# Modeling & Forecasting COVID-19 in NM

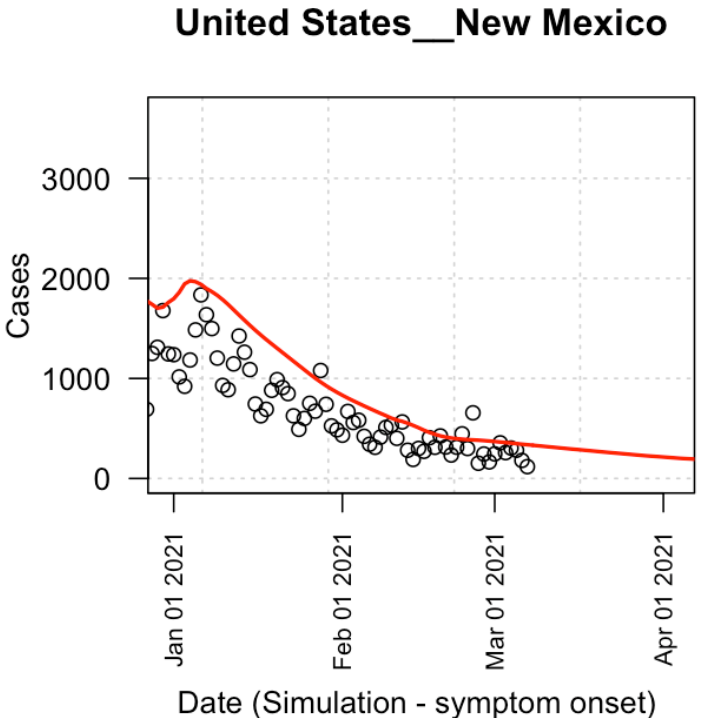
March 9, 2021

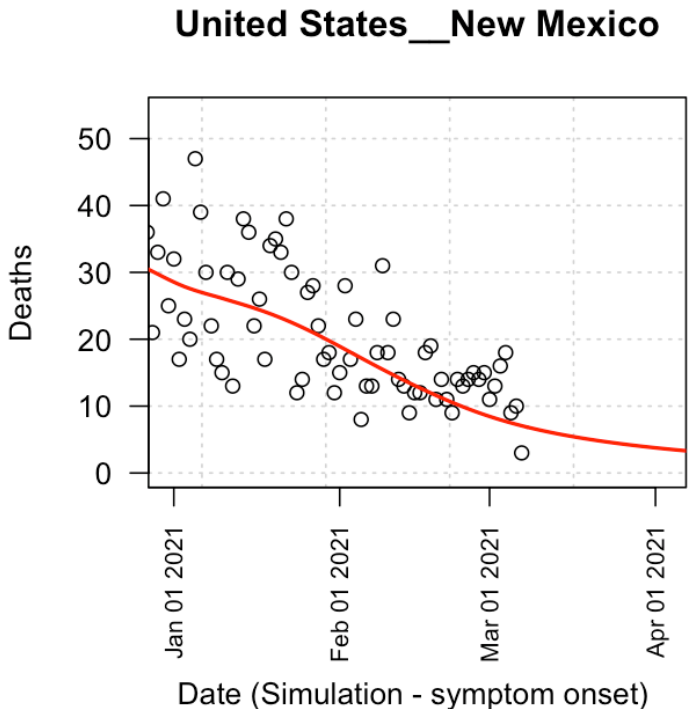


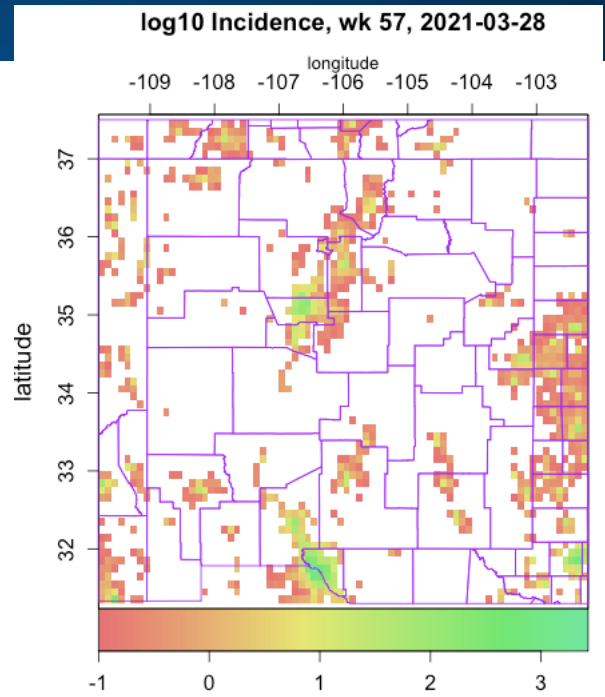
NNSA
National Nuclear Security Administration

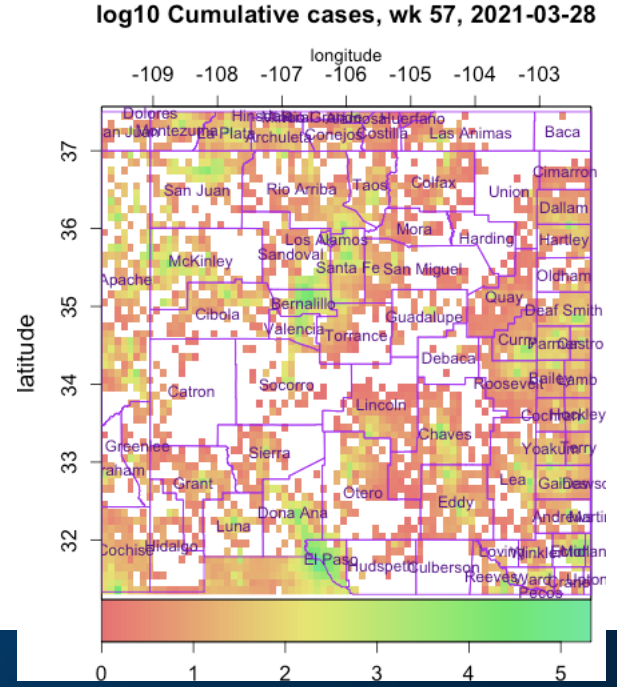
# 09 Mar 2021: EpiGrid modeling

- Underpredicts deaths in the last week; delayed reporting?
- May be over estimating cases in some parts of West Texas.



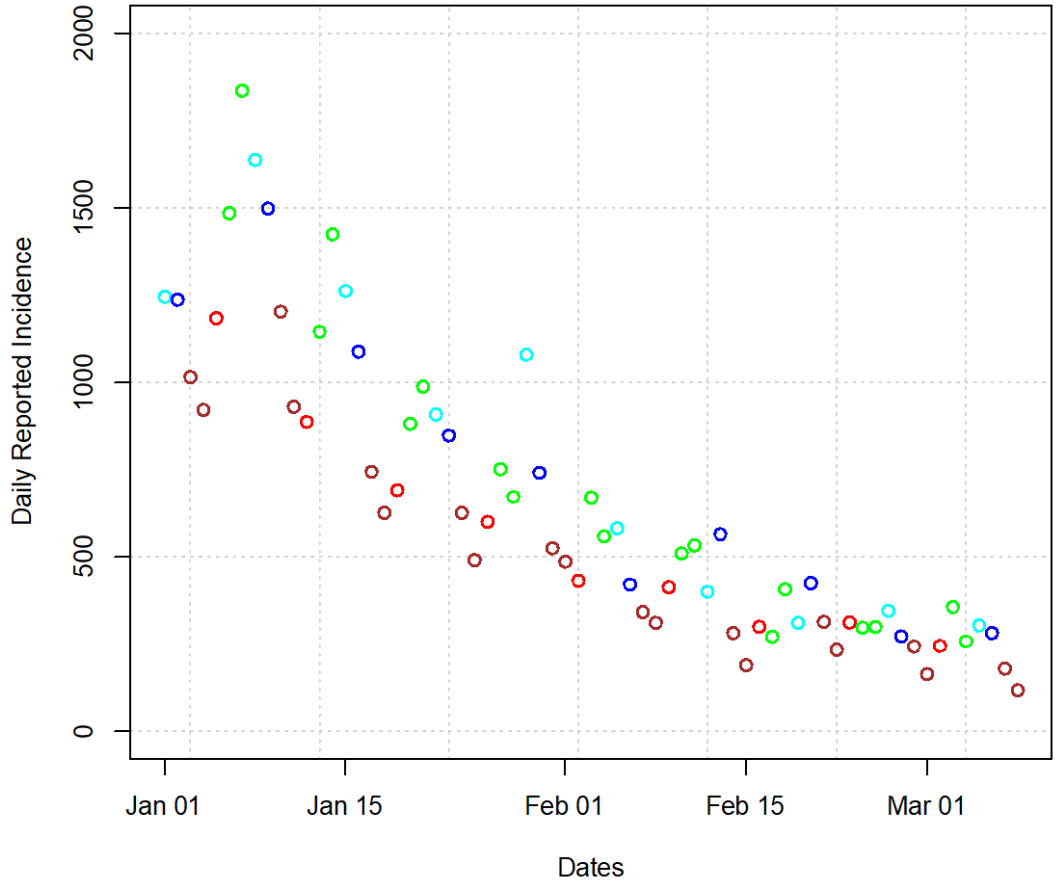



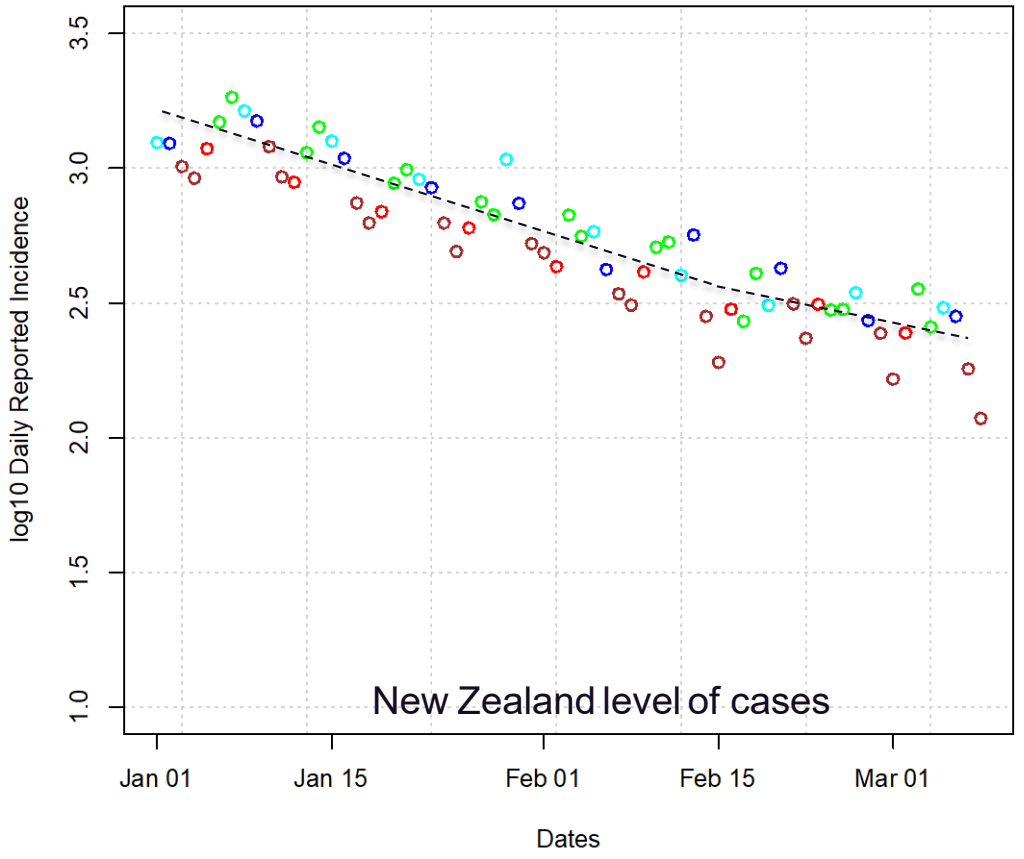



# A look at the raw incidence data

- Sunday, Monday
- Tuesday
- Wednesday/Thursday
- Friday
- Saturday

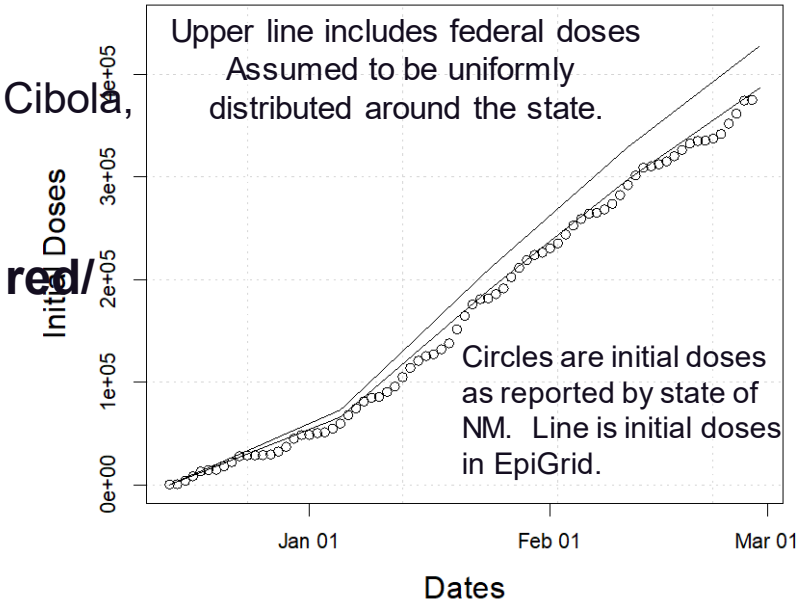
The 190 cases in the Lea county correctional facility are removed from data reported on the 26th. The 1/3 of reported cases that were > 2 wks prior were removed from the 24th.
Within-week variation perhaps more consistent with time.



# 09 March 2021 Model (Mechanistic) – more details and information

- **See Figure for historical prime-dose vaccinations.**
  - Some Federal doses are uniformly distributed around the state, the rest are in McKinley, Cibola, and San Juan.
  - State vaccination rate is still assumed to be slightly lower than peak rate.
- **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.
  - Using current RYGT assignments and extrapolations to more open conditions starting next week.
- **Daily reported cases in El Paso may be rising.**
- **Death rates 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.**
  - 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 possibly non-small at this time.**
  - 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 likely be occurring.

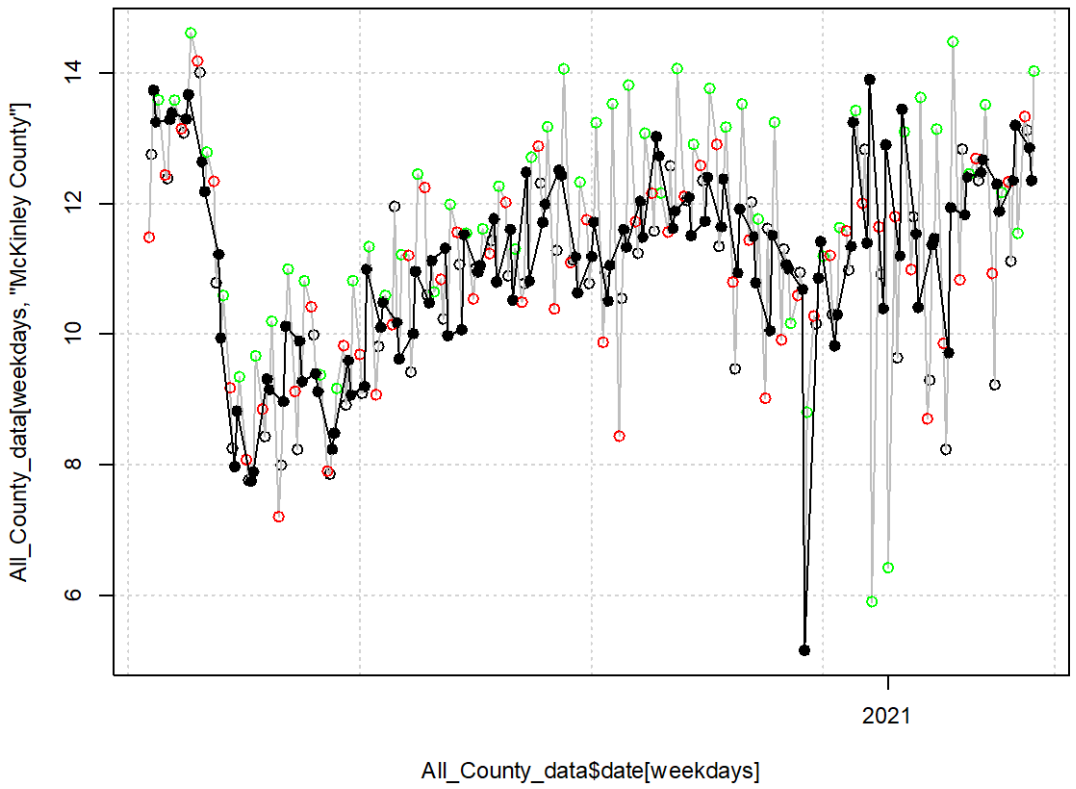


# T-80 Mobility – northern counties (Data only)

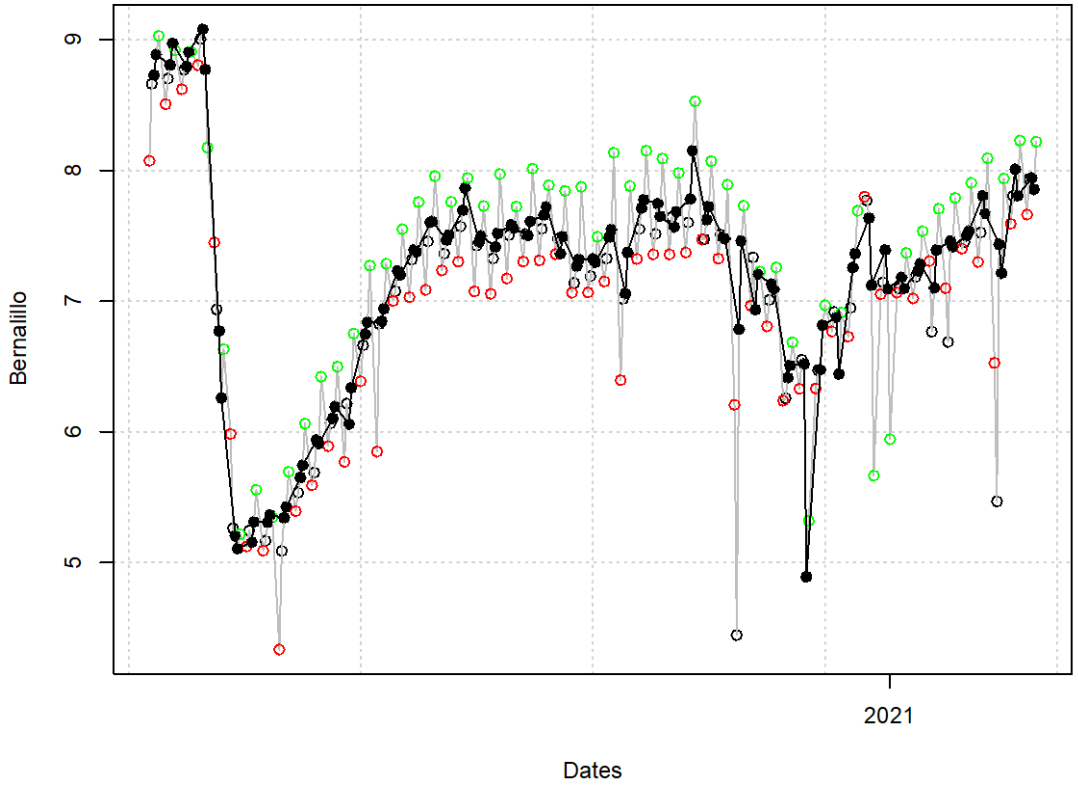
- Bernalillo, Los Alamos, McKinley, Rio Arriba San Juan, Santa Fe, Taos had stable mobility.
- Sandoval, Valencia had increasing mobility.

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

McKinley




Bernalillo

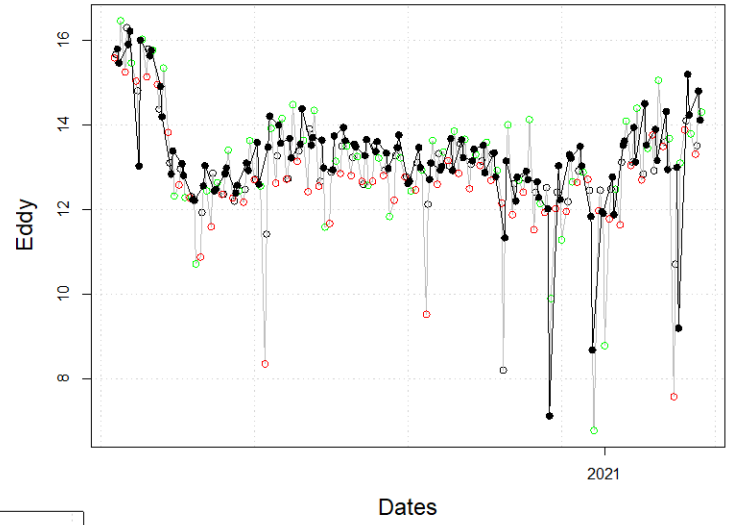


# T-80 Mobility – southern counties and Curry (Data only)

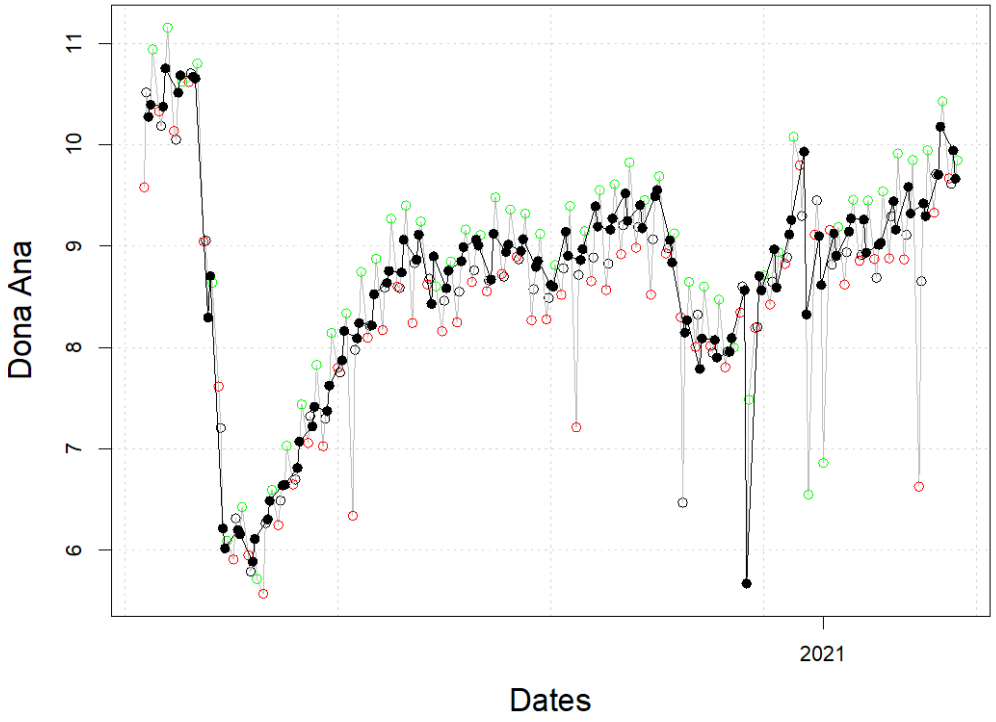
- Dona Ana, Chaves, Eddy, Lea, Lincoln, Luna, Otero, Roosevelt, and Socorro had stable mobility.
- Grant and Curry had slightly increasing mobility.

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

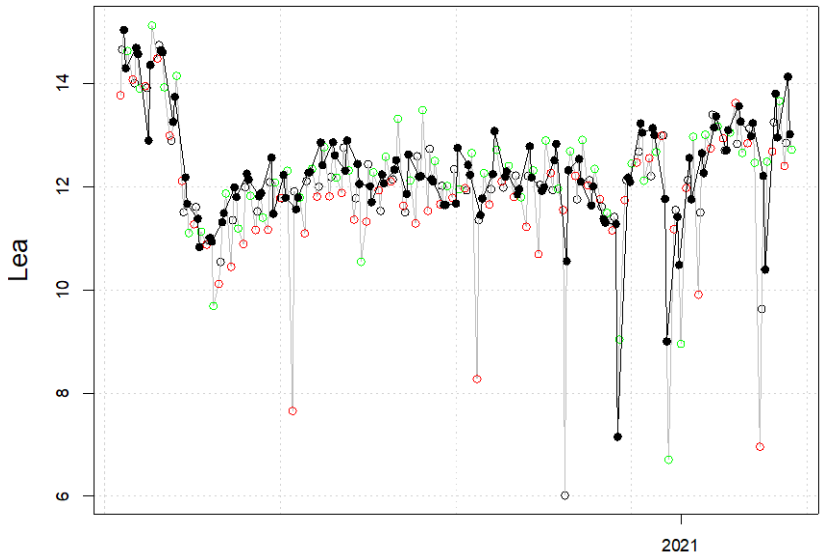
Eddy




Dona Ana

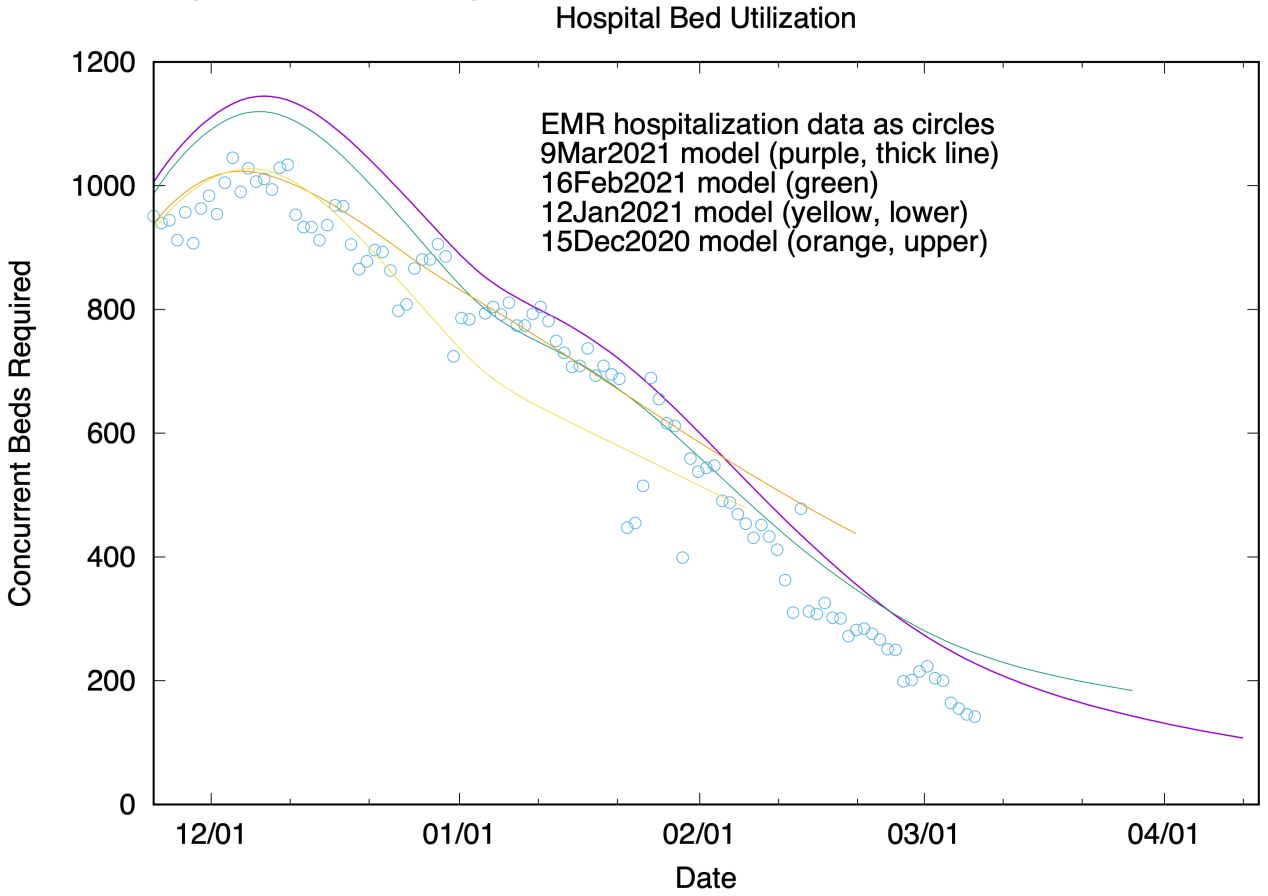


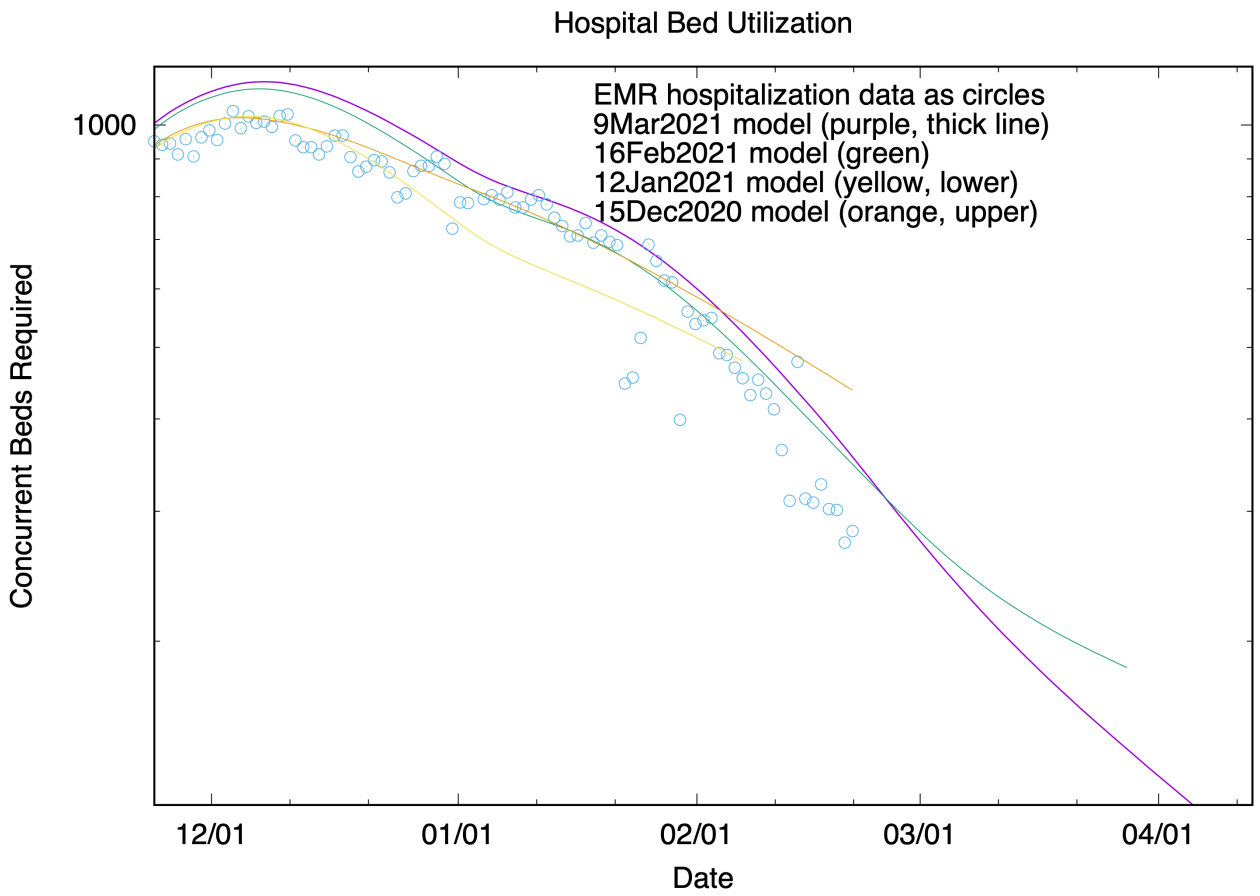

Lea



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

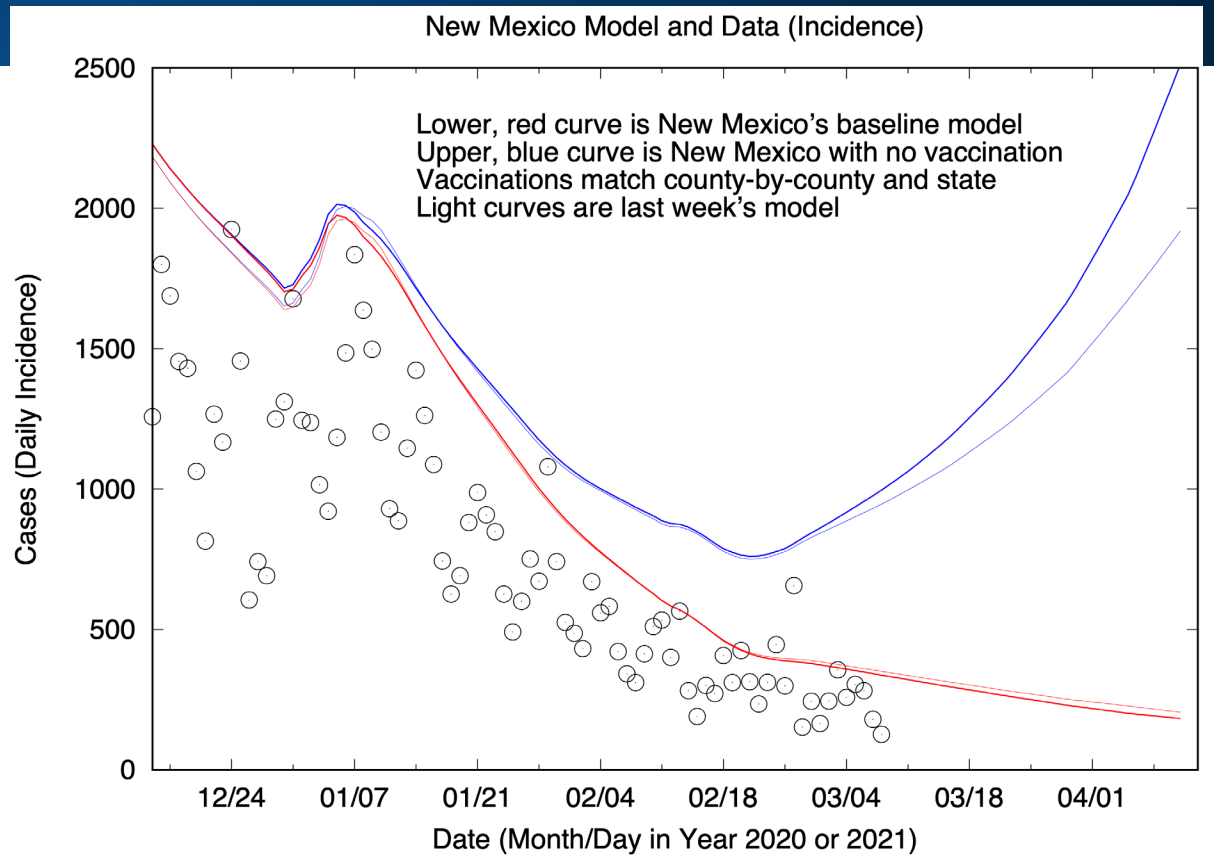
- Left panel: Linear vs. time (y-scale=0:1200) shows hospital beds.
- Right panel: Log vs. time, same data and models (y-scale = 120:1200, 10x).
- Divergence between 15Dec2020 model, subsequent EMR data, and later EG models reflects the impact of vaccination.
- Continued drops (purple) in the model as compared with 16Feb2021 reflect small adjustments of the model in late December, January, and February.

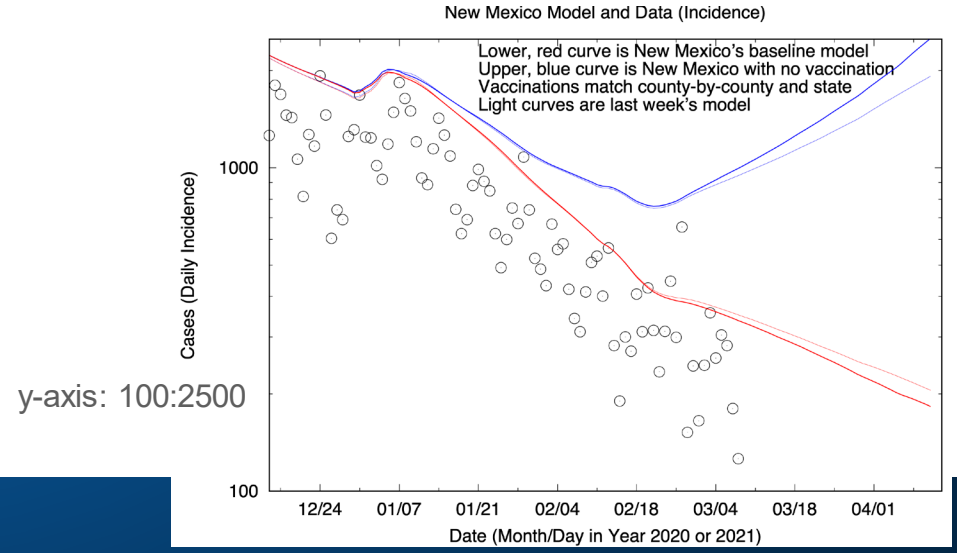


# Effect of Vaccination on Incidence

- Vaccination is lowering daily incidence >60%.
- Quarantine *currently* plays a larger role in epidemic control than vaccination.
- Infection control appears to be comparable to vaccination.
- Currently modeling 90% vaccine effectiveness.
- Mar 9th model: ~490k people vaccinated (1 or 2 doses).
- By-county matching to vaccination.
- Flattening of daily incidence is the anticipated effect of red to green and turquoise counties and increased mobility.
- Easily confused with variant virus replacement, but timing relative to by-county transitions suggests business opening is the most significant driver.
- NM is currently trading relaxed infection control for vaccination. This sets a "speed limit" to relaxation!
- Assuming only susceptible people are vaccinated.
- Unchanged quarantine effectiveness assumed in all cases.



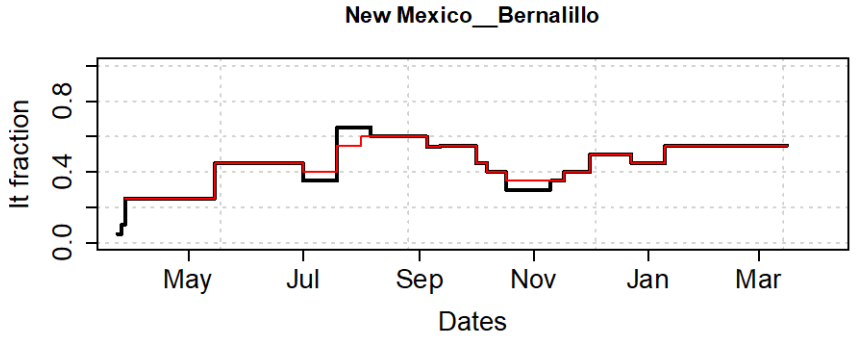

y-axis: 100:2500

## Situational Awareness (less to say by-county than in the past):

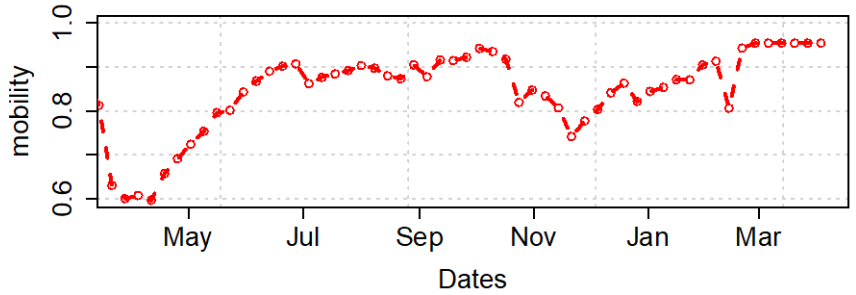
- Decrease of incidence unclear in some higher population locations: e.g. Valencia

- Torrance and Taos may be having outbreaks.

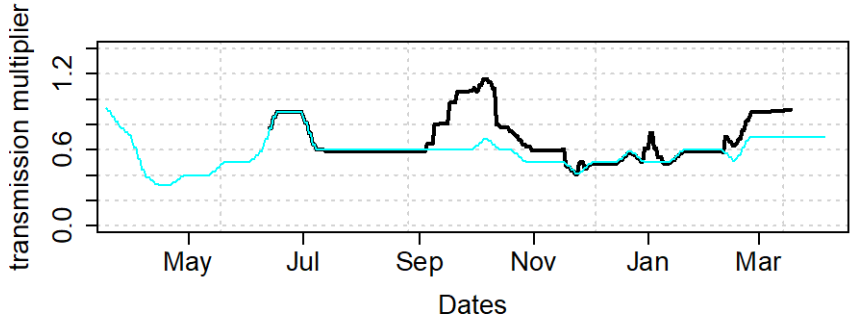
# Separating mechanistic effects: Captured effects of mitigations




Quarantine
Red is base value
Black is values used for Bernalillo
~50% relative to unmitigated




Mobility data: an input
Last 5 points are extrapolation

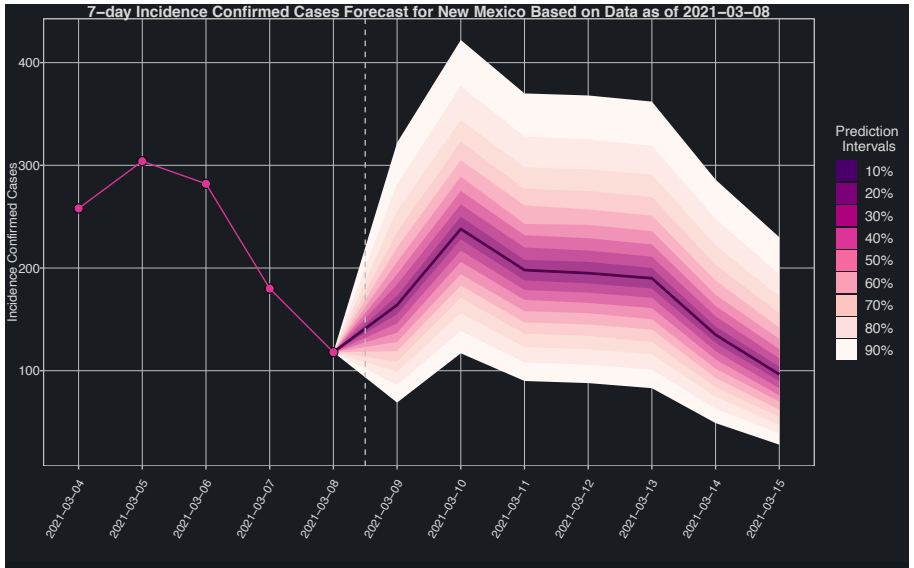



Fractional change in person-to-person transmission
Cyan - mobility based value without PHO modifications (Aug. on)
Black – modified for PHO's, values used for Bernalillo
~20% improvement relative to unmitigated
Has been as large as ~60% in the past (rel. to unmitigated)
Cyan-black difference may reflect variants or turquoise counties

# Conclusions and Discussion

- **New Mexico's daily incidence is slowly declining. Rapid vaccination is crucial to this success given reopening.**
- **Continued control might not be stable against strain replacement at current levels of mitigations.**
- **Increased vaccine supply and administration and/or improved effectiveness of investigation and quarantine are needed.**
- **COVID-19 vaccination reported by the State is responsible for an >60% reduction in daily incidence.**
- **Quarantine plays a comparable role to vaccination in epidemic control.**
- **National and State monitoring for strain emergence is likely improving. Model is *assuming* about 1:1000 variant cases in late January in NM, implies that currently variants might be ~10:1000.**
- **El Paso's daily incidence consistent with rising or constant cases.**
- **Nationwide geographical dispersion is seeding some local transmission and variants.**
- **Testing positivity is ~3%. Within-week variations returning to an established pattern.**
- **Begin shifting the vaccination strategy toward contagion-control in the weeks ahead?**
- **Discussion:**
  - Vaccinating high risk-of-mortality populations is likely lowering hospital loads since late January, 2021.
  - Good infection control in schools appears to be well-correlated with improved outcomes. Improved PPE may be required in response to viral variant emergence. Meal times, busses, and passing periods are likely the riskiest school-related activities.
  - *Epidemiological* evidence does not rule out a more contagious variant of SARS-CoV-2 in New Mexico (as compared with Milan-like variants).
  - Daily incidence is low enough that testing may soon be qualitatively larger than incidence, providing opportunities:
  - The importance of case investigation and quarantine might *rise* in reaction to vaccine-associated control (lower number of cases to track).
  - Geographical or ring-like vaccination might be feasible. 29 Counties, 26 cases, 20x testing may imply that 500 targeted doses could help…?
  - 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 2021–03–08**

| Week | Best Case (5th Percentile) | Middle Case (50th Percentile)^ | Worst Case (95th Percentile) |
|---|---|---|---|
| 2021–03–08 | | 187,040* | |
| 2021–03–15 | 187,565 | 188,260 | 189,391 |
| 2021–03–22 | 188,031 | 189,422 | 191,758 |
| 2021–03–29 | 188,460 | 190,674 | 194,366 |
| 2021–04–05 | 188,933 | 192,076 | 197,289 |
| 2021–04–12 | 189,422 | 193,648 | 200,667 |
| 2021–04–19 | 189,935 | 195,339 | 204,590 |

*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 2021–03–08**

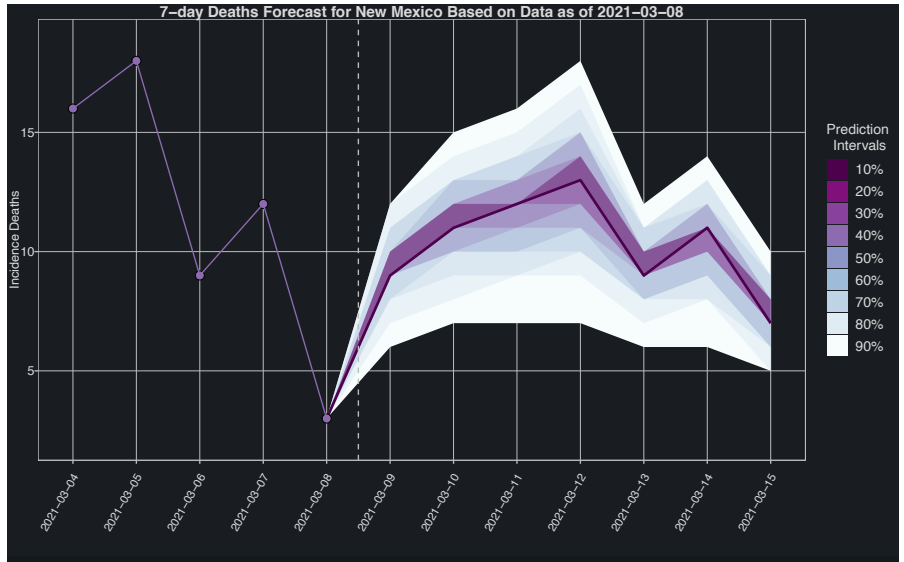
| Week | Best Case (5th Percentile) | Middle Case (50th Percentile)^ | Worst Case (95th Percentile) |
|---|---|---|---|
| 2021–03–08 | | 249* | |
| 2021–03–15 | 75 | 174 | 336 |
| 2021–03–22 | 67 | 166 | 338 |
| 2021–03–29 | 61 | 179 | 373 |
| 2021–04–05 | 68 | 200 | 418 |
| 2021–04–12 | 70 | 225 | 483 |
| 2021–04–19 | 73 | 242 | 560 |

*Last reported confirmed cases count
^Closest–matching scenario

**So what?**

**The <u>daily</u> number of cases are expected to range between 74 and 373 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 2021–03–08**

| Week | Best Case (5th Percentile) | Middle Case (50th Percentile)^ | Worst Case (95th Percentile) |
|---|---|---|---|
| 2021–03–08 | | 3,811* | |
| 2021–03–15 | 3,857 | 3,885 | 3,903 |
| 2021–03–22 | 3,896 | 3,953 | 3,992 |
| 2021–03–29 | 3,931 | 4,017 | 4,085 |
| 2021–04–05 | 3,964 | 4,080 | 4,188 |
| 2021–04–12 | 3,996 | 4,147 | 4,320 |
| 2021–04–19 | 4,027 | 4,219 | 4,490 |

*Last reported deaths count
^Closest–matching scenario

**6–Week Forecast of Daily Average of Deaths for New Mexico Based on Data as of 2021–03–08**

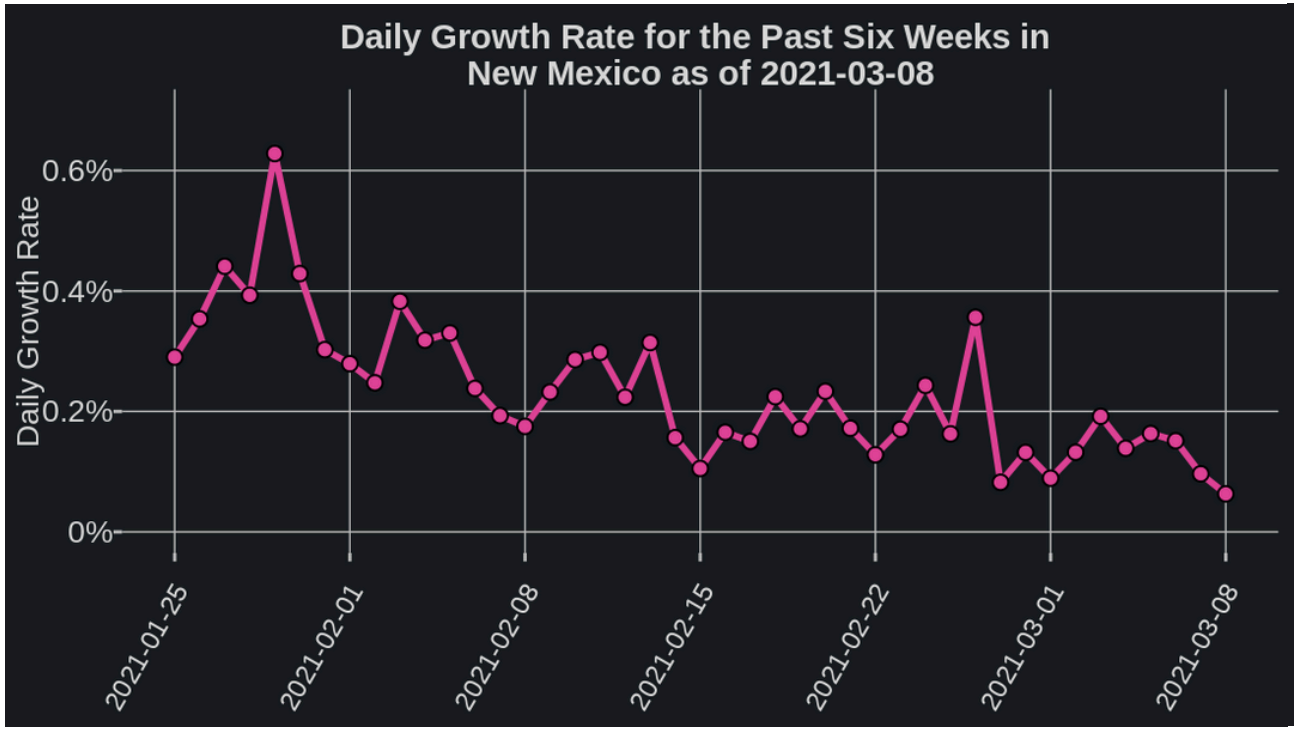
| Week | Best Case (5th Percentile) | Middle Case (50th Percentile)^ | Worst Case (95th Percentile) |
|---|---|---|---|
| 2021–03–08 | | 12* | |
| 2021–03–15 | 7 | 11 | 13 |
| 2021–03–22 | 6 | 10 | 13 |
| 2021–03–29 | 5 | 9 | 13 |
| 2021–04–05 | 5 | 9 | 15 |
| 2021–04–12 | 5 | 10 | 19 |
| 2021–04–19 | 4 | 10 | 24 |

*Last reported confirmed deaths
^Closest–matching scenario

**So what?**

**The <u>daily</u> number of deaths are expected to range between 5 and 13 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 2021-03-08

| Week | Best Case (5th Percentile) | Middle Case (50th Percentile)^ | Worst Case (95th Percentile) |
|---|---|---|---|
| 2021-03-08 | | 0.13%* | |
| 2021-03-15 | 0.040% | 0.093% | 0.18% |
| 2021-03-22 | 0.035% | 0.088% | 0.18% |
| 2021-03-29 | 0.033% | 0.094% | 0.19% |
| 2021-04-05 | 0.036% | 0.10% | 0.21% |
| 2021-04-12 | 0.037% | 0.12% | 0.24% |
| 2021-04-19 | 0.039% | 0.12% | 0.28% |

*Last weekly mean daily growth rate

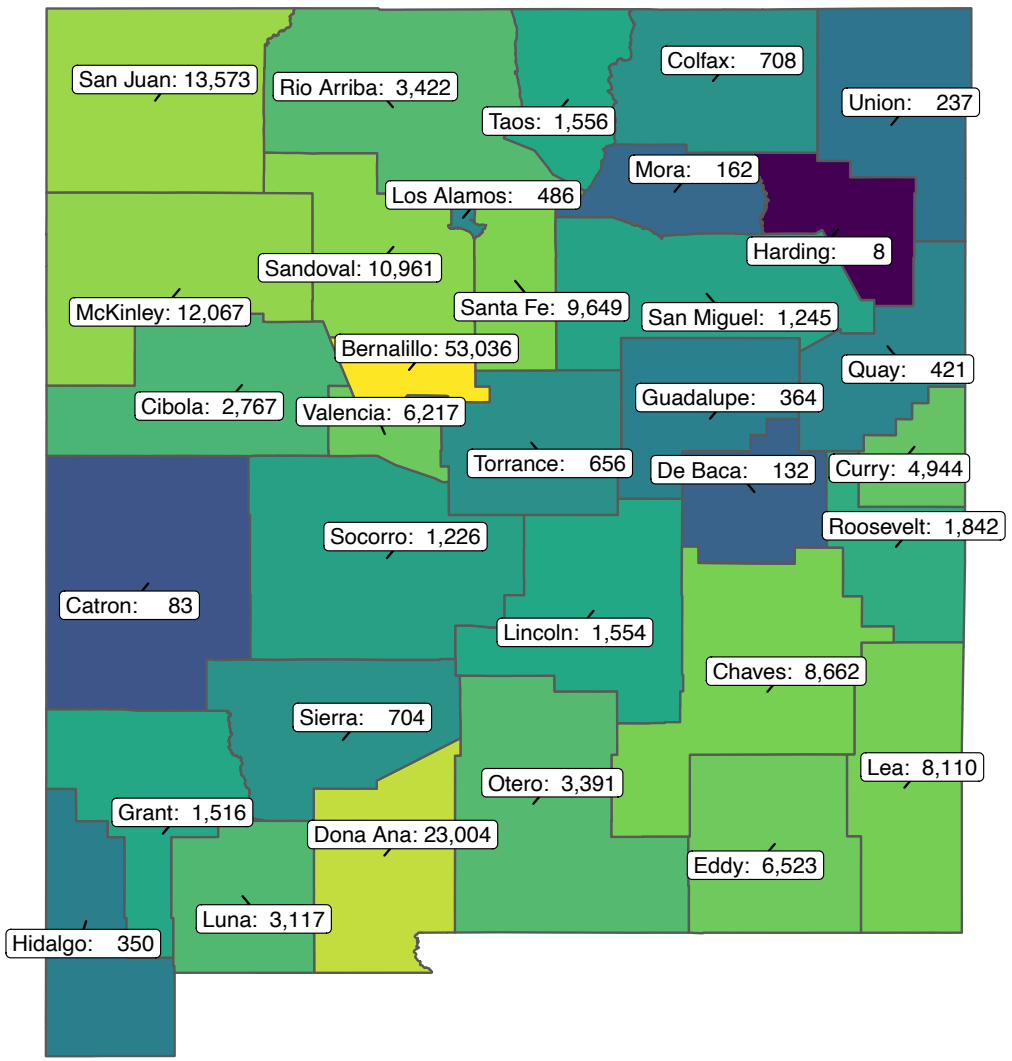
^Closest-matching scenario

## So what?

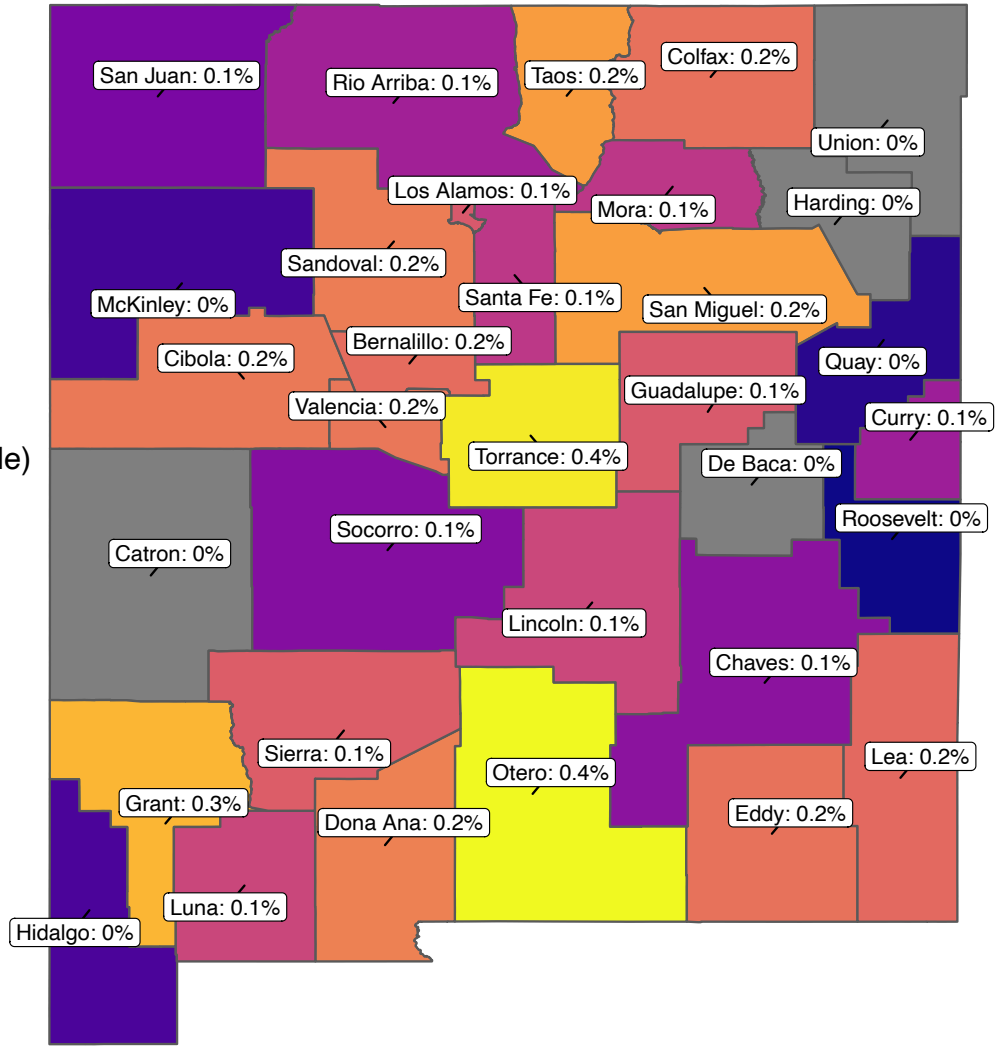
**As of March 8th, the average growth rate in NM is at 0.13% (down from 0.18%)**

# > Regional Growth Rates, Hospitalizations, & Shelter Forecasts

# Cumulative Cases & Daily Growth Rate for NM: March 8



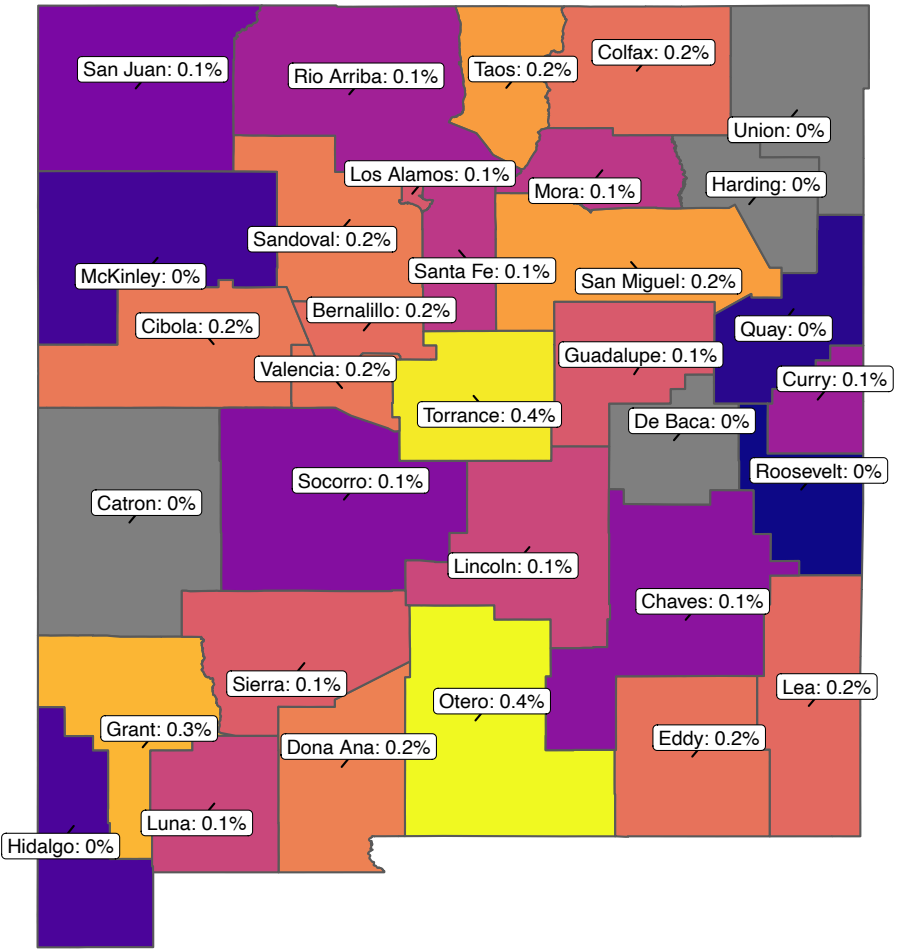

Cases
(Log Scale)
22,026
2,981
403
55

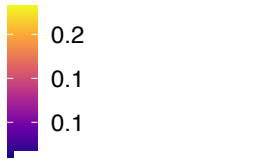



7–day–average
daily growth rate (%)
0.2
0.1
0.1

*Growth rate is in cumulative cases

# Daily Growth Rate for NM Mar 8



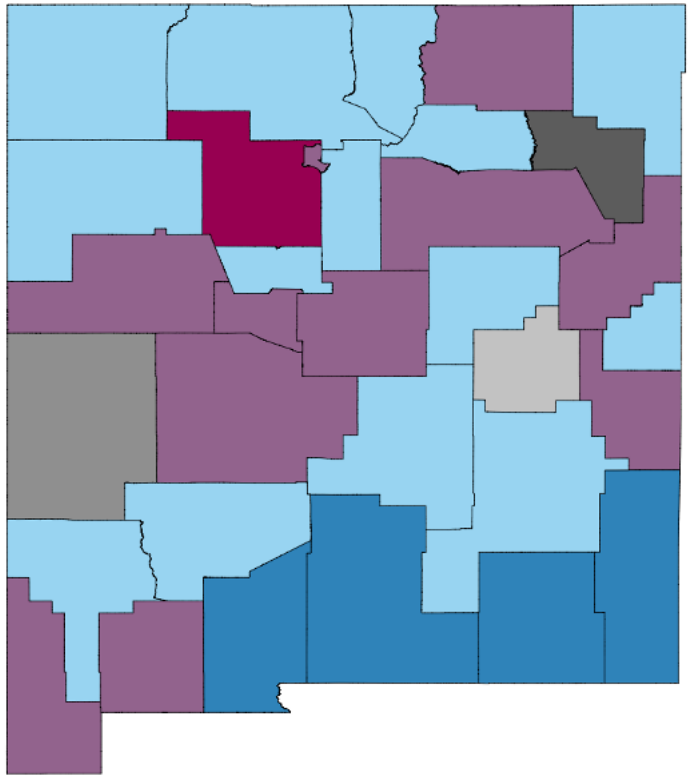

*arrows indicate more than 0.5% difference in growth rate from last week's analysis; growth rate is in cumulative cases

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

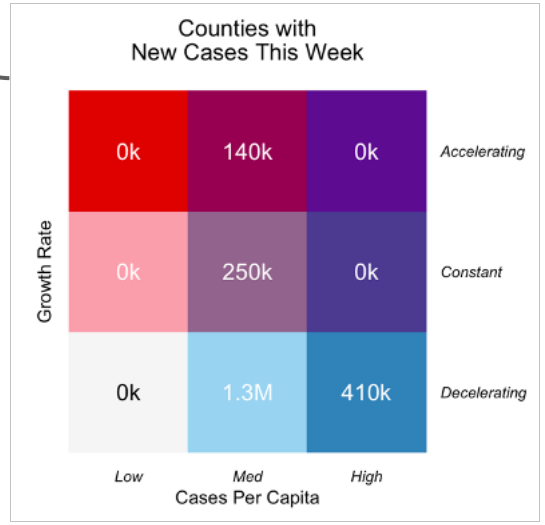
| County | Daily Growth Rate | Change |
|---|---|---|
| San Juan | 0.1% | = |
| Rio Arriba | 0.1% | = |
| Sierra | 0.1% | = |
| McKinley | 0.0% | = |
| Sandoval | 0.2% | = |
| Santa Fe | 0.1% | = |
| Cibola | 0.2% | = |
| Bernalillo | 0.2% | = |
| Valencia | 0.2% | = |
| Torrance | 0.4% | = |
| Lincoln | 0.1% | = |
| San Miguel | 0.2% | = |
| Chaves | 0.1% | = |
| Dona Ana | 0.2% | = |
| Otero | 0.4% | = |
| Lea | 0.2% | = |
| Eddy | 0.2% | = |
| Curry | 0.1% | = |
| Grant | 0.3% | = |
| Luna | 0.1% | = |
| Taos | 0.2% | = |

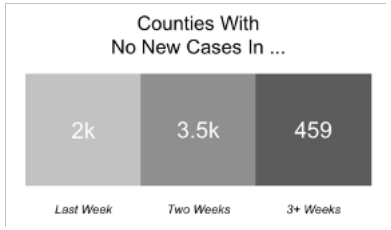
# Weekly Growth Rate for NM: Another View (Mar 8)

**COVID-19 across New Mexico**
*A 7-day moving window comparison*
*March 8, 2021*



Impacted New Mexicans



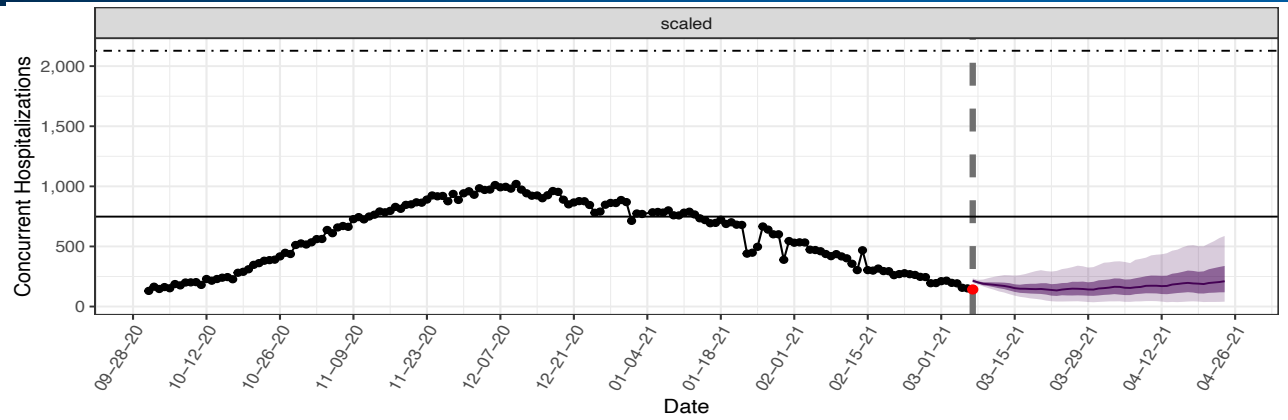

Number of New Mexicans living in regions with particular combinations of per capita case counts and 7-day growth rates

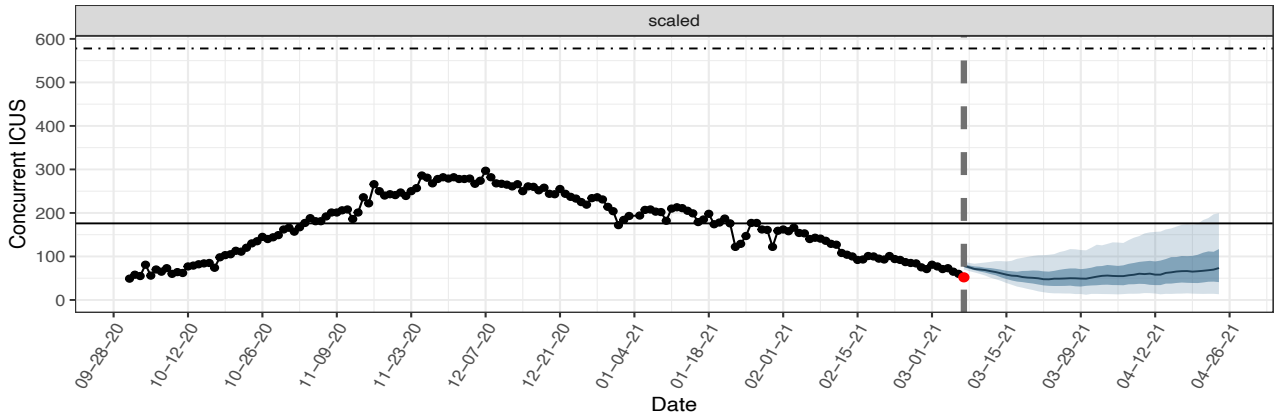
## So what?

- Most people in New Mexico are living in a county that is decelerating with medium per-capita case counts
- Counties with high per capita case counts: Dona Ana, Eddy, Lea, Otero
- Sandoval is accelerating

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

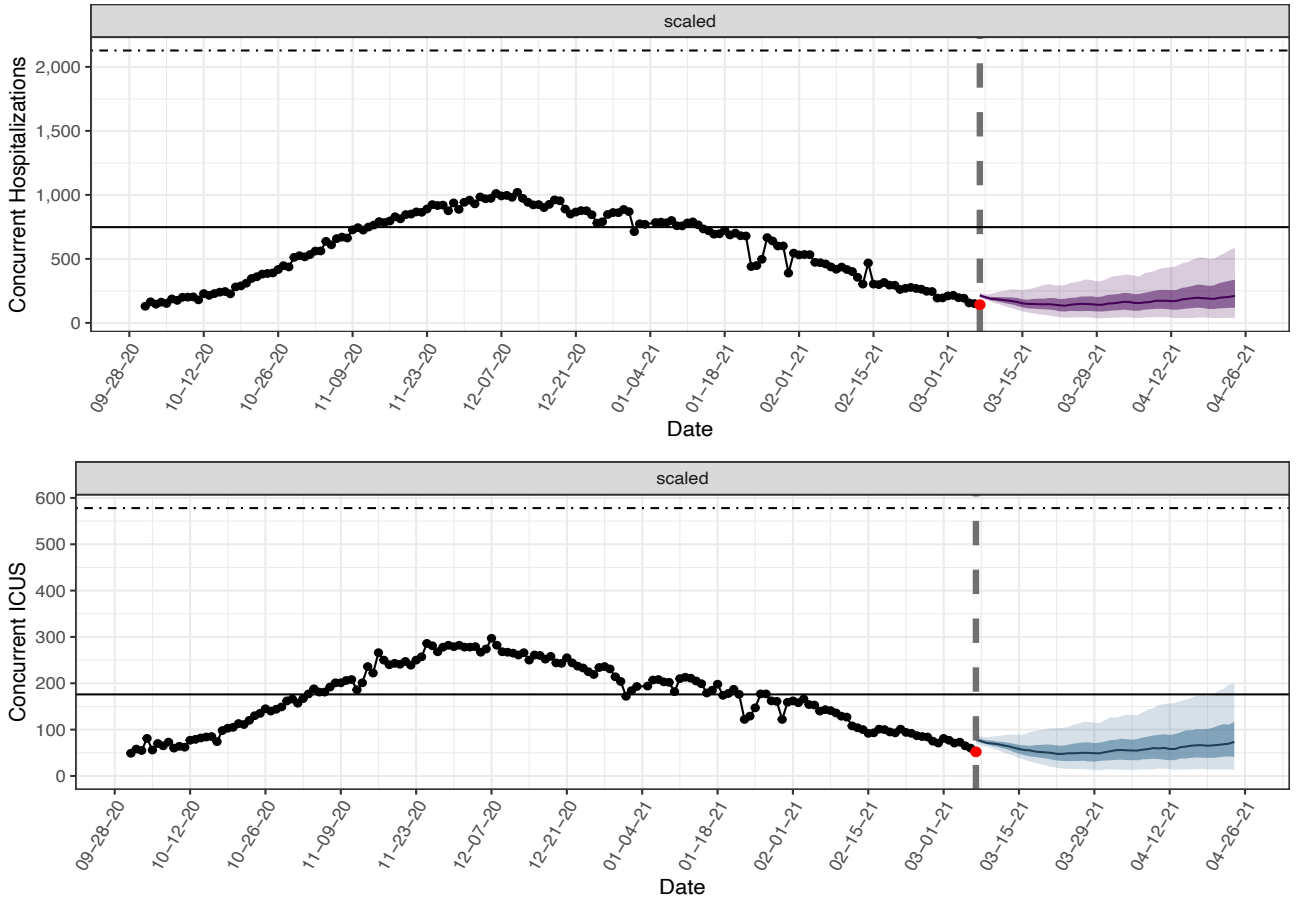
| Week | Qu. 5% (best case) | Qu. 50% (median) | Qu. 95% (worst case) |
|---|---|---|---|
| 3/14 | 44 | 61 | 89 |
| 3/21 | 20 | 50 | 103 |
| 3/28 | 13 | 50 | 116 |
| 4/4 | 13 | 55 | 132 |
| 4/11 | 16 | 61 | 155 |
| 4/18 | 15 | 66 | 174 |

"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. It is tracking closer to best case scenario.**

# 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

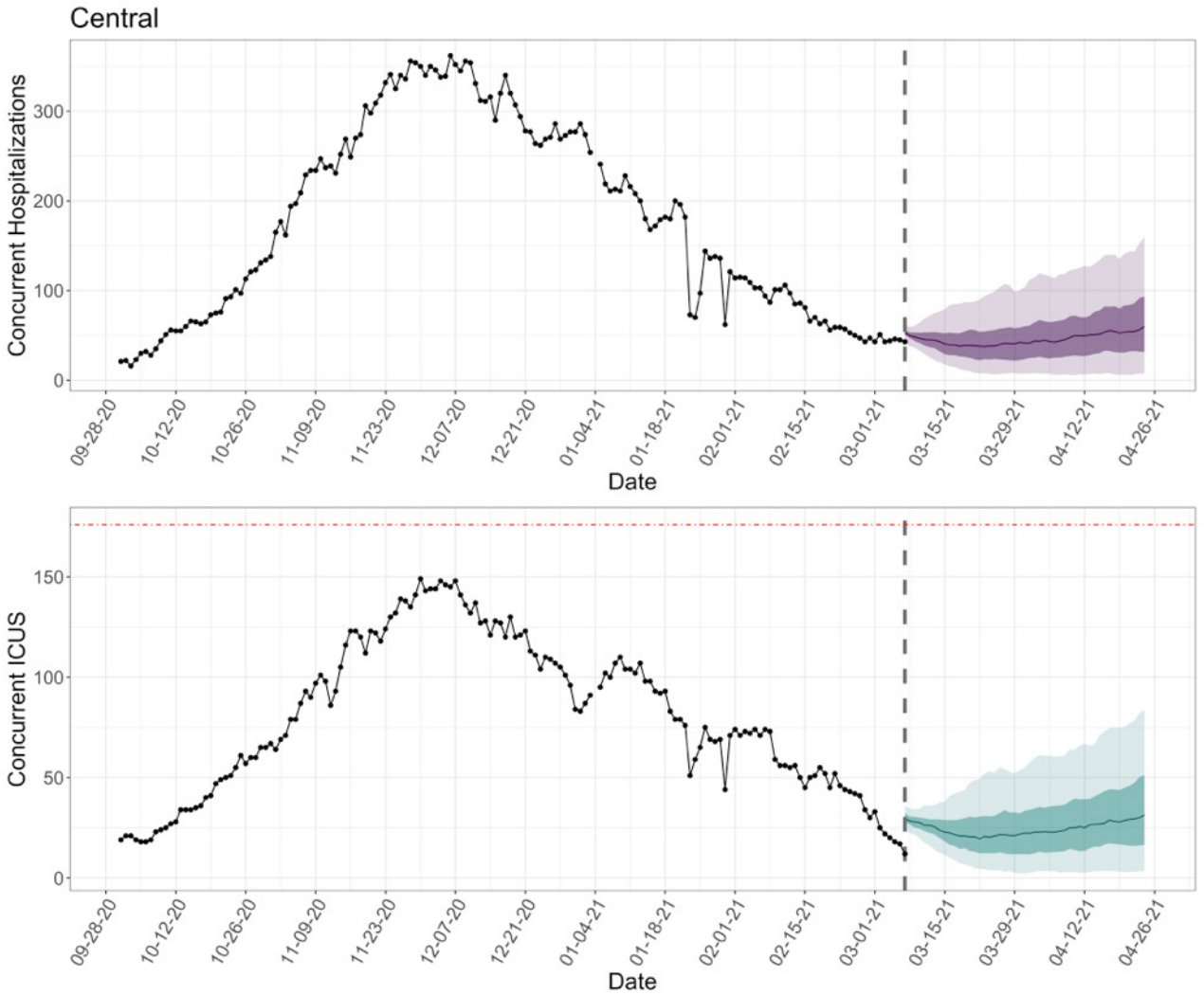
| Week | Qu. 5% (best case) | Qu. 50% (median) | Qu. 95% (worst case) |
|---|---|---|---|
| 3/14 | 58 | 102 | 171 |
| 3/21 | 30 | 92 | 192 |
| 3/28 | 28 | 96 | 218 |
| 4/4 | 30 | 108 | 244 |
| 4/11 | 29 | 113 | 276 |
| 4/18 | 28 | 126 | 337 |

"Scaled" Scenario

**So what?**

**Med-surge general bed needs are predicted to decrease during the next 3 weeks. It is tracking with best case scenario.**

# Regional Hospitalization Forecasts: Central



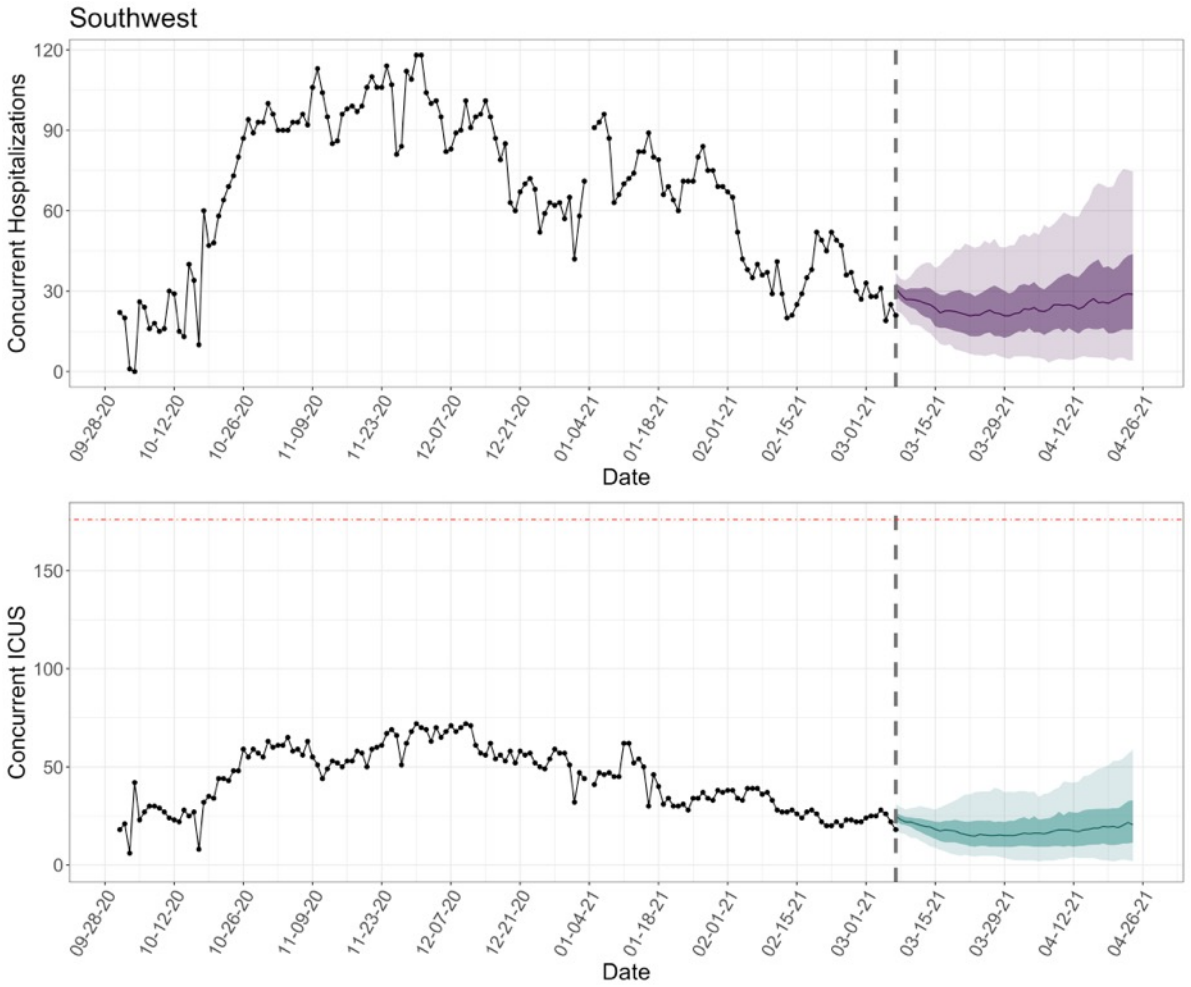

## Concurrent COVID-19 ICUs beds: Central

| Week | Qu. 5% (best case) | Qu. 50% (median) | Qu. 95% (worst case) |
|---|---|---|---|
| 3/14 | 12 | 24 | 38 |
| 3/21 | 5 | 21 | 49 |
| 3/28 | 3 | 21 | 53 |
| 4/4 | 3 | 23 | 61 |
| 4/11 | 3 | 26 | 66 |
| 4/18 | 3 | 28 | 75 |

**So what?**

**ICU bed usage is expected to <u>decrease.</u> The model is over-estimating ICUs in this region.**

# Regional Hospitalization Forecasts: Southwest



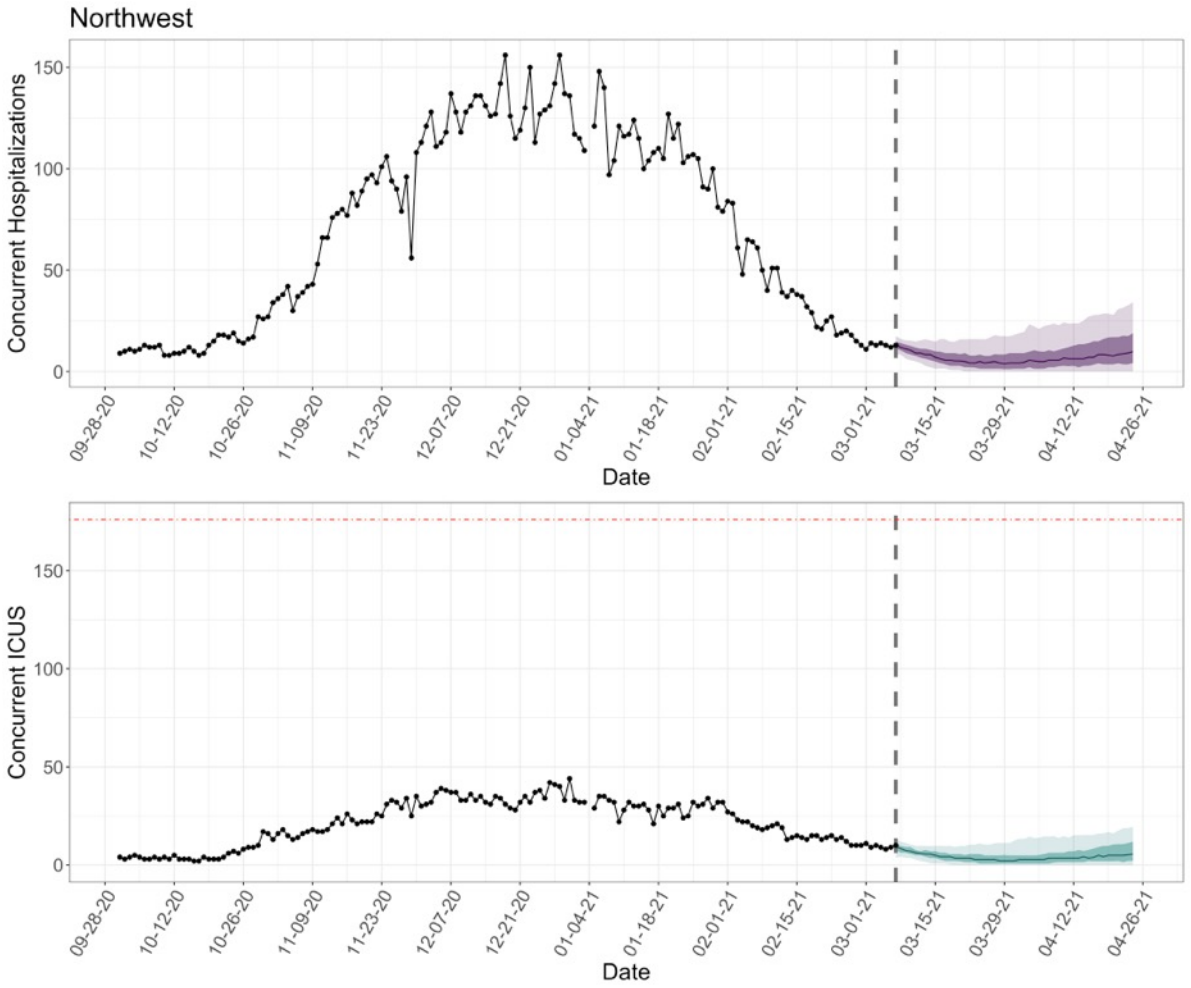

## Concurrent COVID-19 ICUs beds: Southwest

| Week | Qu. 5% (best case) | Qu. 50% (median) | Qu. 95% (worst case) |
|---|---|---|---|
| 3/14 | 9 | 19 | 29 |
| 3/21 | 5 | 16 | 36 |
| 3/28 | 4 | 15 | 39 |
| 4/4 | 2 | 16 | 37 |
| 4/11 | 4 | 18 | 42 |
| 4/18 | 2 | 20 | 50 |

**So what?**

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

# Regional Hospitalization Forecasts: Northwest



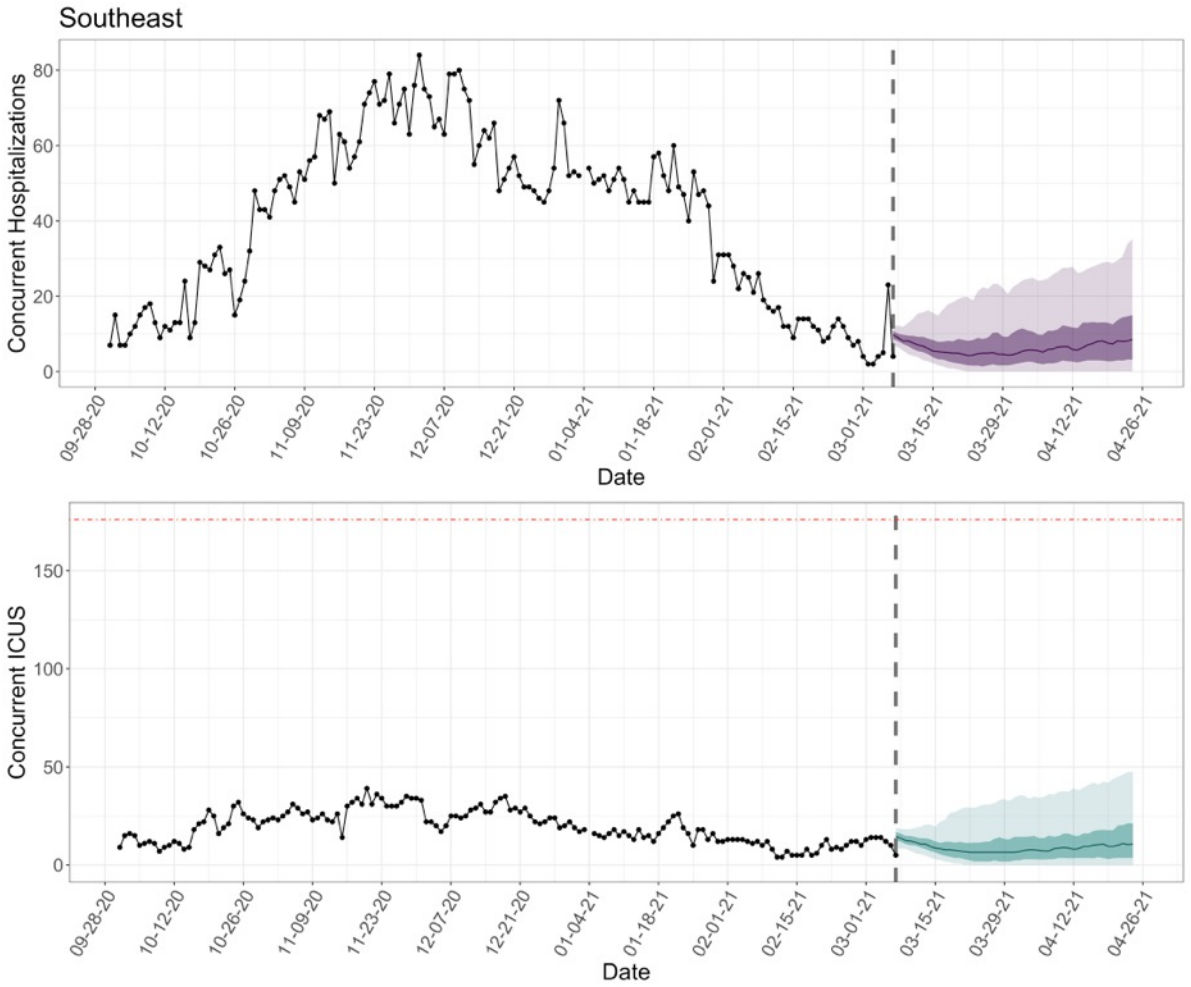

## Concurrent COVID-19 ICUs beds: Northwest

| Week | Qu. 5% (best case) | Qu. 50% (median) | Qu. 95% (worst case) |
|---|---|---|---|
| 3/14 | 1 | 6 | 10 |
| 3/21 | 0 | 3 | 10 |
| 3/28 | 0 | 2 | 11 |
| 4/4 | 0 | 3 | 14 |
| 4/11 | 0 | 3 | 14 |
| 4/18 | 0 | 4 | 16 |

**So what?**

**ICU bed usage is expected to stay low in the Northwest region**

# Regional Hospitalization Forecasts: Southeast



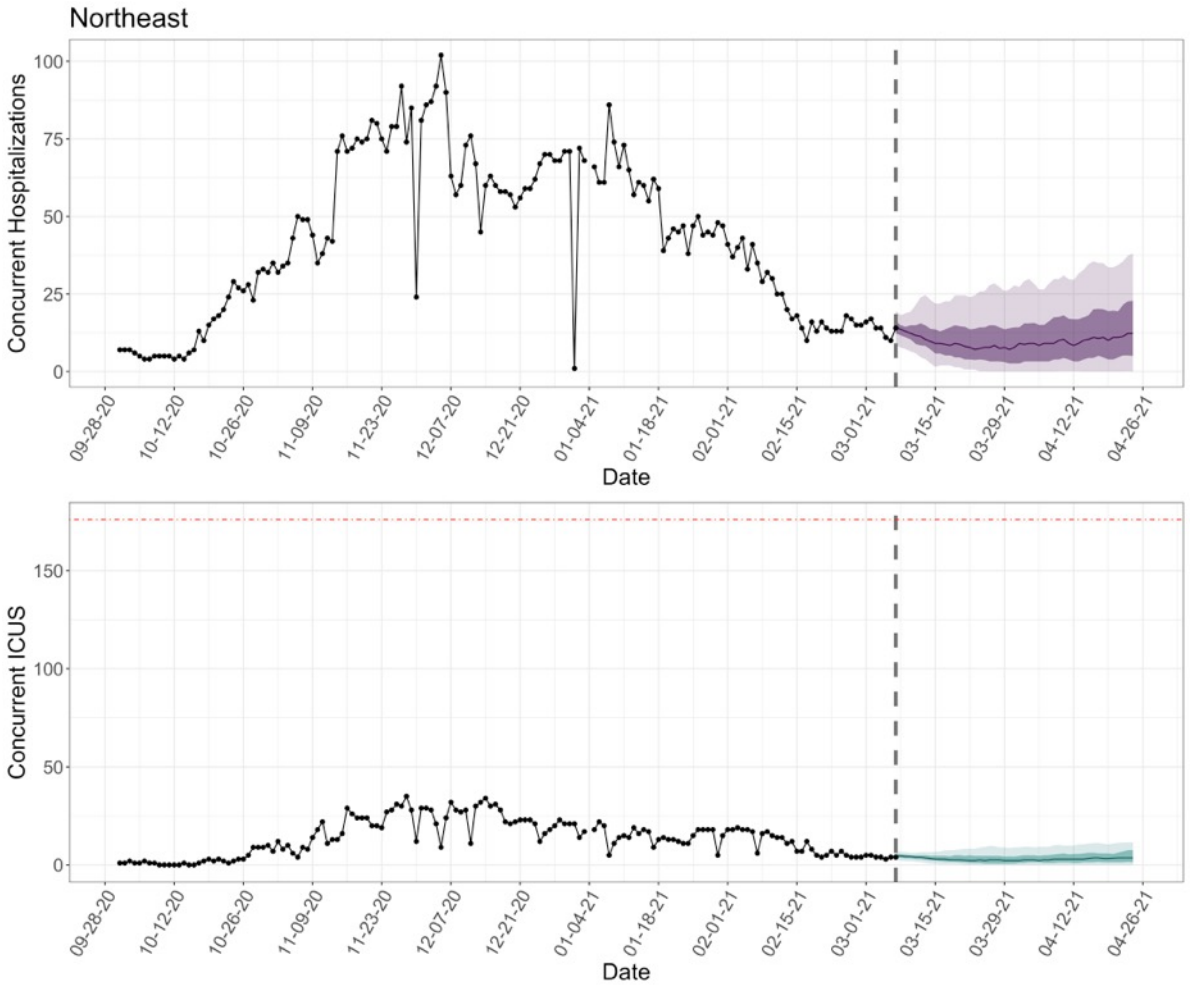

## Concurrent COVID-19 ICUs beds: Southeast

| Week | Qu. 5% (best case) | Qu. 50% (median) | Qu. 95% (worst case) |
|---|---|---|---|
| 3/14 | 4 | 9 | 21 |
| 3/21 | 0 | 7 | 29 |
| 3/28 | 0 | 7 | 33 |
| 4/4 | 0 | 8 | 35 |
| 4/11 | 0 | 9 | 37 |
| 4/18 | 0 | 11 | 42 |

**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) |
|---|---|---|---|
| 3/14 | 1 | 3 | 7 |
| 3/21 | 0 | 2 | 8 |
| 3/28 | 0 | 3 | 9 |
| 4/4 | 0 | 3 | 9 |
| 4/11 | 0 | 3 | 10 |
| 4/18 | 0 | 3 | 11 |

**So what?**

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

# > Non-Congregational Shelter Forecast

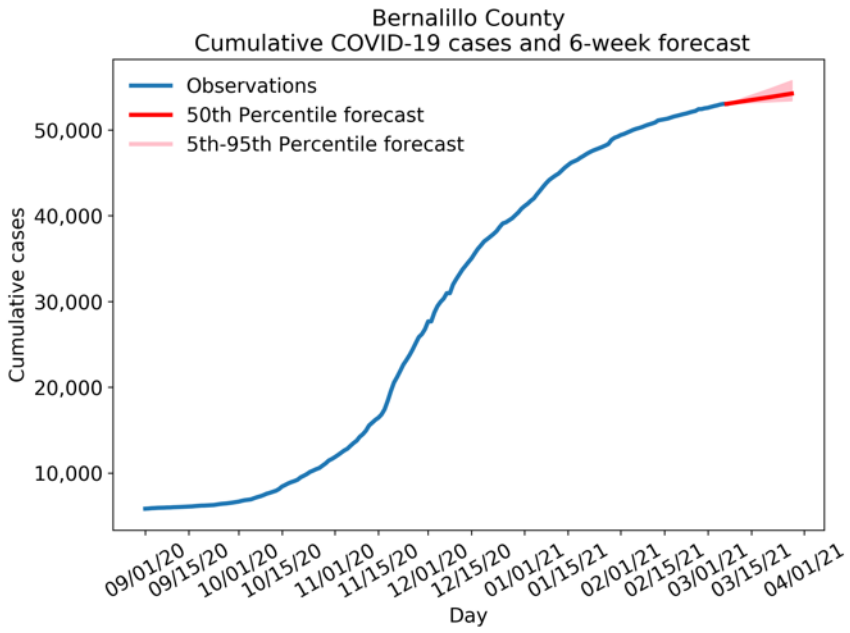
# Non-Congregate Shelter Forecast

- **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 3/7/21: **53,036**
Number of shelter rooms available: **221**
Total number of patients/medical workers (including specialty): **13**
Number of patients: **9**
Number of medical workers: **4**
Occupied rooms:new cases ratio: **0.15**
2-week avg. new cases per day: **86**



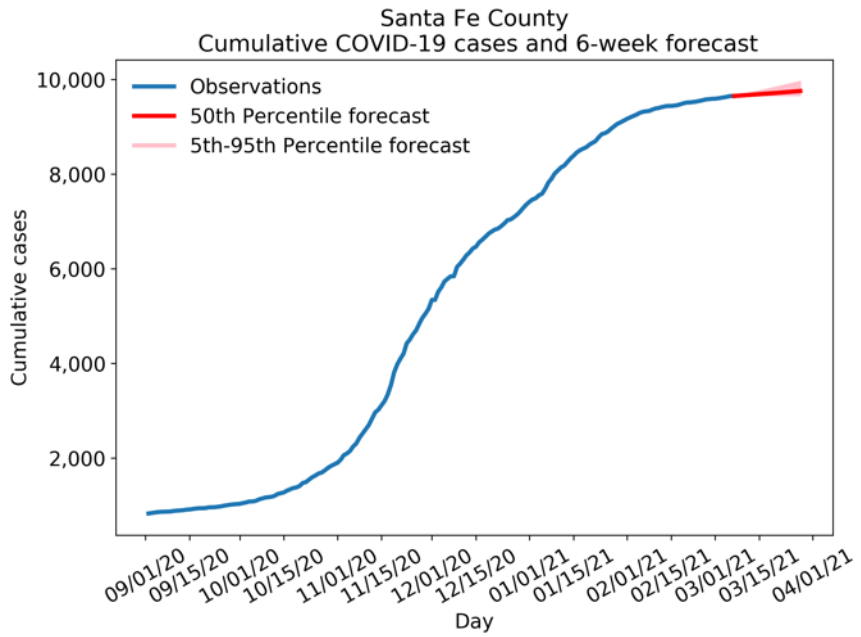

| | 3/7/21 | 3/14/21 | 3/21/21 |
|---|---|---|---|
| Total cases | 53,438 (53,175-53,933) | 53,828 (53,303-54,812) | 54,240 (53,425-55,751) |
| # of rooms needed | 9 (3-19) | 8 (3-19) | 9 (3-20) |
| Deficit (-) or surplus of rooms | 212 | 213 | 212 |
| # of rooms needed (new forecast method) | 11 | 10 | 10 |

2-week avg. new cases per day decreased from 96 last week to 86 this week

Last week we forecasted 30 (11-63) rooms in use, 35 rooms with the adjustment; there are 13 actually in use, we flipped from under forecasting to over forecasting.

# Non-Congregate Shelter Forecast: Santa Fe

Number of cases as of 3/7/21: **9,649**
Number of shelter rooms available: **52**
Total number of patients/medical workers (including specialty): **9**
Number of patients: **9**
Number of medical workers: **0**
Occupied rooms:new cases ratio: **0.93**
2-week avg. new cases per day: **10**



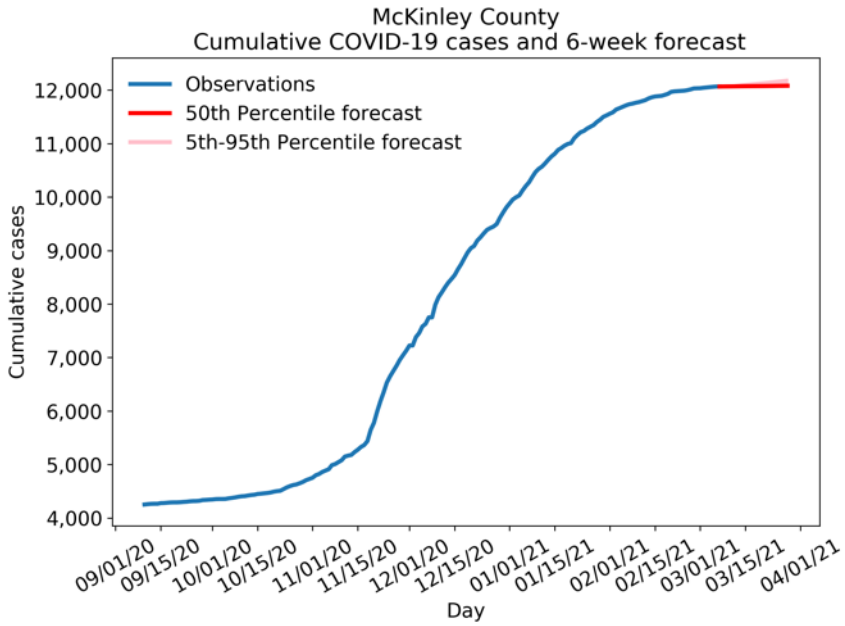

| | 3/7/21 | 3/14/21 | 3/21/21 |
|---|---|---|---|
| Total cases | 9,682 (9,655-9,745) | 9,716 (9,659-9,848) | 9,755 (9,663-9,957) |
| # of rooms needed | 4 (0-13) | 5 (1-14) | 5 (1-14) |
| Deficit (-) or surplus of rooms | 48 | 47 | 47 |
| # of rooms needed (new forecast method) | 7 | 6 | 6 |

2-week avg. new cases per day decreased from 11 last week to 10 this week

Last week we forecasted 13 (3-31) rooms in use, 19 rooms with the adjustment; there are 9 actually in use, so we flipped from under forecasting to over forecasting

# Non-Congregate Shelter Forecast: McKinley

Number of cases as of 3/7/21: **12,067**
Number of shelter rooms available: **160**
Total number of patients/medical workers (including specialty): **9**
Number of patients: **5**
Number of medical workers: **4**
Occupied rooms:new cases ratio: **1.4**
2-week avg. new cases per day: **6**



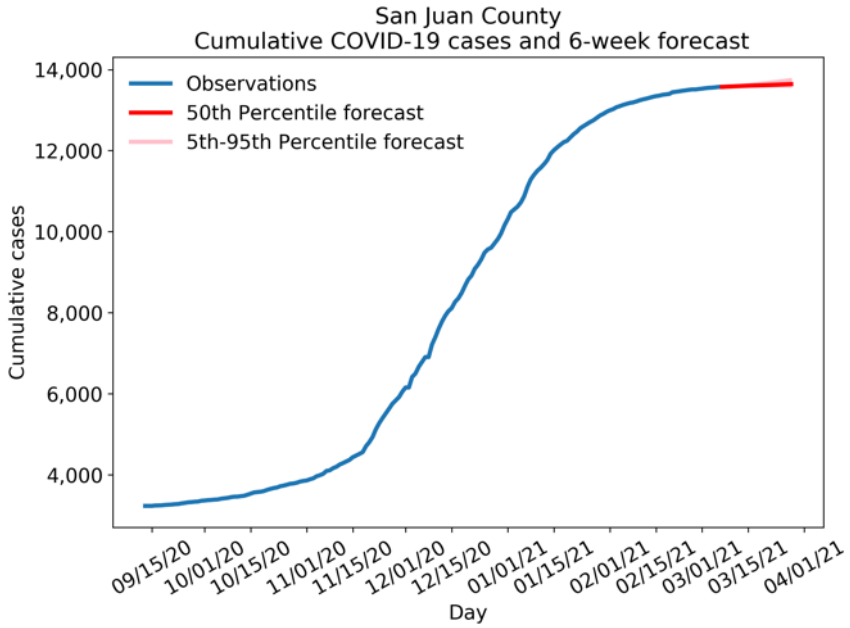

| | 3/7/21 | 3/14/21 | 3/21/21 |
|---|---|---|---|
| Total cases | 12,073 (12,067-12,119) | 12,077 (12,067-12,160) | 12,082 (12,067-12,206) |
| # of rooms needed | 1 (0-10) | 1 (0-8) | 1 (0-9) |
| Deficit (-) or surplus of rooms | 159 | 159 | 159 |
| # of rooms needed (new forecast method) | 5 | 4 | 3 |

2-week avg. new cases per day decreased from 12 last week to 6 this week

Last week we forecasted 4 (0-19) rooms in use, 12 rooms with the adjustment; there are 9 actually in use, so we are between the two forecasting methods

# Non-Congregate Shelter Forecast: San Juan

Number of cases as of 3/7/21: **13,573**
Number of shelter rooms available: **21**
Total number of patients/medical workers (including specialty): **4**
Number of patients: **4**
Number of medical workers: **0**
Occupied rooms:new cases ratio: **0.46**
2-week avg. new cases per day: **9**




| | 3/7/21 | 3/14/21 | 3/21/21 |
|---|---|---|---|
| Total cases | 13,599 (13,575-13,645) | 13,619 (13,575-13,710) | 13,641 (13,575-13,780) |
| # of rooms needed | 2 (0-5) | 1 (0-4) | 1 (0-5) |
| Deficit (-) or surplus of rooms | 19 | 20 | 20 |
| # of rooms needed (new forecast method) | 3 | 2 | 2 |

2-week avg. new cases per day decreased from 14 last week to 9 this week.

Last week we forecasted 0 (0-1) rooms in use, 1 room with the adjustment; there are 4 actually in use so we are under forecasting