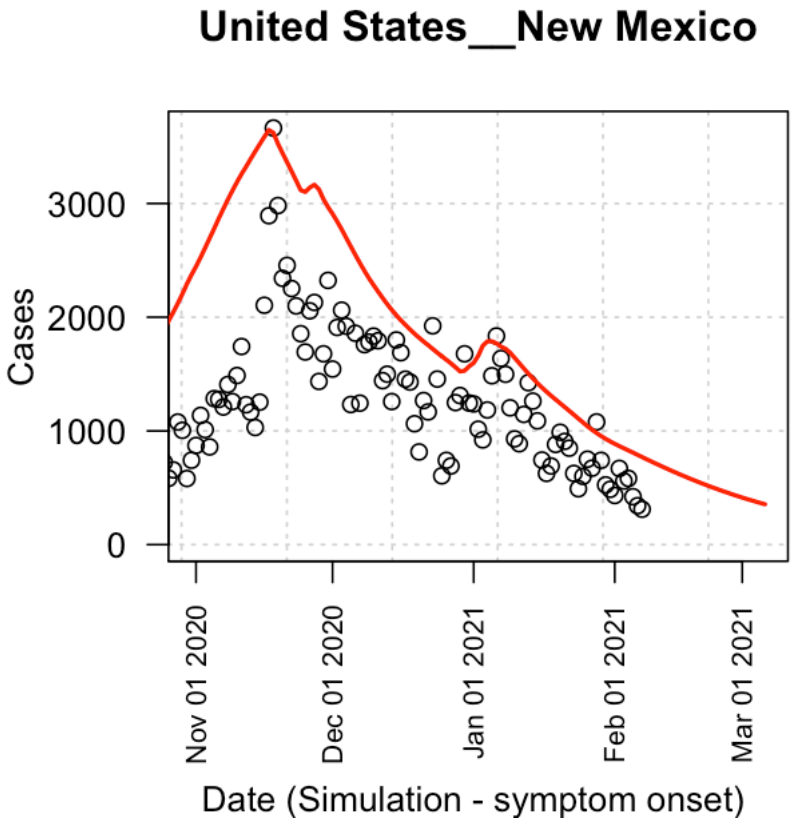
Modeling & Forecasting COVID-19 in NM

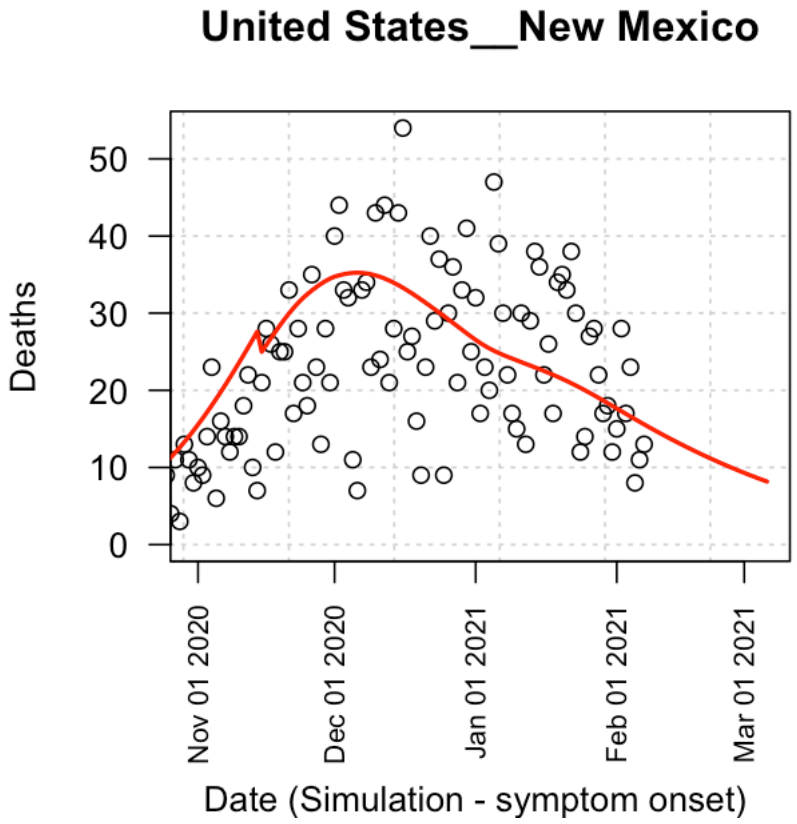
February 9, 2021

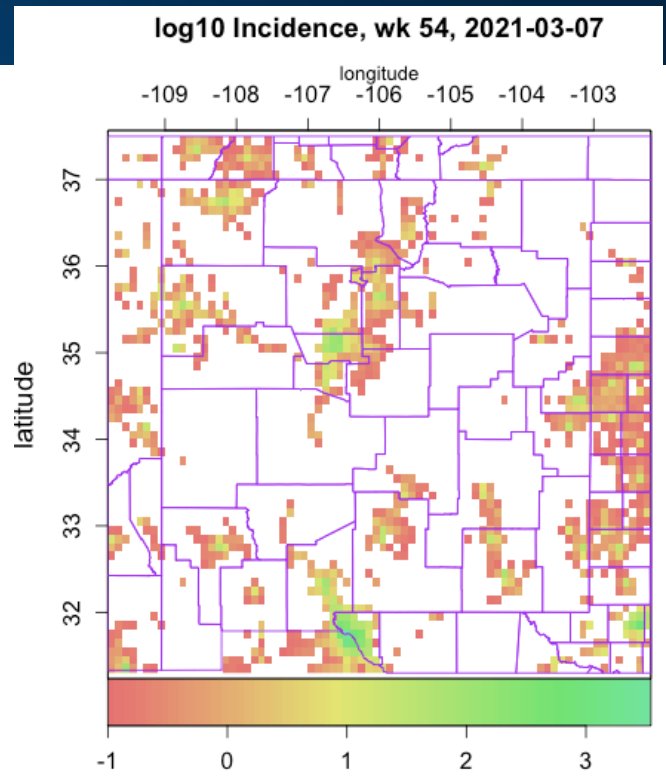
NNSA
National Nuclear Security Administration

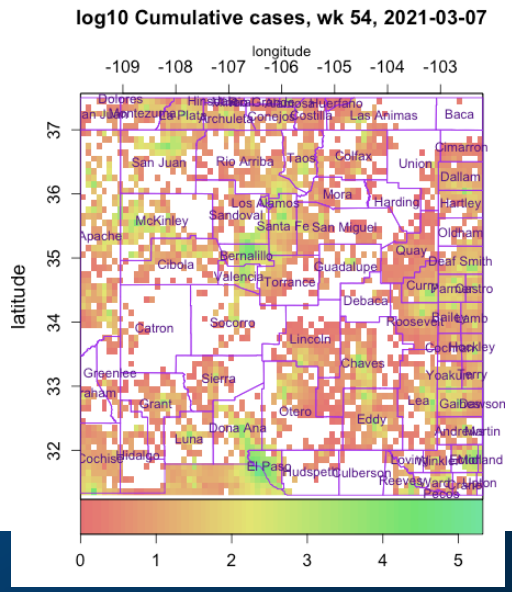
09 Feb 2021: EpiGrid modeling

- A 20% increase in transmissibility is assumed for yellow/green counties as compared with red counties.



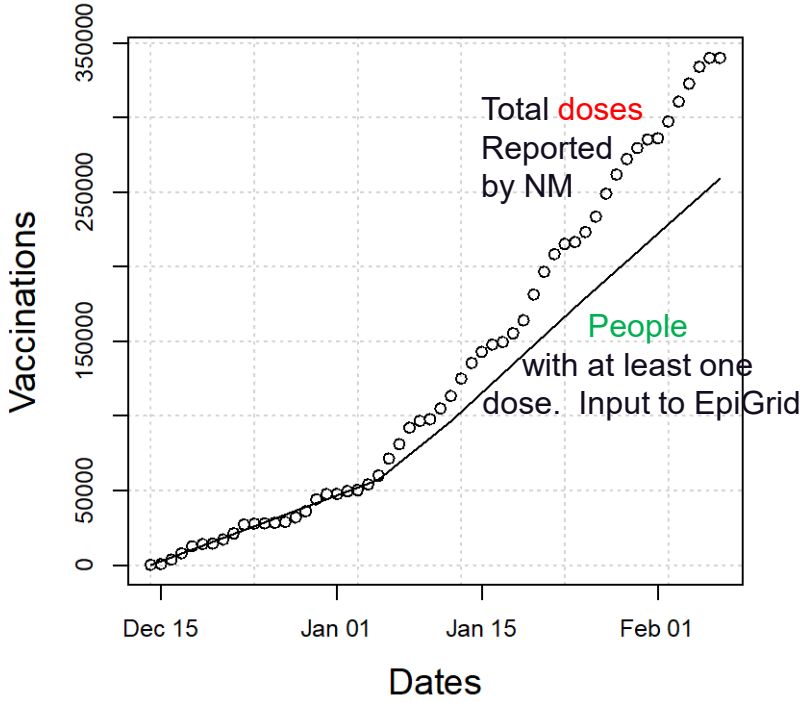






09 February 2021 Model (EpiGrid) – more details and information

- **Daily reported cases in El Paso are approximately constant.**
- **Vaccination starts Dec. 15th with 2600 people per day changing to 5600 people per day on Jan 6th, to 6370 per day on Jan 13th, and 6160 per day on Jan 25th and 90% vaccine effectiveness. 252,000 people have at least one dose.**
- **Vaccination rates by are implemented such that the cumulative numbers match by-county for the Feb 8th state of NM numbers.** The time sequence increases the same way for each county.
- **Transmission is based on mobility with modifications due to PHO's and red/yellow/green.**
  - Modeling of public reaction and public health orders (PHO) similar to previous models.
- **Death rates now include some of the inhomogeneity by-county**
  - Counties with larger at-risk populations have higher death rates.
  - Starting to model the expected change in death rate due to vaccination of older population.
- **Isolation and quarantine rates are assumed to be stable based on state reported quarantine times.**
  - Swab to results times: Assuming 1-3 days
  - Base isolation rates mostly modeled as 50% Dec. 8th-22nd,45% until Jan 10th then are increased to 55%.
- **Baseline results reflect novel variants of SARS-CoV-2. The effect is numerically very small at this time.**
  - Potential for a 50% increase in contagion/force of infection *in the future*.
  - No epidemiological evidence yet for strain replacement in New Mexico. Good infection control helps.
  - Properties of novel viral variants are not fully characterized.

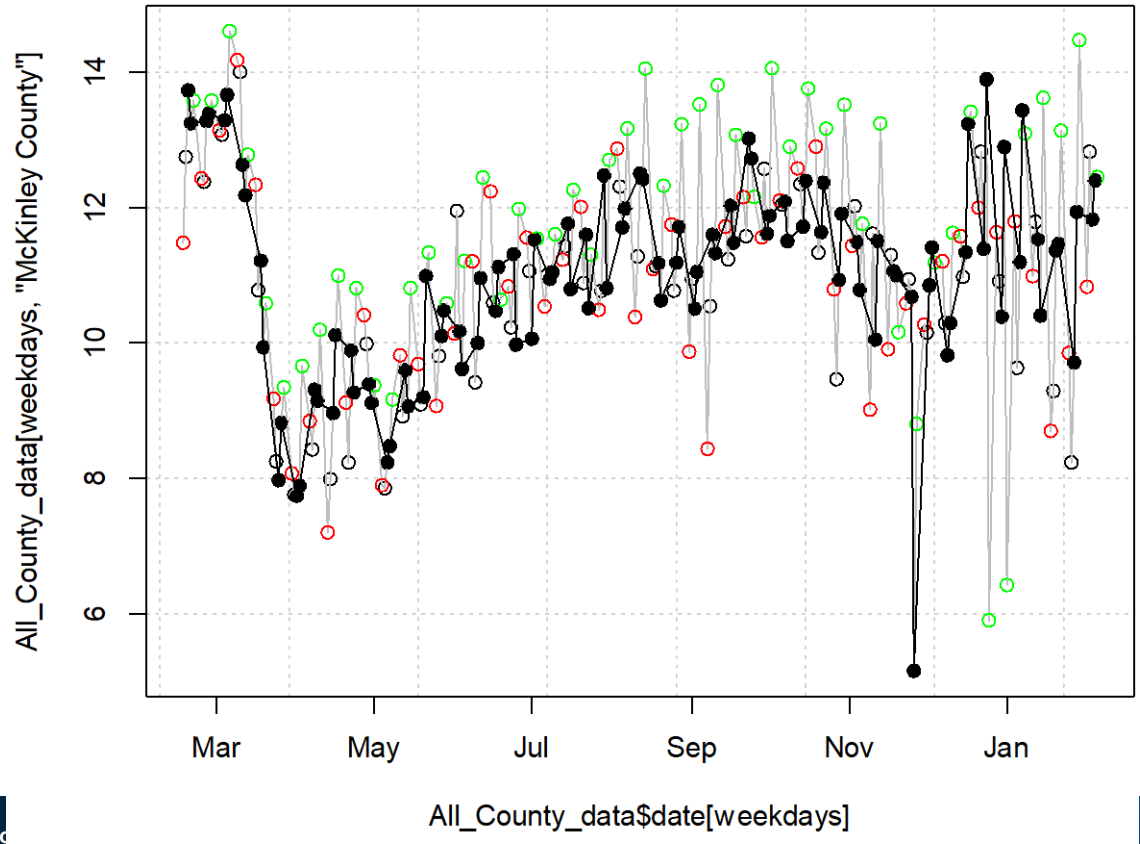


T-80 Mobility – northern counties (Data only).

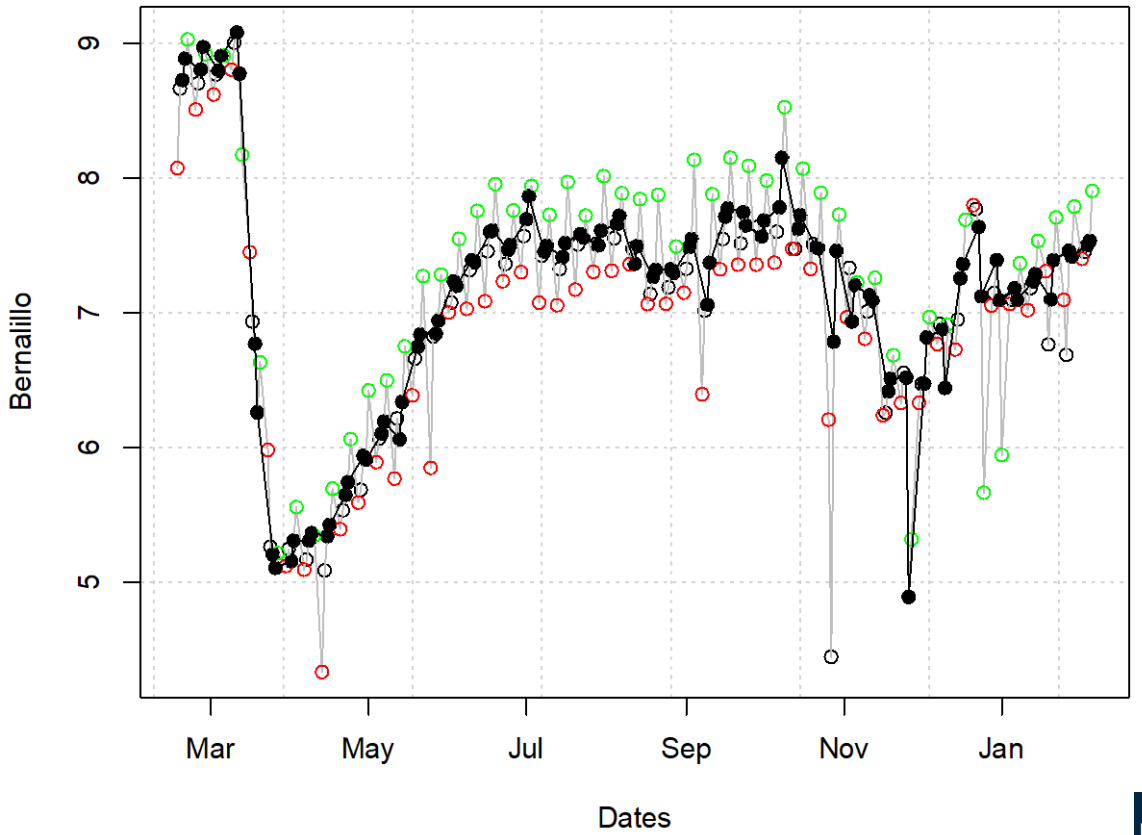
- Bernalillo, Sandoval and Valencia have had increasing mobility over the last 3-4 weeks.
- San Juan also appears to be increasing.
- Los Alamos, McKinley, Rio Arriba, Santa Fe have stable mobility similar mobility to the summer of 2020.
- Taos appears to have decreasing mobility

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

McKinley



Bernalillo

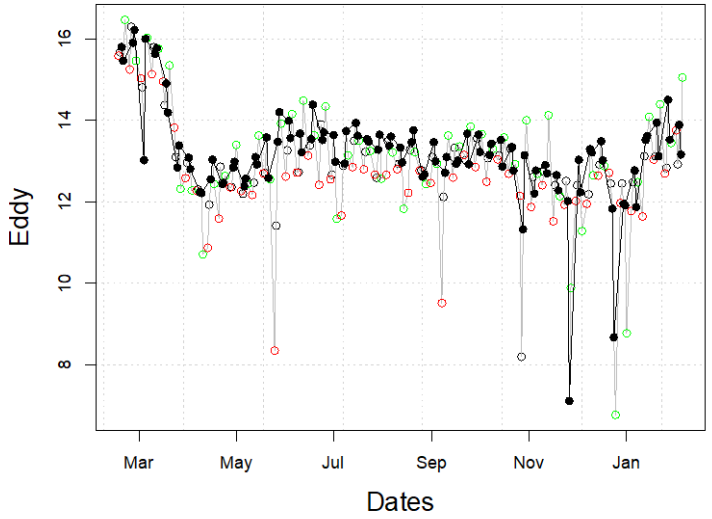


T-80 Mobility – southern counties and Curry (Data only)

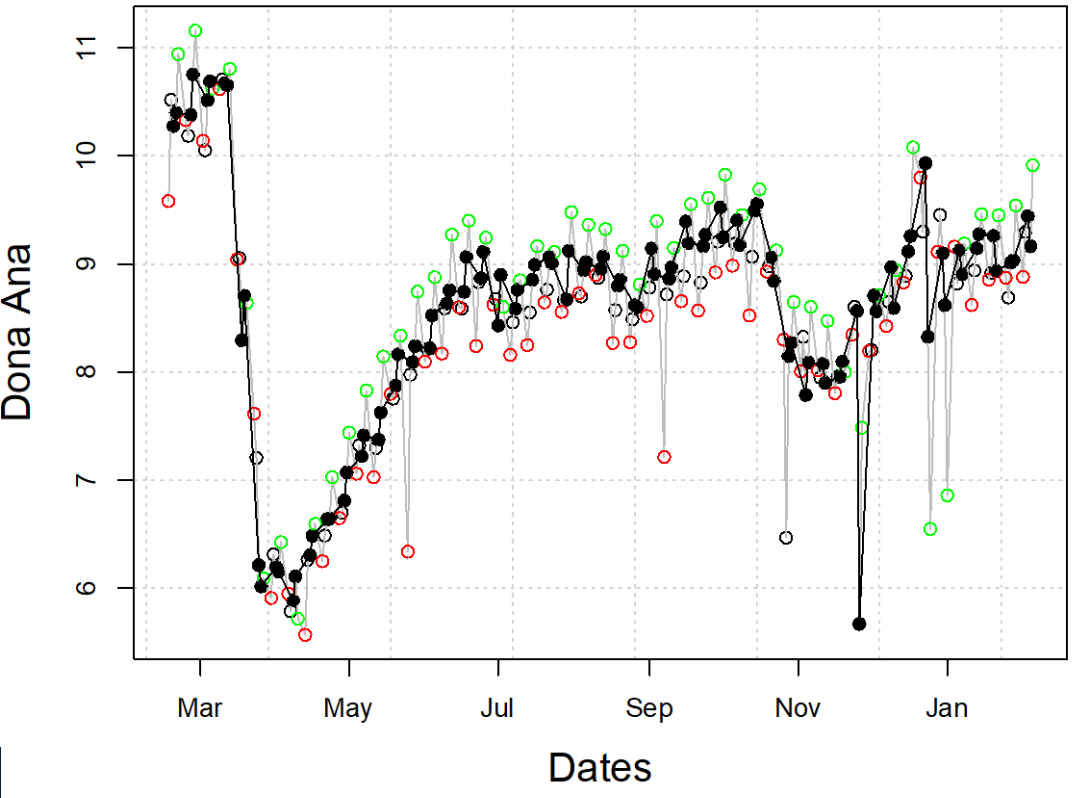
- Dona Ana, Chaves, Curry, and Lea may have increasing mobility
- Eddy, Grant , Lincoln, Luna, Roosevelt, Socorro are stable (to within the noise).
- Stable at high level? But otherwise ”boring” …

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

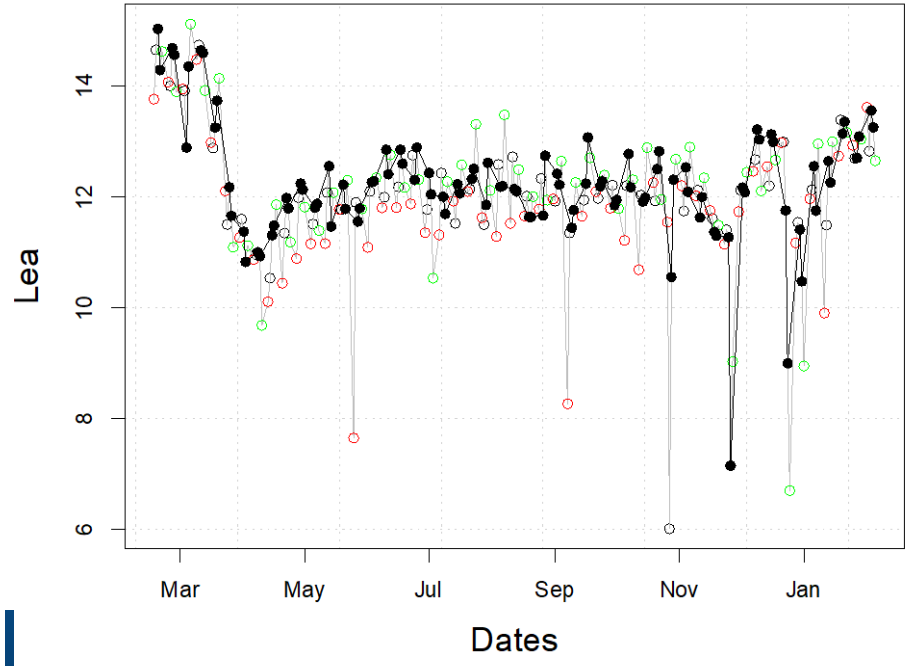
Eddy



Dona Ana

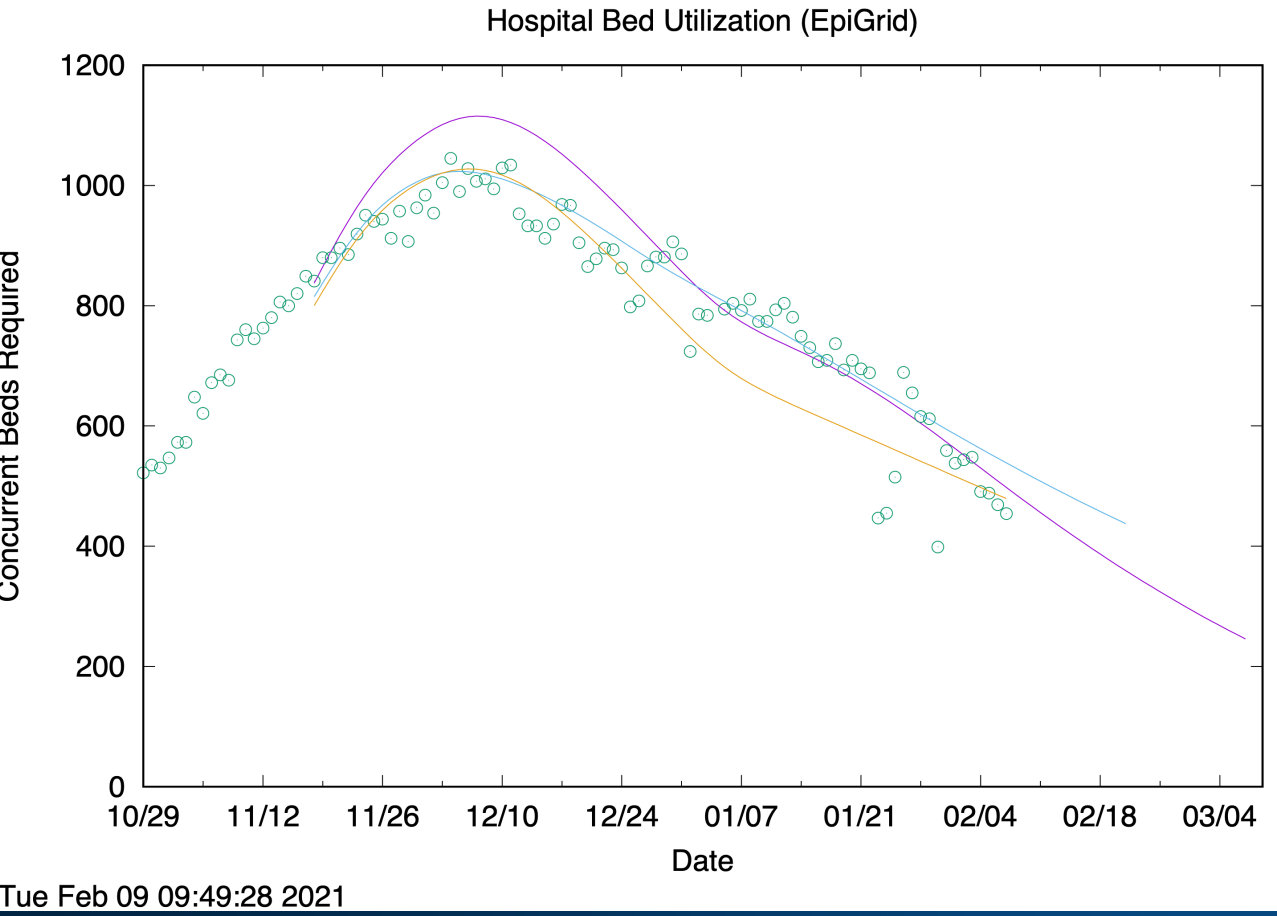


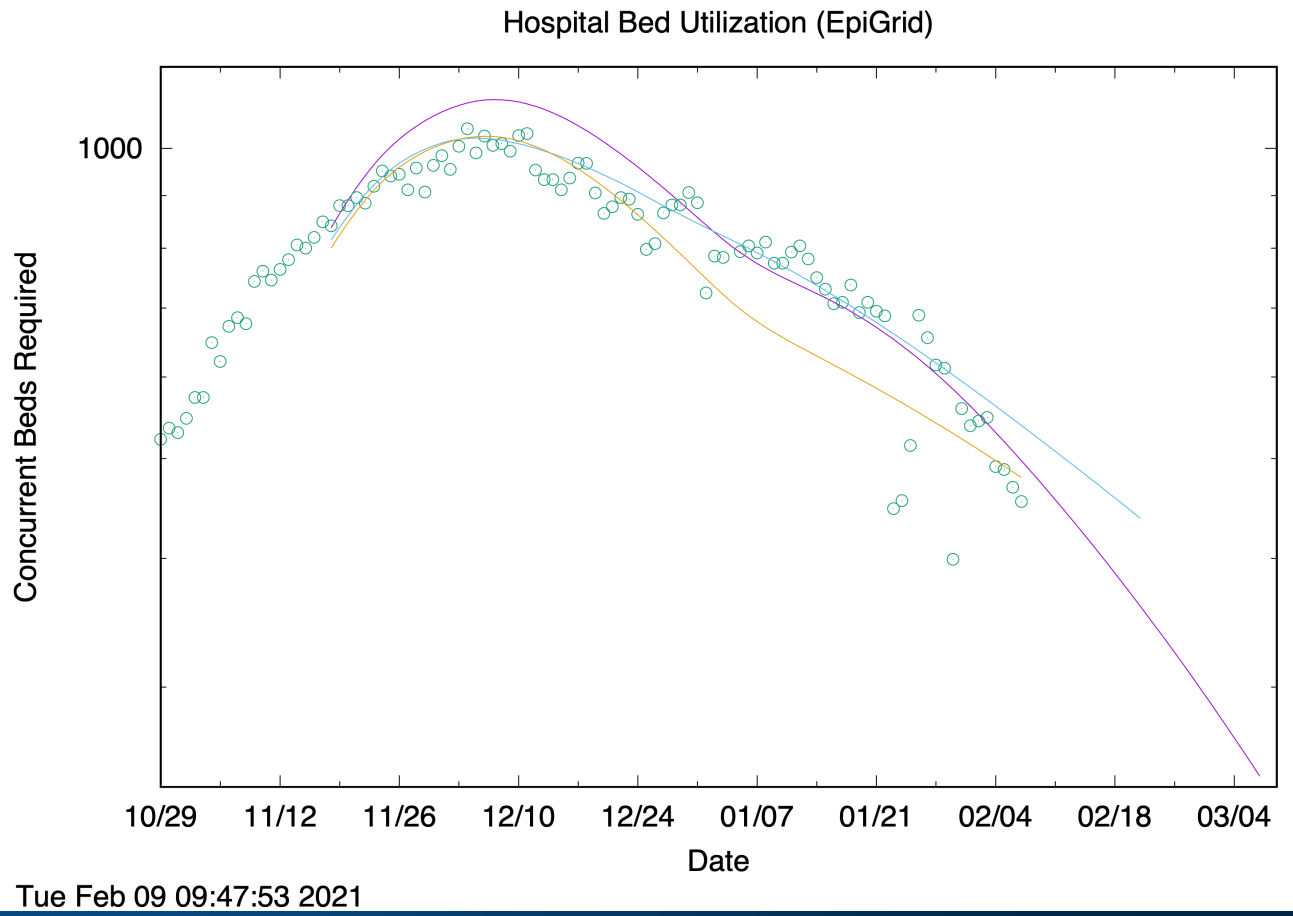
Lea



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

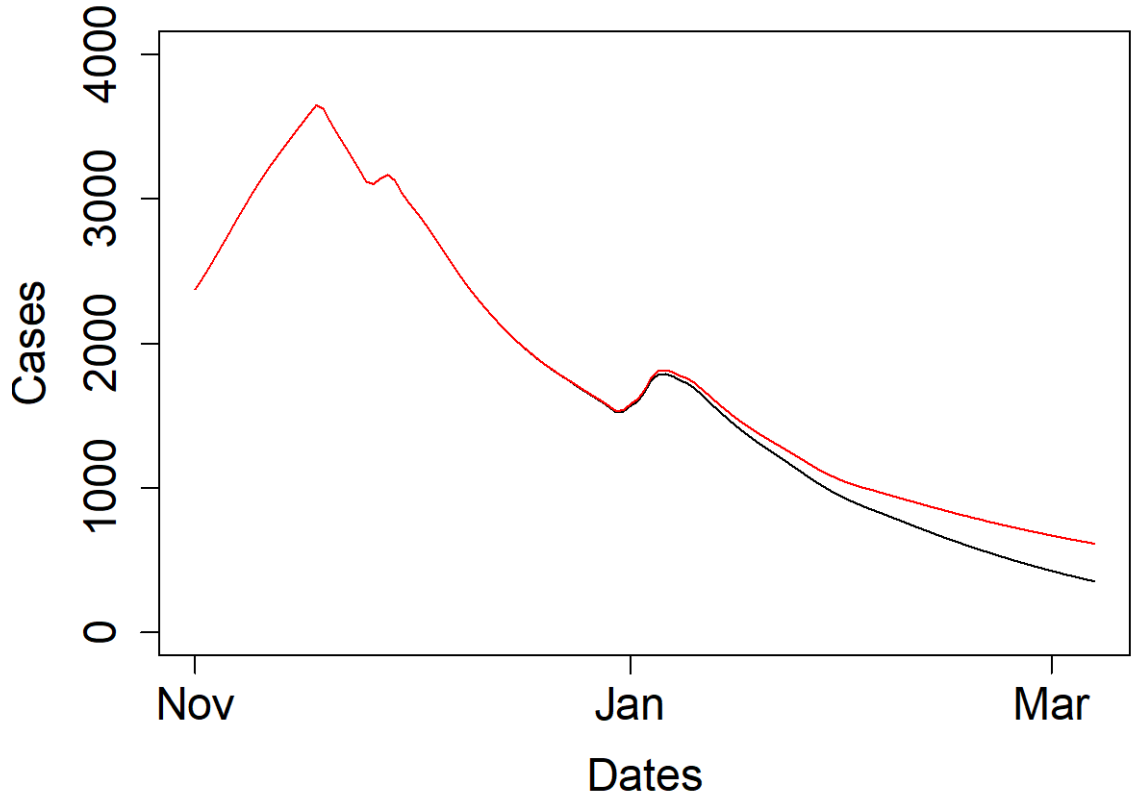
- Left panel: Linear vs. time (y-scale=0:1200) shows hospital beds. Models: 09Feb21 (purple), 12Jan21 (yellow), 15Dec20 (cyan).
- Right panel: Log vs. time, same data and models (y-scale = 240:1200, 5x instead of 4x).
- Christmas and New Year's are 4-5x Thanksgiving modulation of the force of infection/level of contagion.
- Unresolved hospitalized COVID-19 cases dating from Christmas and New Year's are declining.





Effect of Vaccination on Incidence

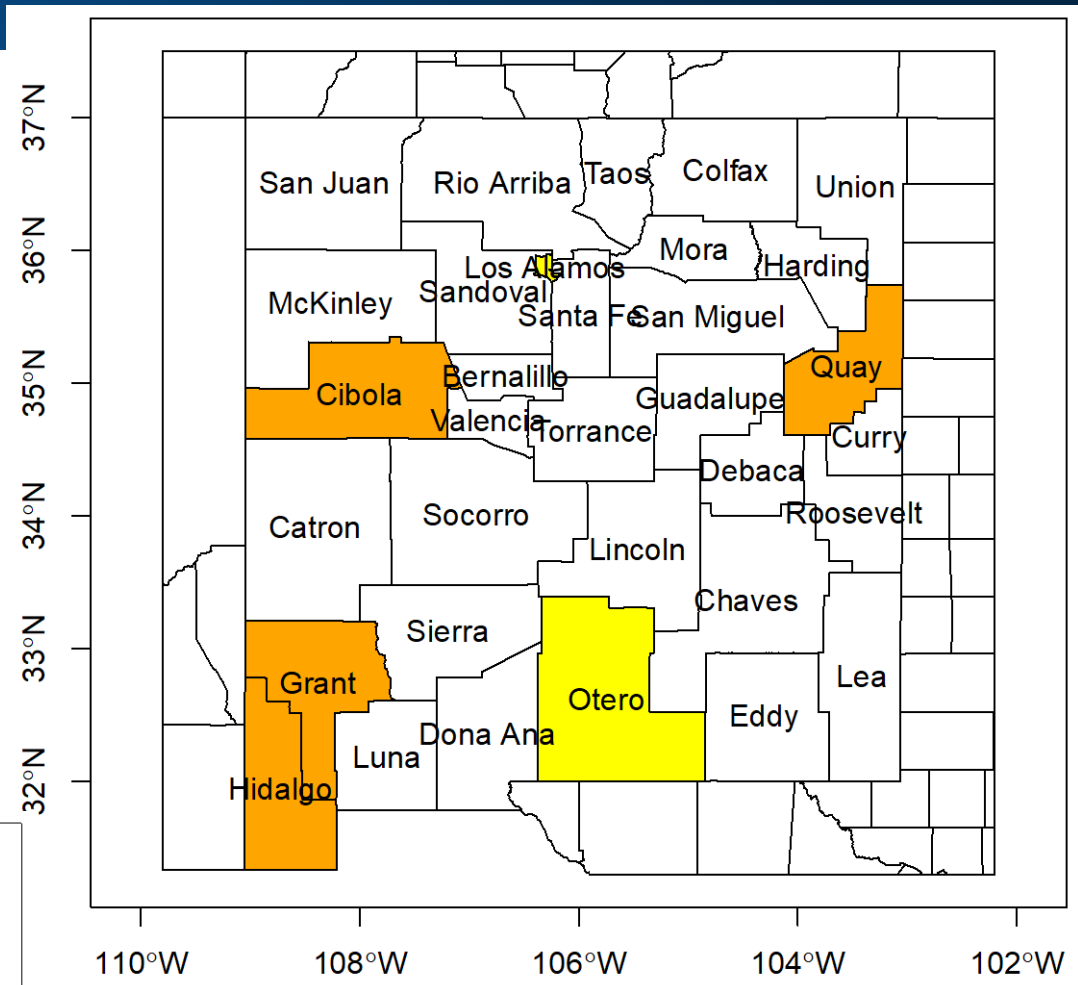
16% decrease on Feb. 9th



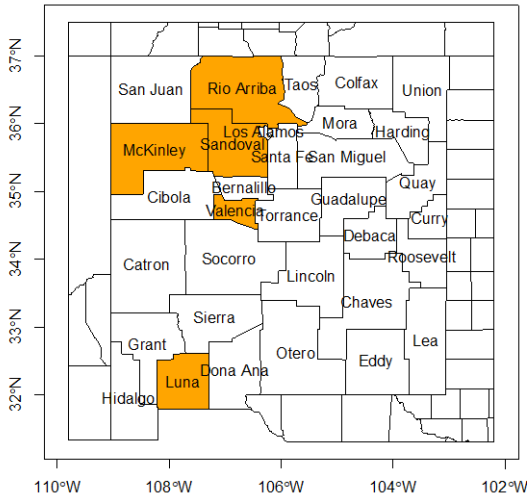
Red – No Vaccination
Black – Vaccination
(same result as on slide 1)

Situational Awareness:

- Cases in Cibola, Grant, Hidalgo and Quay may not be decreasing.
- Cases in Los Alamos and Otero are decreasing but still much higher than at the start of October. *In contrast* other counties will have incidence similar to early October in a week or 2 on the current trajectory
- As was shown last week, Luna, Rio Arriba, Sandoval, and Valencia are decreasing, but transmission/force of infection is still high. Transmission/force of infection in McKinley is now very close to the expected mobility based level.
- A decline in incidence in San Juan county most strongly resembles the results of a strict lock-down. Cases and hospitalizations will eventually provide further information on the epidemic course.



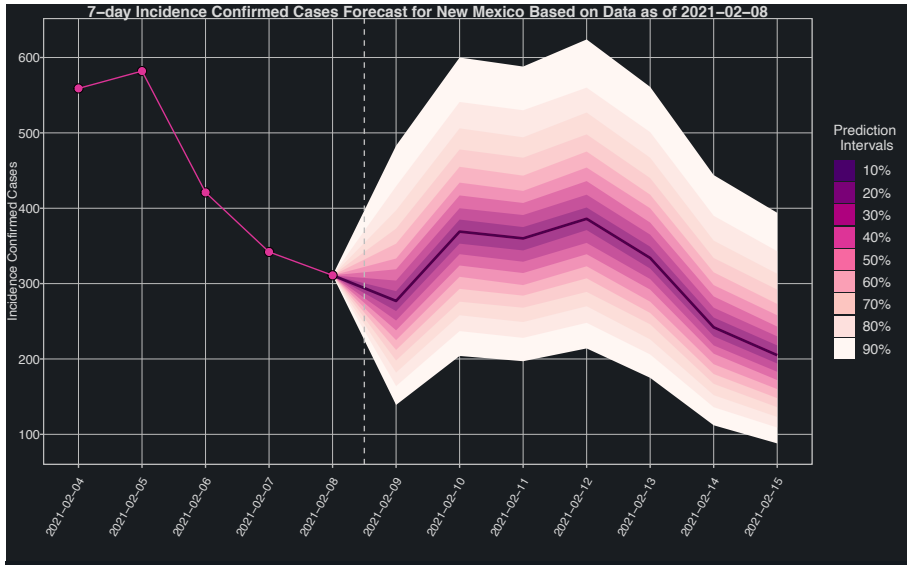
Last week



Conclusions and Discussion

- **New Mexico's daily incidence is slowly declining state-wide.**
- **COVID-19 vaccination reported by the State is responsible for an >~12% reduction in daily incidence.**
- **Infection control and quarantine continue to play significantly larger roles than vaccination in epidemic control.**
- **Multiple viral variants continue to pose a risk to epidemic control. National and State monitoring for strain emergence is likely improving. Model is *assuming* about 1:1000 variant cases in late January.**
- **El Paso's daily incidence is roughly flat.**
- **Nationwide geographical dispersion is seeding some local transmission and variants.**
- **Testing suggests that situational awareness is fair to good.**
- **Targeting vaccine to high-mortality areas and populations will have the largest immediate effect on this model.**
- **Discussion:**
  - Vaccinating high risk-of-mortality populations will lower the mortality rate *and* further lower hospital loading.
  - Good infection control is schools appears to be well-correlated with improved outcomes. Improved PPE may be required in response to viral variant emergence. Meal times, buses, and passing periods are likely the riskiest school-related activities.
  - There is not yet clear *epidemiological* evidence for a more contagious variant of SARS-CoV-2 in New Mexico. This is not a warning system.
  - Qualitatively higher testing rates (i.e. 10x) can substantially offset local epidemics (i.e. South Korea) by facilitating tracing and quarantine. Sequencing can provide diagnostics, and provides variant-level information that is likely to become important in the near future, and is compatible with high testing rates.
  - Elimination of COVID-19 removes or reduces the risk of novel variant emergence.

Short- & Long-Term Forecast for NM: Cases



6–Week Forecast of Confirmed Cases for New Mexico Based on Data as of 2021–02–08

Week	Best Case (5th Percentile)	Middle Case (50th Percentile)^	Worst Case (95th Percentile)
2021–02–08		177,867*	
2021–02–15	178,996	180,045	181,552
2021–02–22	179,887	181,924	185,002
2021–03–01	180,722	183,904	188,858
2021–03–08	181,563	186,170	193,396
2021–03–15	182,539	188,830	198,850
2021–03–22	183,801	191,938	204,987

*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 2021–02–08

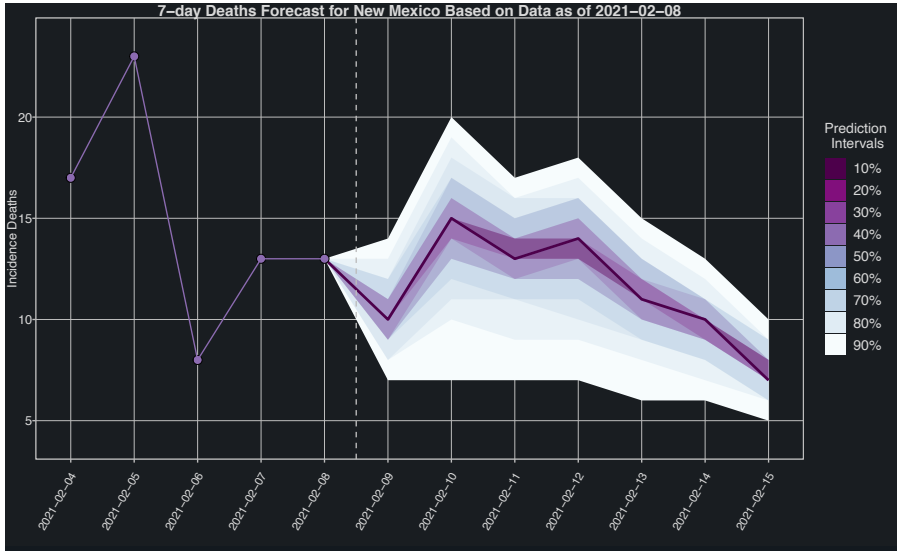
Week	Best Case (5th Percentile)	Middle Case (50th Percentile)^	Worst Case (95th Percentile)
2021–02–08		474*	
2021–02–15	161	311	526
2021–02–22	127	268	493
2021–03–01	119	283	551
2021–03–08	120	324	648
2021–03–15	139	380	779
2021–03–22	180	444	877

*Last reported confirmed cases count
^Closest–matching scenario

So what?

The daily number of cases are expected to be around 300 in the next few weeks

Short- & Long-Term Forecast for NM: Deaths



6–Week Forecast of Deaths for New Mexico Based on Data as of 2021–02–08

Week	Best Case (5th Percentile)	Middle Case (50th Percentile)^	Worst Case (95th Percentile)
2021–02–08		3,412*	
2021–02–15	3,459	3,495	3,510
2021–02–22	3,495	3,553	3,583
2021–03–01	3,523	3,600	3,649
2021–03–08	3,546	3,642	3,725
2021–03–15	3,565	3,684	3,821
2021–03–22	3,580	3,731	3,931

*Last reported deaths count
^Closest–matching scenario

6–Week Forecast of Daily Average of Deaths for New Mexico Based on Data as of 2021–02–08

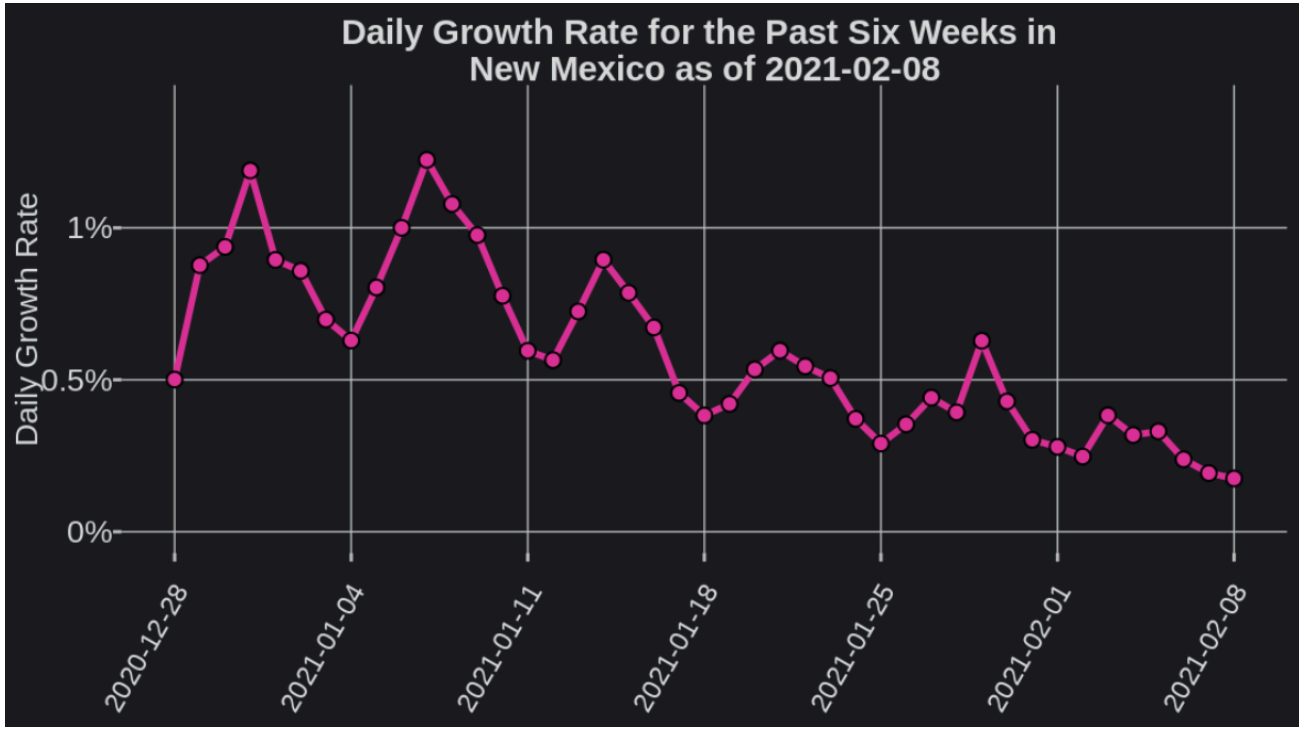
Week	Best Case (5th Percentile)	Middle Case (50th Percentile)^	Worst Case (95th Percentile)
2021–02–08		17*	
2021–02–15	7	12	14
2021–02–22	5	8	10
2021–03–01	4	7	9
2021–03–08	3	6	11
2021–03–15	3	6	14
2021–03–22	2	7	16

*Last reported confirmed deaths
^Closest–matching scenario

So what?

The daily number of deaths are expected to be around 10 in the next few weeks

Growth Rate for NM



6-Week Forecast of the Average Weekly Growth Rate for New Mexico Based on Data as of 2021-02-08

Week	Best Case (5th Percentile)	Middle Case (50th Percentile)^	Worst Case (95th Percentile)
2021-02-08		0.27%*	
2021-02-15	0.090%	0.17%	0.29%
2021-02-22	0.071%	0.15%	0.27%
2021-03-01	0.066%	0.15%	0.30%
2021-03-08	0.066%	0.18%	0.34%
2021-03-15	0.077%	0.20%	0.40%
2021-03-22	0.098%	0.23%	0.44%

*Last weekly mean daily growth rate

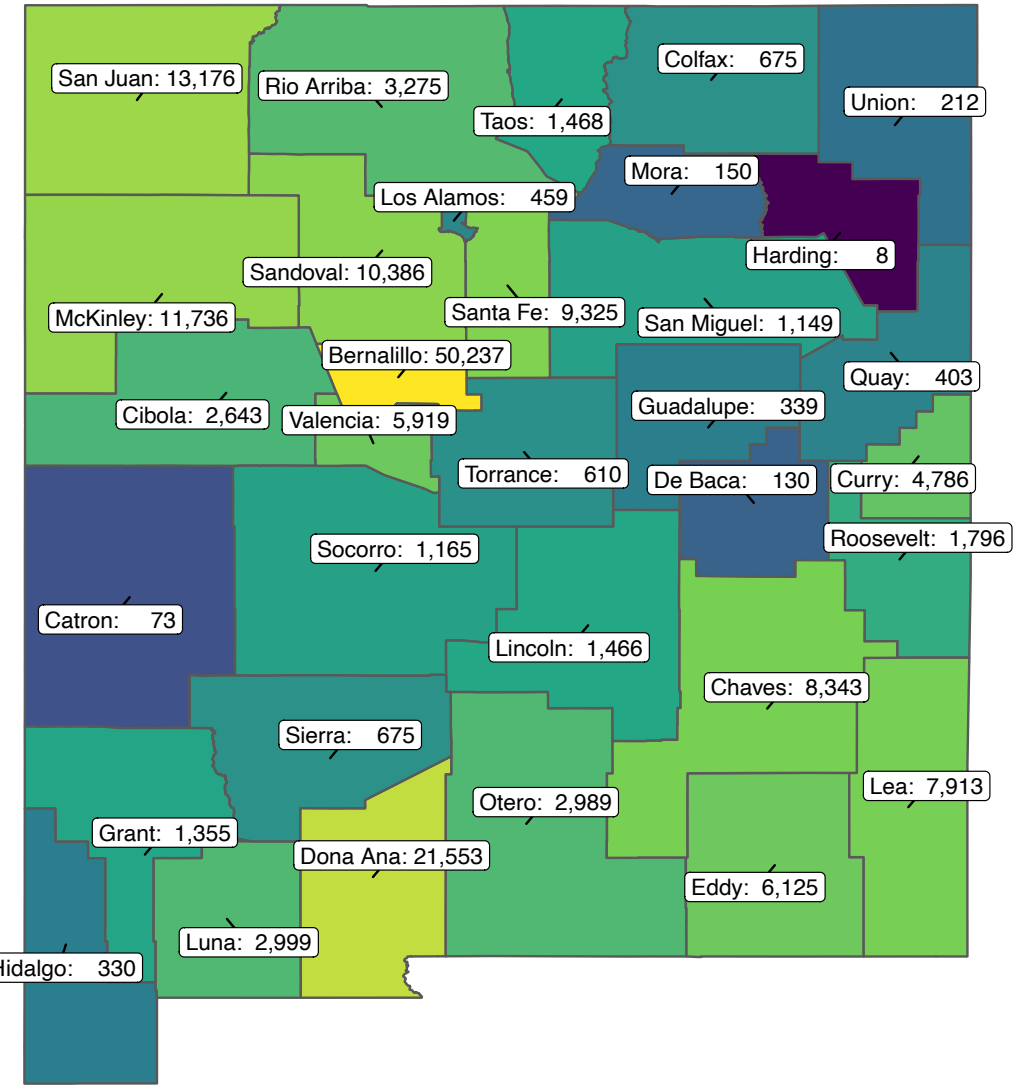
^Closest-matching scenario

So what?

As of February 8th, the average growth rate in NM is at 0.2% (down from 0.4%)

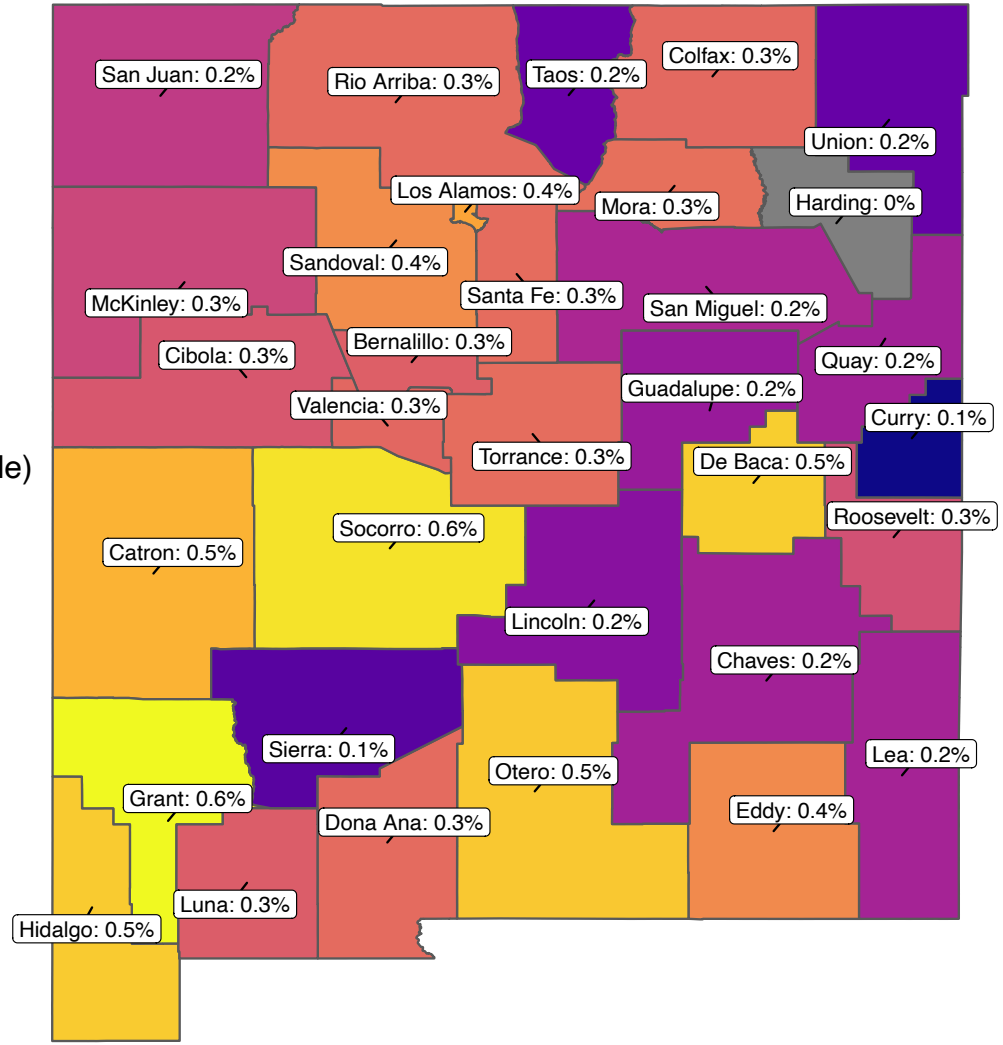
> Regional Growth Rates, Hospitalization & Shelter Forecasts

Cumulative Cases & Daily Growth Rate for NM: Feb 8



Cases
(Log Scale)

22,026
2,981
403
55

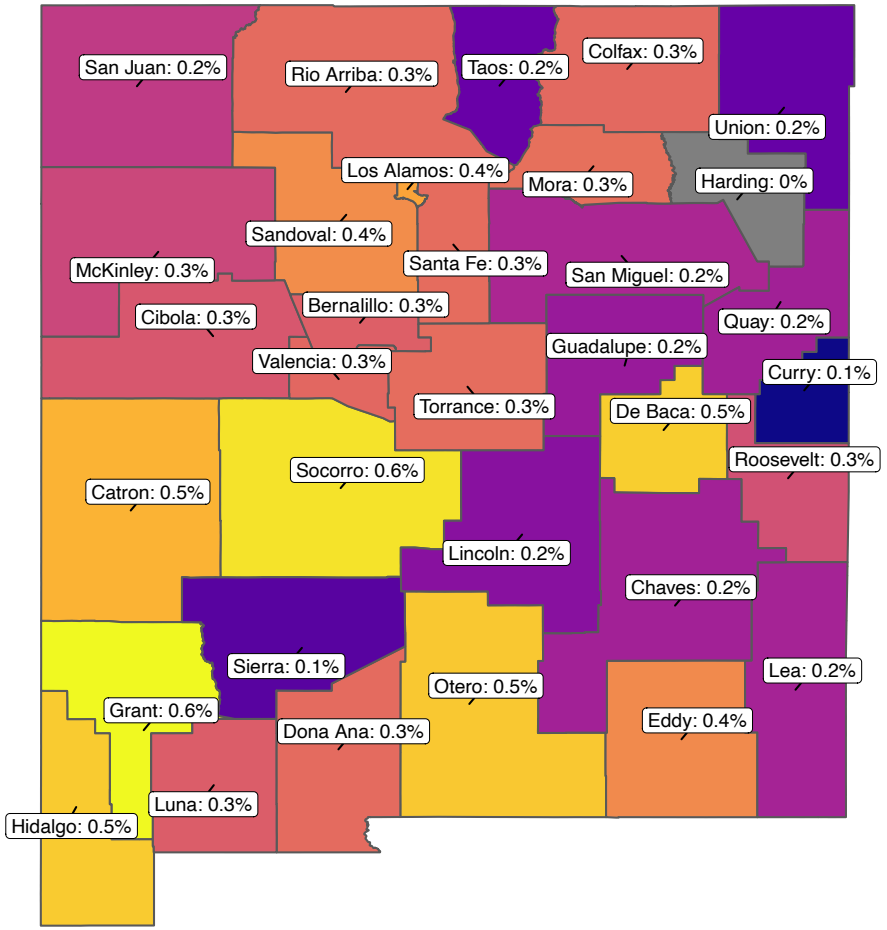


7–day–average
daily growth rate (%)

0.5
0.2
0.1

*Growth rate is in cumulative cases

Daily Growth Rate for NM Feb 8



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

Socorro 0.6% =
Mora 0.3% =
Roosevelt 0.3% =
DeBaca 0.5% =
Los Alamos 0.4% =
Catron 0.5% =
Quay 0.2% =
Union 0.2% =
Colfax 0.3% =
Harding 0.0% =
Hidalgo 0.5% =

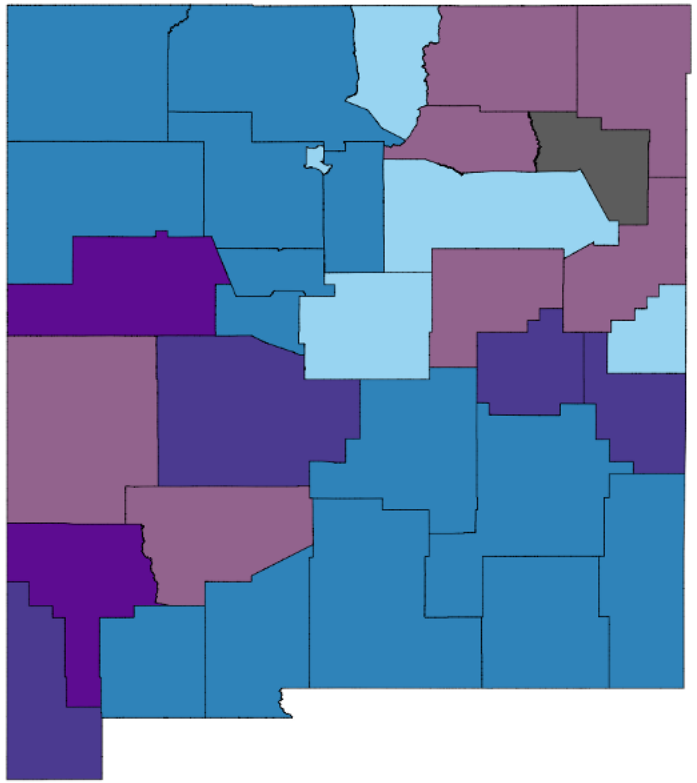
County	Daily Growth Rate	Change
San Juan	0.2%	=
Rio Arriba	0.3%	=
Sierra	0.1%	=
McKinley	0.3%	=
Sandoval	0.4%	=
Santa Fe	0.3%	=
Cibola	0.3%	=
Bernalillo	0.3%	=
Valencia	0.3%	=
Torrance	0.3%	=
Lincoln	0.2%	↓
San Miguel	0.2%	↓
Chaves	0.2%	=
Dona Ana	0.3%	=
Otero	0.5%	=
Lea	0.2%	=
Eddy	0.4%	=
Curry	0.1%	=
Grant	0.6%	=
Luna	0.3%	=
Taos	0.2%	↓

Weekly Growth Rate for NM: Another View (Feb 8)

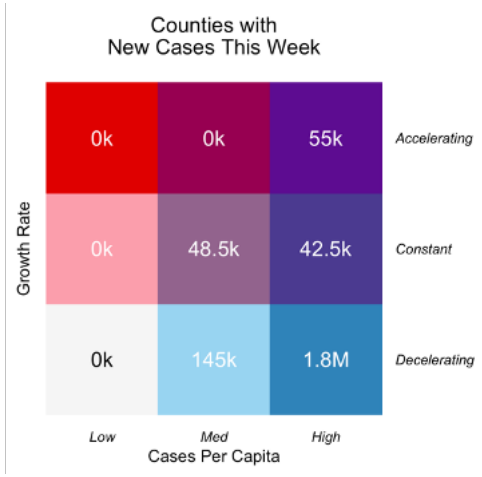
COVID-19 across New Mexico

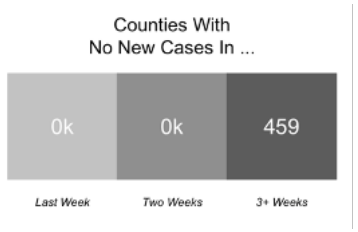
A 7-day moving window comparison

February 8, 2020



Impacted New Mexicans





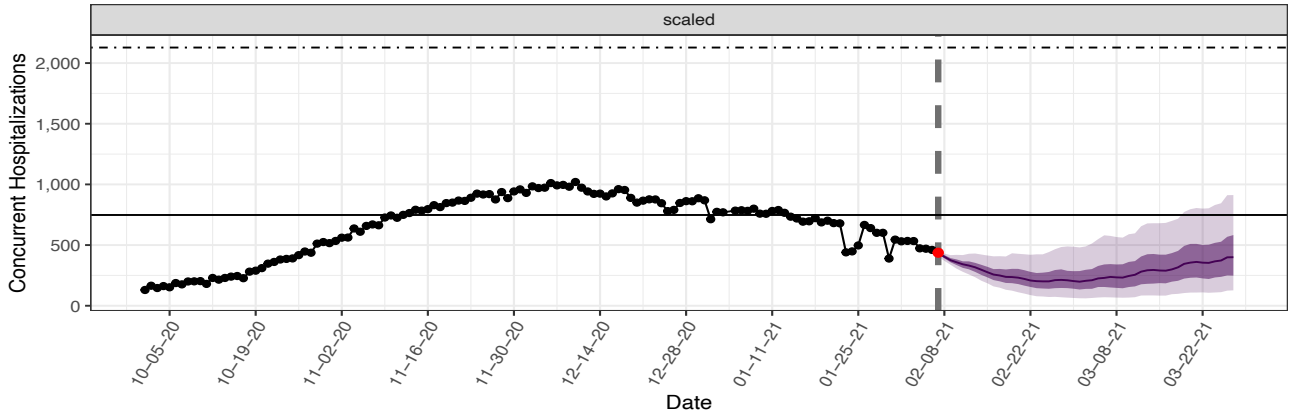
So what?

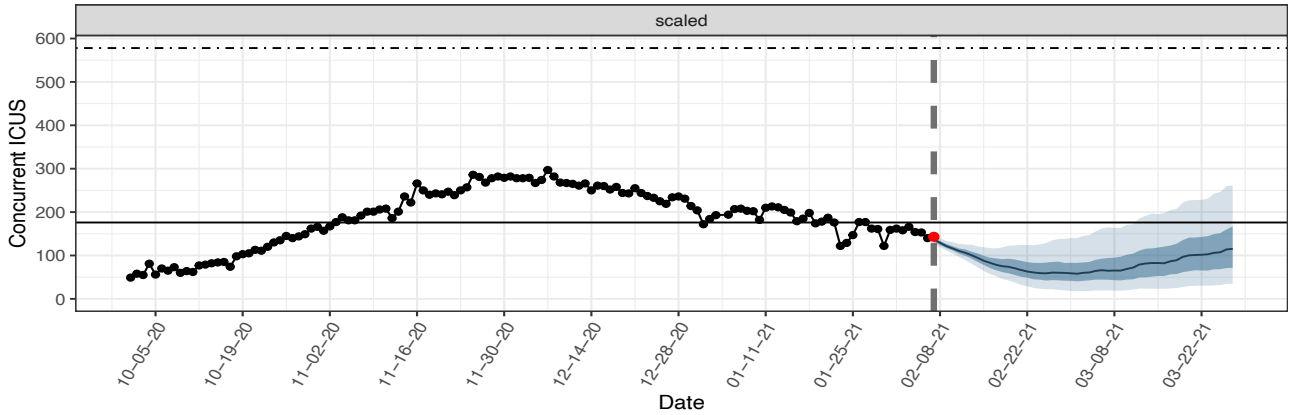
- Most people in New Mexico are living in a county that is decelerating with high per-capita case counts
- Counties with >500 weekly cases per 100k: None
- Cibola and Grant are accelerating; the southwest and northeast corners are constant

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

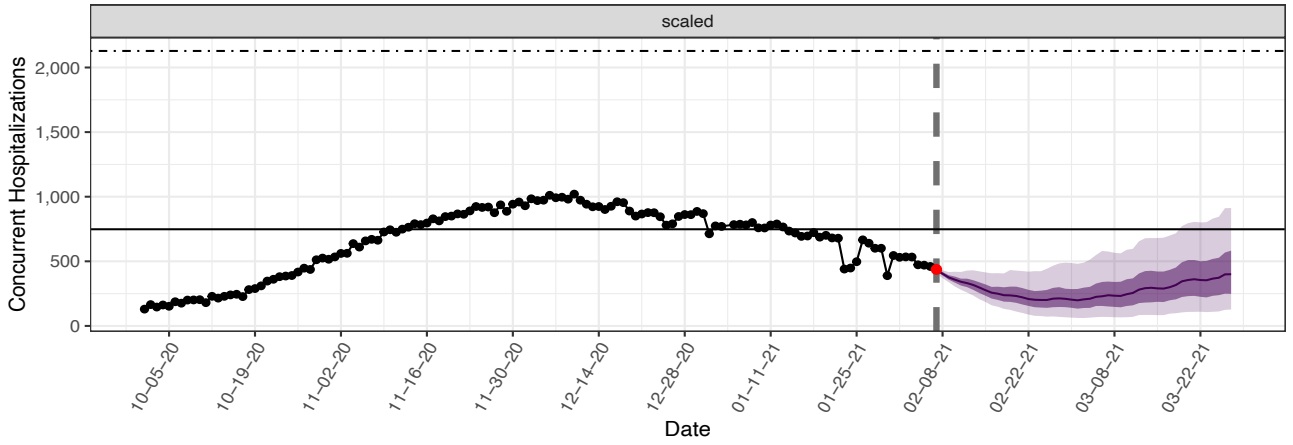
Week	Qu. 5% (best case)	Qu. 50% (median)	Qu. 95% (worst case)
2/14	73	95	121
2/21	32	67	124
2/28	20	60	138
3/7	20	65	165
3/14	24	83	196
3/21	30	101	228

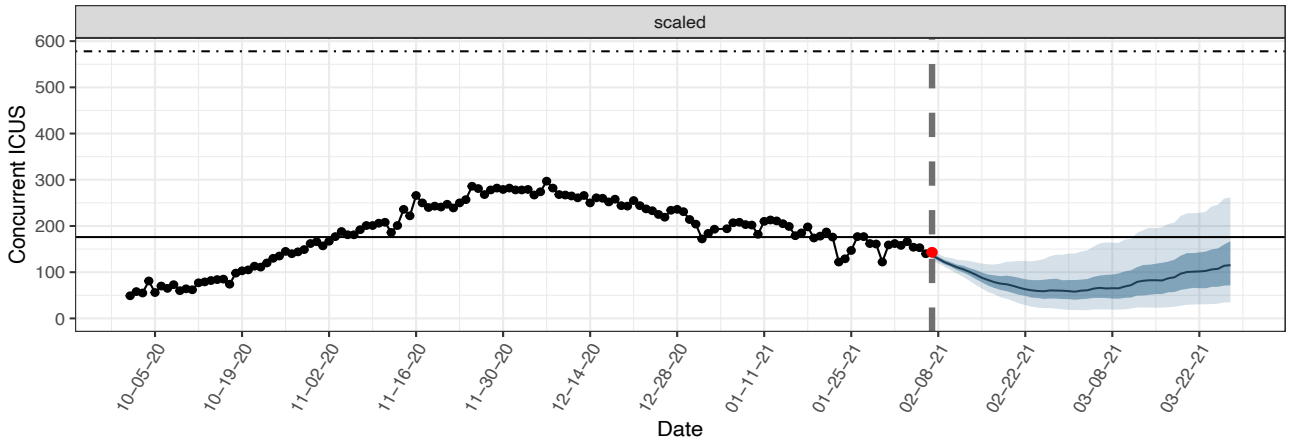
"Scaled" Scenario

So what?

We are below ICU bed capacity for concurrent COVID-19 patients. Model is predicting a decrease over the next 3 weeks and then leveling off or potentially an increase again

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





Concurrent COVID-19 non-ICU "med-surge" beds

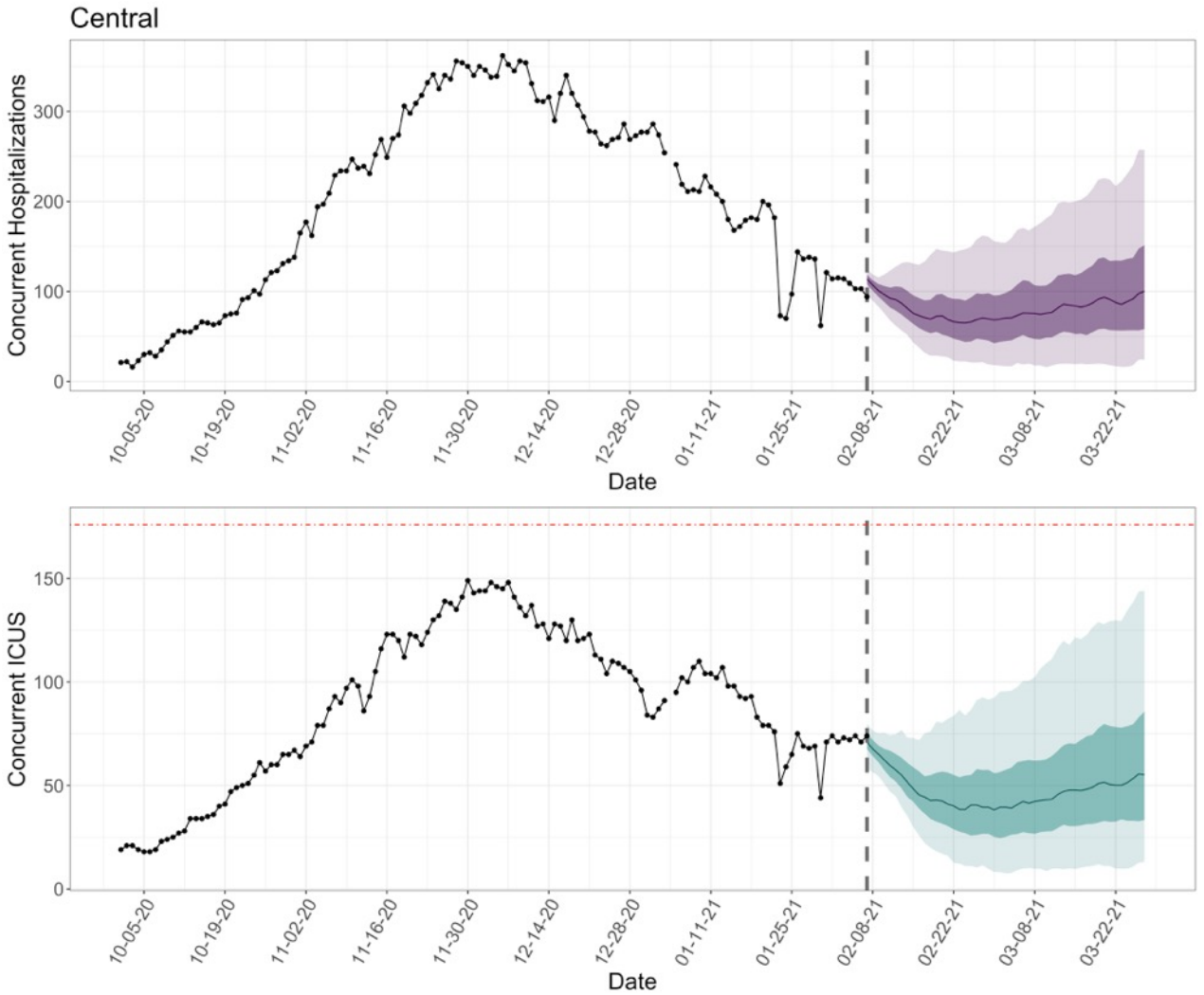
Week	Qu. 5% (best case)	Qu. 50% (median)	Qu. 95% (worst case)
2/14	134	202	301
2/21	68	155	300
2/28	47	150	351
3/7	49	173	411
3/14	61	213	484
3/21	79	260	578

"Scaled" Scenario

So what?

Med-surge general bed needs are predicted to decrease during the next 3 weeks

Regional Hospitalization Forecasts: Central



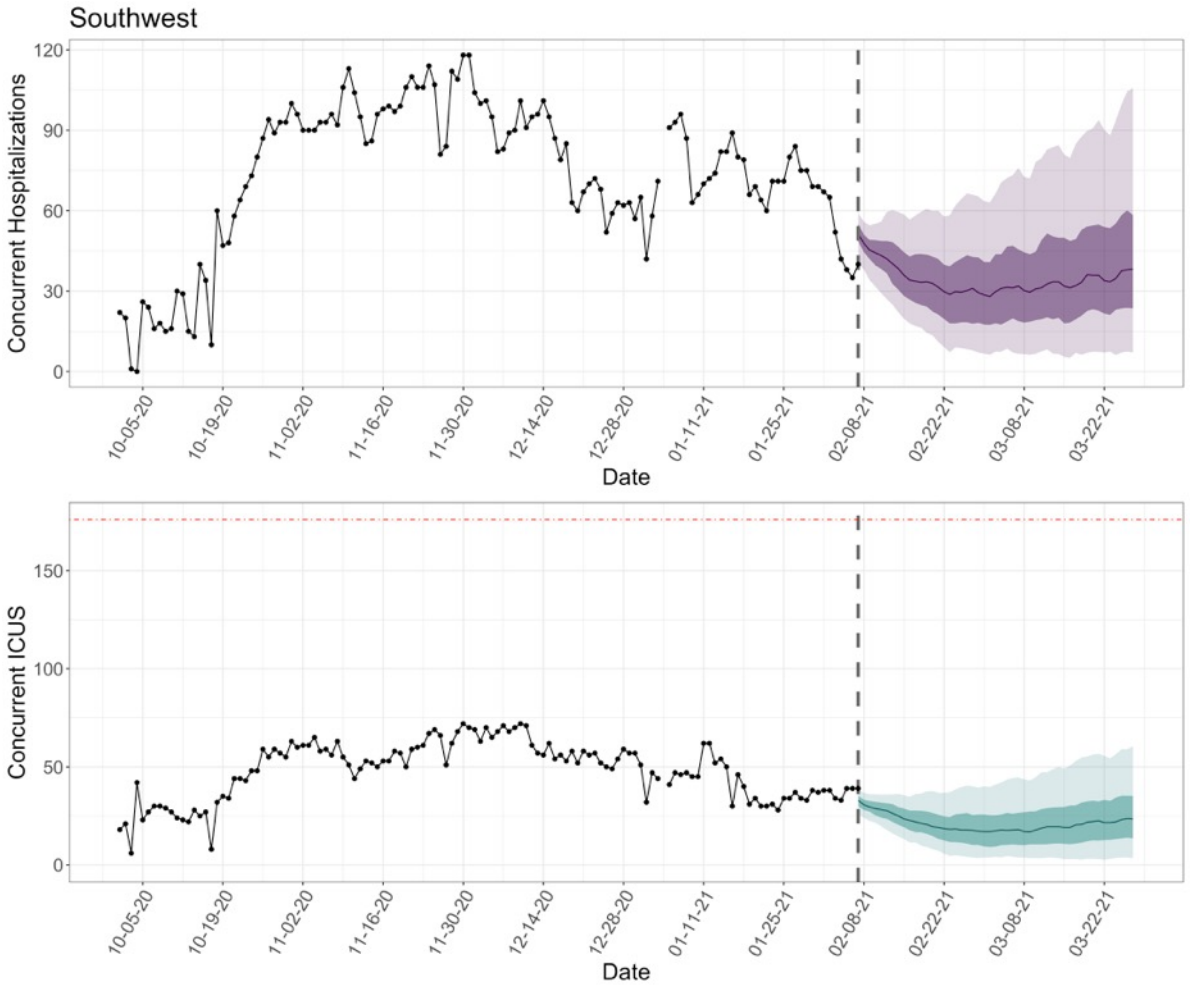
Concurrent COVID-19 ICUs beds: Central

Week	Qu. 5% (best case)	Qu. 50% (median)	Qu. 95% (worst case)
2/14	35	52	73
2/21	16	41	82
2/28	10	40	92
3/7	10	41	101
3/14	10	48	118
3/21	11	51	129

So what?

ICU bed usage is expected to <u>decrease slowly</u>

Regional Hospitalization Forecasts: Southwest



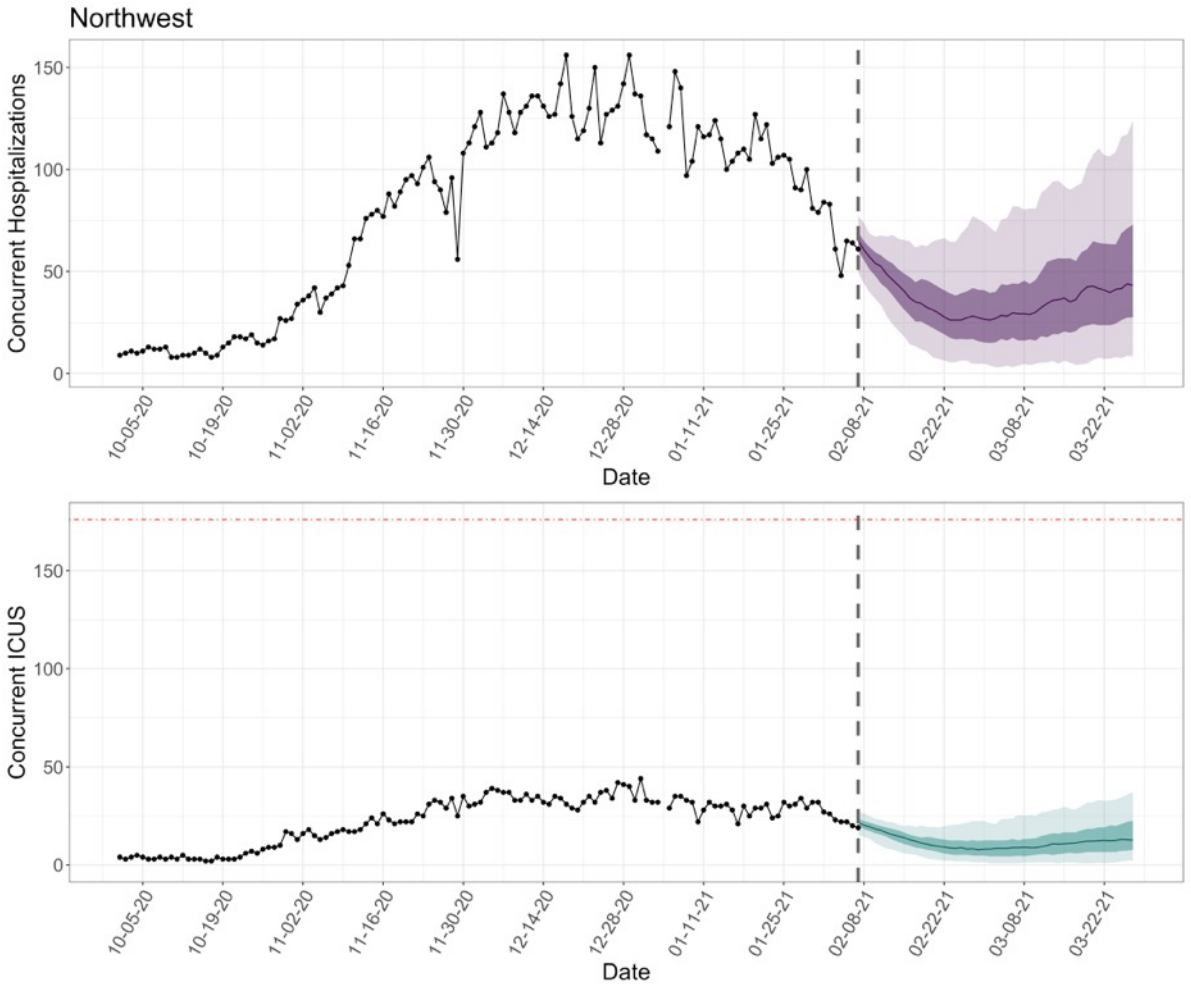
Concurrent COVID-19 ICUs beds: Southwest

Week	Qu. 5% (best case)	Qu. 50% (median)	Qu. 95% (worst case)
2/14	15	25	36
2/21	7	19	37
2/28	4	17	39
3/7	4	18	45
3/14	3	20	50
3/21	3	23	57

So what?

ICU bed usage is expected to decline in the Southwest region.

Regional Hospitalization Forecasts: Northwest



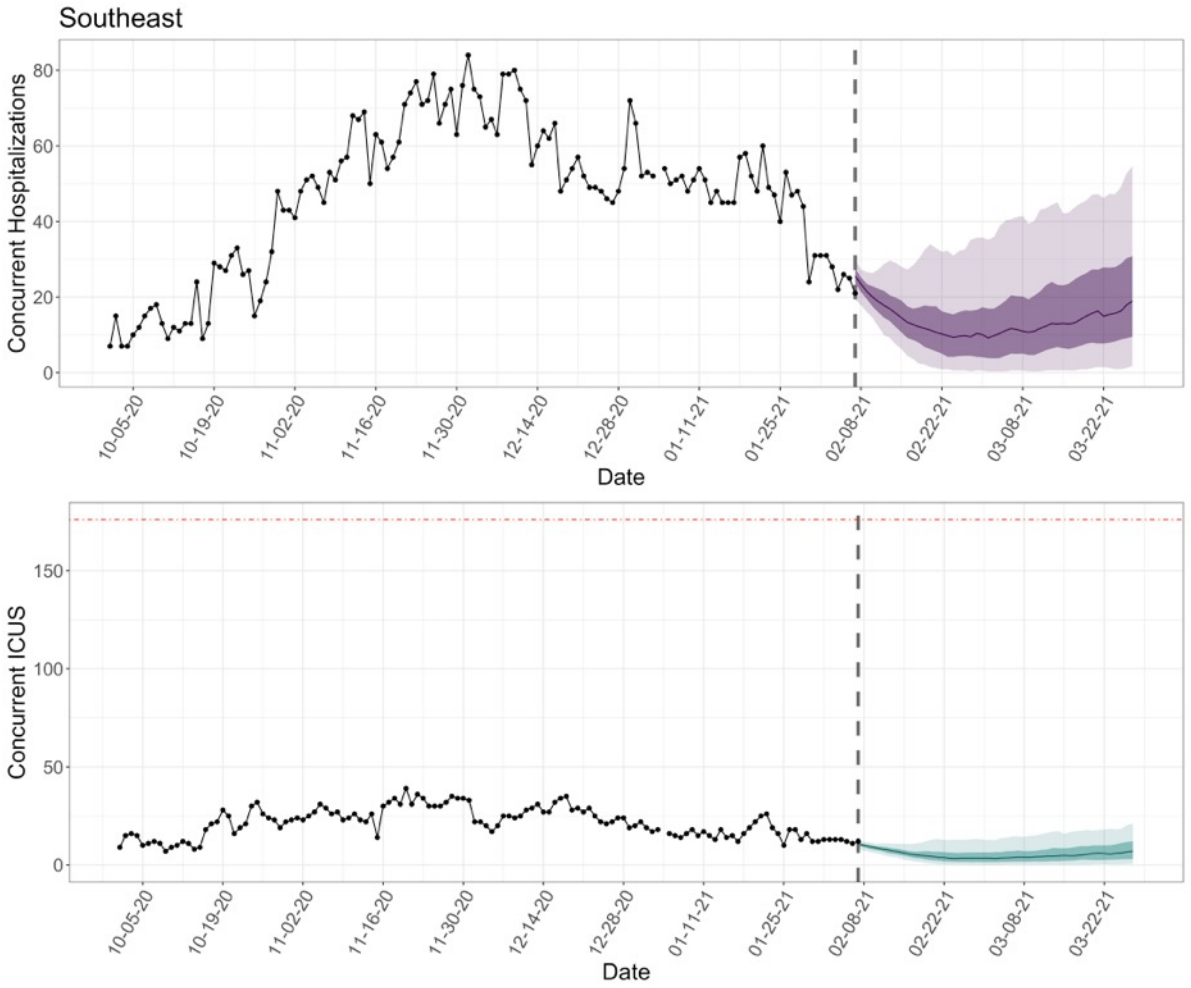
Concurrent COVID-19 ICUs beds: Northwest

Week	Qu. 5% (best case)	Qu. 50% (median)	Qu. 95% (worst case)
2/14	7	15	21
2/21	3	10	19
2/28	1	8	22
3/7	1	9	26
3/14	1	11	29
3/21	1	12	33

So what?

ICU bed usage is expected to <u>decrease</u> in the Northwest region

Regional Hospitalization Forecasts: Southeast



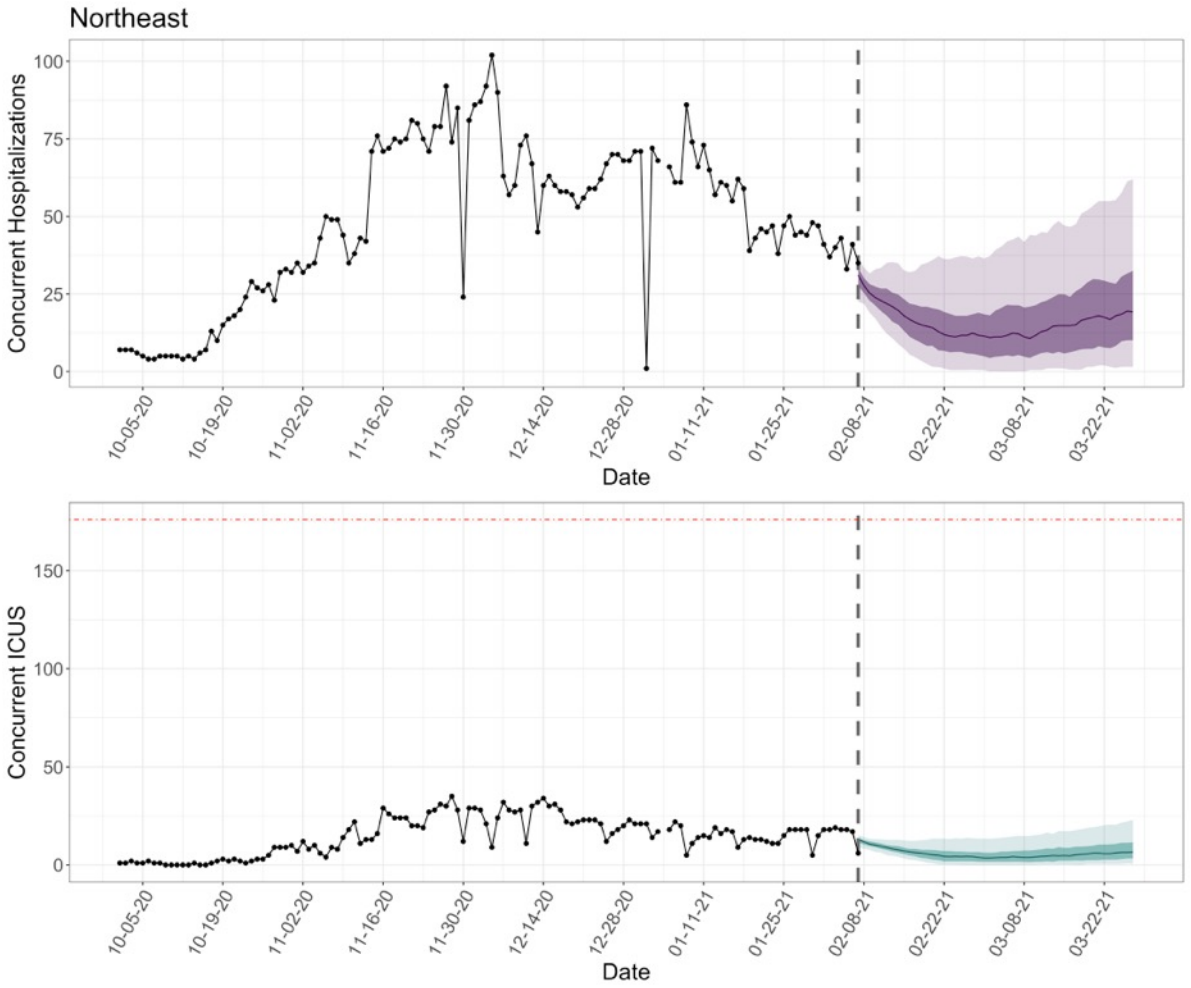
Concurrent COVID-19 ICUs beds: Southeast

Week	Qu. 5% (best case)	Qu. 50% (median)	Qu. 95% (worst case)
2/14	4	7	11
2/21	0	4	13
2/28	0	3	13
3/7	0	4	15
3/14	0	5	17
3/21	1	6	18

So what?

ICU bed usage is expected to <u>be low</u> in the Southeast region

Regional Hospitalization Forecasts: Northeast



Concurrent COVID-19 ICUs beds: Northeast

Week	Qu. 5% (best case)	Qu. 50% (median)	Qu. 95% (worst case)
2/14	4	8	13
2/21	0	5	13
2/28	0	4	13
3/7	0	4	15
3/14	0	5	17
3/21	1	6	20

So what?

ICU bed usage is expected to be low in the Northeast region

> Non-Congregational Shelter Forecast

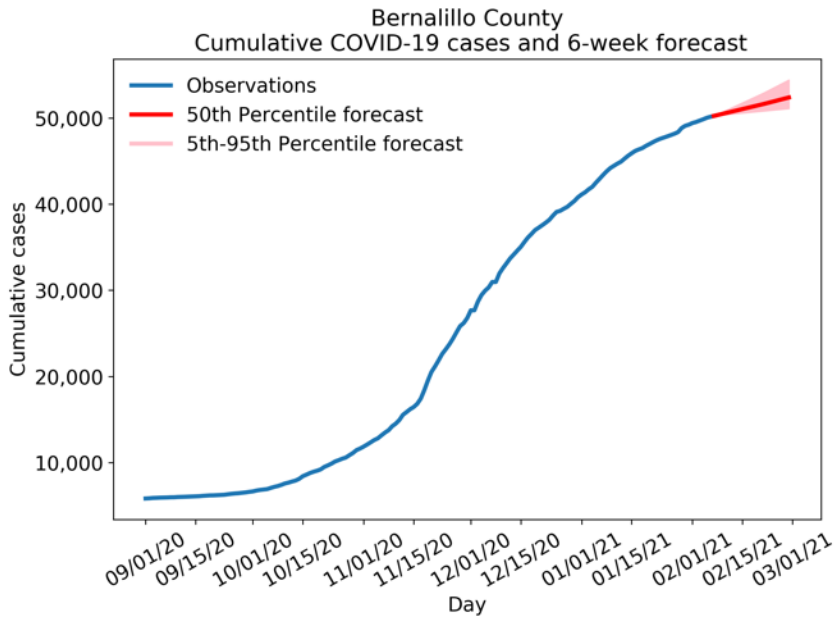
Non-Congregate Shelter Forecast

- **Our goal is to inform the capacity of shelters for forecasting the need of additional rooms**
- **We calculate a ratio between the mean number of daily new cases over the previous two weeks to current occupied rooms**
  - We apply this ratio to the forecast of COVID-19 cases from the LANL COFFEE model to estimate the number of rooms needed
- **We use the spread in the case forecast to report a subsequent spread in the shelter forecast**
- **We calculate the number of new rooms need by applying the ratio of occupied rooms:new cases to the number of cases forecasted in each county**

- **NEW AS OF 2/7/21: We added a second forecast method for comparison by averaging the shelter forecast with current shelters in use to smooth the forecast**

Non-Congregate Shelter Forecast: Bernalillo

Number of cases as of 2/7/21: **50,237**
Number of shelter rooms available: **221**
Total number of patients/medical workers (including specialty): **41**
Number of patients: **38**
Number of medical workers: **3**
Occupied rooms:new cases ratio: **0.23**
2-week avg. new cases per day: **179**



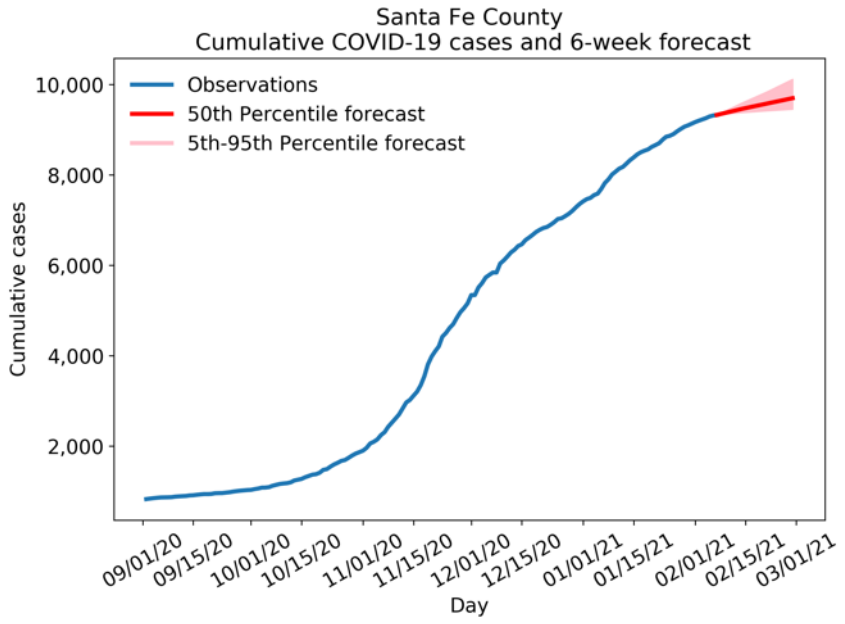
	2/14/21	2/21/21	2/28/21
Total cases	50,937 (50,542-51,566)	51,630 (50,821-52,916)	52,381 (51,105-54,413)
# of rooms needed	23 (10-43)	23 (9-44)	25 (9-49)
Deficit (-) or surplus of rooms	198	198	196
# of rooms needed (new forecast method)	32	29	28

2-week avg. new cases per day decreased from 205 last week to 179 this week

We continue to under forecast for Bernalillo; the new forecast may help correct this.

Non-Congregate Shelter Forecast: Santa Fe

Number of cases as of 2/7/21: **9,325**
Number of shelter rooms available: **52**
Total number of patients/medical workers (including specialty): **12**
Number of patients: **12**
Number of medical workers: **0**
Occupied rooms:new cases ratio: **0.35**
2-week avg. new cases per day: **34**



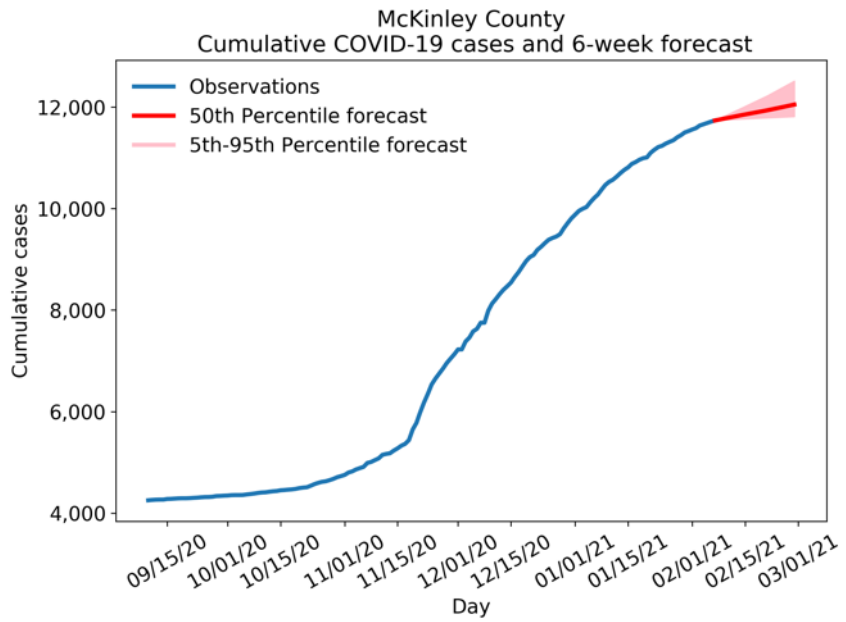
	2/14/21	2/21/21	2/28/21
Total cases	9,460 (9,379-9,592)	9,578 (9,420-9,841)	9,696 (9,454-10,115)
# of rooms needed	7 (3-13)	6 (2-12)	6 (2-14)
Deficit (-) or surplus of rooms	45	46	46
# of rooms needed (new forecast method)	9	8	8

2-week avg. new cases per day decreased from 45 last week to 34 this week

Shelter use dropped dramatically from 30 last week to 12 this week.

Non-Congregate Shelter Forecast: McKinley

Number of cases as of 2/7/21: **11,736**
Number of shelter rooms available: **160**
Total number of patients/medical workers (including specialty): **31**
Number of patients: **26**
Number of medical workers: **5**
Occupied rooms:new cases ratio: **0.87**
2-week avg. new cases per day: **36**



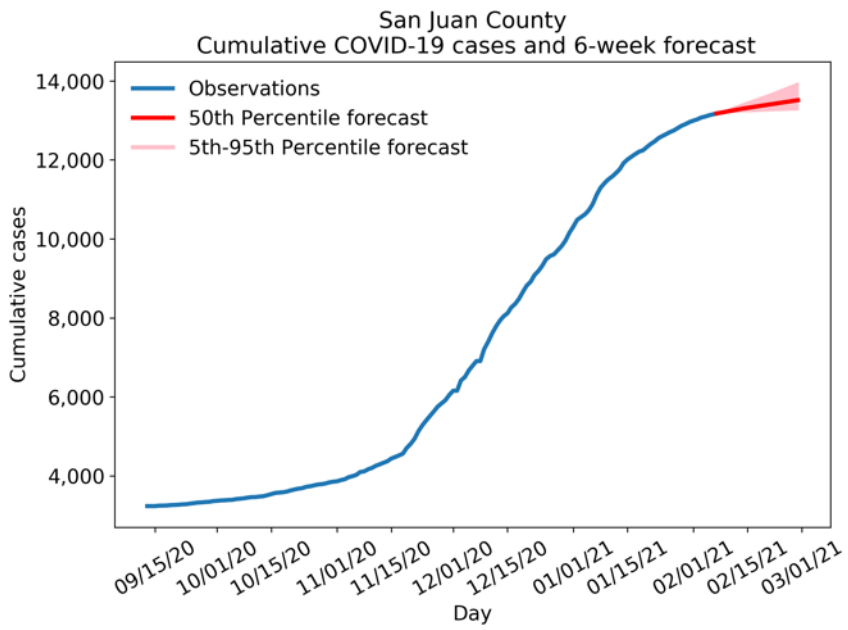
	2/14/21	2/21/21	2/28/21
Total cases	11,841 (11,767-11,978)	11,939 (11,791-12,227)	12,049 (11,815-12,512)
# of rooms needed	13 (4-30)	12 (3-31)	14 (3-35)
Deficit (-) or surplus of rooms	147	148	146
# of rooms needed (new forecast method)	22	19	17

2-week avg. new cases per day decreased from 44 last week to 36 this week

We continue to under forecast for McKinley; the new forecast may help correct this.

Non-Congregate Shelter Forecast: San Juan

Number of cases as of 2/7/21: **13,176**
Number of shelter rooms available: **21**
Total number of patients/medical workers (including specialty): **2**
Number of patients: **2**
Number of medical workers: **0**
Occupied rooms:new cases ratio: **0.05**
2-week avg. new cases per day: **41**



	2/14/21	2/21/21	2/28/21
Total cases	13,304 (13,222-13,433)	13,409 (13,251-13,676)	13,513 (13,275-13,951)
# of rooms needed	1 (0-2)	1 (0-2)	1 (0-2)
Deficit (-) or surplus of rooms	20	20	20
# of rooms needed (new forecast method)	2	1	1

2-week avg. new cases per day decreased from 58 last week to 41 this week.

Last week we forecasted 2 shelter rooms needed [1-5] and 2 are currently in use

Patterns Through Time