# Modeling & Forecasting COVID-19 in NM

December 8, 2020



NNSA
National Nuclear Security Administration

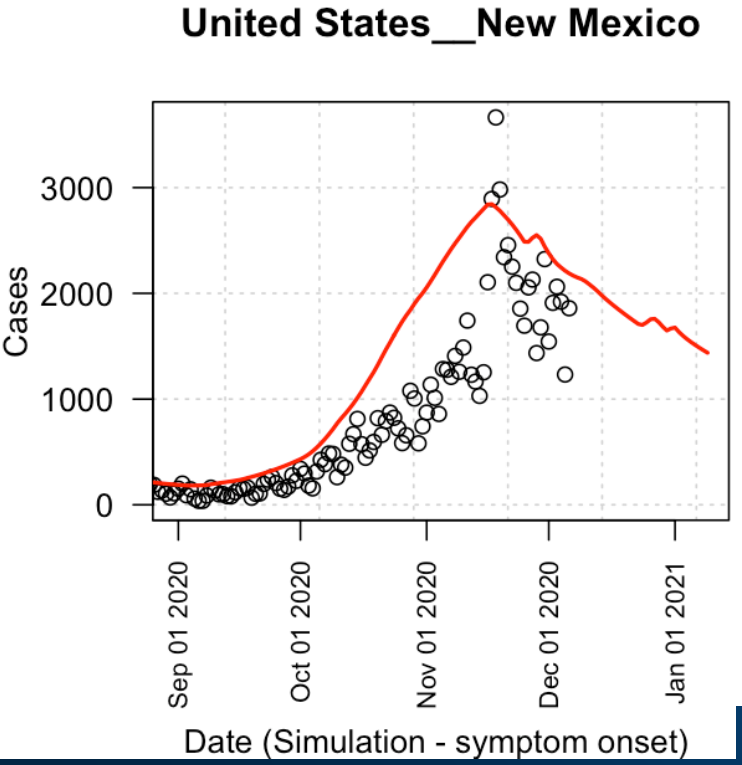
# 08 Dec 2020: EpiGrid modeling

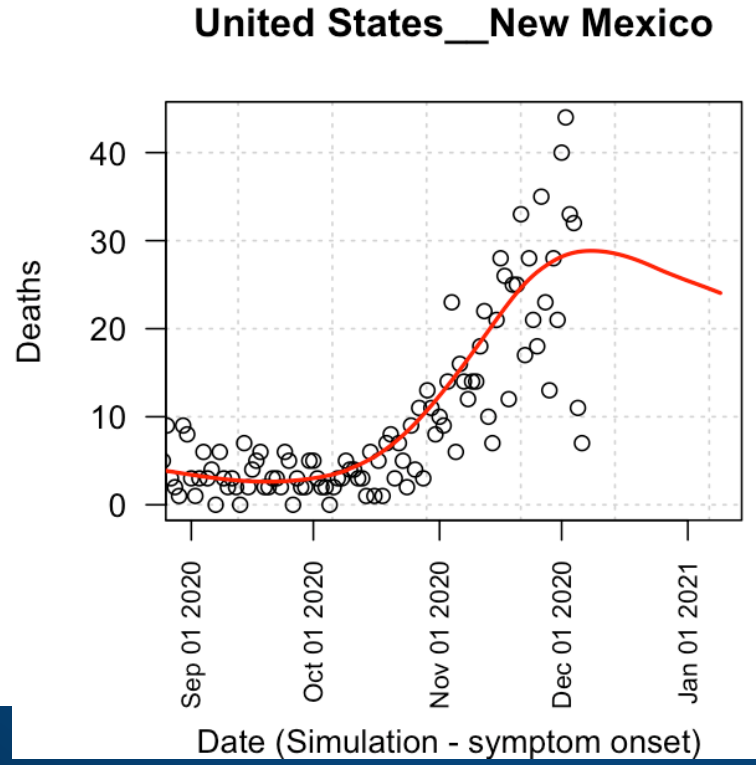
- Assumes all counties remain in their current (almost all “red”) category under the new county-by-county system. (More precisely we assume that transmission parameters stay as they are.)

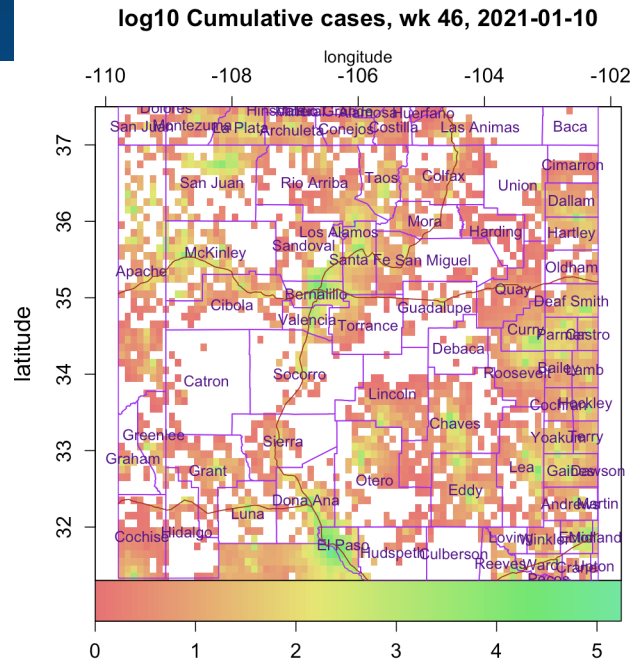
- Quarantine modeled at 40%.

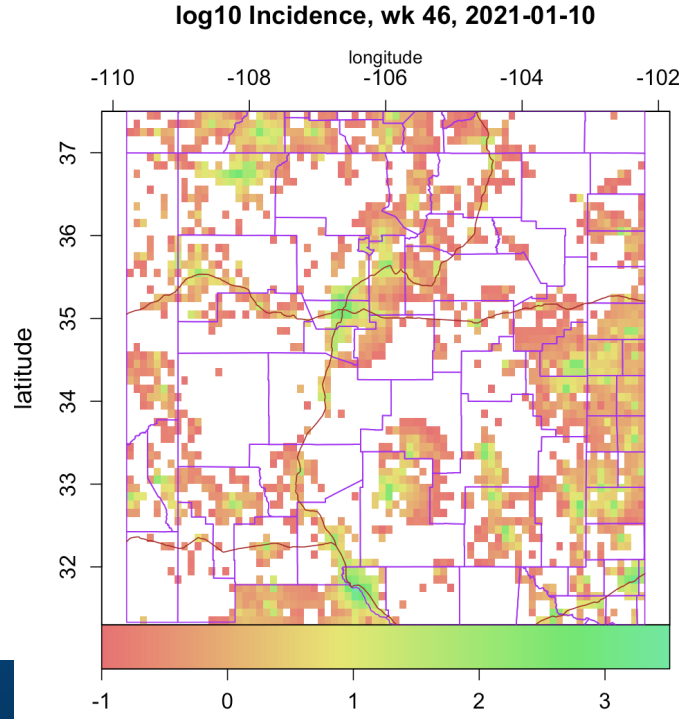
- Small increases in transmission are assumed for Thanksgiving, Christmas and New Year’s. Thanksgiving is a moderately constrained “bump” at this time.

- Last six days of mortality figures average is equal to the red curve (~28/day).



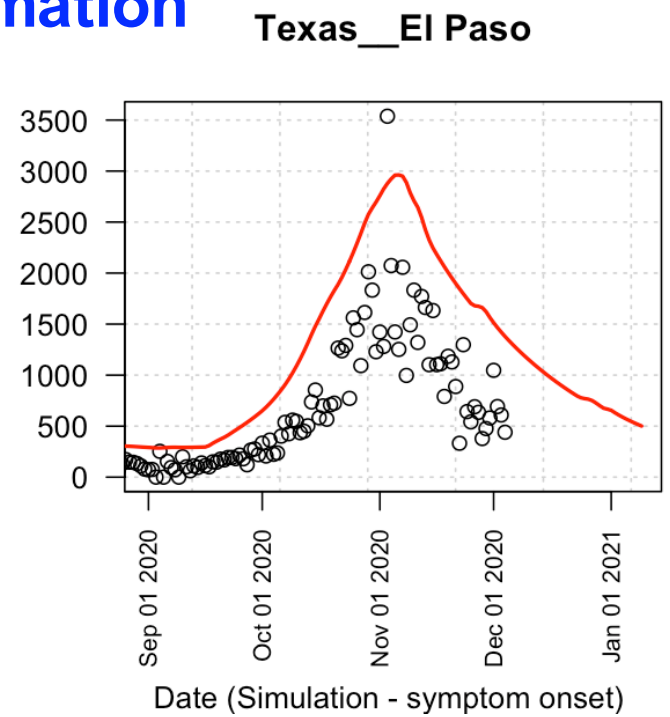
# 08 December 2020 Model (EpiGrid) – more details and information

- **Reported cases in El Paso are still decreasing; positivity dropped to 15%.**
  - The decrease is modeled, *but assume a large number of unreported cases.*

- **Transmission is based on mobility with modifications due to PHO's.**
  - Modeling of public reaction and public health orders (PHO) is similar to previous models.
  - Geographical heterogeneity of mobility accounts for the majority of variations in the force of infection from county-to-county.

- **Death rates now include more of the inhomogeneity by-county**
  - Counties with higher-risk populations have higher death rates.

- **Isolation and quarantine rates are assumed to be stable.**
  - Swab to results times: Assuming 1-3 days
  - Time to quarantine contacts is *up slightly* from last week from 25 hrs to 30 hrs (Nov. 26th).
  - Base isolation rate is 0.4 for NM.

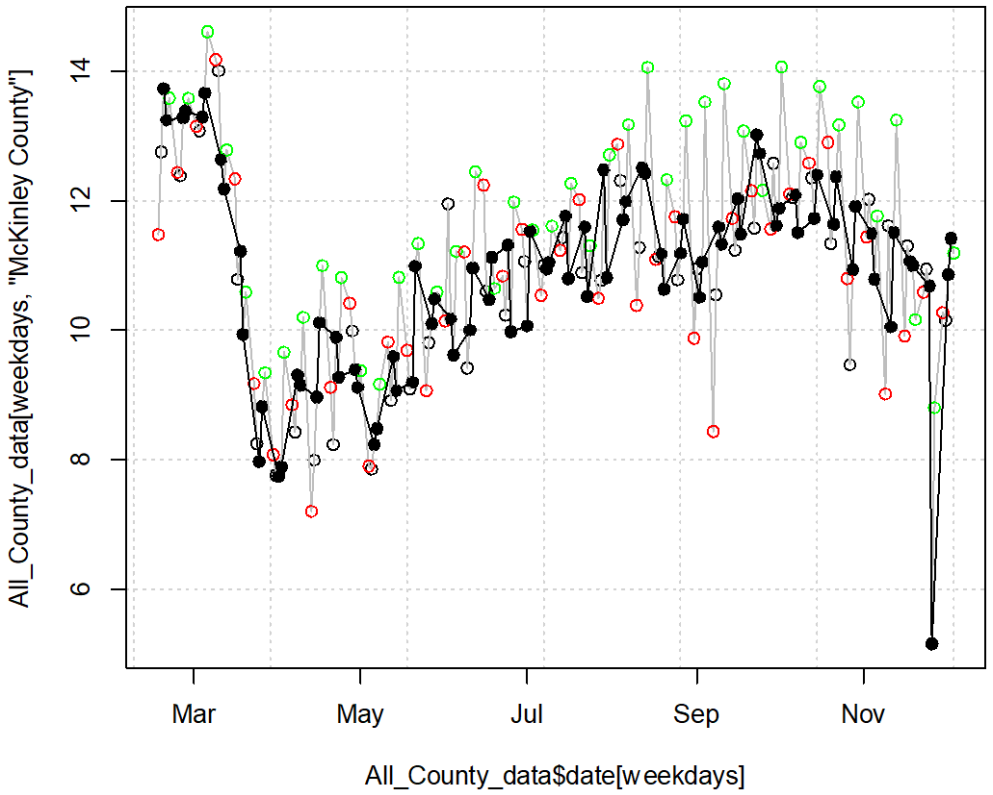


# Mobility – northern counties (Data only).

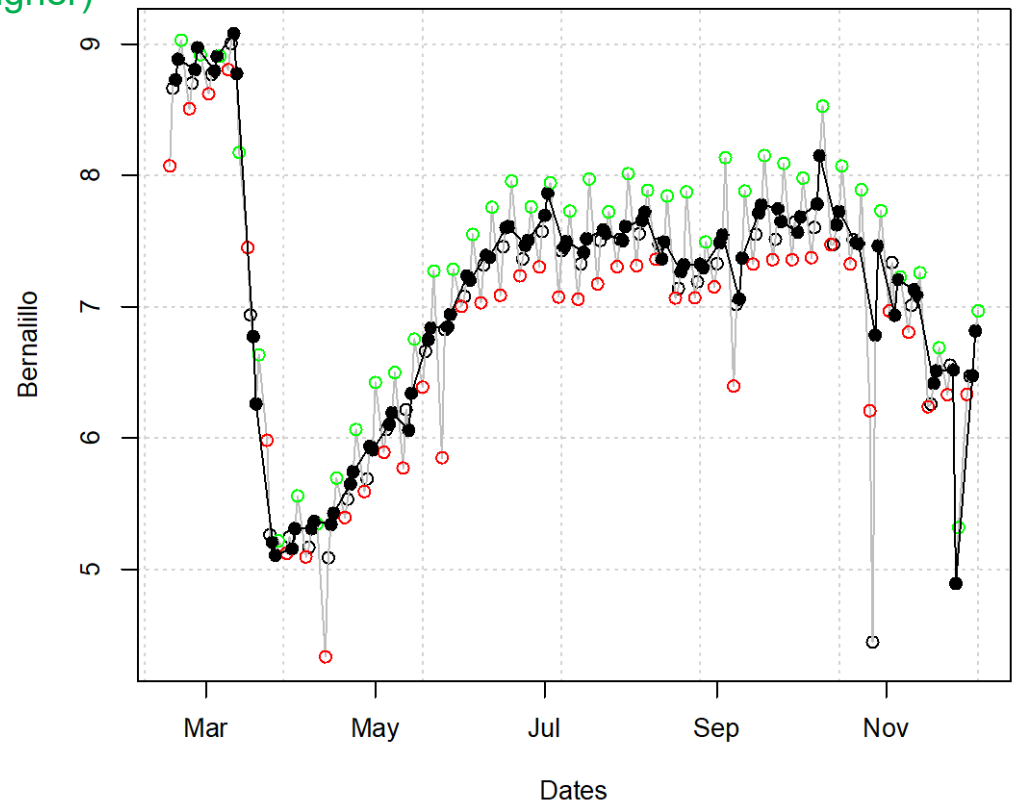
Bernalillo, McKinley, Rio Arriba, Sandoval, San Juan, Santa Fe, and Taos all at similar levels or slightly higher than immediately pre-Thanksgiving.

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

McKinley



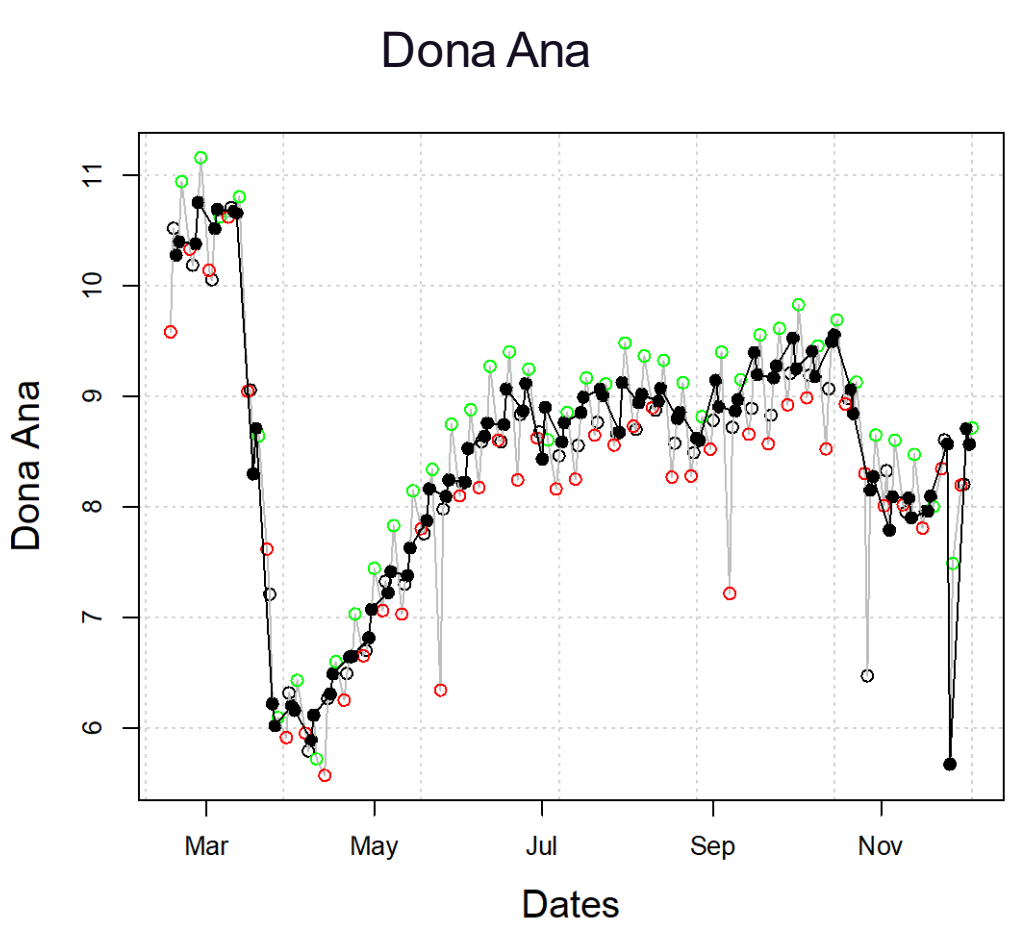

Bernalillo

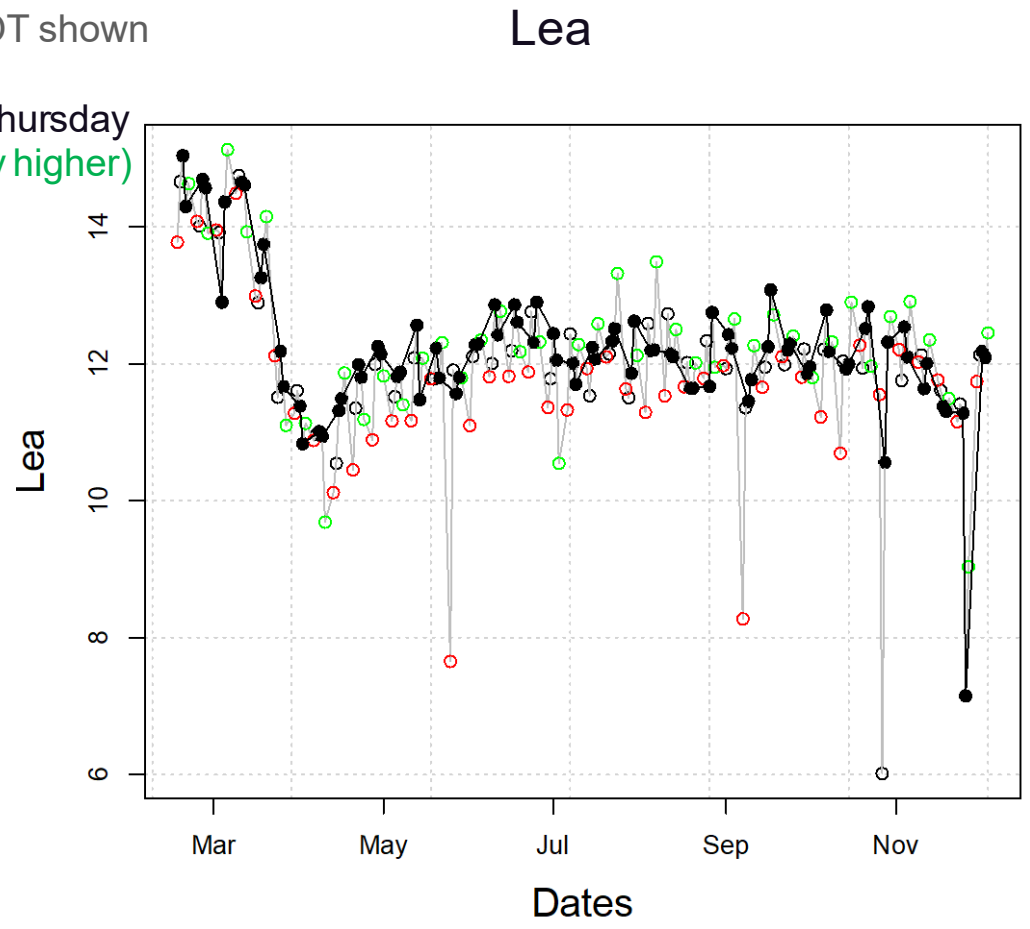


# Mobility – southern counties (and Curry) (Data only)

Most counties have increased mobility over pre-Thanksgiving values including Dona Ana, Lea, and Luna. Eddy, Chaves, Roosevelt Curry have small increases.

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



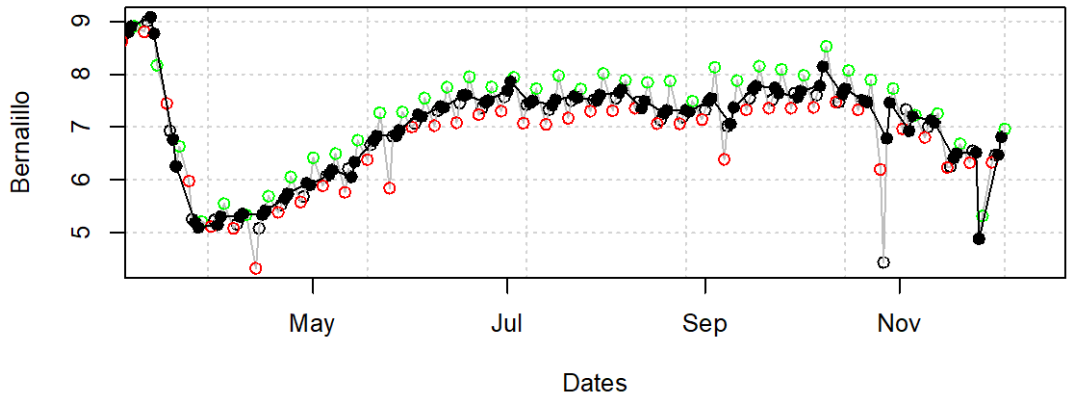



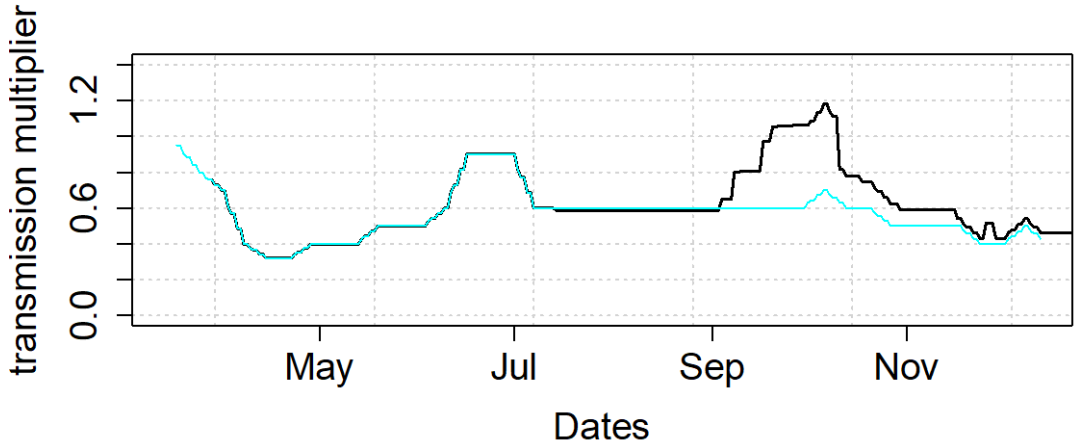
# Transformation from T-80 mobility to disease transmission

- The top curve is T-80 mobility data
  - Weekends NOT shown
  - Monday
  - Wednesday/Thursday
  - Friday (usually higher)

- The cyan curve (~delayed mobility) in the bottom graph reflects 2 changes from T-80.
  - The mobility that was decreasing shifted to later times
    - This shift is needed because of transmission in families
  - The increases in transmission in June, at least partly due to the June 1 PHO, have been added.
- In the black curve the modulations due to PHO's and behaviors in Sept., Oct. and Nov. have also been added.

- Note that increases in transmission are correlated not just with high mobility (presumably contact rate), but also with modulation upward (presumably dangerous behavior).

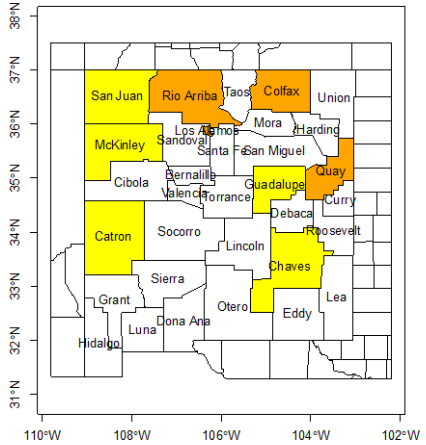


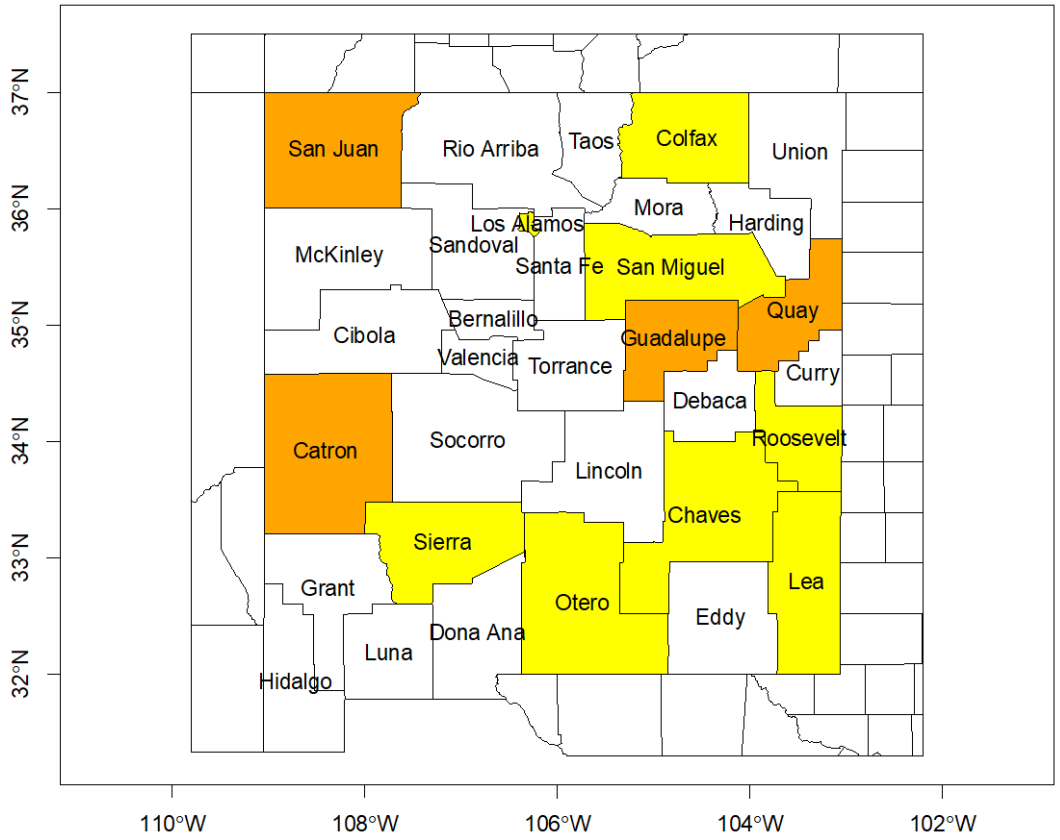



# Situational Awareness:
# Some counties may not be slowing down as fast as others

- Catron, DeBaca, Guadalupe, Quay, San Juan appear to not yet have decreasing daily case counts
- Chaves, Colfax, Lea, Lincoln, Los Alamos, Otero, San Miguel, Roosevelt, Sierra also may not have decreasing daily case counts

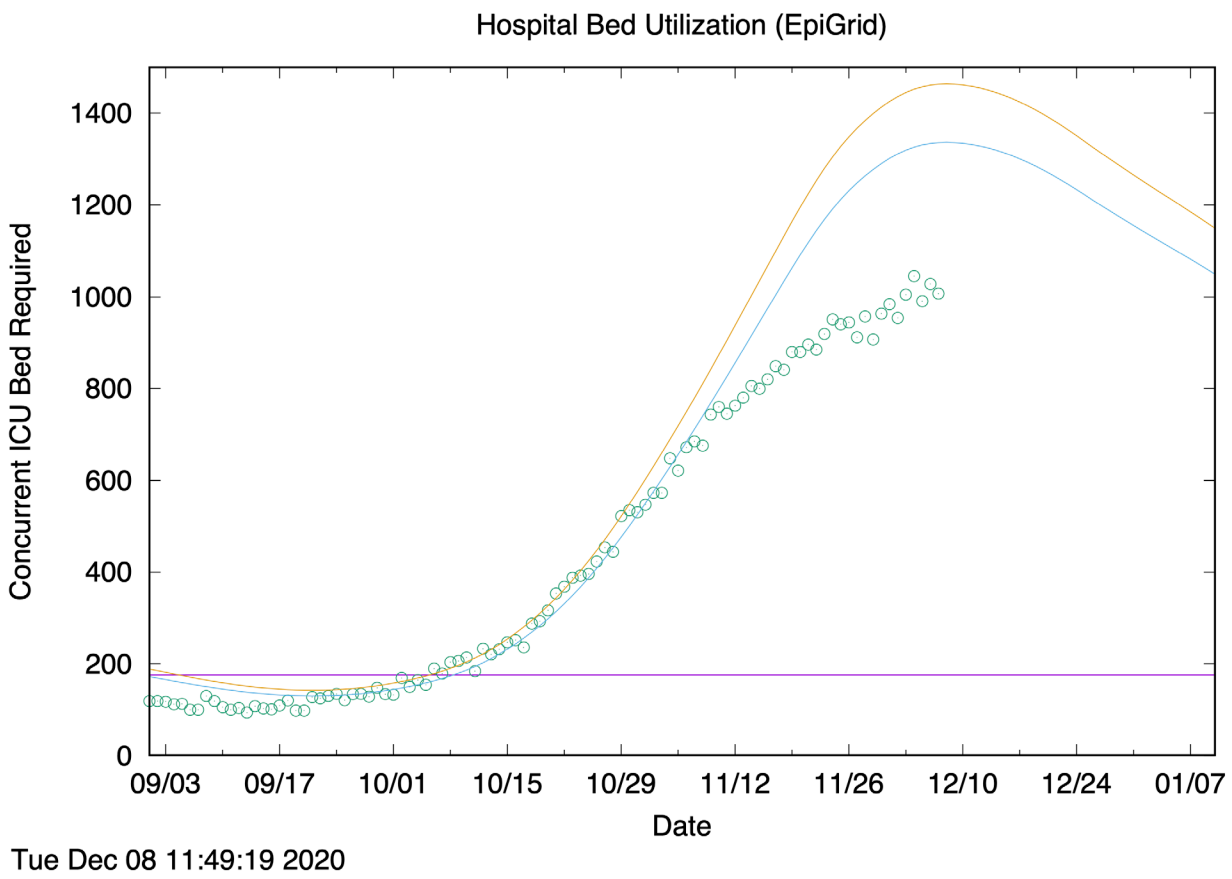
Last week

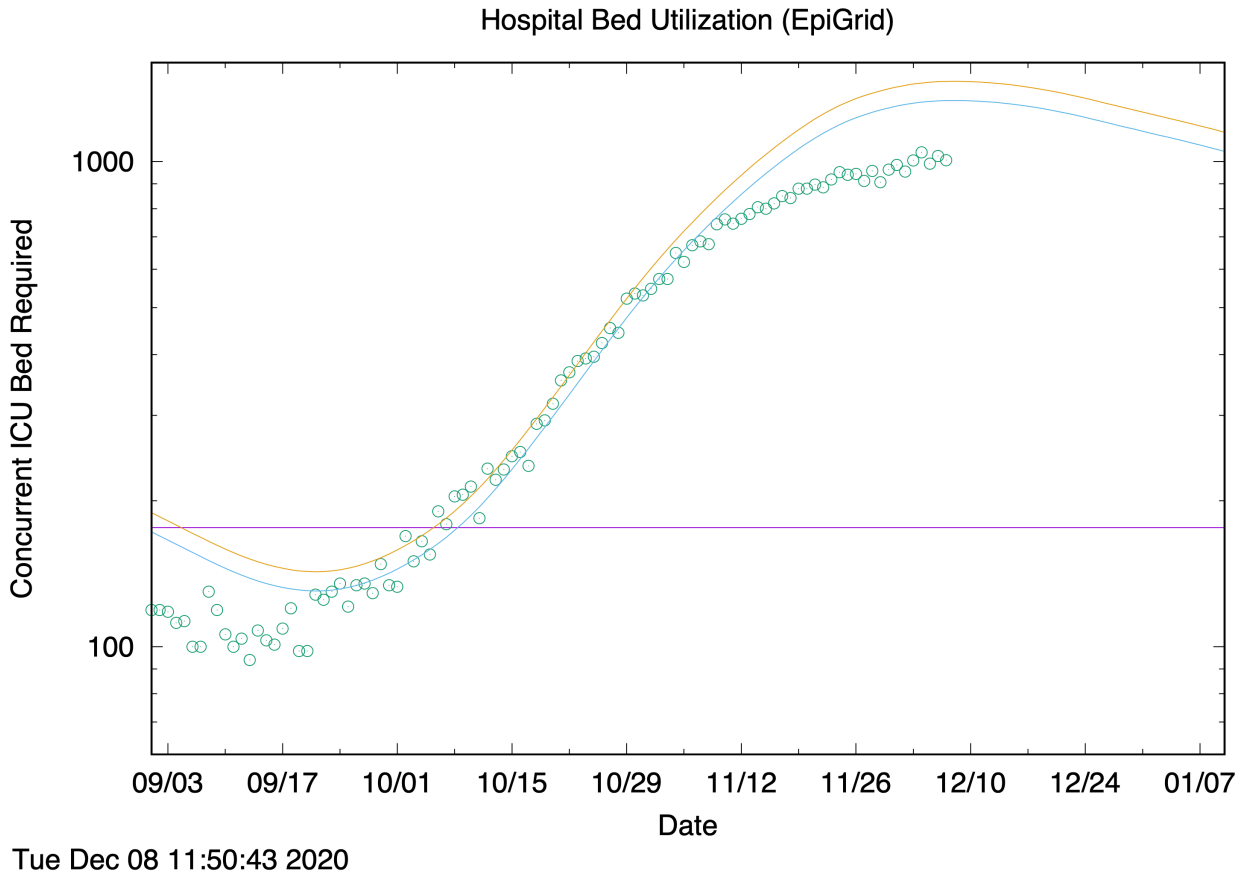


# Hospital bed concurrent usage by COVID-19 patients

- Left panel: Linear vs. time shows hospital utilization and capacity. Current week's model only, upper and lower likely outcomes.
- Right panel: Log vs. time, same data and model.
- November 16th PHO and Thanksgiving are now parameterized.
- Out-patient care has a strong favorable impact on hospital bed requirements.

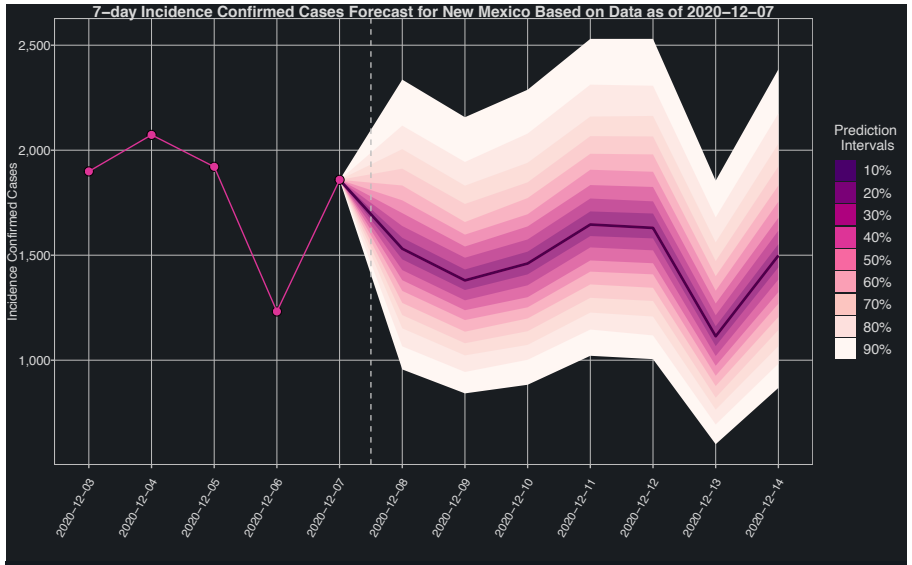


# Conclusions and Discussion

- **Thanksgiving Day Holiday bump appears mild, but New Mexico's epidemic spread is improving *very* slowly. Probably unstable to any significant perturbation.**
- **The New Mexico epidemic is geographically dispersed for the foreseeable future.**
- **Nationwide geographical dispersion requires that state-to-state travel plays an important role.**
- ***Bernalillo likely plays a substantial role driving ICU need/requirements.***
- **NM Test positivity remains well above 7%. >~12% recently.**
- **El Paso's daily incidence continues to decline. Testing positivity suggests a substantial undercount of cases even in the context of falling incidence.**
- **Vaccination will not alter these results until at least the first week of January, possibly the end of January.**
- **Targeting high-mortality rate areas and populations will likely be reflected first in these calculations.**
- **At-home oxygen supplementation appears to be a substantial lowering to the general bed load in New Mexico as compared with July.**
- **Discussion:**
  - For re-opening: low-risk activities first. Higher risk later.
  - Schools are highly mitigated, and elementary school provides little evidence for in-school spread?
  - School staff as a boost to case investigation and tracing? Guam is using cell phone apps.
  - Indoor, un-masked activities are inherently risky. How to mitigate? Airflow in addition to distance? For re-opening…
  - Changes in terminology? "Pre-existing conditions" are present for what fraction of the middle-aged population?
  - Qualitatively higher testing rates (i.e. 10x) can substantially offset local epidemics (i.e. South Korea) by facilitating tracing. This will take time to plan and execute, but candidate technologies exist. Bar-coded sequencing with high-through put sequencing of viral clinical samples. Multiple 10k/day approaching 100k/day?

# Short- & Long-Term Forecast for NM: Cases




**6–Week Forecast of Confirmed Cases for New Mexico Based on Data as of 2020–12–07**

| Week | Best Case (5th Percentile) | Middle Case (50th Percentile) | Worst Case (95th Percentile)^ |
|---|---|---|---|
| 2020–12–07 | | 109,947* | |
| 2020–12–14 | 116,256 | 120,204 | 125,913 |
| 2020–12–21 | 122,040 | 130,581 | 142,455 |
| 2020–12–28 | 127,415 | 140,995 | 160,057 |
| 2021–01–04 | 132,630 | 151,436 | 178,029 |
| 2021–01–11 | 137,954 | 162,251 | 198,300 |
| 2021–01–18 | 142,978 | 173,049 | 219,380 |

*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 2020–12–07**

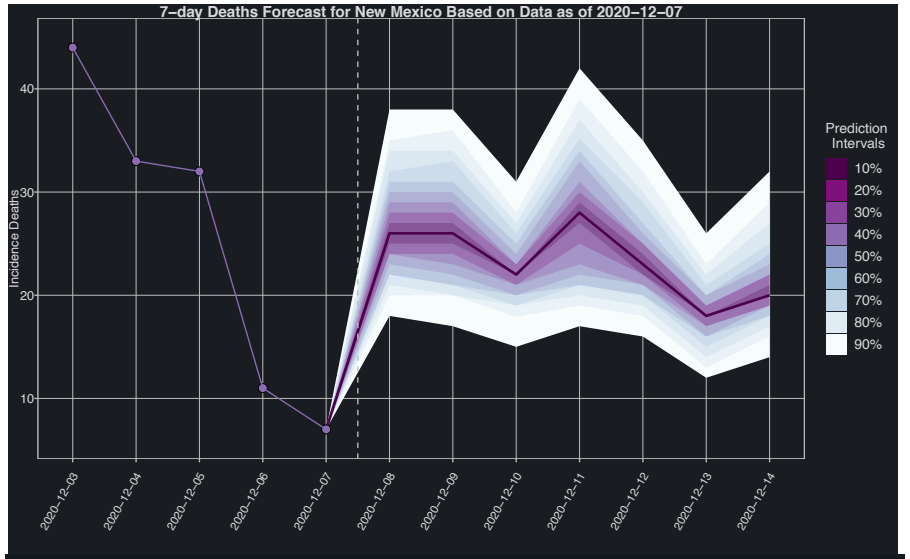
| Week | Best Case (5th Percentile) | Middle Case (50th Percentile) | Worst Case (95th Percentile)^ |
|---|---|---|---|
| 2020–12–07 | | 1,836* | |
| 2020–12–14 | 901 | 1,465 | 2,281 |
| 2020–12–21 | 826 | 1,482 | 2,363 |
| 2020–12–28 | 768 | 1,488 | 2,515 |
| 2021–01–04 | 745 | 1,492 | 2,567 |
| 2021–01–11 | 760 | 1,545 | 2,896 |
| 2021–01–18 | 718 | 1,543 | 3,011 |

*Last reported confirmed cases count
^Closest–matching scenario

**So what?**

**The daily number of cases is expected to range between 900 and 2,300 in the next two weeks**

# Short- & Long-Term Forecast for NM: Deaths




**6–Week Forecast of Deaths for New Mexico Based on Data as of 2020–12–07**

| Week | Best Case (5th Percentile) | Middle Case (50th Percentile)^ | Worst Case (95th Percentile) |
|---|---|---|---|
| 2020–12–07 | | 1,756* | |
| 2020–12–14 | 1,874 | 1,920 | 1,979 |
| 2020–12–21 | 1,980 | 2,072 | 2,201 |
| 2020–12–28 | 2,074 | 2,223 | 2,416 |
| 2021–01–04 | 2,161 | 2,374 | 2,628 |
| 2021–01–11 | 2,245 | 2,523 | 2,843 |
| 2021–01–18 | 2,326 | 2,672 | 3,078 |

*Last reported deaths count
^Closest–matching scenario

**6–Week Forecast of Daily Average of Deaths for New Mexico Based on Data as of 2020–12–07**

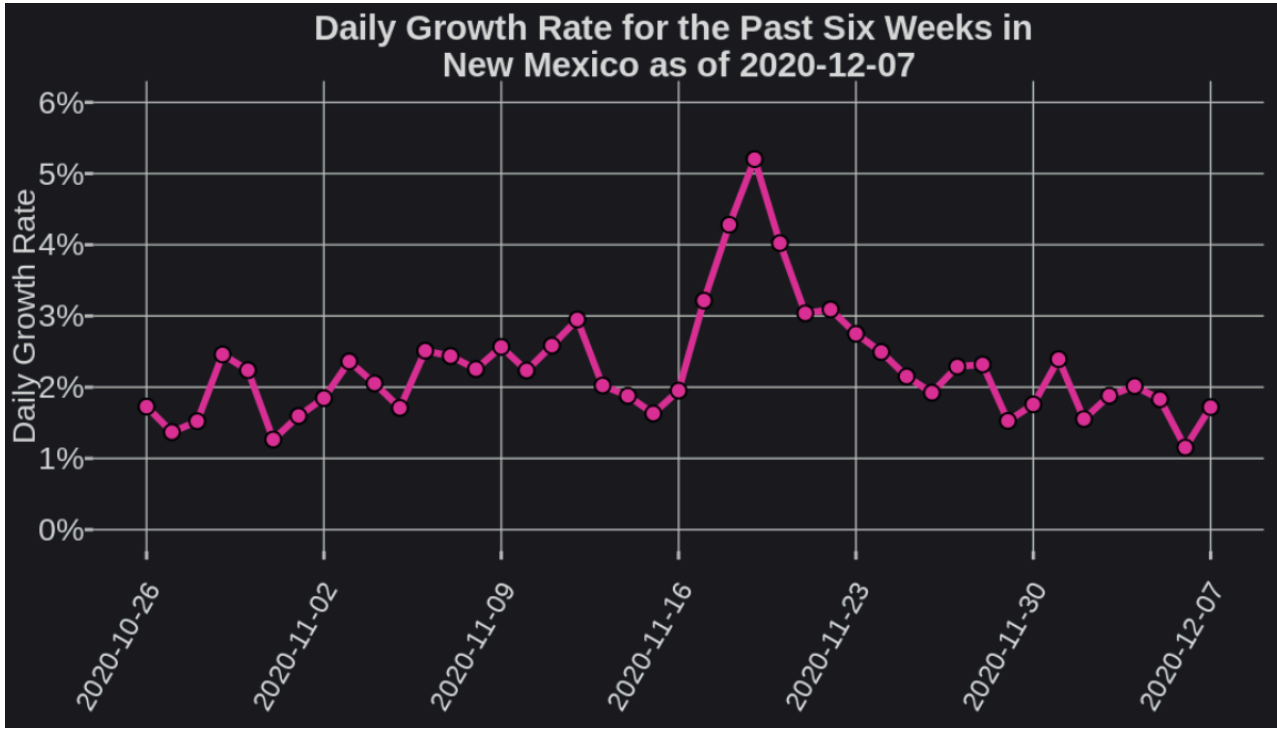
| Week | Best Case (5th Percentile) | Middle Case (50th Percentile)^ | Worst Case (95th Percentile) |
|---|---|---|---|
| 2020–12–07 | | 27* | |
| 2020–12–14 | 17 | 23 | 32 |
| 2020–12–21 | 15 | 22 | 32 |
| 2020–12–28 | 13 | 22 | 31 |
| 2021–01–04 | 12 | 22 | 30 |
| 2021–01–11 | 12 | 21 | 31 |
| 2021–01–18 | 12 | 21 | 34 |

*Last reported confirmed deaths
^Closest–matching scenario

**So what?**

**The daily number of deaths is expected to range between 17 and 32 in the next two weeks**

# Growth Rate for NM




6-Week Forecast of the Average Weekly Growth Rate for New Mexico Based on Data as of 2020-12-07

| Week | Best Case (5th Percentile) | Middle Case (50th Percentile) | Worst Case (95th Percentile)^ |
|---|---|---|---|
| 2020-12-07 | | 1.8%* | |
| 2020-12-14 | 0.80% | 1.3% | 2.0% |
| 2020-12-21 | 0.70% | 1.2% | 1.8% |
| 2020-12-28 | 0.62% | 1.1% | 1.7% |
| 2021-01-04 | 0.57% | 1.0% | 1.5% |
| 2021-01-11 | 0.56% | 0.99% | 1.6% |
| 2021-01-18 | 0.51% | 0.92% | 1.5% |

*Last weekly mean daily growth rate

^Closest-matching scenario

## So what?

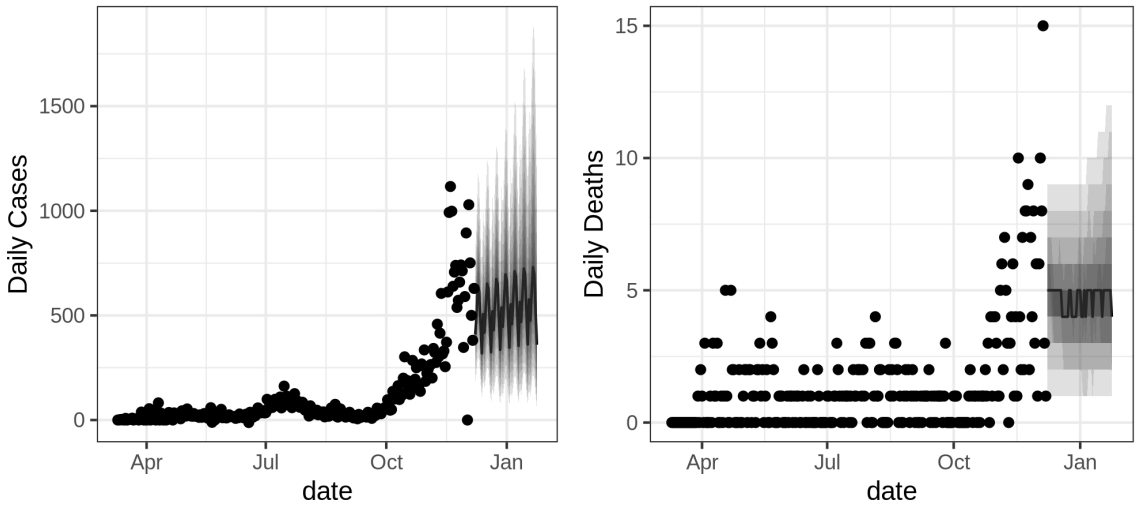
**As of December 7th, the average growth rate in NM is at 1.8% (down from 2.1%)**

**Deaths have been increasing by an average of 1.6% per day (same as last week)**

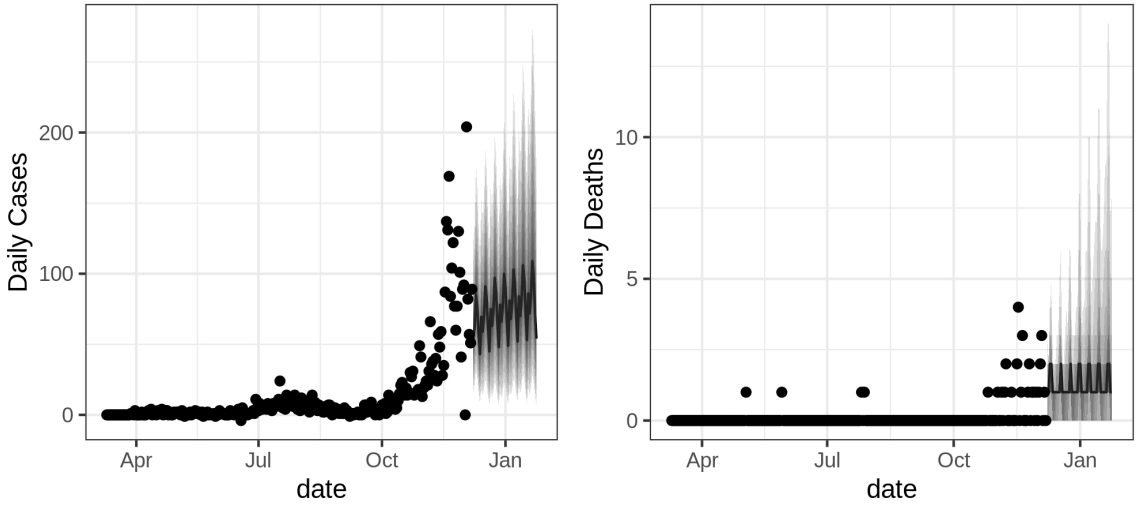
# > Regional Forecasts, Growth Rates, & Hospitalizations

# Central Region Forecasts

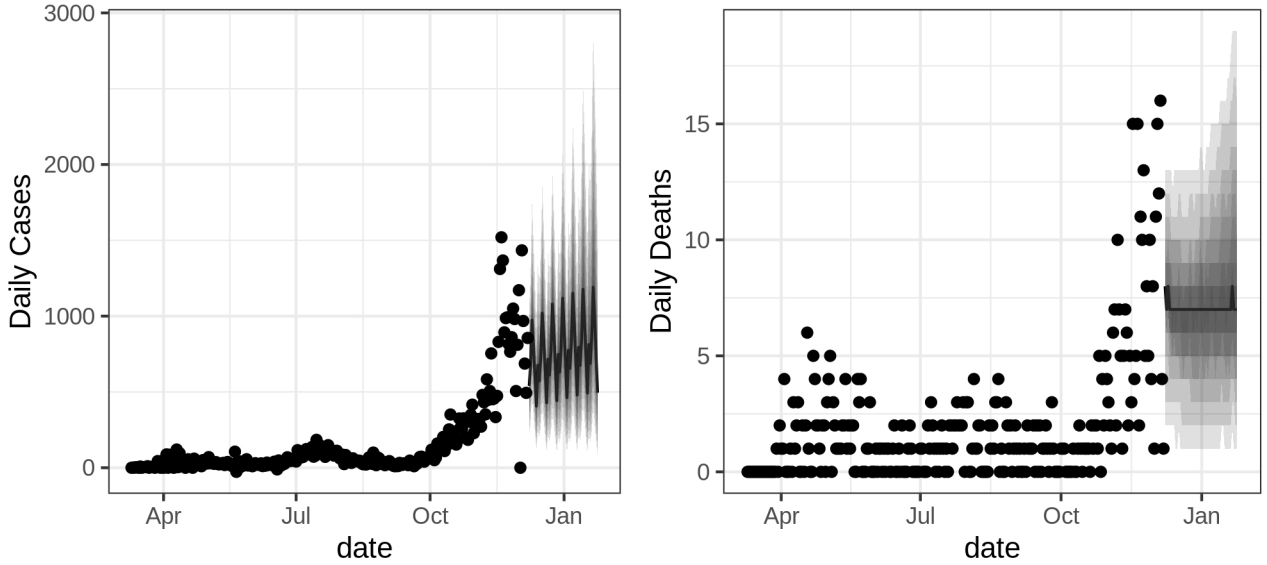
*New Mexico - Bernalillo*




*New Mexico - Valencia*




*Health Region - NM Central Region*

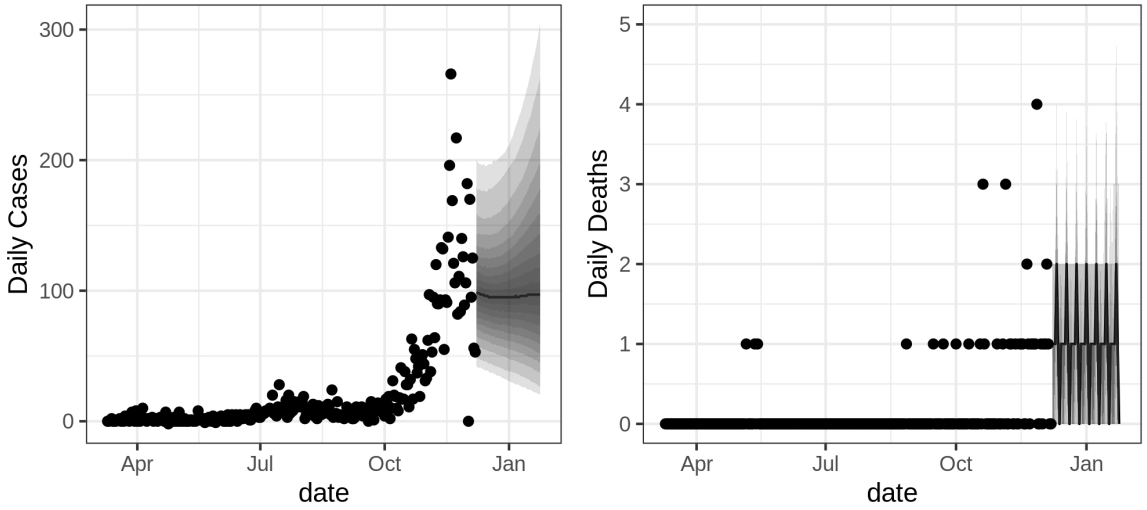



**So what?**

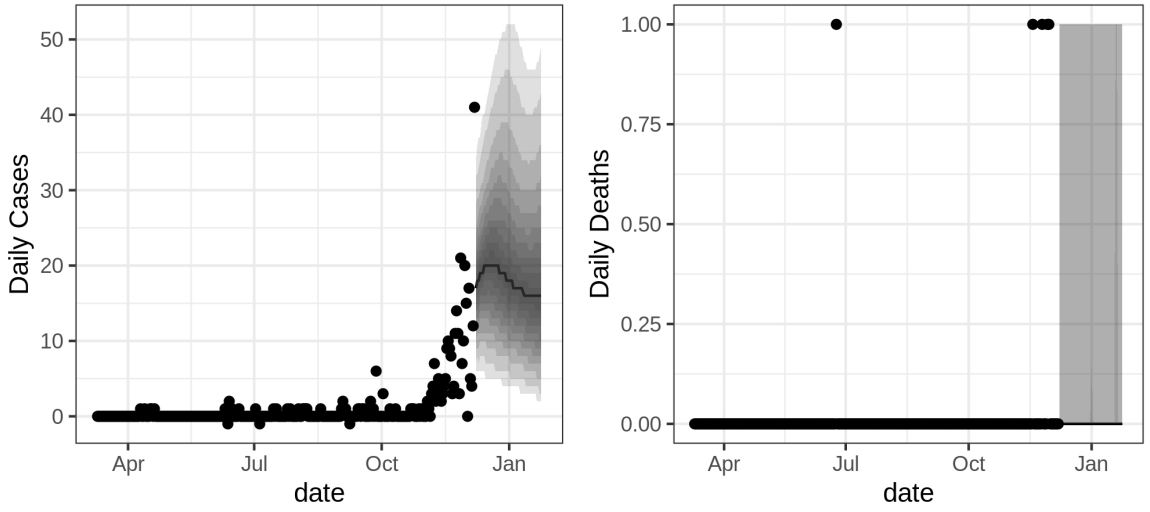
**The average number of cases for the Central Region is expected to be around 700 next week**

# Northeast Region Forecasts

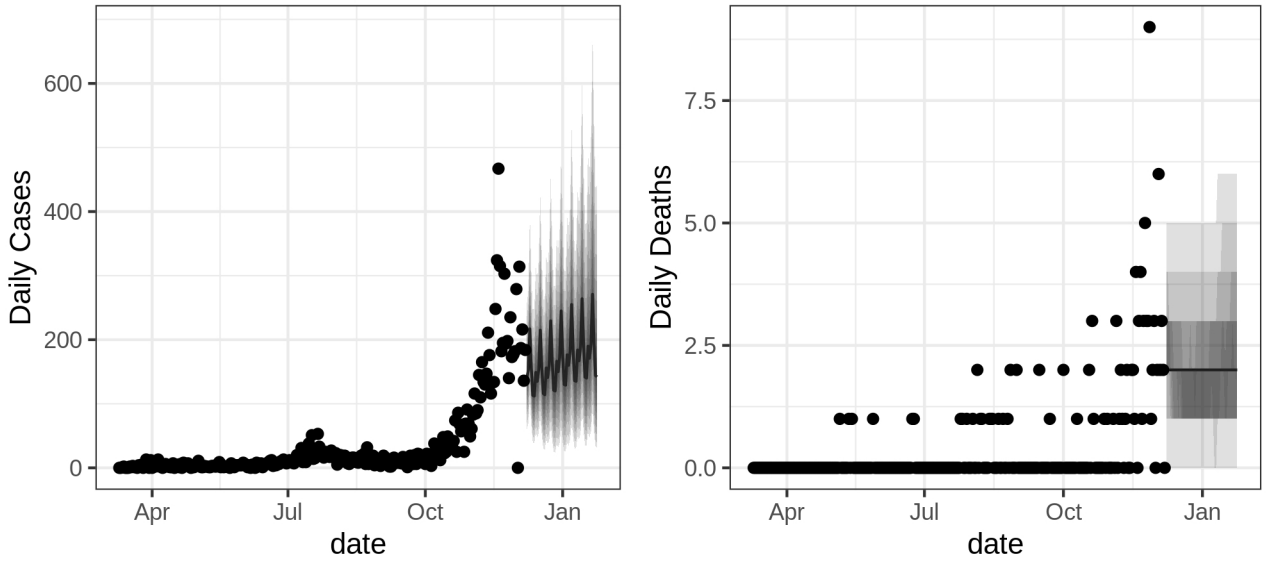
*New Mexico - Santa Fe*




*New Mexico - Colfax*




*Health Region - NM Northeast Region*

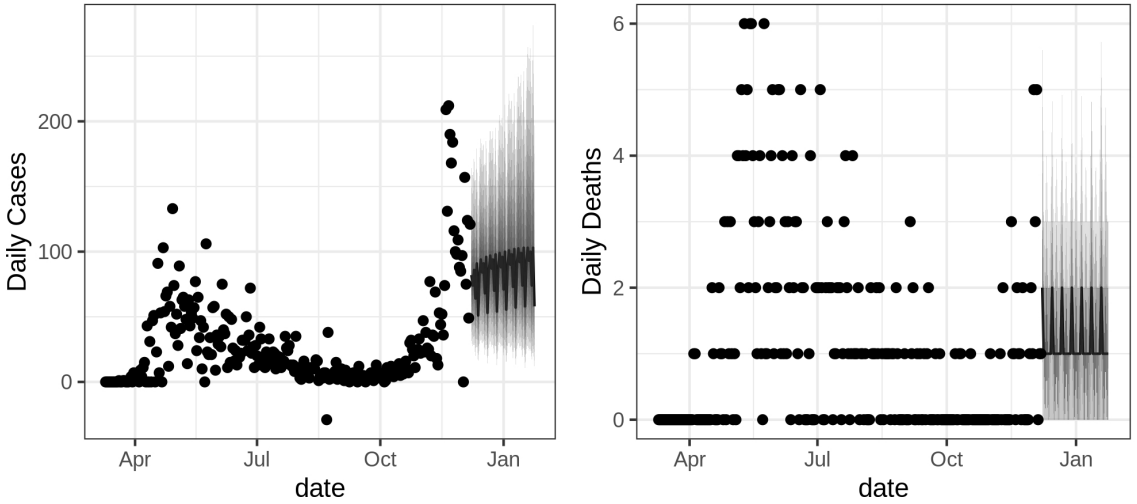



**So what?**

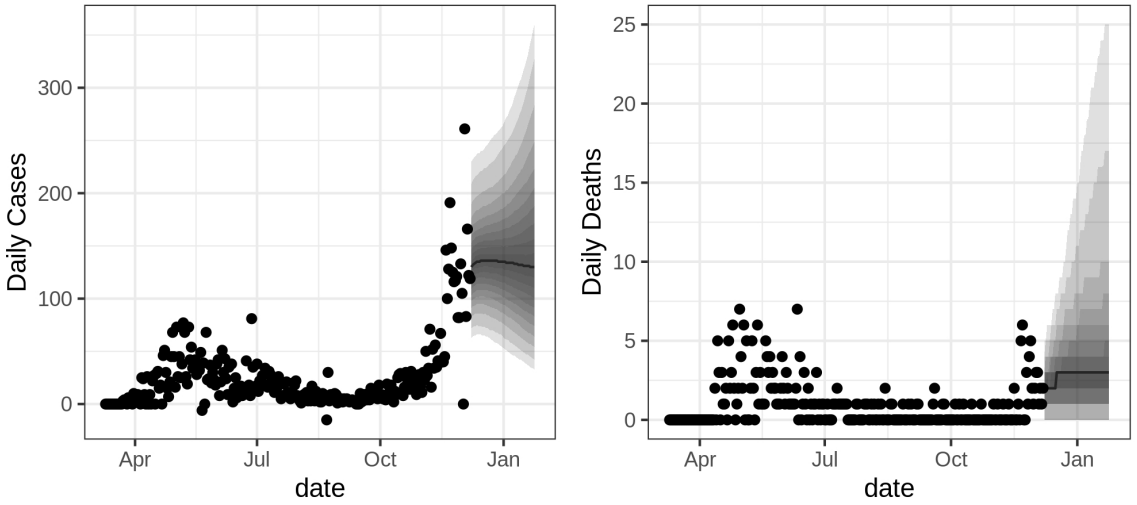
**The average number of cases for the Northeast Region is expected to be around 150 next week**

# Northwest Region Forecasts

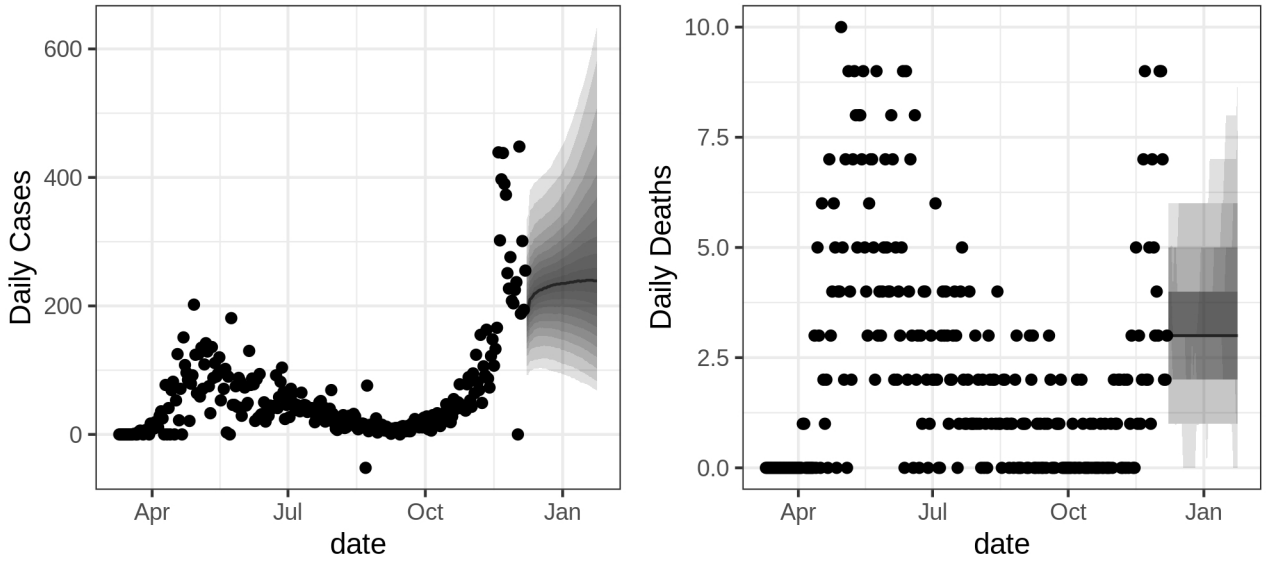
*New Mexico - McKinley*




*New Mexico - San Juan*




*Health Region - NM Northwest Region*

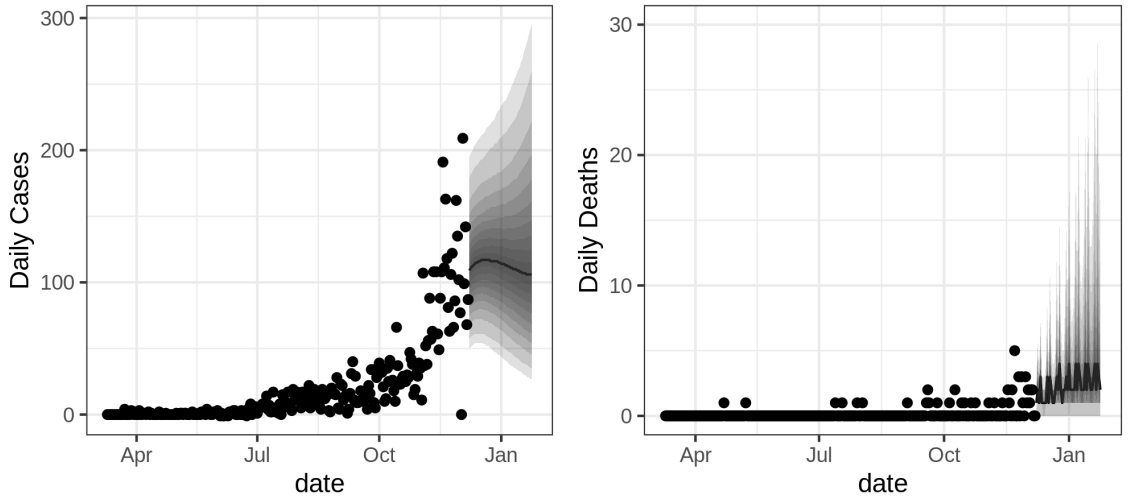



**So what?**

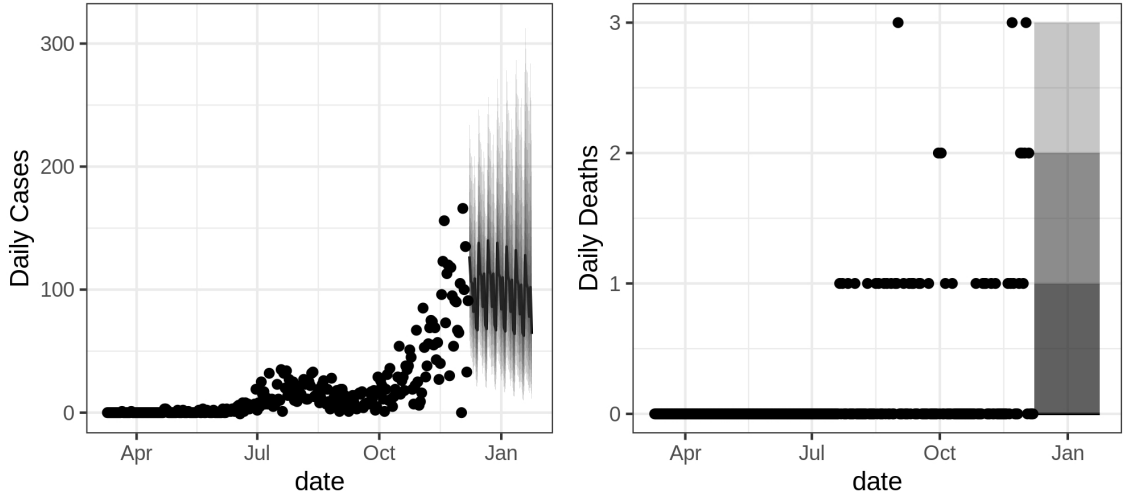
**The average number of cases for the Northwest Region is expected to be around 220 next week**

# Southeast Region Forecasts

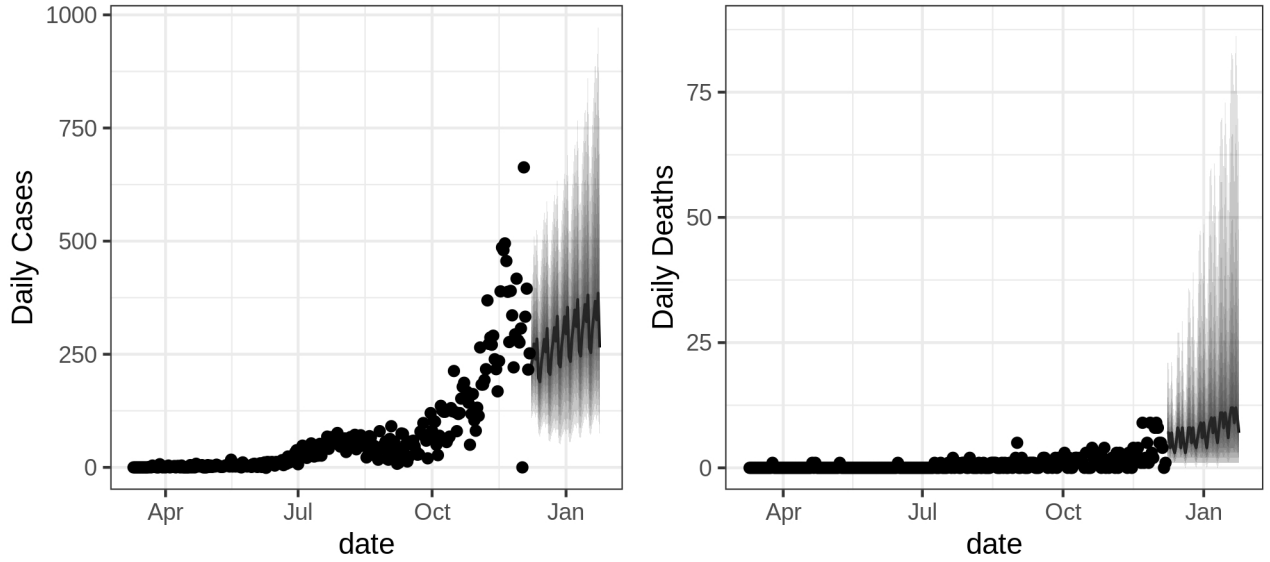
*New Mexico - Chaves*




*New Mexico - Lea*




*Health Region - NM Southeast Region*

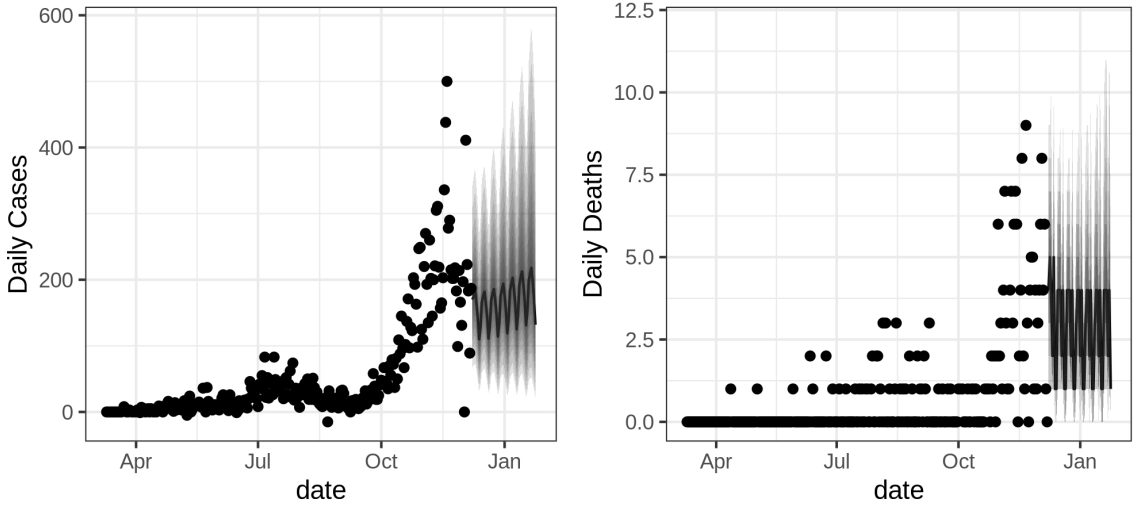



**So what?**

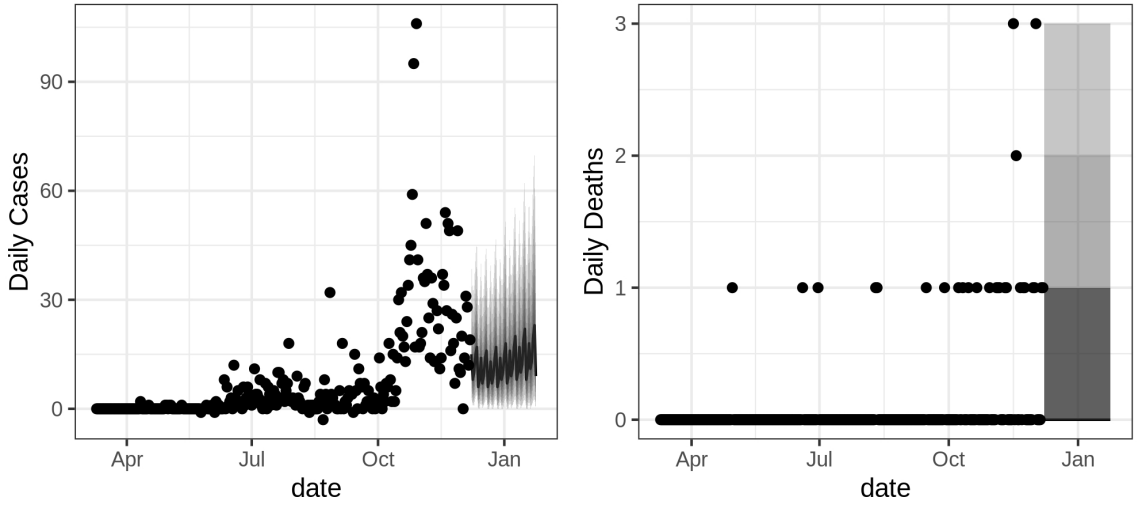
**The average number of cases for the Southeast Region is expected to be around 240 next week**

# Southwest Region Forecasts

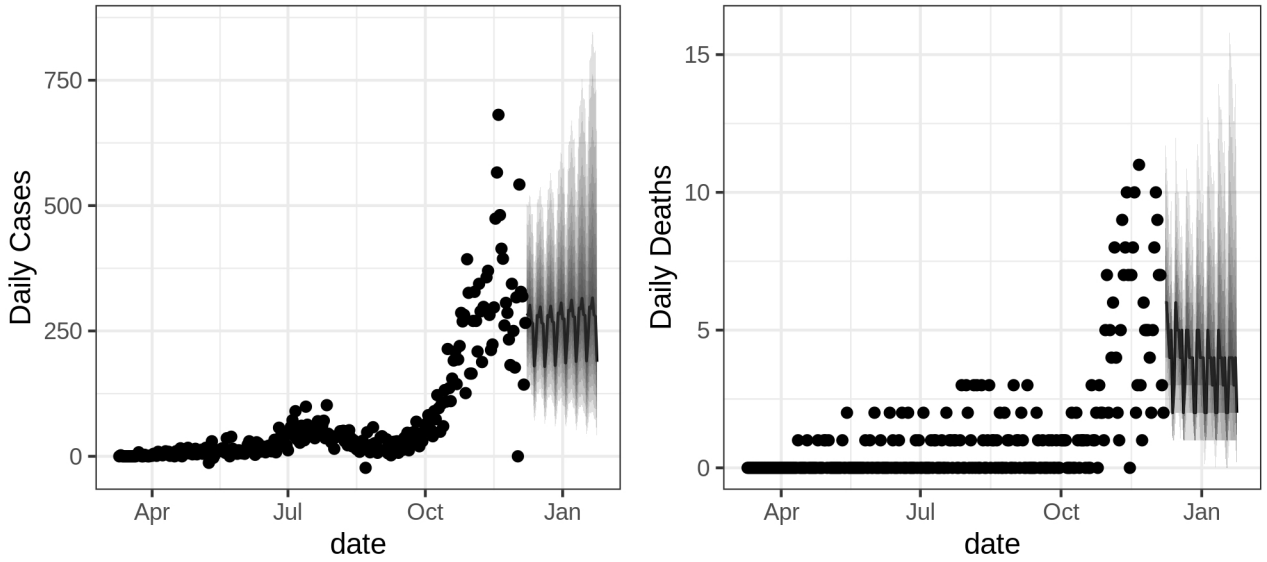
*New Mexico - Dona Ana*




*New Mexico - Luna*



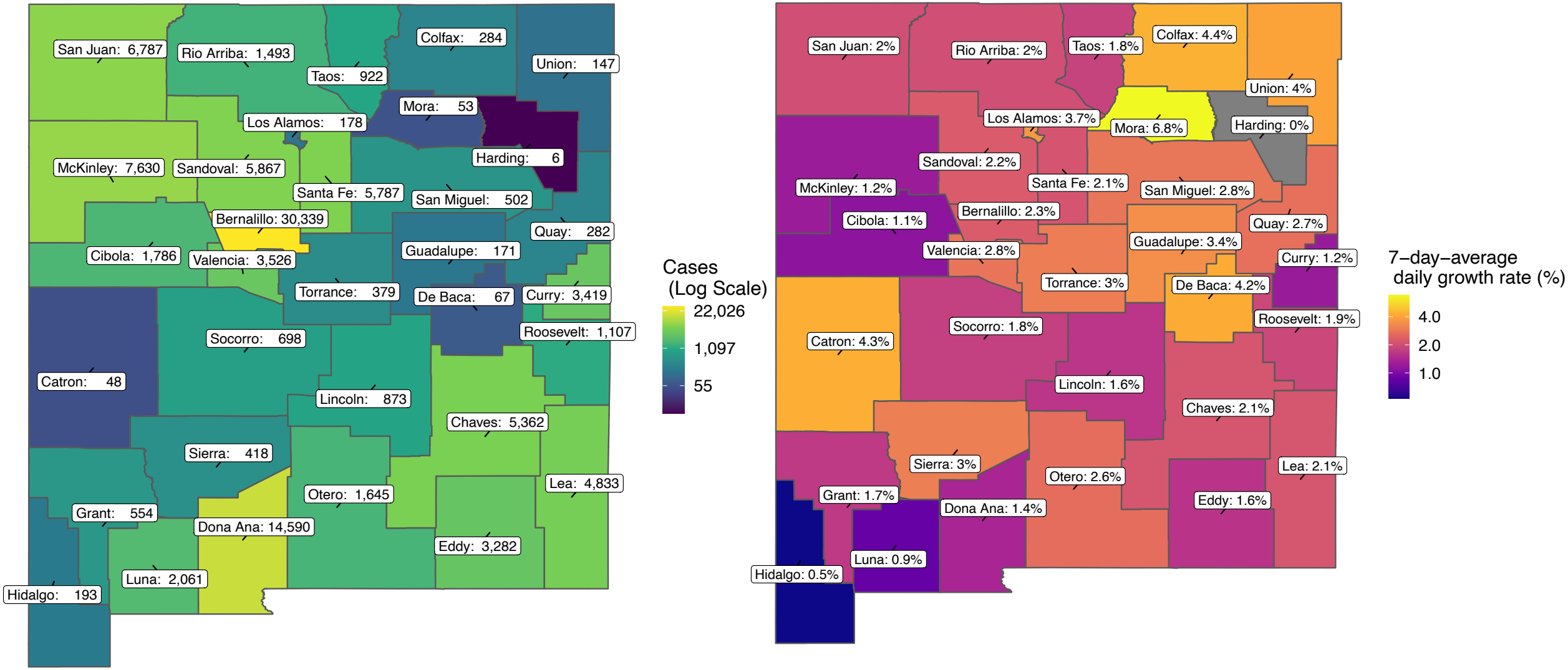

*Health Region - NM Southwest Region*



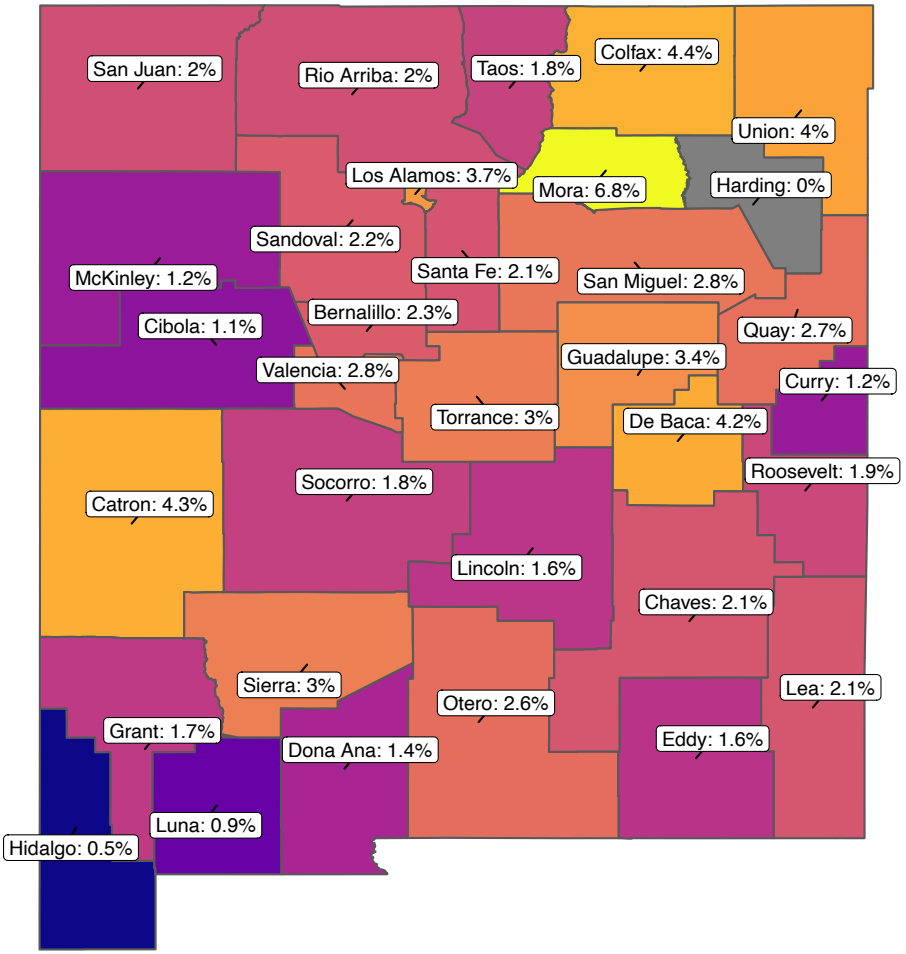

**So what?**

**The average number of cases for the Southwest Region is expected to be around 250 next week**

# Cumulative Cases & Daily Growth Rate for NM: Dec 7



# Daily Growth Rate for NM Dec 7




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

Socorro **1.8%** ↓
Roosevelt **1.5%** ↓
Hidalgo 0.5% ↓
DeBaca **4.2%** ↓
Colfax **4.4%** ↓
Quay **2.7%** =

Los Alamos **3.7%** ↑
Mora **6.8%** ↑
Catron **4.3%** ↑
Union **4.0%** ↓

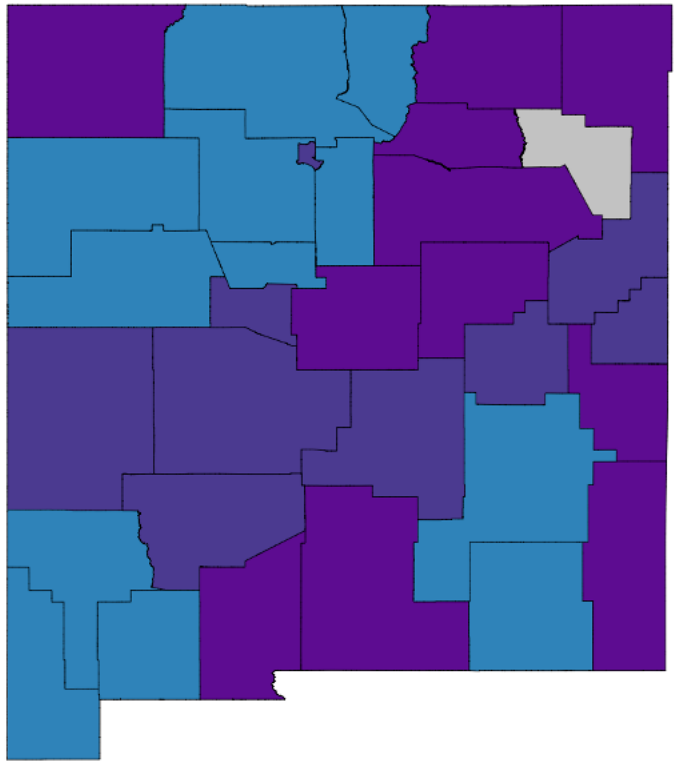
| County | Daily Growth Rate | Change |
|---|---|---|
| San Juan | **2.0%** | = |
| Rio Arriba | **2.0%** | ↓ |
| Sierra | **3.0%** | ↓ |
| McKinley | **1.2%** | ↓ |
| Sandoval | **2.2%** | ↓ |
| Santa Fe | **2.1%** | ↓ |
| Cibola | **1.1%** | ↓ |
| Bernalillo | **2.3%** | ↓ |
| Valencia | **2.8%** | ↓ |
| Torrance | **3.0%** | ↓ |
| Lincoln | **1.6%** | ↓ |
| San Miguel | **2.8%** | ↑ |
| Chaves | **2.1%** | = |
| Dona Ana | **1.4%** | = |
| Otero | **2.6%** | ↑ |
| Lea | **2.1%** | = |
| Eddy | **1.6%** | ↓ |
| Curry | **1.2%** | = |
| Grant | **1.7%** | = |
| Luna | 0.9% | ↓ |
| **Taos** | **1.8%** | ↓ |

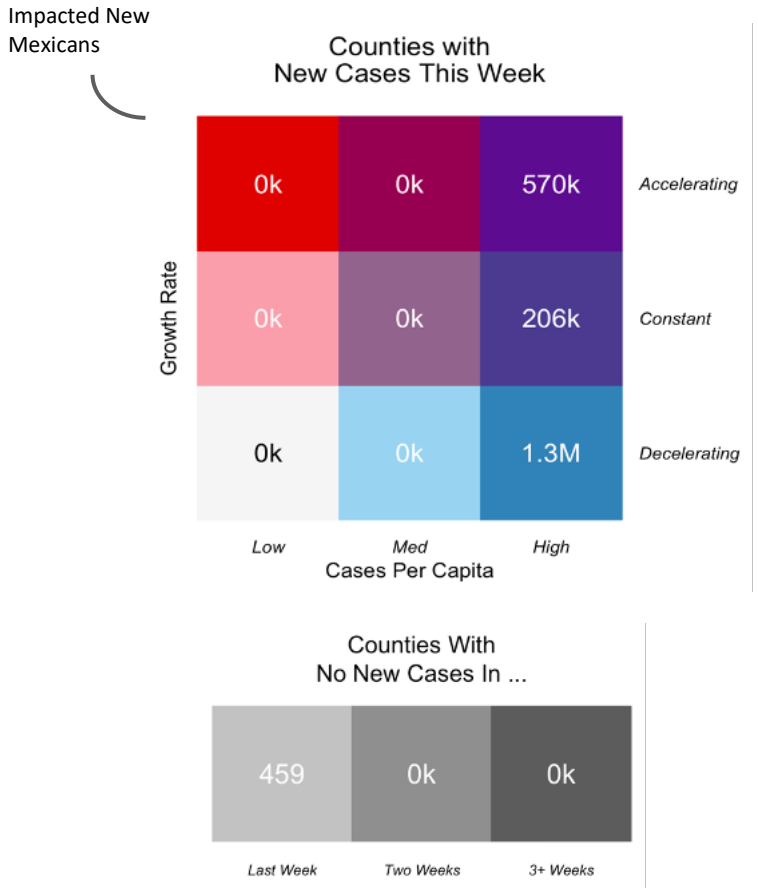
# Weekly Growth Rate for NM: Another View (Dec 7)

**COVID-19 across New Mexico**

*A 7-day moving window comparison*

*December 7, 2020*





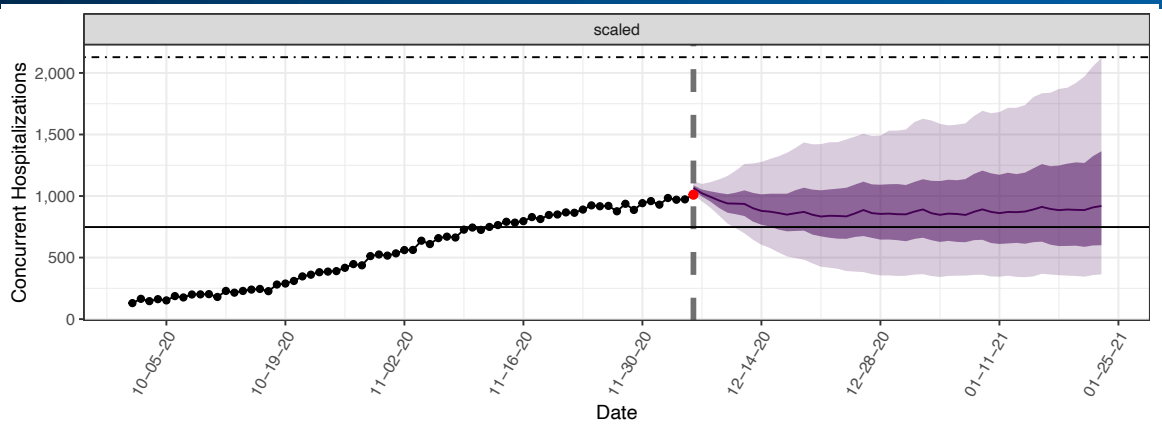

## So what?

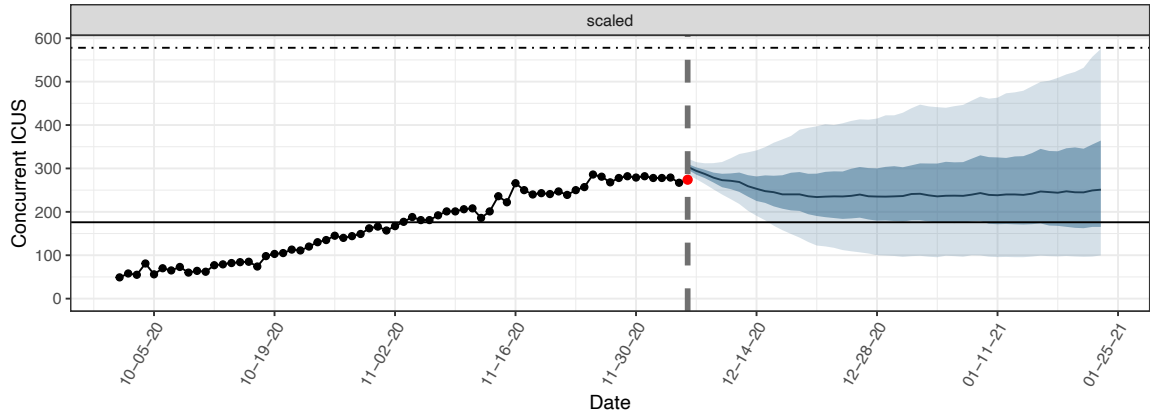
- New Mexico is a mix of mostly decelerating (1.3M people live in a decelerating county), constant growth rate (206k) and accelerating (570k)
- 12 counties are still accelerating

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

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

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




## Concurrent COVID-19 ICUs beds

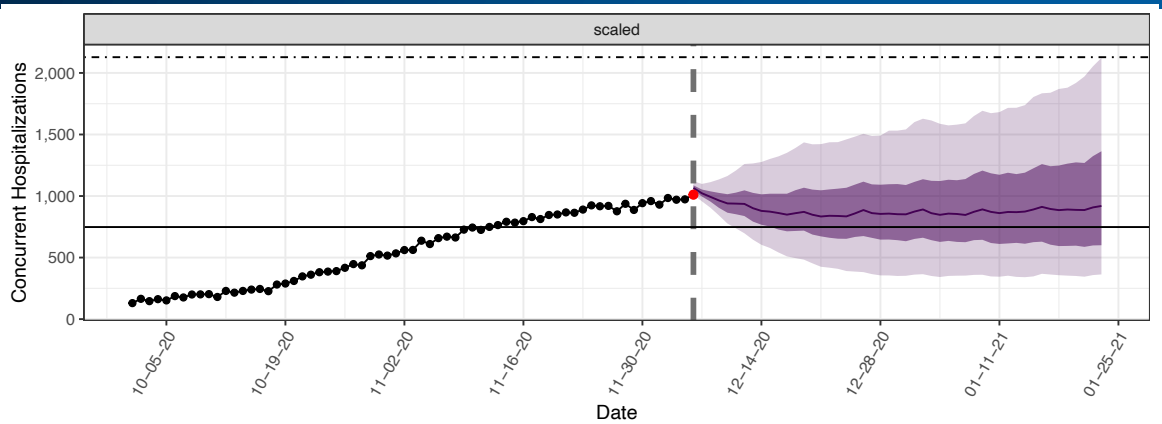
| Week | Qu. 5% (best case) | Qu. 50% (median) | Qu. 95% (worst case) |
|---|---|---|---|
| 12/13 | 203 | 259 | 337 |
| 12/20 | 131 | 236 | 394 |
| 12/27 | 104 | 236 | 412 |
| 1/3 | 97 | 238 | 443 |
| 1/10 | 97 | 239 | 461 |
| 1/17 | 98 | 245 | 502 |

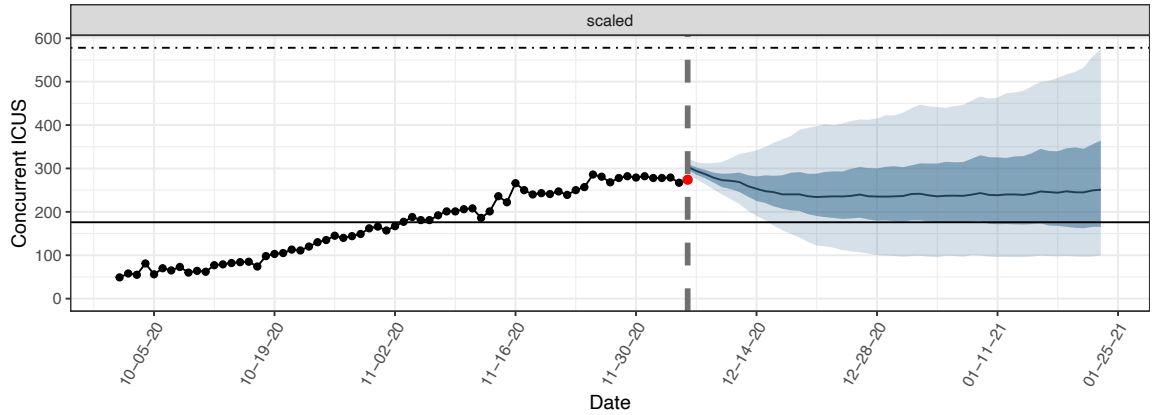
"Scaled" Scenario

## So what?

**We are <u>over baseline ICU bed capacity</u> for concurrent COVID-19 patients; our model is tracking between median and worse this week. Predict between 236—394 concurrent COVID-19 ICU beds needed by December 20**

# 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

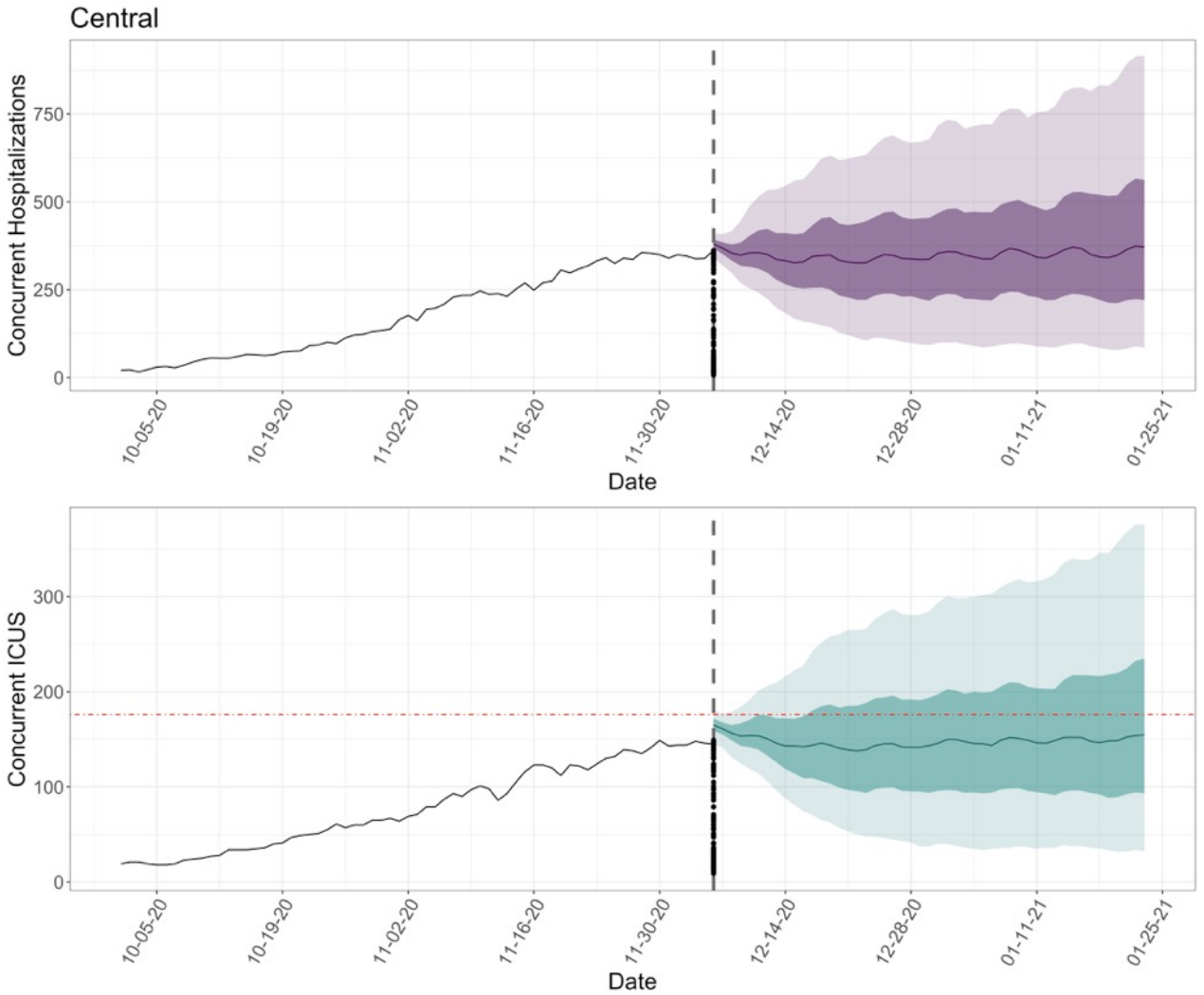
| Week | Qu. 5% (best case) | Qu. 50% (median) | Qu. 95% (worst case) |
|---|---|---|---|
| 12/13 | 443 | 642 | 928 |
| 12/20 | 323 | 612 | 1027 |
| 12/27 | 262 | 625 | 1075 |
| 1/3 | 254 | 623 | 1171 |
| 1/10 | 250 | 632 | 1212 |
| 1/17 | 264 | 649 | 1337 |

"Scaled" Scenario

**So what?**

**Ventilator needs are increasing and tracking between median and worst case scenario this week; med-surge beds, needing between 612—1027 beds by December 20**

# Regional Hospitalization Forecasts: Central



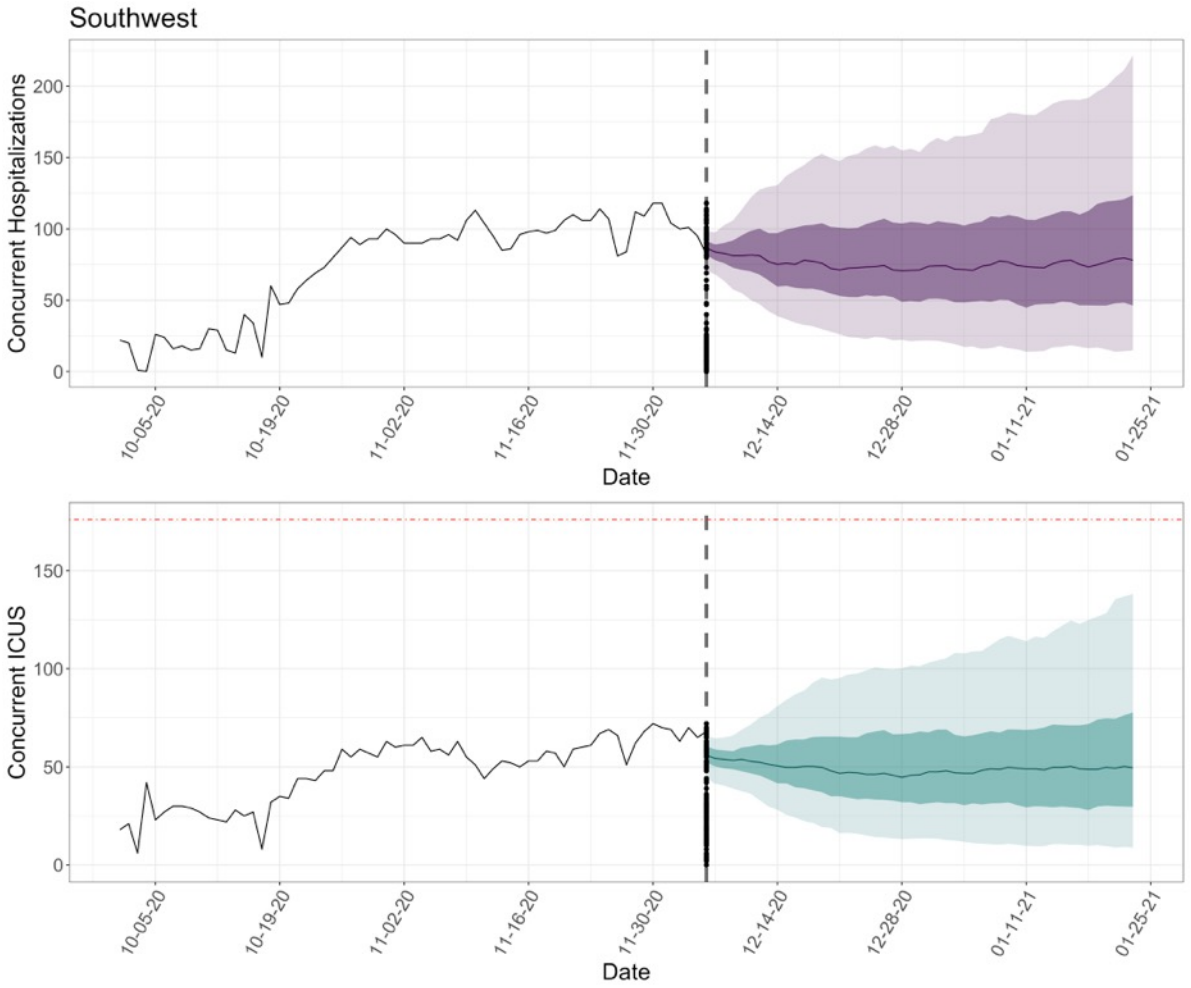

## Concurrent COVID-19 ICUs beds: Central

| Week | Qu. 5% (best case) | Qu. 50% (median) | Qu. 95% (worst case) |
|---|---|---|---|
| 12/13 | 96 | 146 | 210 |
| 12/20 | 57 | 141 | 260 |
| 12/27 | 43 | 142 | 282 |
| 1/3 | 36 | 148 | 299 |
| 1/10 | 36 | 149 | 315 |
| 1/17 | 36 | 148 | 339 |

**So what?**

**ICU bed usage is expected to remain steady in the Central region until December 27**

# Regional Hospitalization Forecasts: Southwest



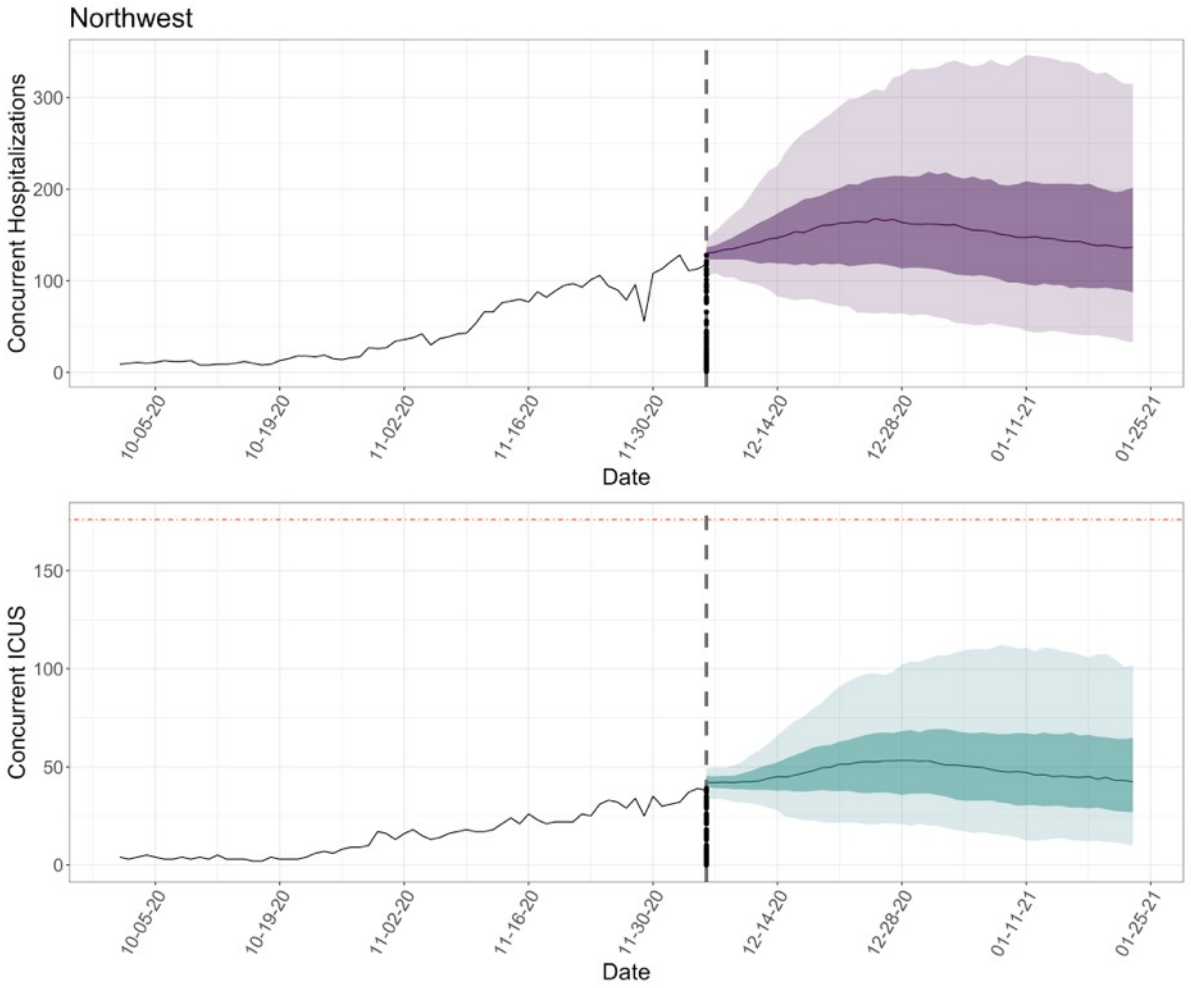

## Concurrent COVID-19 ICUs beds: Southwest

| Week | Qu. 5% (best case) | Qu. 50% (median) | Qu. 95% (worst case) |
|---|---|---|---|
| 12/13 | 30 | 51 | 77 |
| 12/20 | 19 | 48 | 95 |
| 12/27 | 14 | 46 | 100 |
| 1/3 | 12 | 47 | 108 |
| 1/10 | 10 | 49 | 115 |
| 1/17 | 10 | 49 | 123 |

**So what?**

**ICU bed usage is expected to <u>decrease</u> slowly in the Southwest region. Estimates are noisy**

# Regional Hospitalization Forecasts: Northwest



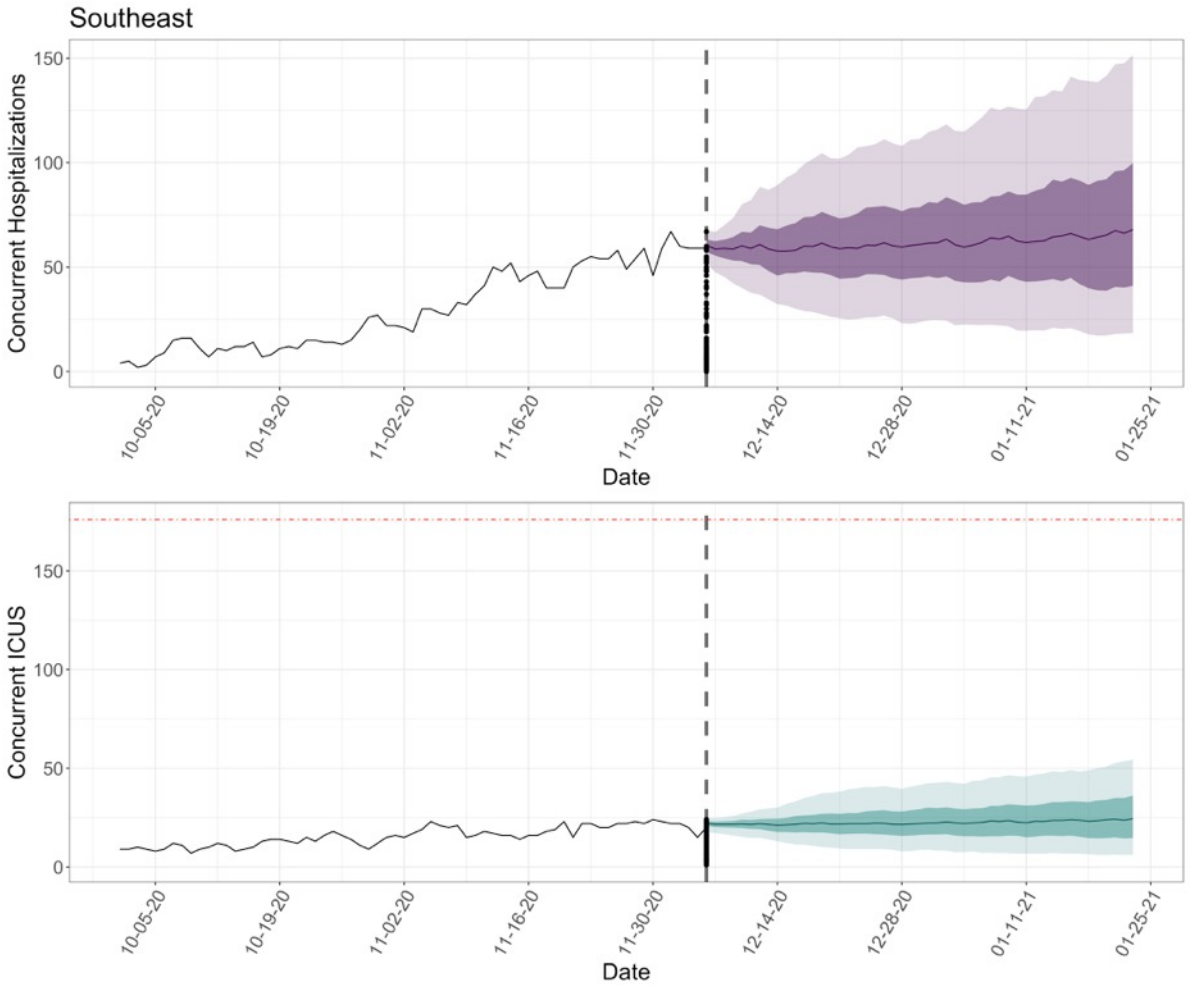

## Concurrent COVID-19 ICUs beds: Northwest

| Week | Qu. 5% (best case) | Qu. 50% (median) | Qu. 95% (worst case) |
|---|---|---|---|
| 12/13 | 29 | 44 | 62 |
| 12/20 | 22 | 50 | 87 |
| 12/27 | 21 | 53 | 98 |
| 1/3 | 18 | 51 | 108 |
| 1/10 | 14 | 48 | 110 |
| 1/17 | 12 | 45 | 107 |

**So what?**

**ICU bed usage is expected to <u>increase</u> in the Northwest region until December 27**

# Regional Hospitalization Forecasts: Southeast



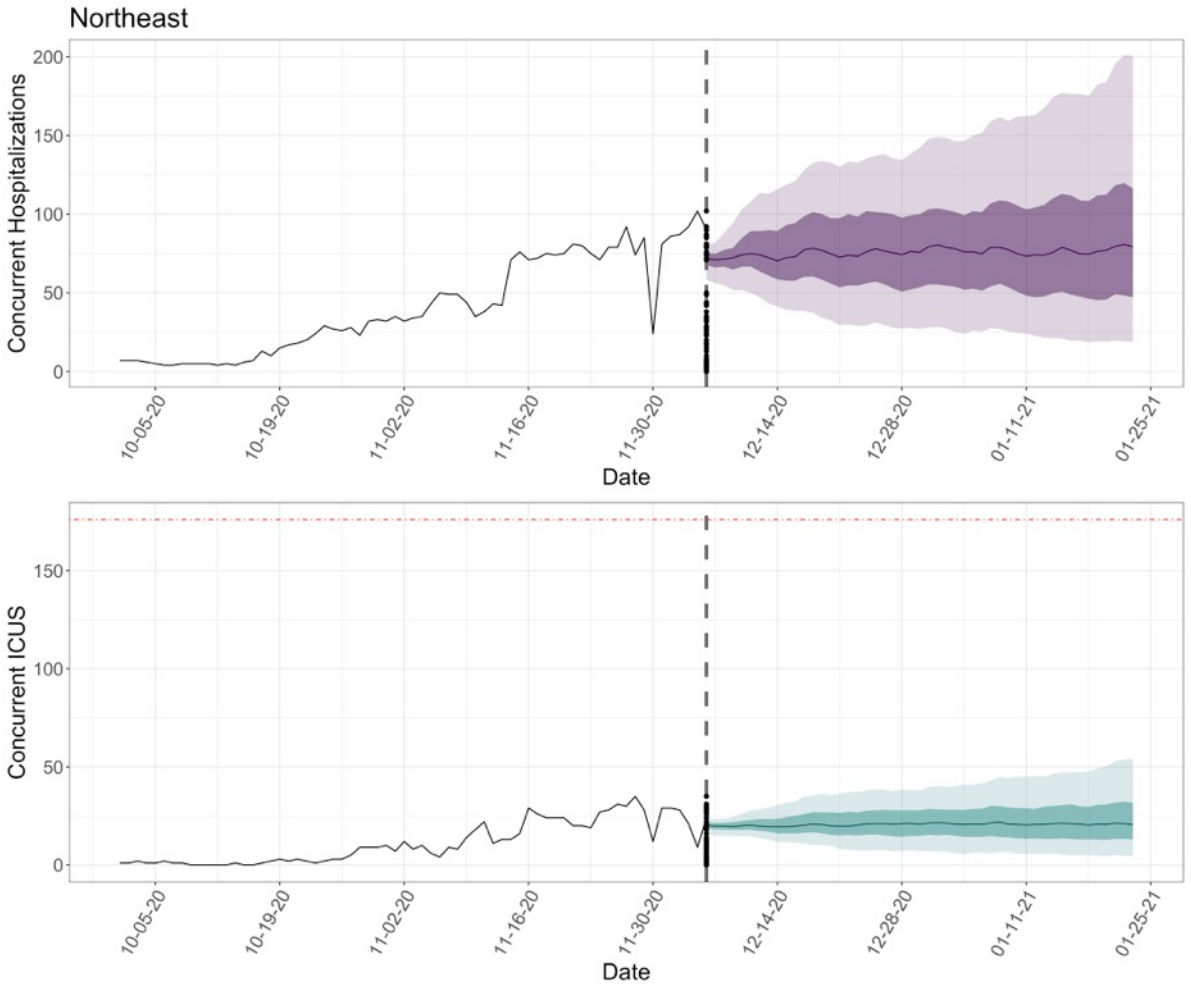

## Concurrent COVID-19 ICUs beds: Southeast

| Week | Qu. 5% (best case) | Qu. 50% (median) | Qu. 95% (worst case) |
|---|---|---|---|
| 12/13 | 14 | 22 | 30 |
| 12/20 | 10 | 22 | 37 |
| 12/27 | 9 | 22 | 40 |
| 1/3 | 7 | 22 | 43 |
| 1/10 | 7 | 23 | 46 |
| 1/17 | 7 | 24 | 48 |

**So what?**

**ICU bed usage is expected to slowly <u>hold steady</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) |
|---|---|---|---|
| 12/13 | 13 | 20 | 29 |
| 12/20 | 10 | 20 | 36 |
| 12/27 | 7 | 21 | 38 |
| 1/3 | 6 | 21 | 40 |
| 1/10 | 6 | 21 | 45 |
| 1/17 | 5 | 21 | 47 |

**So what?**

**ICU bed usage is expected to hold steady in the Northeast region**

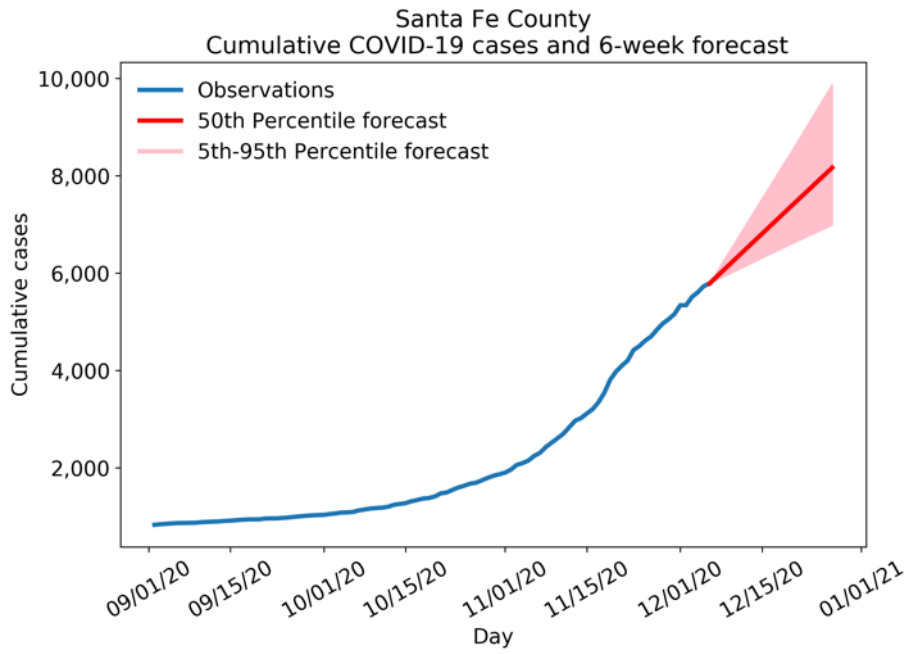
# > Non-Congregational Shelter Forecast

# Non-Congregate Shelter Forecast

- **Our goal is to inform the capacity of Santa Fe and Albuquerque shelters for forecasting the potential that Santa Fe becomes full and guests need to reroute to Albuquerque**
  - We also examine McKinley and San Juan Counties, which historically have had high shelter use
- **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**

# Non-Congregate Shelter Forecast: Santa Fe

Number of cases as of 12/6/20: **5,787**
Number of shelter rooms available: **52**
Total number of patients/medical workers (including specialty): **27**
Number of patients: **26**
Number of medical workers: **1**
2-week avg. new cases per day: **113**

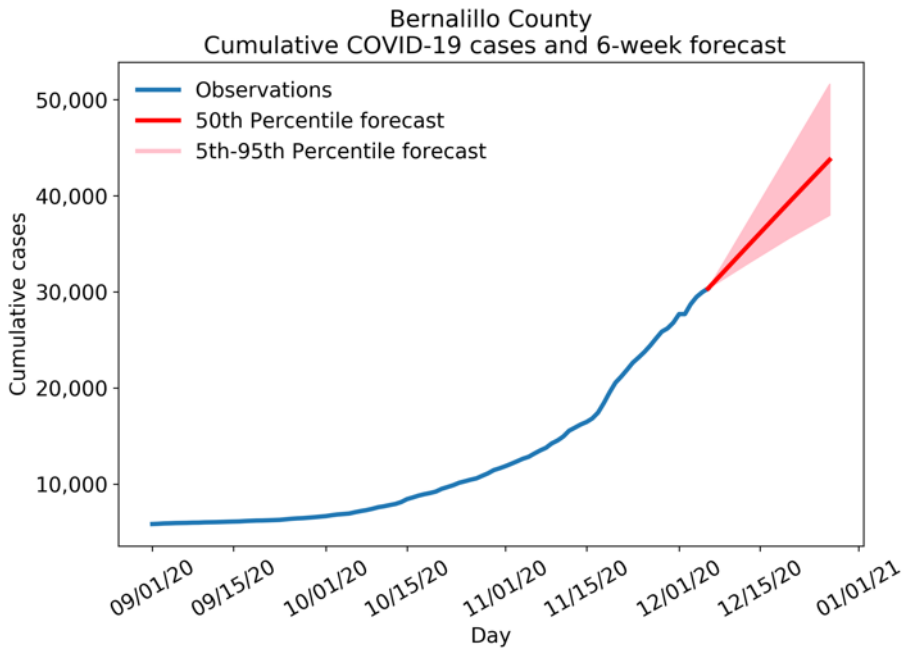



| | 12/13/20 | 12/20/20 | 12/27/20 |
|---|---|---|---|
| Total cases | 6,584 (6,199-7,146) | 7,377 (6,602-8,497) | 8,167 (6,992-9,882) |
| # of rooms needed | 27 (14-46) | 27 (14-46) | 27 (13-47) |
| Deficit (-) or surplus of rooms | 25 | 25 | 25 |

The number of new cases/per day and shelter usage both decreased since last week.

# Non-Congregate Shelter Forecast: Bernalillo

Number of cases as of 12/6/20: **30,339**
Number of shelter rooms available: **191**
Total number of patients/medical workers (including specialty): **61**
Number of patients: **58**
Number of medical workers: **3**
2-week avg. new cases per day: **604**



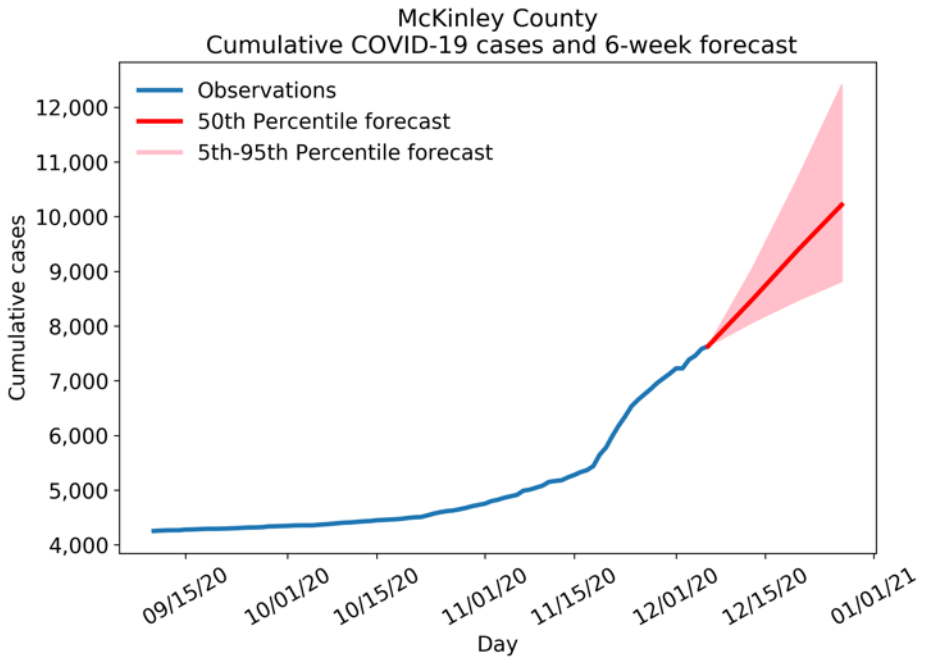

| | 12/13/20 | 12/20/20 | 12/27/20 |
|---|---|---|---|
| Total cases | 34,847 (33,006-37,418) | 39,331 (35,600-44,496) | 43,728 (37,991-51,604) |
| # of rooms needed | 65 (38-102) | 64 (37-102) | 64 (35-103) |
| Deficit (-) or surplus of rooms | 126 | 127 | 127 |

1-week average of new cases per day decreased from 712 cases/day last week to 604 cases/day this week.

There was a small (+4) increase in the number of shelters used.

# Non-Congregate Shelter Forecast: McKinley

Number of cases as of 12/6/20: **7,630**
Number of shelter rooms available: **160**
Total number of patients/medical workers (including specialty): **40**
Number of patients: **38**
Number of medical workers: **2**
2-week avg. new cases per day: **104**

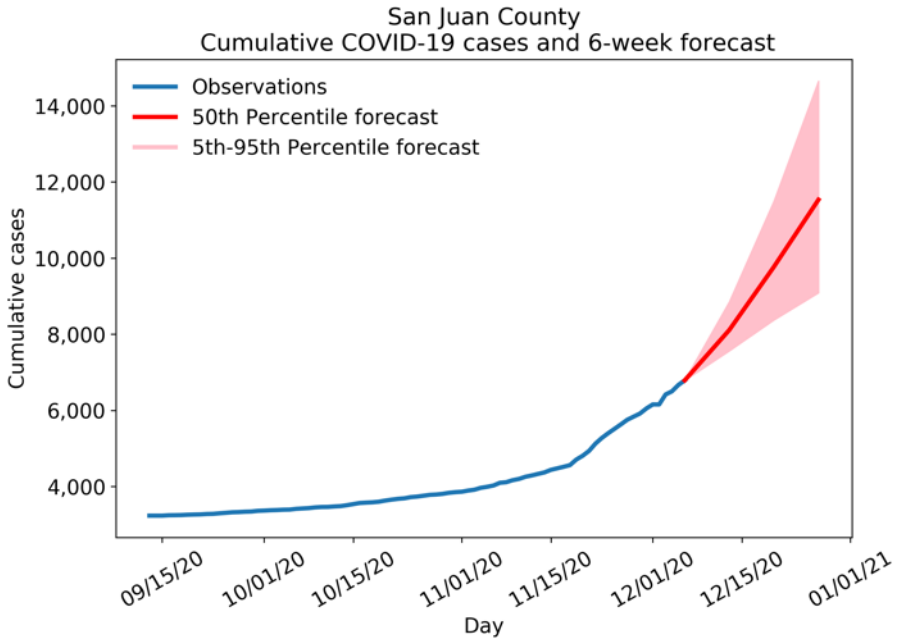



| | 12/13/20 | 12/20/20 | 12/27/20 |
|---|---|---|---|
| Total cases | 8,487 (8,072-9,067) | 9,373 (8,466-10,688) | 10,216 (8,818-12,416) |
| # of rooms needed | 47 (24-79) | 49 (22-89) | 47 (19-95) |
| Deficit (-) or surplus of rooms | 113 | 111 | 113 |

The new cases/day decreased from last week, but shelter usage slightly increased.

# Non-Congregate Shelter Forecast: San Juan

Number of cases as of 12/6/20: **6,787**
Number of shelter rooms available: **25**
Total number of patients/medical workers (including specialty): **9**
Number of patients: **9**
Number of medical workers: **0**
2-week avg. new cases per day: **119**




| | 12/13/20 | 12/20/20 | 12/27/20 |
|---|---|---|---|
| Total cases | 8,110 (7,564-8,850) | 9,770 (8,375-11,493) | 11,535 (9,090-14,651) |
| # of rooms needed | 14 (8-22) | 18 (9-29) | 19 (8-34) |
| Deficit (-) or surplus of rooms (SJ) | 11 | 7 | 6 |

New cases/day slightly increased while shelter usage decreased (-5).