# Modeling & Forecasting COVID-19 in NM

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November 24, 2020

NNSA
National Nuclear Security Administration

# This week's model

- **The stay-at-home order in El Paso *was* having an effect; future unknown.**
  - A Nov. 13th court ruling ended the stay-at-home order. Some reduced transmission is still postulated for El Paso. This is a significant source of uncertainty relevant to Dona Ana county.
- **Modest transmission increases in some counties model "non-mobility" (i.e. other behavioral) transmission increases in those counties.**
  - Counties with transmission increases in Sept. or later are: Bernalillo, Dona Ana (5%), Luna, Santa Fe, Sierra, Socorro, Valencia.
  - Rio Arriba and Taos also have transmission increases, possibly due to the modeling of Colorado not reflecting recent changes.
- **Modeling of public reaction and public health orders (PHO).**
  - Aug. 29th PHO; 30% transmission increase (Chaves, Eddy, Lincoln, Quay are less); ends Nov. 16th. (significant increase over previous est.)
  - Oct 16th PHO; ~3 % transmission reduction; ends Nov. 16th
  - Oct. 23rd PHO; 5 – 10% transmission reduction; ends Nov. 16th
  - When incidence goes up, people's protective behavior improves: 10/100,000/day -> 5% transmission drop; 50/100,000/day -> 10% decrease
  - Nov. 16th PHO; Response to the stay-at-home order is based on reaction to March PHO. Mobility decrease is assumed to be 90% of decrease in March/April.
- **Isolation and quarantine rates are assumed to be improving.**
  - Swab to results times: Estimates vary from 1-3 days to ~60 hours (http://www.tricore.org/covid_19_data_center)
  - Time to quarantine contacts down to 47 hrs (Nov. 6th)
  - Base isolation rate *was* recently 0.35, now for NM week starting Nov. 15th it is 0.5.

# Mobility – northern counties (Data only)

McKinley and San Juan very slight decrease

Bernalillo, Sandoval, Rio Arriba, Santa Fe still dropping.

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



McKinley
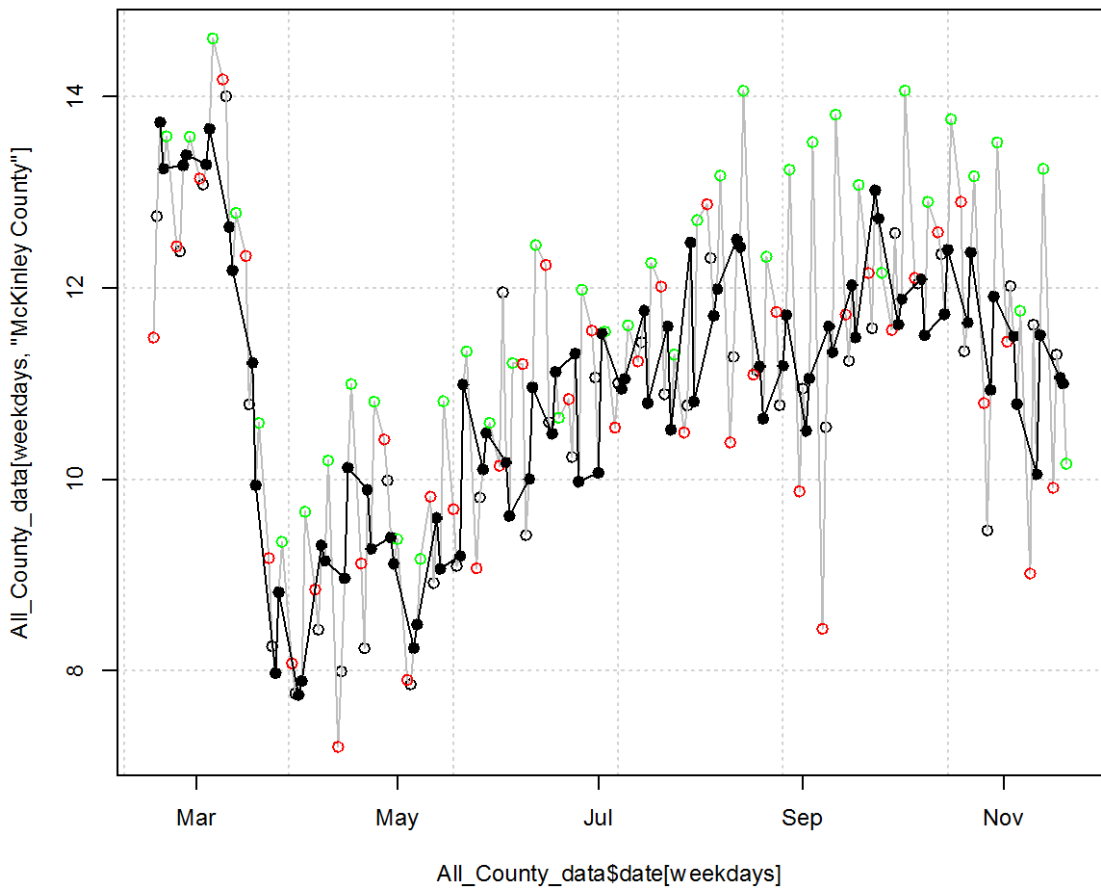


Bernalillo
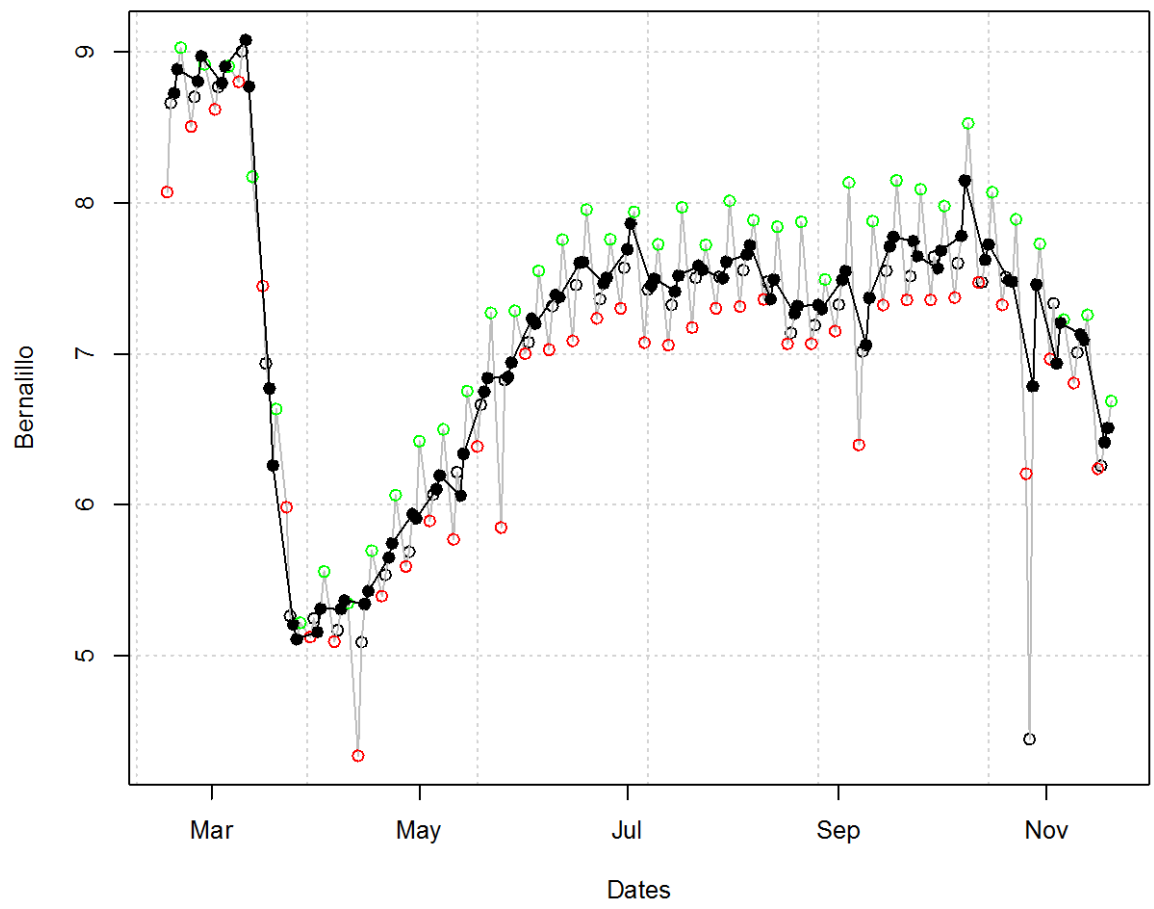
# Mobility – southern counties (Data only)

Dona Ana not decreasing; Lincoln little or no decrease.

Lea, Chaves, Eddy have decreased slightly; approaching April minimum.

Curry, Luna and Roosevelt are decreasing.

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



Dona Ana



Lea
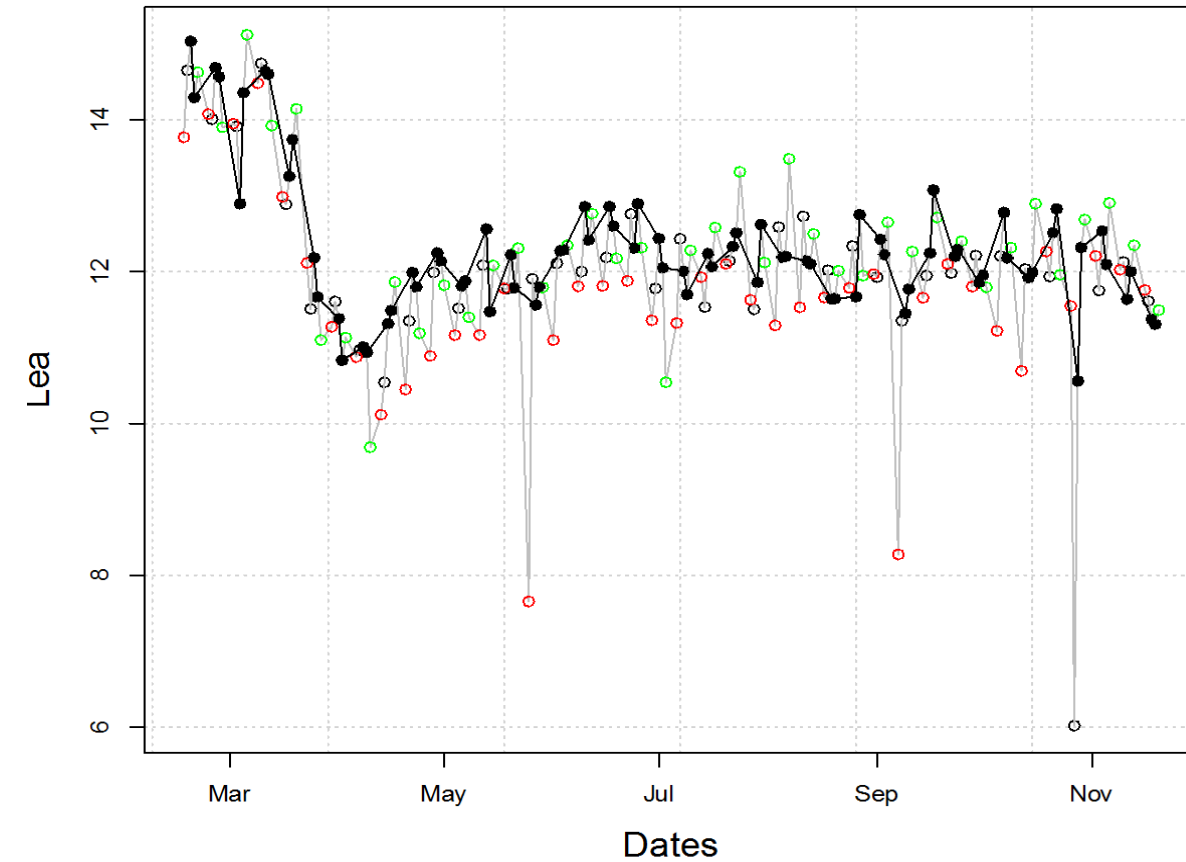
# ICU concurrent usage by COVID-19 patients: Model Revision in Progress: Reporting Delay

- Red (upper): Accounting for delayed reporting of cases, using ICU rates from July and August (with November PHO).
- Yellow (straight): Model from two weeks ago, delayed reporting not corrected (no November PHO).
- Blue (middle): Model from one week ago, delayed reporting not corrected (with November PHO).
- Green (bottom): Accounting for delayed reporting of cases, modification to account for updated ICU rates and practices (w PHO).



Left panel: Linear vs. time shows easy comparison with ICU capacity.

Right panel: Semi-logarithm plot reveals the growth rate or decline rate as a slope, rather than the pure ICU load.
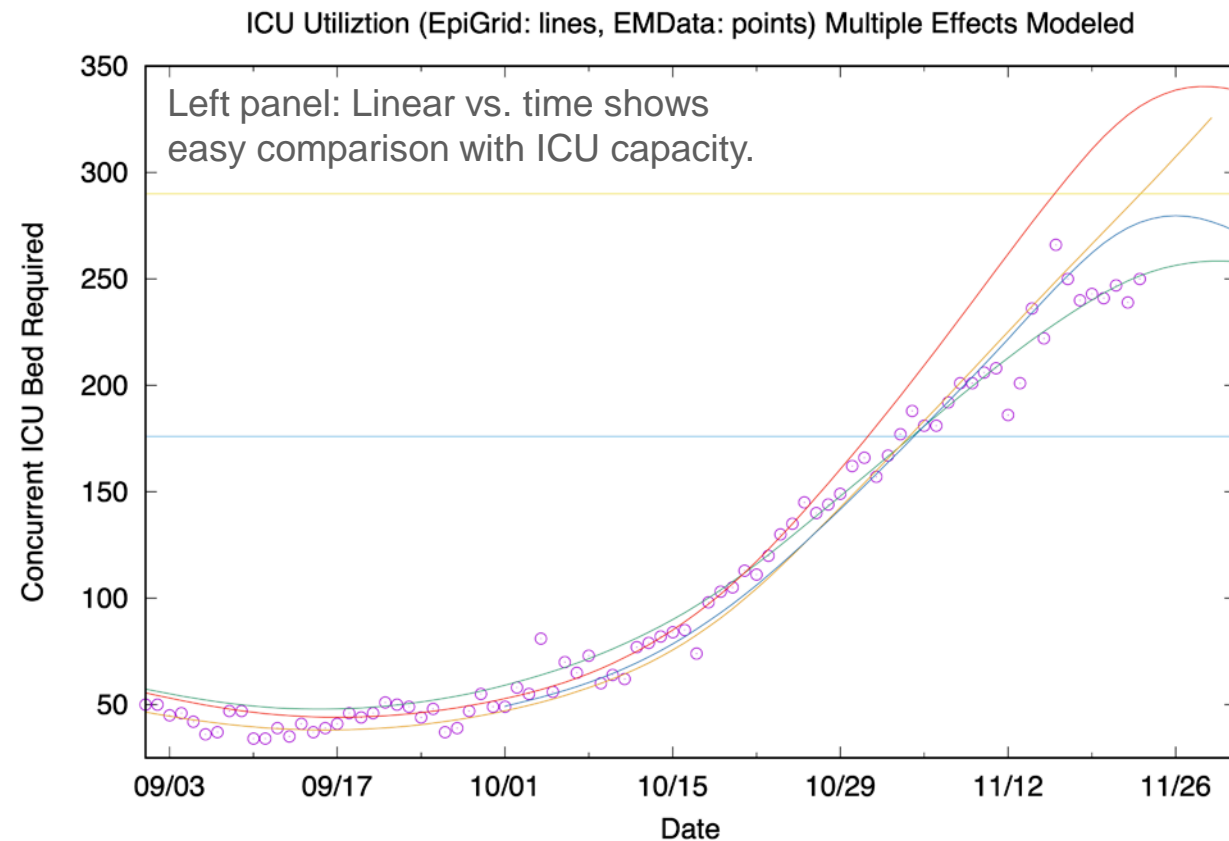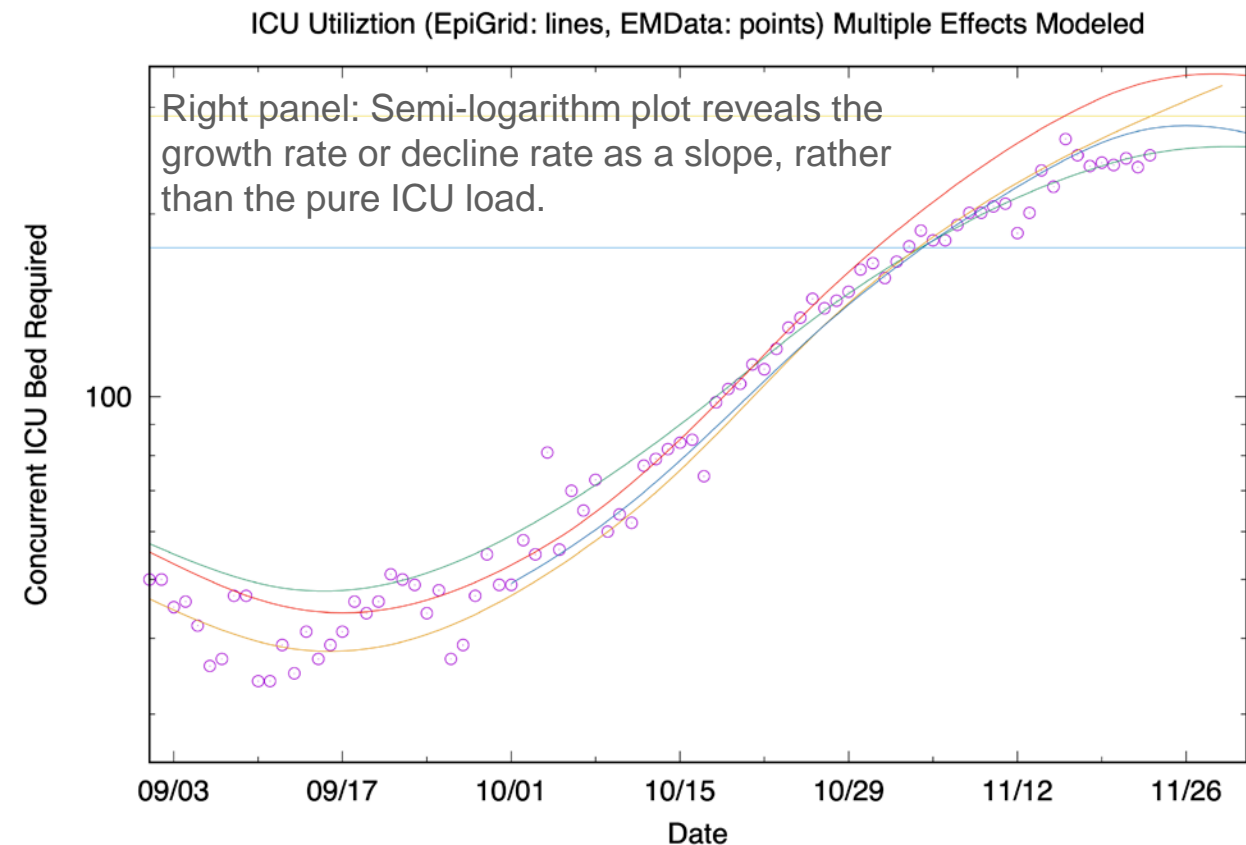
# Conclusions and Discussion

- The New Mexico epidemic continues to be geographically dispersed.
- Nationwide geographical dispersion requires that state-to-state travel plays an important role. Hotel occupancy changes may limit the effect of this source of new cases.
- *Bernalillo still appears to play a substantial role driving ICU need/requirements.*
- A significant number of non-urban and frontier counties now support local epidemics.
- Test positivity remains well above 7%.
- The effect of the abolition of El Paso's shelter-in-place order creates uncertainty for Southern New Mexico, not fully constrained yet. Mobility in Dona Ana has ceased to decline.
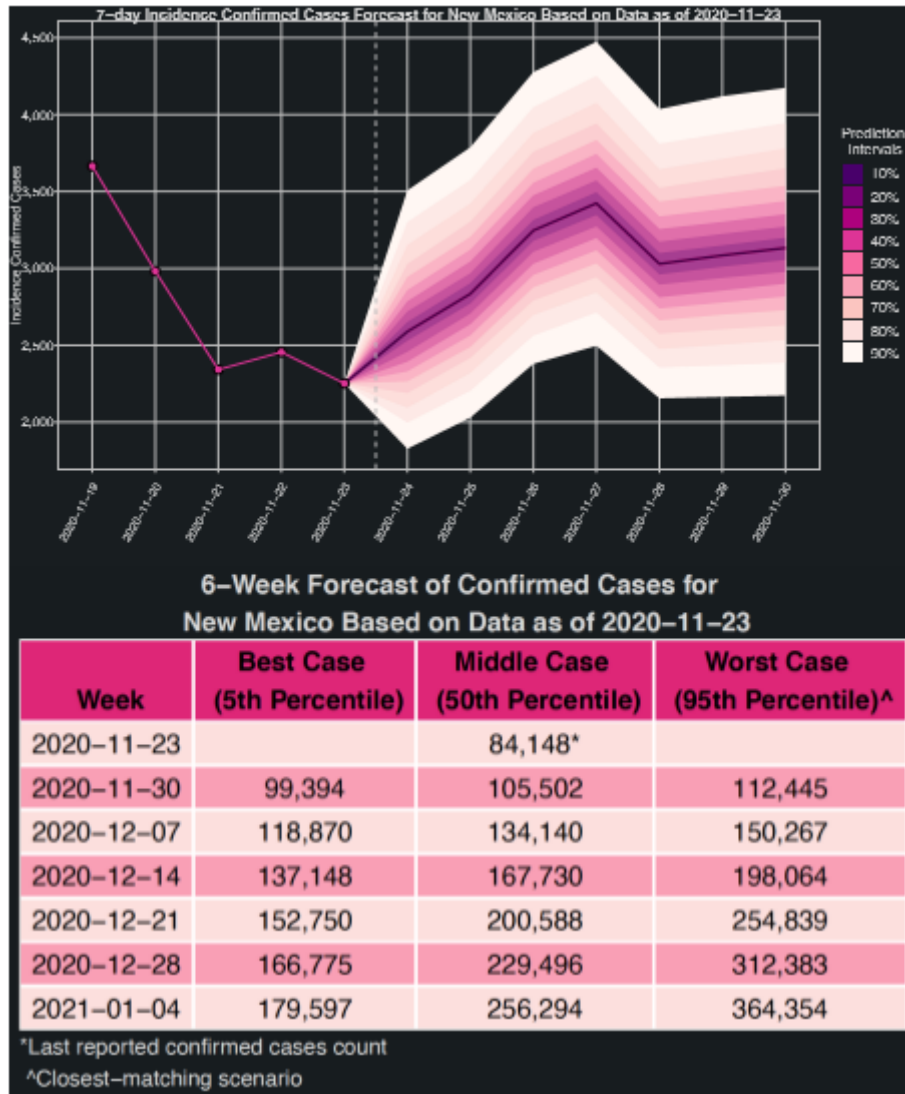- <span style="color:red">Revisions to the EpiGrid model of New Mexico to more completely capture delayed reporting likely mean that current levels of ICU utilization reflect significant changes in hospital practice or notably improved treatment.</span>
- Public health orders in October and November in conjunction with changed hospital practice may give a plateau in ICU utilization in the first week of December.
- 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?
  - 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?
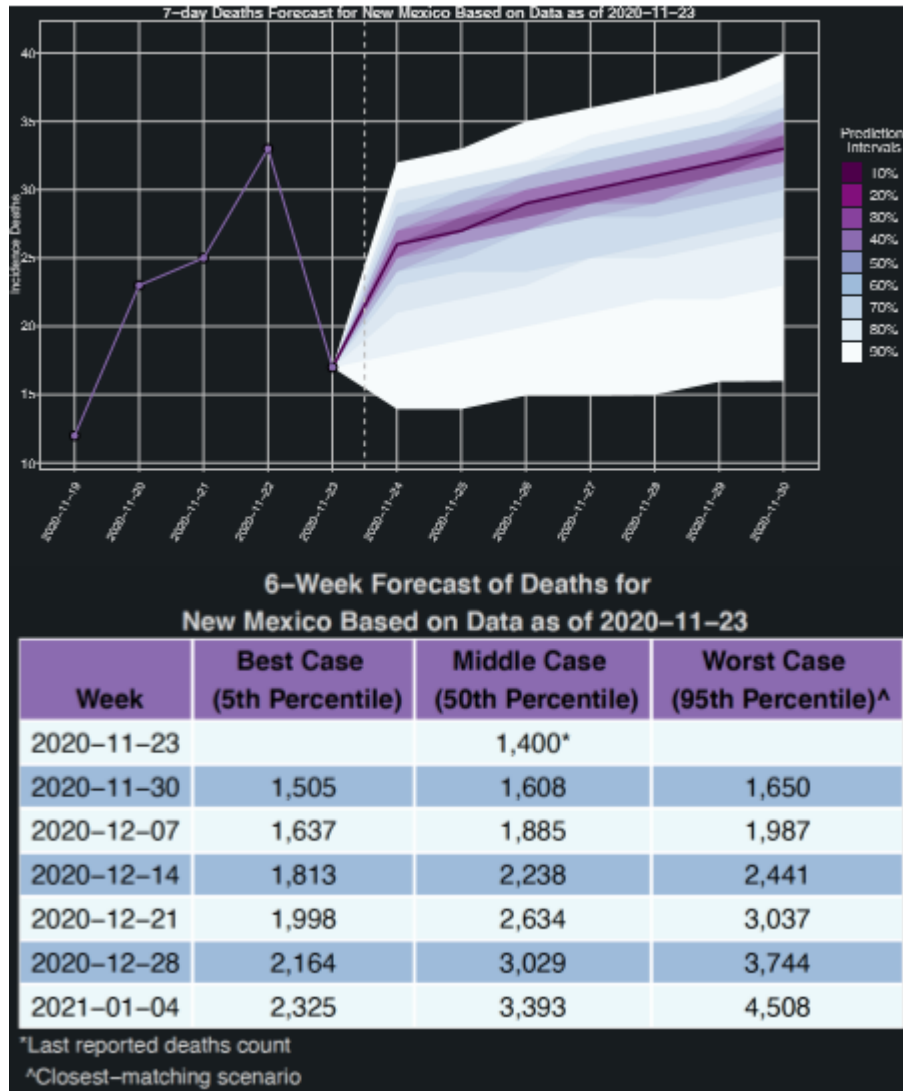
# Short- & Long-Term Forecast for NM: Cases



7-day Incidence Confirmed Cases Forecast for New Mexico Based on Data as of 2020-11-23

**6-Week Forecast of Confirmed Cases for New Mexico Based on Data as of 2020-11-23**

| Week | Best Case (5th Percentile) | Middle Case (50th Percentile) | Worst Case (95th Percentile)^ |
|---|---|---|---|
| 2020-11-23 | | 84,148* | |
| 2020-11-30 | 99,394 | 105,502 | 112,445 |
| 2020-12-07 | 118,870 | 134,140 | 150,267 |
| 2020-12-14 | 137,148 | 167,730 | 198,064 |
| 2020-12-21 | 152,750 | 200,588 | 254,839 |
| 2020-12-28 | 166,775 | 229,496 | 312,383 |
| 2021-01-04 | 179,597 | 256,294 | 364,354 |

*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 2020-11-23**

| Week | Best Case (5th Percentile) | Middle Case (50th Percentile) | Worst Case (95th Percentile)^ |
|---|---|---|---|
| 2020-11-23 | | 2,671* | |
| 2020-11-30 | 2,178 | 3,051 | 4,042 |
| 2020-12-07 | 2,782 | 4,091 | 5,403 |
| 2020-12-14 | 2,611 | 4,799 | 6,828 |
| 2020-12-21 | 2,229 | 4,694 | 8,111 |
| 2020-12-28 | 2,004 | 4,130 | 8,221 |
| 2021-01-04 | 1,832 | 3,828 | 7,424 |

*Last reported confirmed cases count
^Closest-matching scenario

**So what?**

The daily number of cases are expected to range between 2,178 and 5,403 in the next two weeks

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



7-day Deaths Forecast for New Mexico Based on Data as of 2020-11-23

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

**6-Week Forecast of Deaths for New Mexico Based on Data as of 2020-11-23**

| Week | Best Case (5th Percentile) | Middle Case (50th Percentile) | Worst Case (95th Percentile)^ |
|---|---|---|---|
| 2020-11-23 | | 1,400* | |
| 2020-11-30 | 1,505 | 1,608 | 1,650 |
| 2020-12-07 | 1,637 | 1,885 | 1,987 |
| 2020-12-14 | 1,813 | 2,238 | 2,441 |
| 2020-12-21 | 1,998 | 2,634 | 3,037 |
| 2020-12-28 | 2,164 | 3,029 | 3,744 |
| 2021-01-04 | 2,325 | 3,393 | 4,508 |

*Last reported deaths count
^Closest-matching scenario

**6-Week Forecast of Daily Average of Deaths for New Mexico Based on Data as of 2020-11-23**

| Week | Best Case (5th Percentile) | Middle Case (50th Percentile) | Worst Case (95th Percentile)^ |
|---|---|---|---|
| 2020-11-23 | | 23* | |
| 2020-11-30 | 15 | 30 | 36 |
| 2020-12-07 | 19 | 40 | 48 |
| 2020-12-14 | 25 | 50 | 65 |
| 2020-12-21 | 26 | 57 | 85 |
| 2020-12-28 | 24 | 56 | 101 |
| 2021-01-04 | 23 | 52 | 109 |

*Last reported confirmed deaths
^Closest-matching scenario

## So what?
The daily number of deaths are expected to range between 15 and 48 in the next two weeks

# Growth Rate for NM



Daily Growth Rate for the Past Six Weeks in New Mexico as of 2020-11-23

6-Week Forecast of the Average Weekly Growth Rate for New Mexico Based on Data as of 2020-11-23

| Week | Best Case (5th Percentile) | Middle Case (50th Percentile) | Worst Case (95th Percentile)^ |
|---|---|---|---|
| 2020-11-23 | | 3.7%* | |
| 2020-11-30 | 2.4% | 3.3% | 4.2% |
| 2020-12-07 | 2.6% | 3.5% | 4.2% |
| 2020-12-14 | 2.1% | 3.2% | 4.0% |
| 2020-12-21 | 1.6% | 2.6% | 3.7% |
| 2020-12-28 | 1.3% | 1.9% | 3.0% |
| 2021-01-04 | 1.1% | 1.6% | 2.2% |

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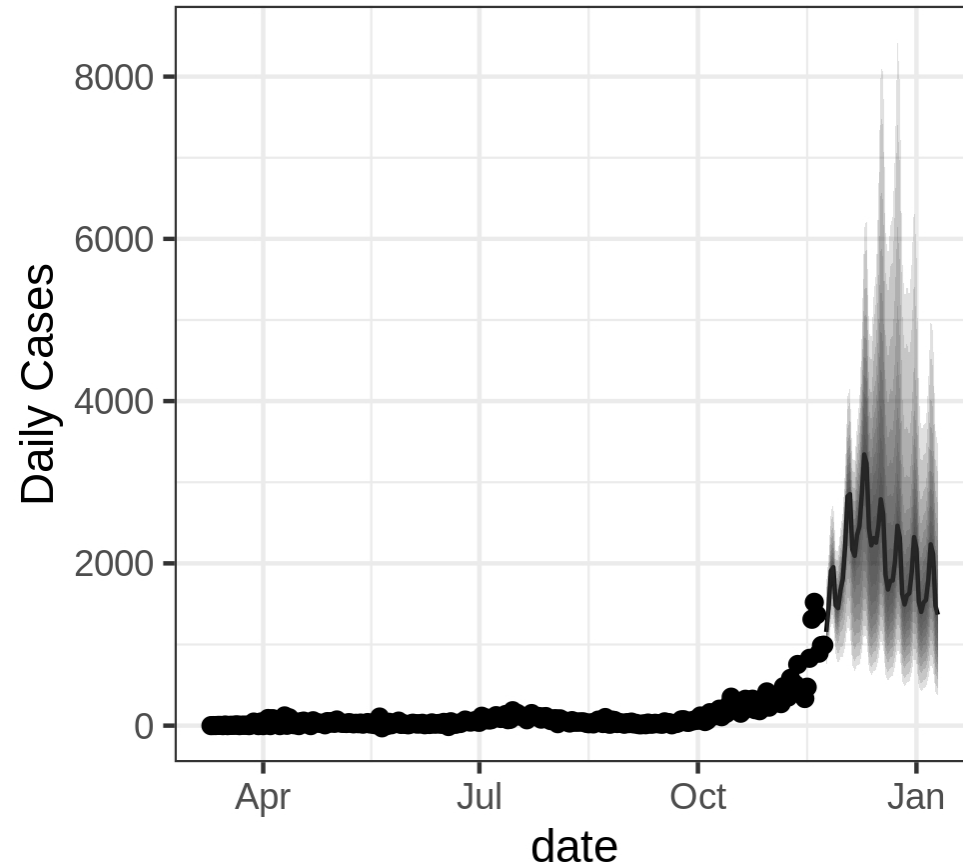^Closest-matching scenario

## So what?

- As of November 23rd, the average growth case rate in NM is at 3.7% (up from 2.2%)
- Deaths have been increasing by an average of 1.8% per day

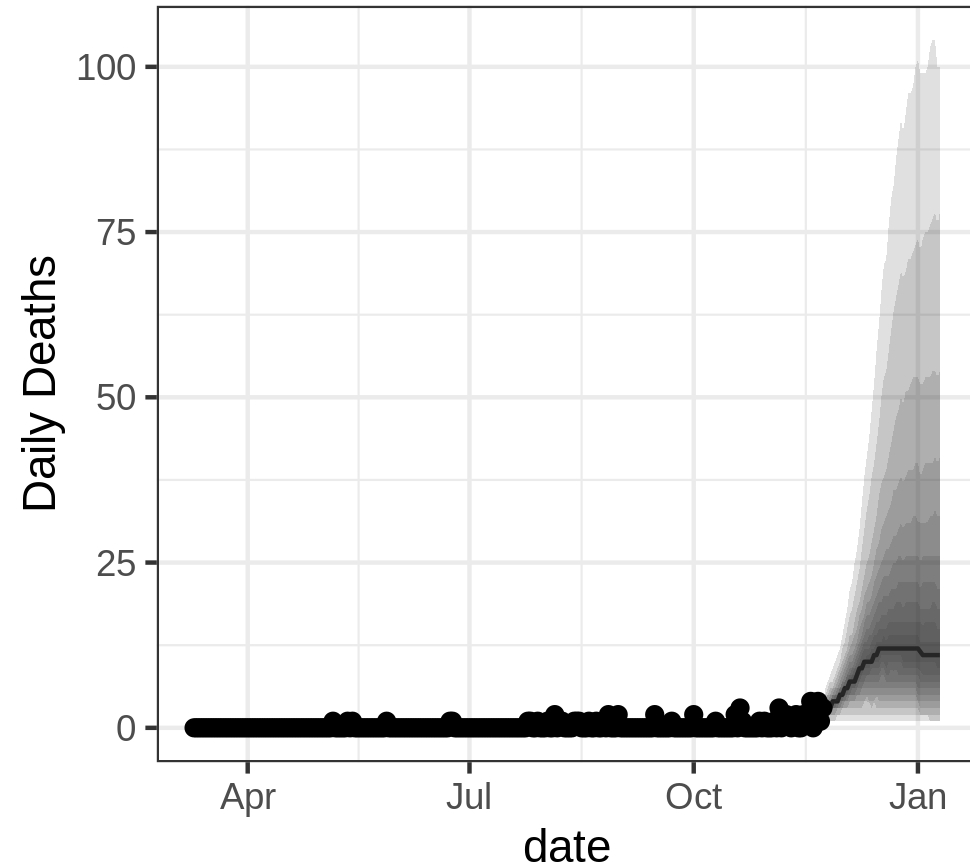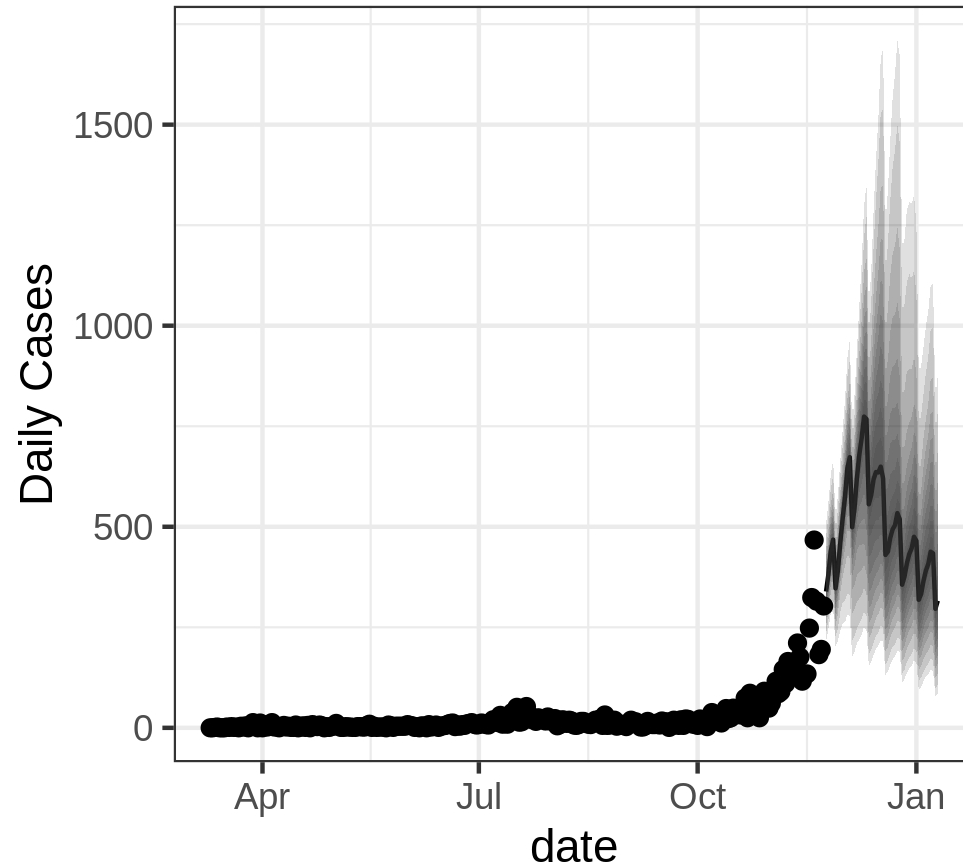# > Regional Forecasts, Growth Rates, & Hospitalizations

# Central Region Forecasts
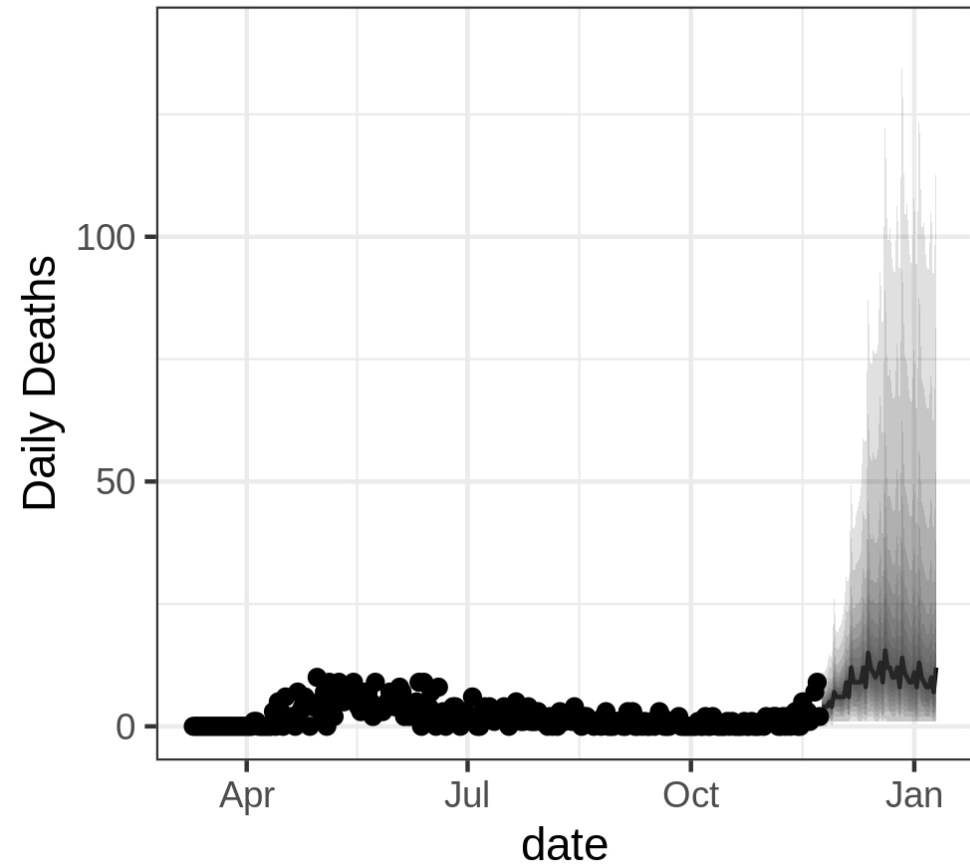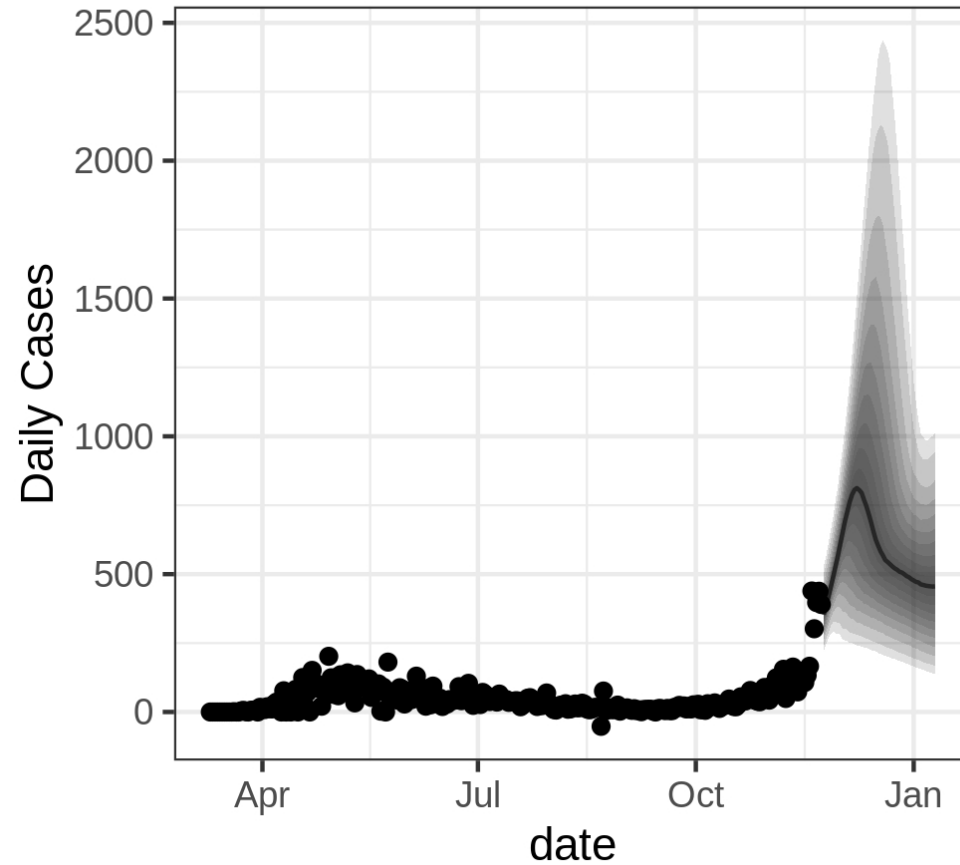
## Health Region - NM Central Region
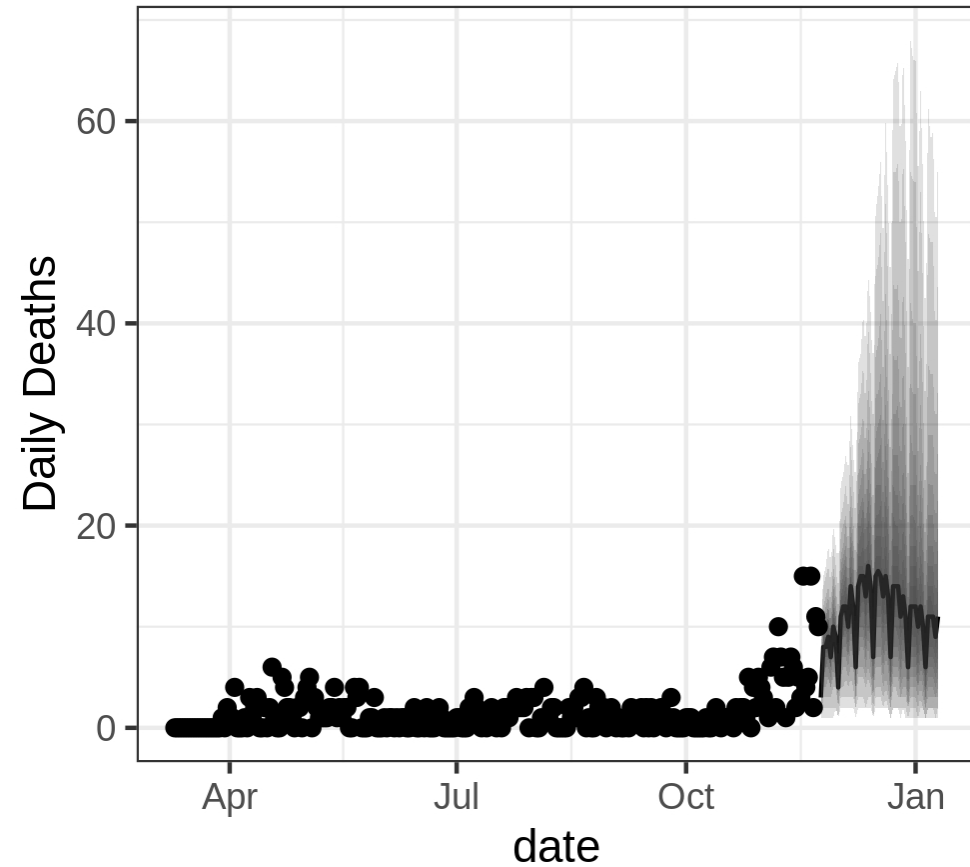
# Northeast Region Forecasts
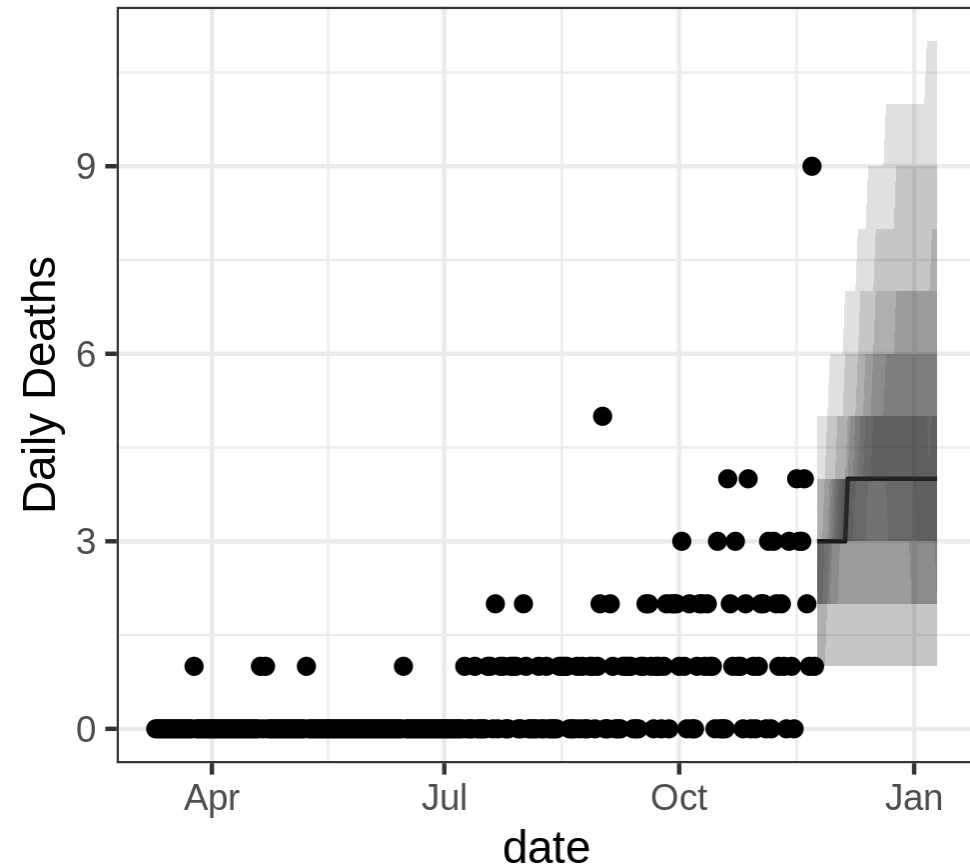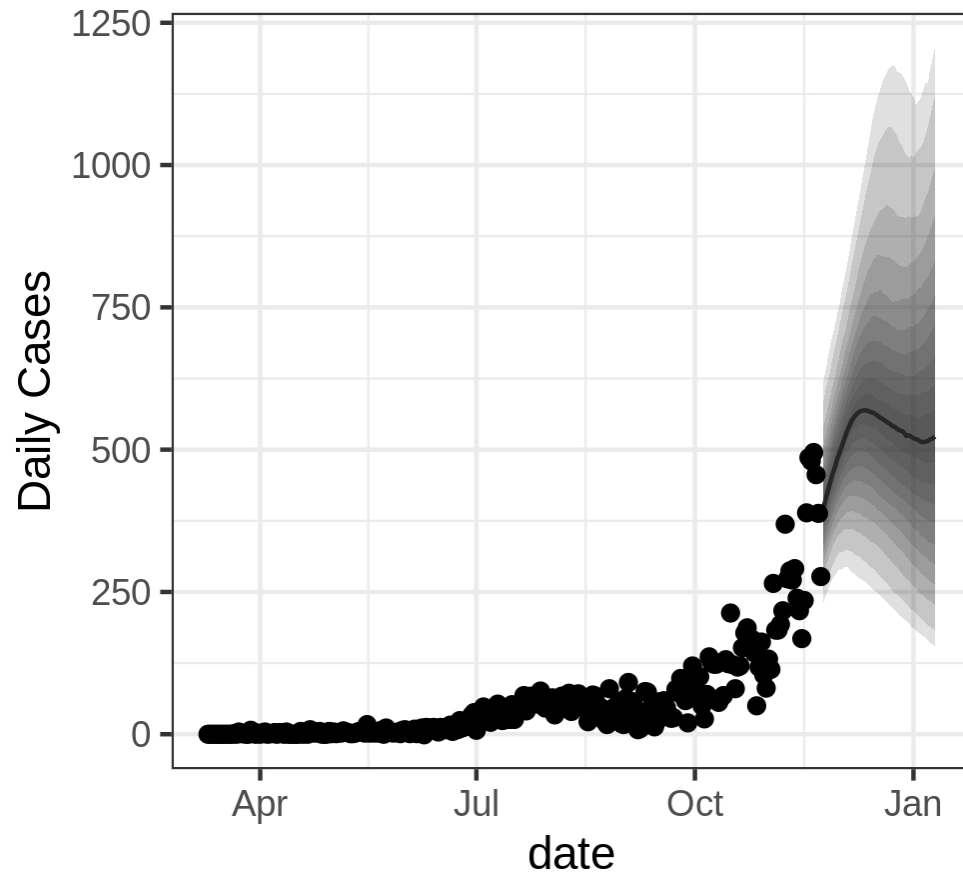
## Health Region - NM Northeast Region

# Northwest Region Forecasts
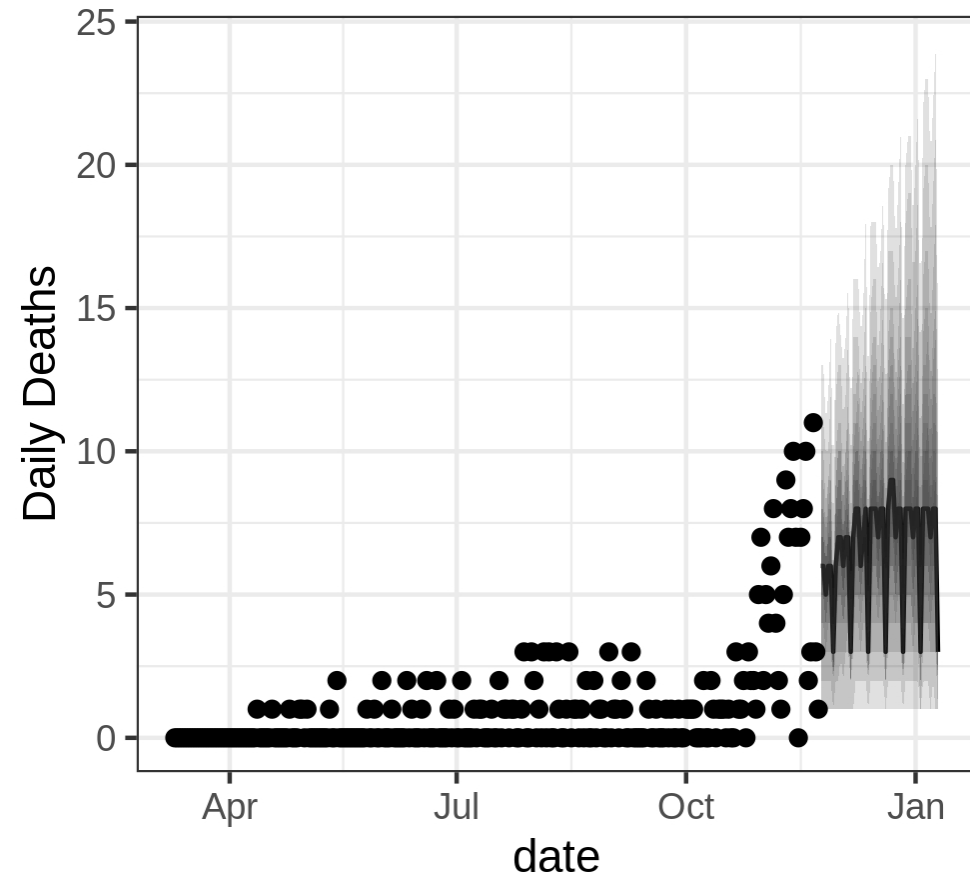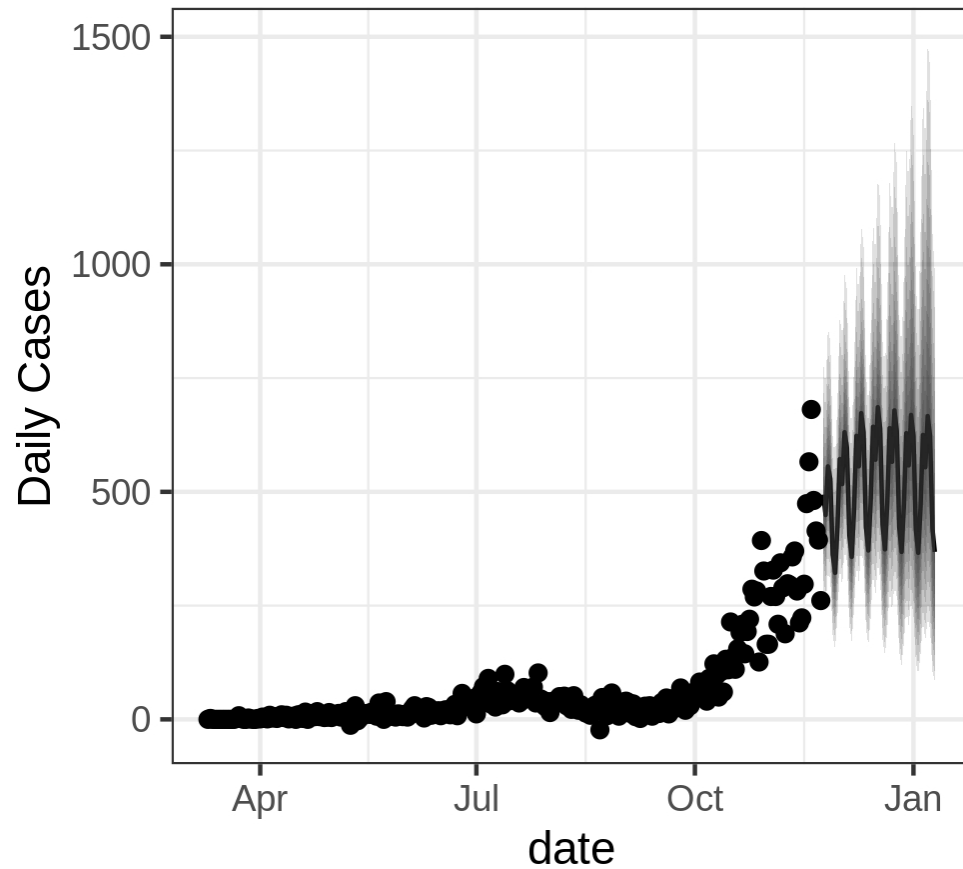
## Health Region - NM Northwest Region

# Southeast Region Forecasts

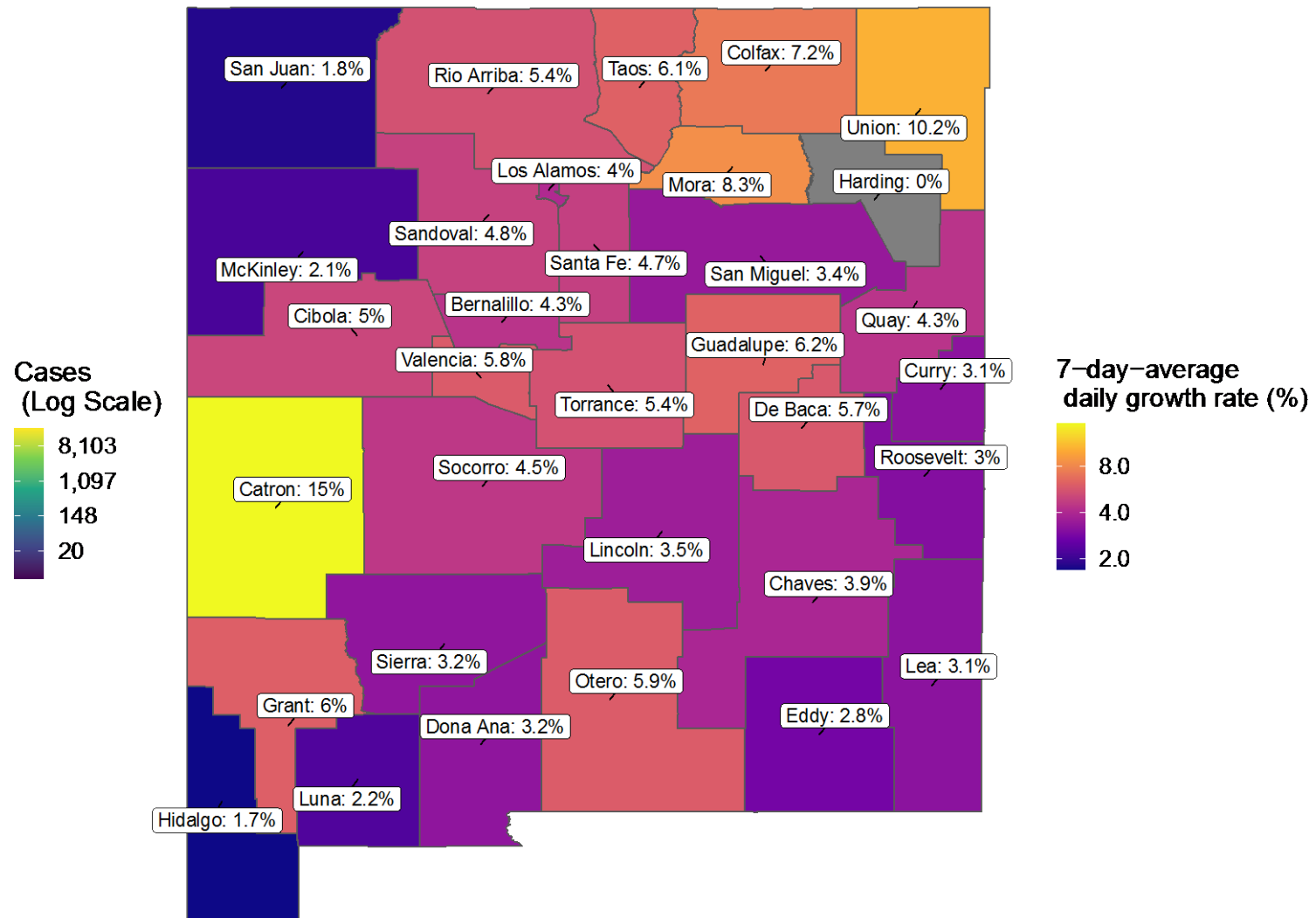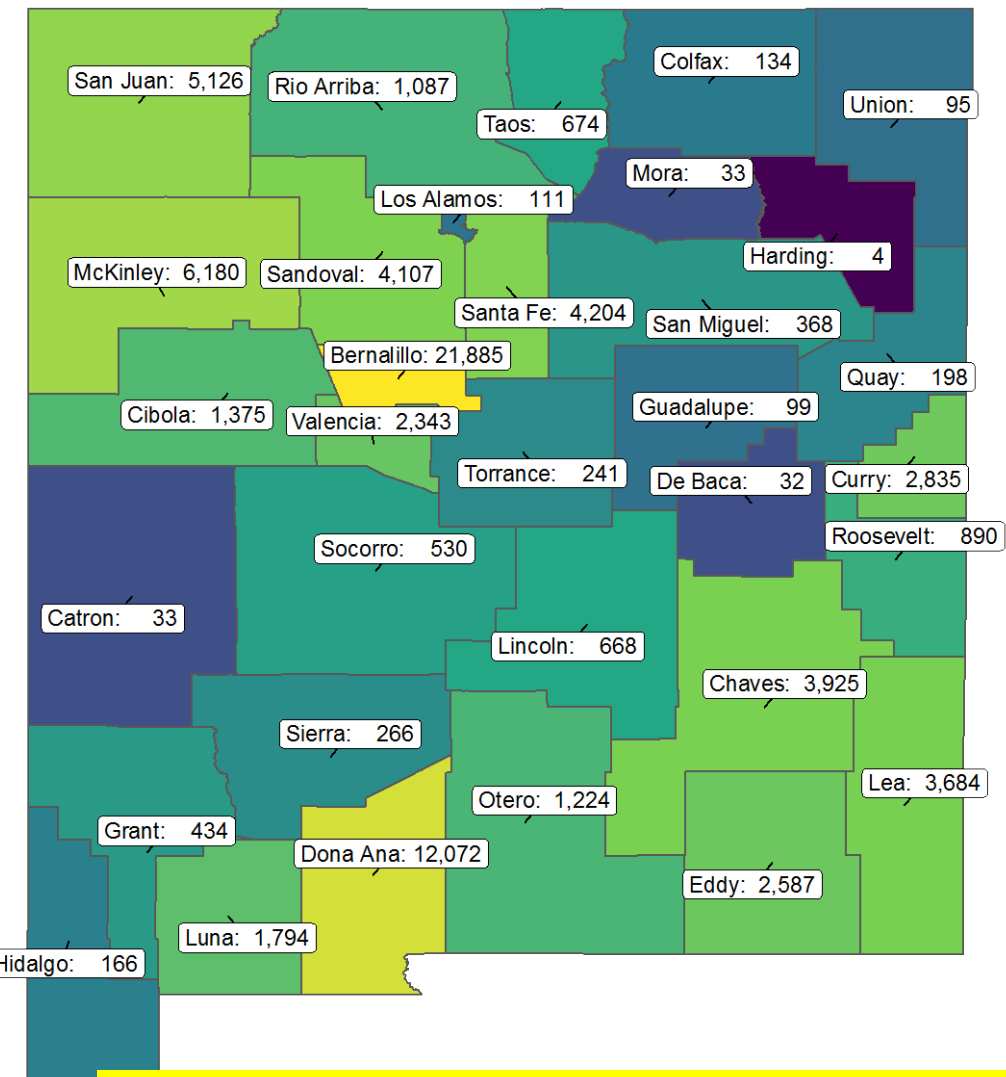## Health Region - NM Southeast Region

# Southwest Region Forecasts

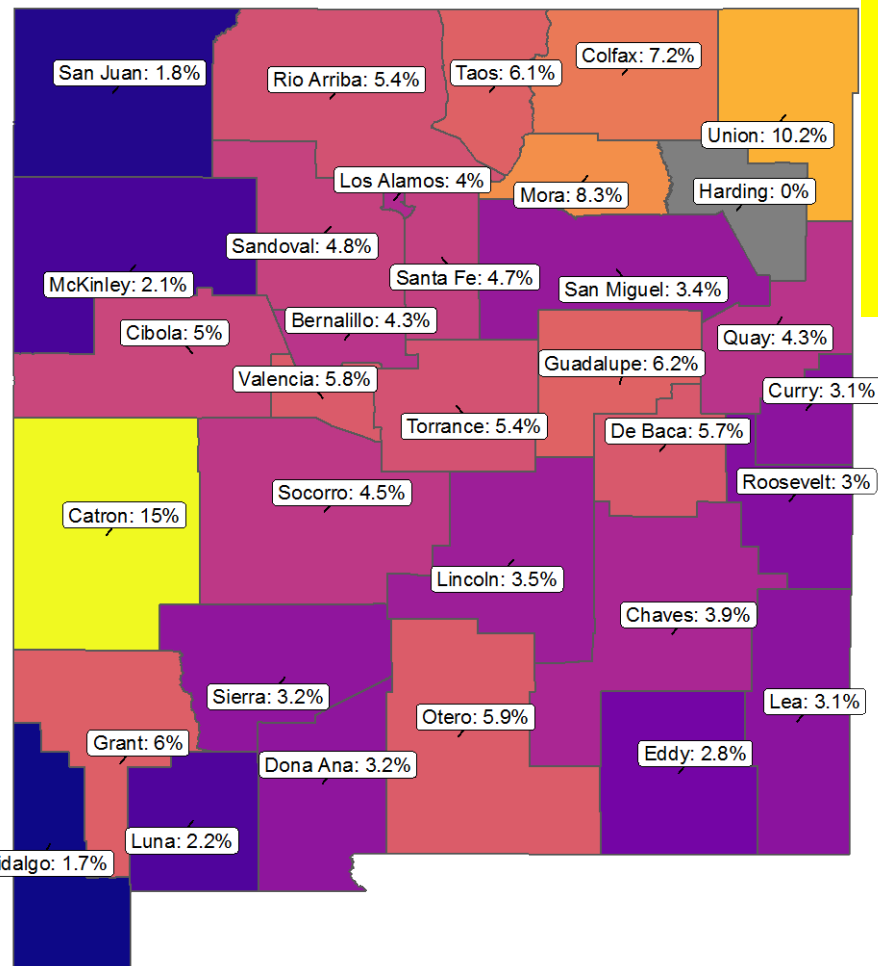## Health Region - NM Southwest Region

# Cumulative Cases & Daily Growth Rate for NM: Nov 23



Caveat: Total cases and computed growth rates are too high due to reported backlog last week

# Daily Growth Rate for NM Nov 23



Caveat: Total cases and growth rates are too high due to reported backlog last week. Except for down and equal, red color is the same as last week to reflect likely status minus backlog.

7-day-average daily growth rate (%)

8.0
4.0
2.0

Socorro **4.8%** ↑
Los Alamos **4.0%** =
Mora **8.3%** ↑
Roosevelt **3.0%** ↑
Hidalgo **1.7%** =
DeBaca **5.7%** ↓

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

**Colfax 7.2%** ↑
**Quay** 4.2% ↑
Catron **15.0%** ↑
Union **10.2%** ↑

Los Alamos National Laboratory

| County | Daily Growth Rate | Change |
|---|---|---|
| San Juan | 1.8% | ↑ |
| Rio Arriba | 5.4% | ↑ |
| Sierra | 3.2% | ↑ |
| McKinley | 2.1% | ↑ |
| Sandoval | 4.8% | ↑ |
| Santa Fe | 4.7% | ↑ |
| Cibola | 5.0% | ↑ |
| Bernalillo | 4.3% | ↑ |
| Valencia | 5.8% | ↑ |
| Torrance | 5.4% | ↑ |
| Lincoln | 3.5% | ↑ |
| San Miguel | 3.4% | ↑ |
| Chaves | 3.9% | ↑ |
| Dona Ana | 3.2% | ↑ |
| Otero | 5.9% | ↑ |
| Lea | 3.1% | ↑ |
| Eddy | 2.8% | ↑ |
| Curry | 3.1% | ↑ |
| Grant | 6.0% | ↑ |
| Luna | 2.2% | ↑ |
| Taos | 6.1% | ↑ |

**COVID-19 across New Mexico**

*A 7-day moving window comparison*
*November 23, 2020*

Impacted New Mexicans

**Counties with New Cases This Week**

| | Low Cases Per Capita | Med Cases Per Capita | High Cases Per Capita | |
|---|---|---|---|---|
| Growth Rate | 0k | 0k | 2.07M | Accelerating |
| | 0k | 0k | 25k | Constant |
| | 0k | 0k | 0k | Decelerating |

**Counties With No New Cases In ...**

| Last Week | Two Weeks | 3+ Weeks |
|---|---|---|
| 459k | 0k | 0k |
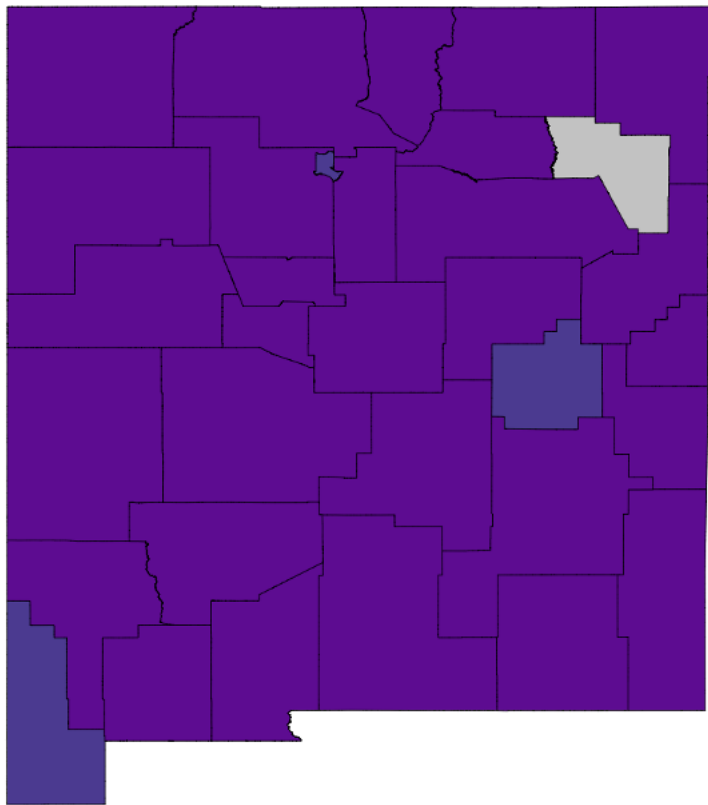
Number of New Mexicans living in regions with particular combinations of per capita case counts and growth rates
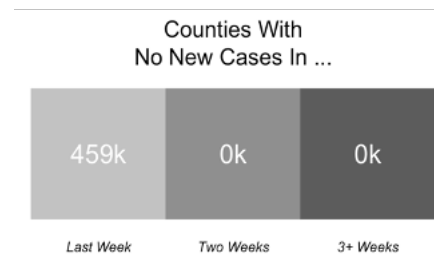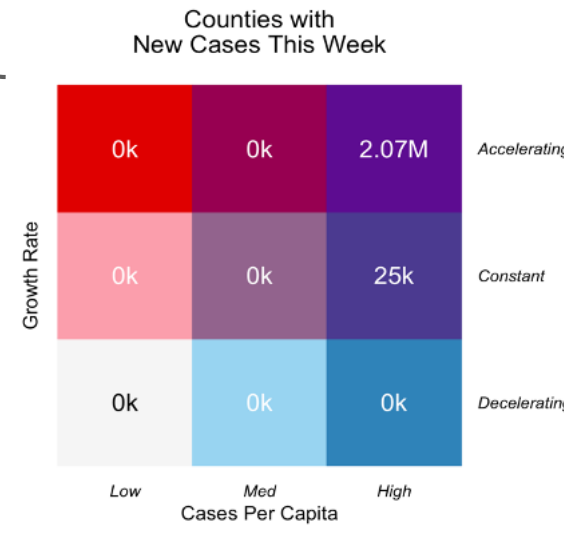
## So what?

- MOST New Mexicans continue to live in a county with <u>accelerating growth rates and high per-capita case counts</u>
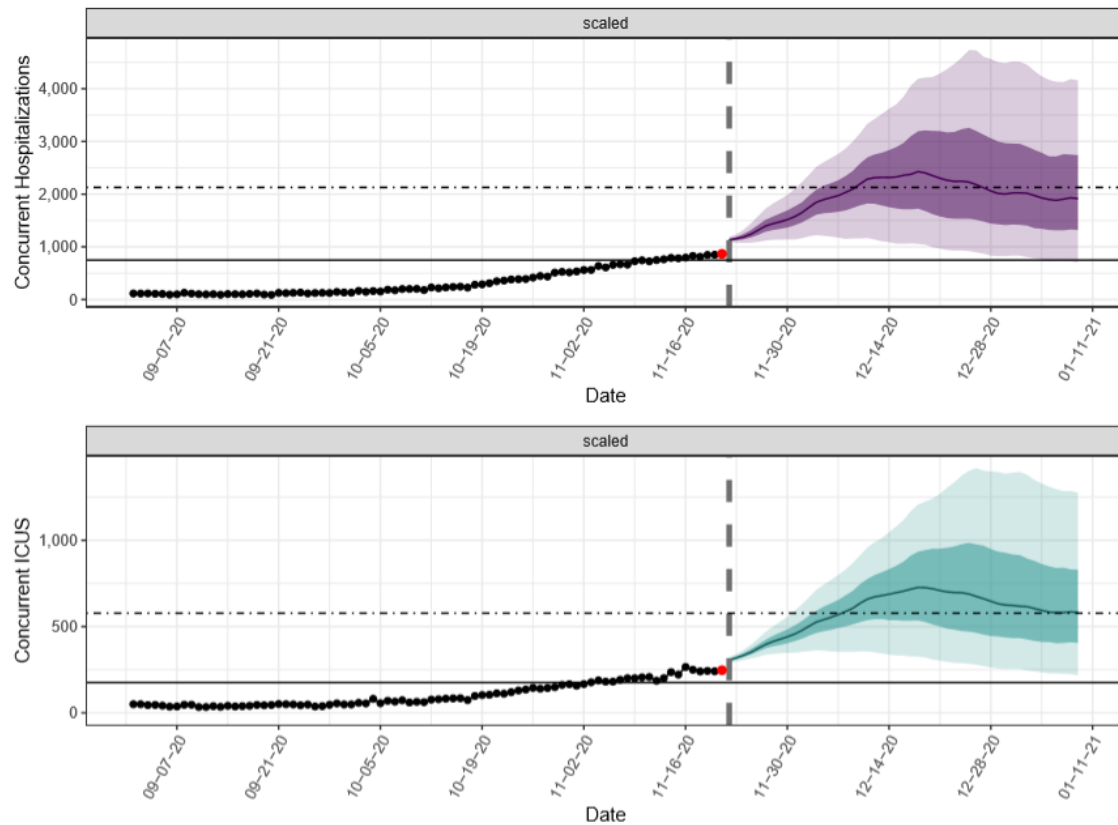
Caveat: Total cases and growth rates are too high due to reported backlog last week

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

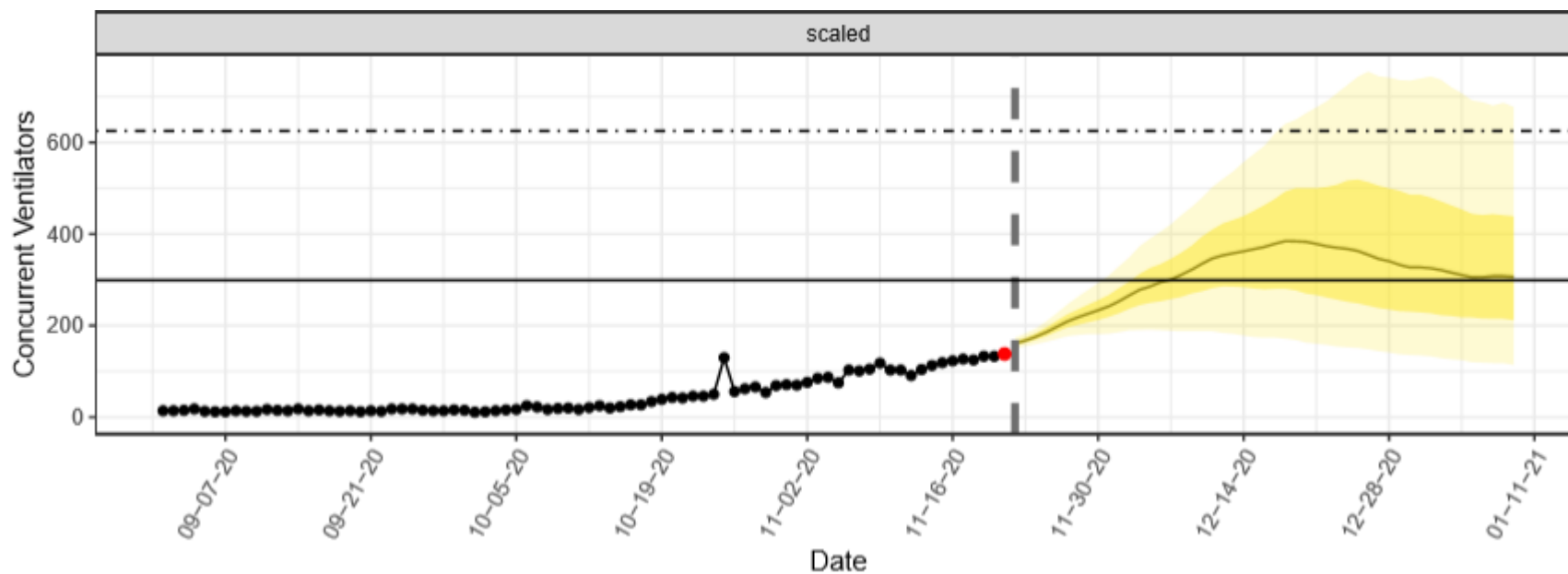| Week | Qu. 5% (best case) | Qu. 50% (median) | Qu. 95% (worst case) |
|------|-------------------|------------------|---------------------|
| 11/29 | 345 | 427 | 528 |
| 12/6 | 356 | 554 | 771 |
| 12/13 | 344 | 680 | 1013 |
| 12/20 | 308 | 719 | 1242 |
| 12/27 | 272 | 662 | 1404 |
| 1/3 | 241 | 604 | 1350 |

"Scaled" Scenario

## So what?

We are <u>over baseline ICU bed capacity</u> for concurrent COVID-19 patients; predictions reach between 350-700 concurrent COVID-19 ICU beds needed by mid-December

Caveat: Total cases and growth rates are too high due to reported backlog last week. Actual estimates with corrections will likely fall between 5%-50% shown here.

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



## So what?

It's possible that we may approach or exceed available ventilators by mid-December

Caveat: Total cases and growth rates are too high due to reported backlog last week. Actual estimates with corrections will likely fall between 5%-50% shown here.

# Regional Hospitalization Forecasts: Central
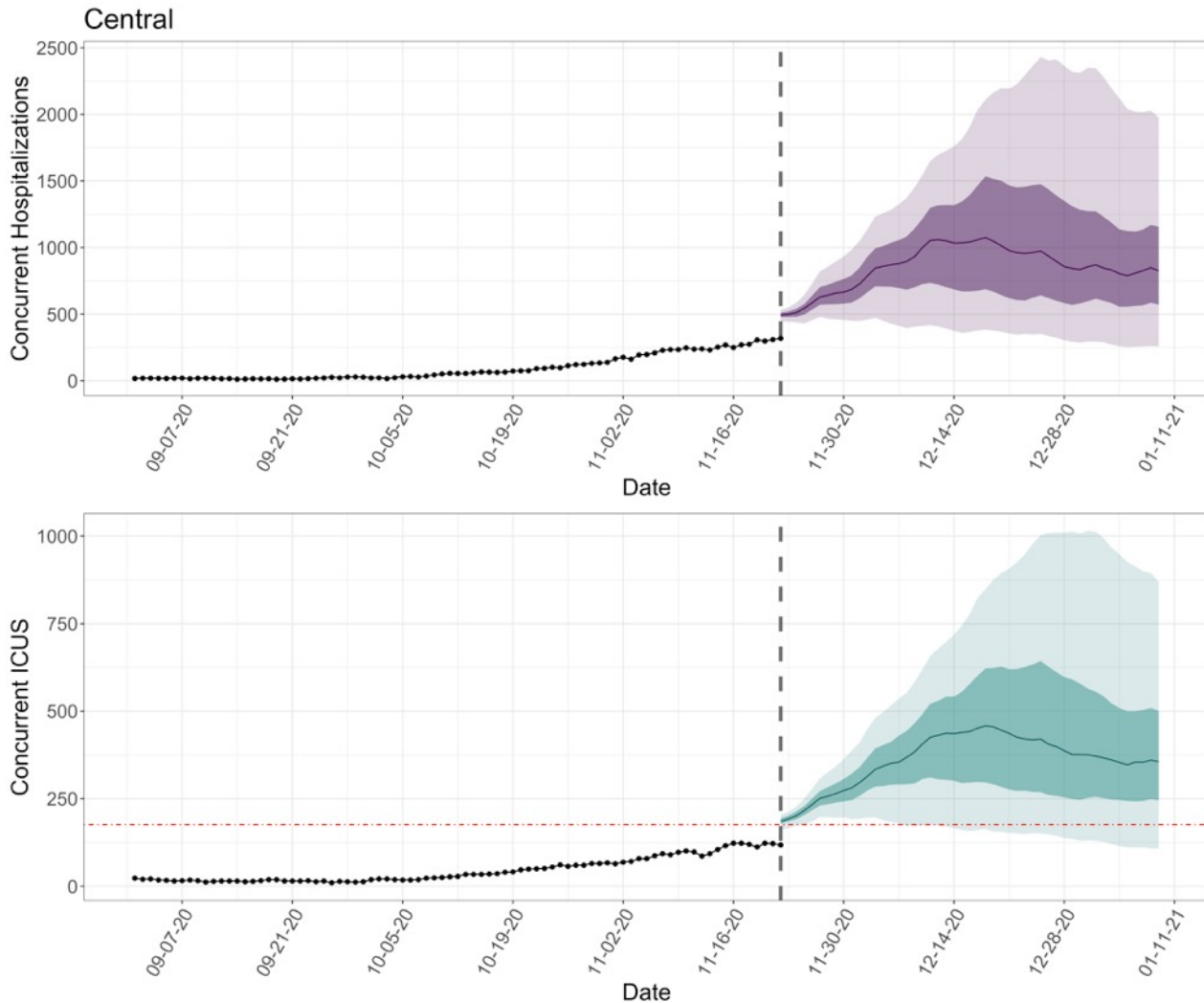


Central

## Concurrent COVID-19 ICUs beds: Central

| Week | Qu. 5% (best case) | Qu. 50% (median) | Qu. 95% (worst case) |
|---|---|---|---|
| 11/29 | 196 | 265 | 343 |
| 12/6 | 184 | 351 | 517 |
| 12/13 | 170 | 437 | 698 |
| 12/20 | 155 | 446 | 894 |
| 12/27 | 144 | 399 | 1011 |
| 1/3 | 121 | 361 | 967 |

Caveat: Total cases and growth rates are too high due to reported backlog last week.
Actual estimates with corrections will likely fall between 5%-50% shown here.

# Regional Hospitalization Forecasts: Southwest



Southwest

## Concurrent COVID-19 ICUs beds: Southwest

| Week | Qu. 5% (best case) | Qu. 50% (median) | Qu. 95% (worst case) |
|---|---|---|---|
| 11/29 | 52 | 73 | 99 |
| 12/6 | 46 | 87 | 134 |
| 12/13 | 41 | 98 | 160 |
| 12/20 | 40 | 100 | 186 |
| 12/27 | 32 | 96 | 197 |
| 1/3 | 27 | 90 | 196 |

Caveat: Total cases and growth rates are too high due to reported backlog last week.
Actual estimates with corrections will likely fall between 5%-50% shown here.
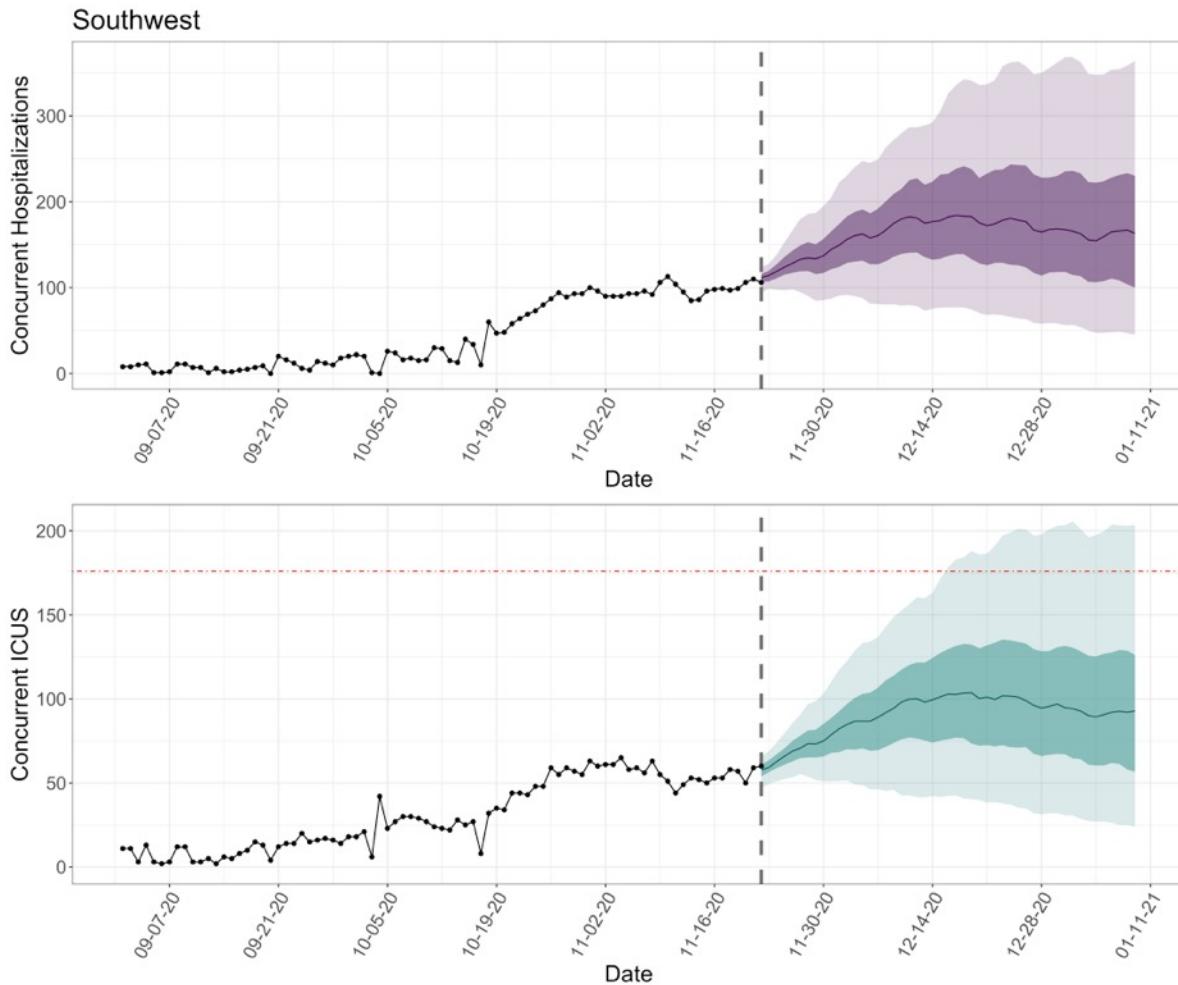
# Regional Hospitalization Forecasts: Northwest



Northwest

## Concurrent COVID-19 ICUs beds: Northwest

| Week | Qu. 5% (best case) | Qu. 50% (median) | Qu. 95% (worst case) |
|------|--------------------|-------------------|----------------------|
| 11/29 | 41 | 60 | 79 |
| 12/6 | 39 | 79 | 120 |
| 12/13 | 34 | 98 | 167 |
| 12/20 | 33 | 98 | 224 |
| 12/27 | 29 | 92 | 252 |
| 1/3 | 25 | 83 | 239 |

Caveat: Total cases and growth rates are too high due to reported backlog last week.
Actual estimates with corrections will likely fall between 5%-50% shown here.
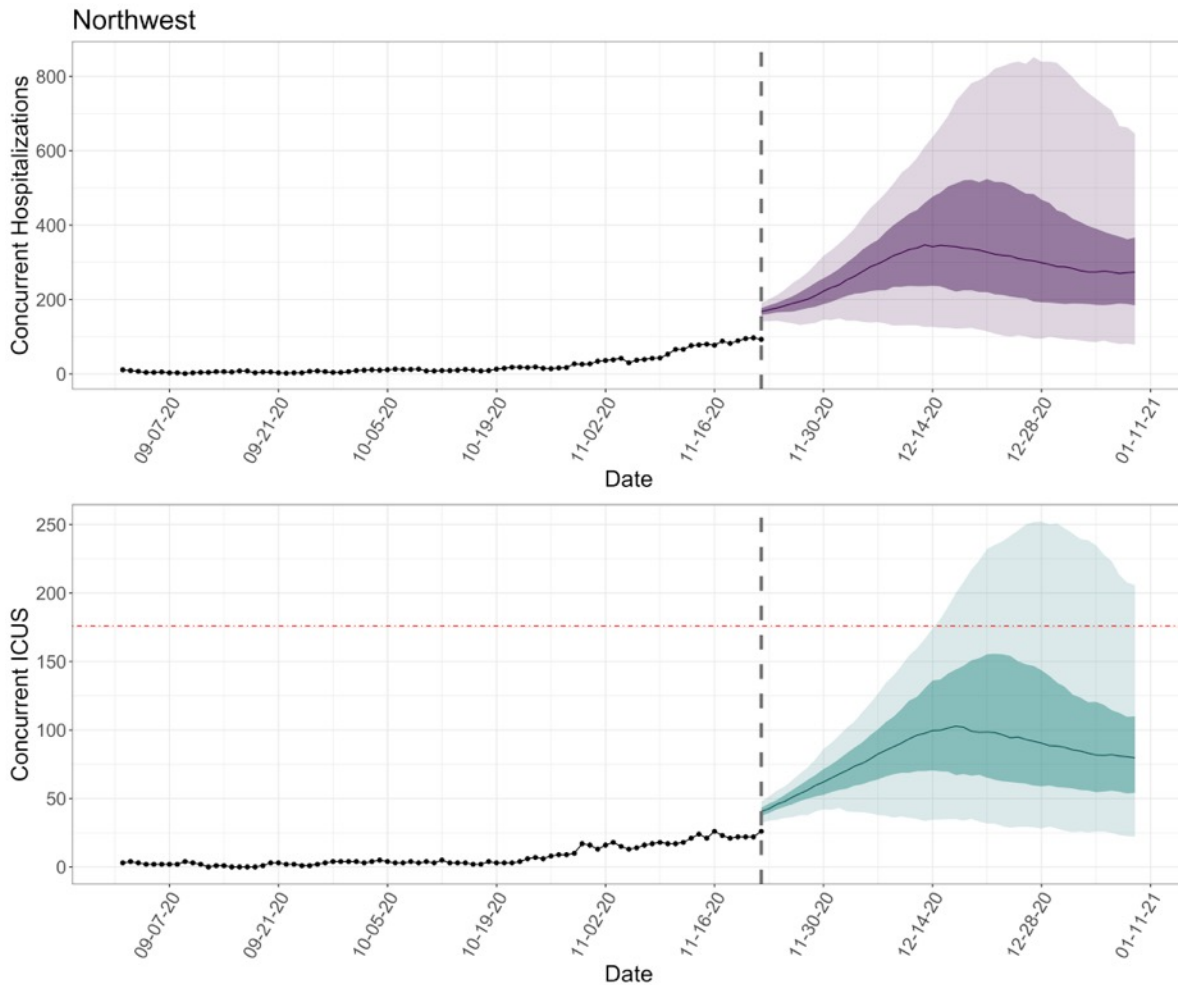
# Regional Hospitalization Forecasts: Southeast



## Concurrent COVID-19 ICUs beds: Southeast

| Week | Qu. 5% (best case) | Qu. 50% (median) | Qu. 95% (worst case) |
|---|---|---|---|
| 11/29 | 27 | 39 | 52 |
| 12/6 | 26 | 52 | 83 |
| 12/13 | 23 | 61 | 118 |
| 12/20 | 20 | 56 | 147 |
| 12/27 | 17 | 53 | 162 |
| 1/3 | 16 | 50 | 142 |

Caveat: Total cases and growth rates are too high due to reported backlog last week.
Actual estimates with corrections will likely fall between 5%-50% shown here.
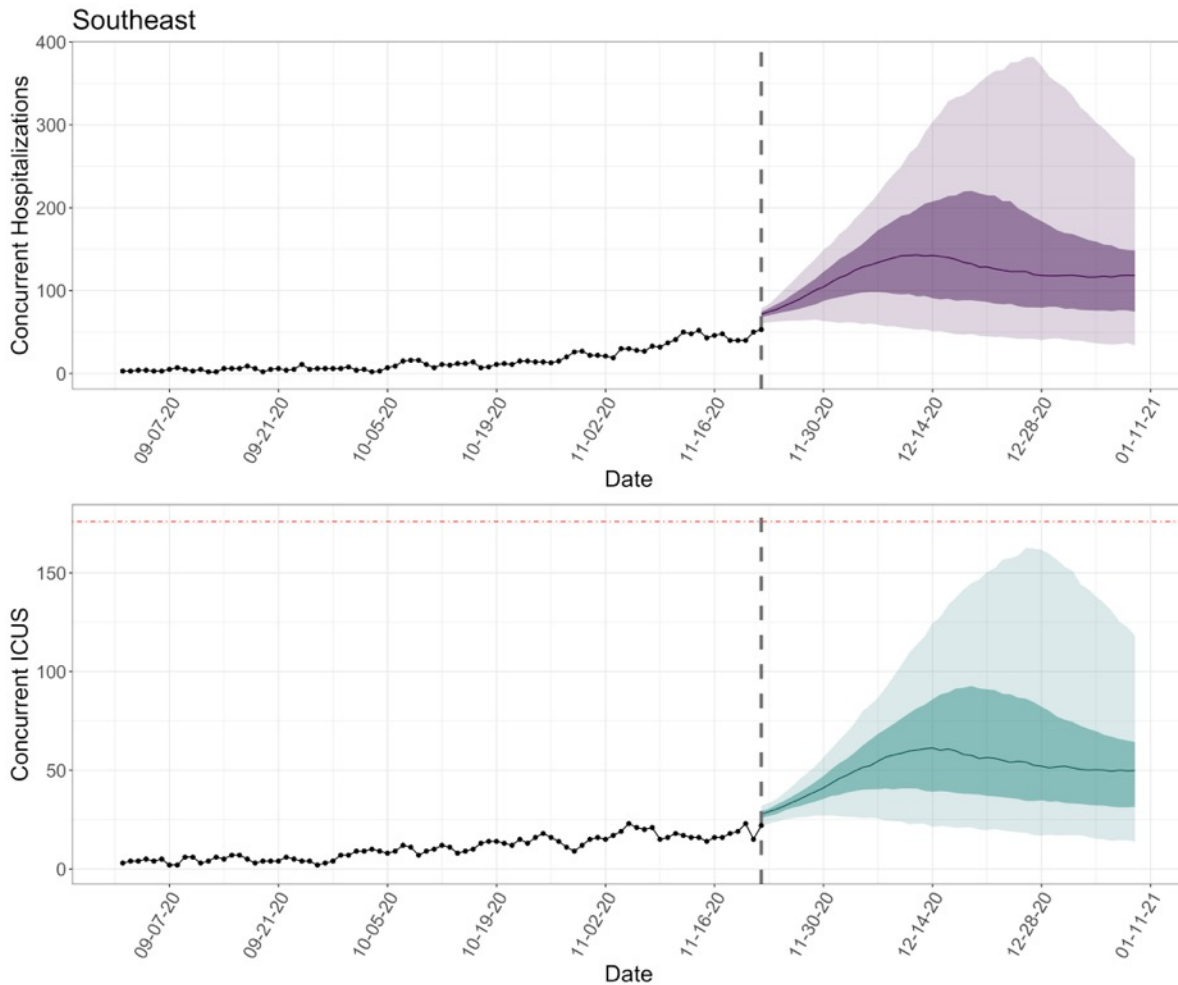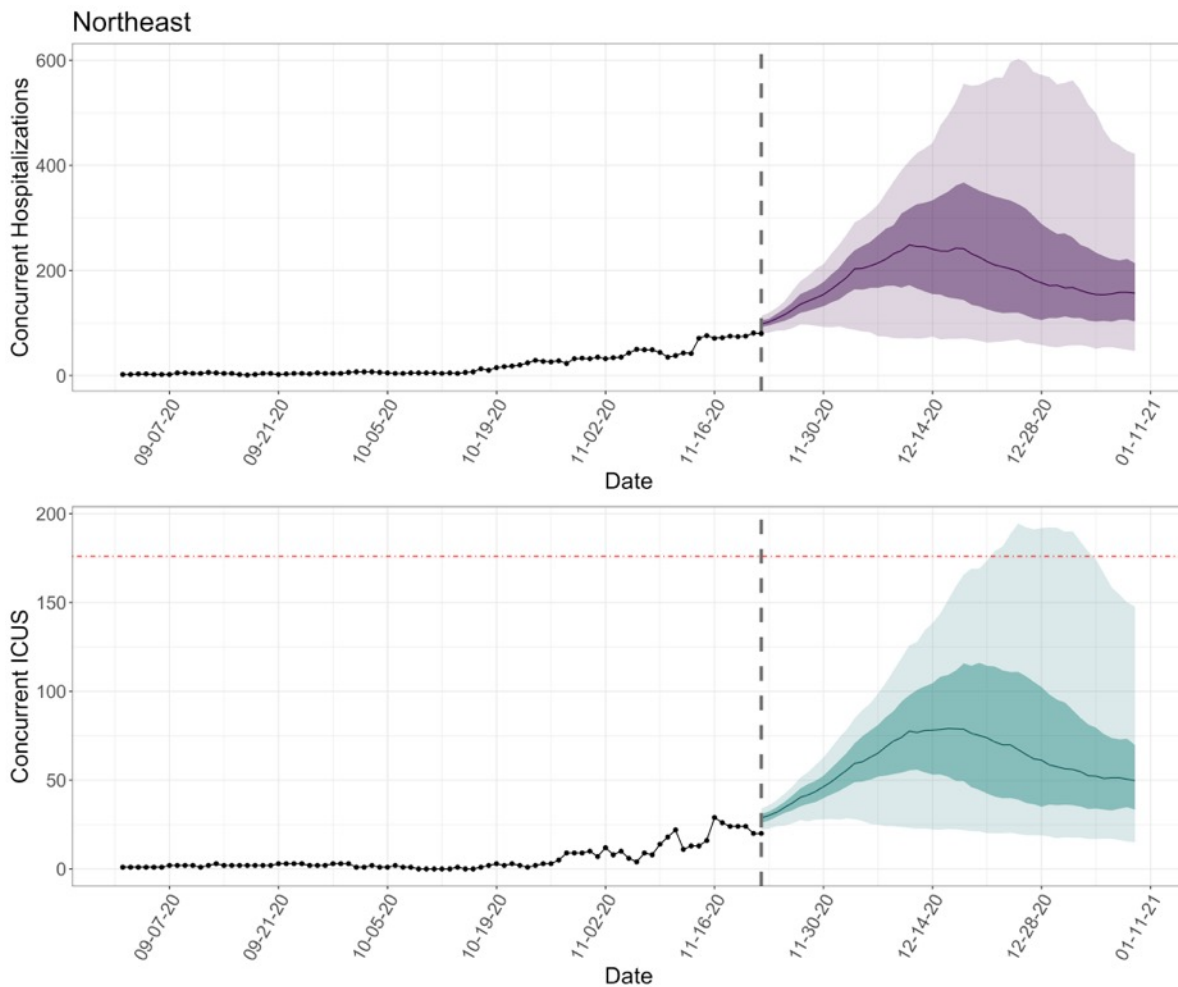
# Regional Hospitalization Forecasts: Northeast



Northeast

## Concurrent COVID-19 ICUs beds: Northeast

| Week | Qu. 5% (best case) | Qu. 50% (median) | Qu. 95% (worst case) |
|---|---|---|---|
| 11/29 | 28 | 44 | 59 |
| 12/6 | 25 | 63 | 93 |
| 12/13 | 23 | 78 | 134 |
| 12/20 | 21 | 75 | 169 |
| 12/27 | 19 | 62 | 191 |
| 1/3 | 17 | 52 | 179 |

Caveat: Total cases and growth rates are too high due to reported backlog last week.
Actual estimates with corrections will likely fall between 5%-50% shown here.

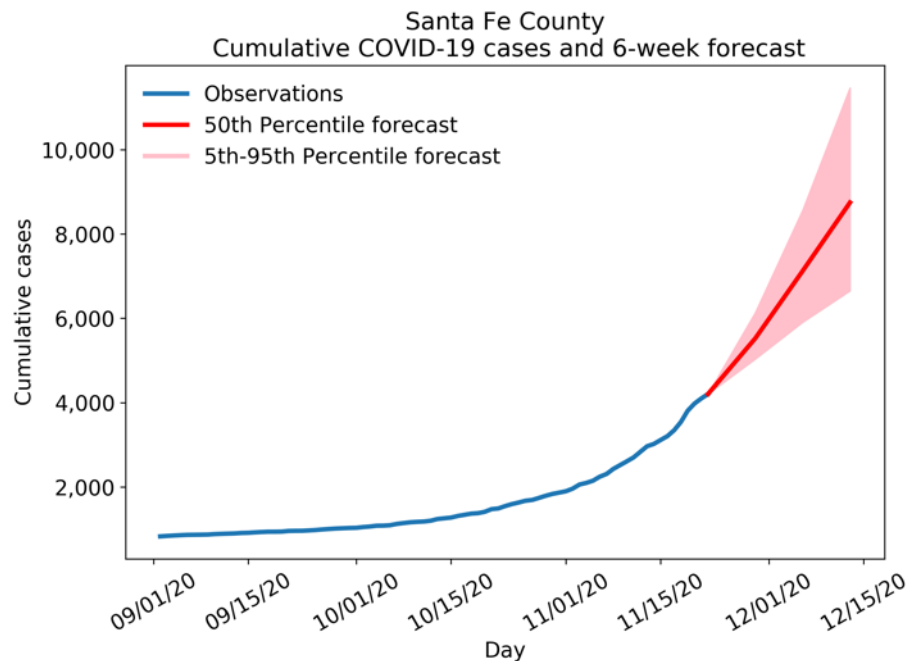# > Non-Congregational Shelter Forecast

# 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 11/22/20: **4,204**
Number of shelter rooms available: **52**
Total number of patients/medical workers (including specialty): **40**
Number of patients: **39**
Number of medical workers: **1**
2-week avg. new cases per day: **127**



Santa Fe County
Cumulative COVID-19 cases and 6-week forecast

| | 11/29/20 | 12/6/20 | 12/13/20 |
|---|---|---|---|
| Total cases | 5,526 (5,036-6,135) | 7,124 (5,908-8,562) | 8,747 (6,653-11,467) |
| # of rooms needed | 60 (37-87) | 72 (39-109) | 73 (34-131) |
| Deficit (-) or surplus of rooms | -8 | -20 | -21 |

The 50th percentile forecast depicts the Santa Fe shelters may be over capacity by 8 rooms in a week.

The 5th percentile forecast depicts there will be 15 rooms still available in a week.

# Non-Congregate Shelter Forecast: Bernalillo

Number of cases as of 11/22/20: **21,885**
Number of shelter rooms available: **191**
Total number of patients/medical workers
(including specialty): **122**
Number of patients: **118**
Number of medical workers: **4**
2-week avg. new cases per day: **580**

| | 11/29/20 | 12/6/20 | 12/13/20 |
|---|---|---|---|
| Total cases | 28,097 (26,116-30,510) | 36,441 (31,194-42,168) | 46,106 (35,675-57,315) |
| # of rooms needed | 186 (127-259) | 251 (152-350) | 290 (134-455) |
| Deficit (-) or surplus of rooms | 5 | -60 | -99 |



Bernalillo County
Cumulative COVID-19 cases and 6-week forecast
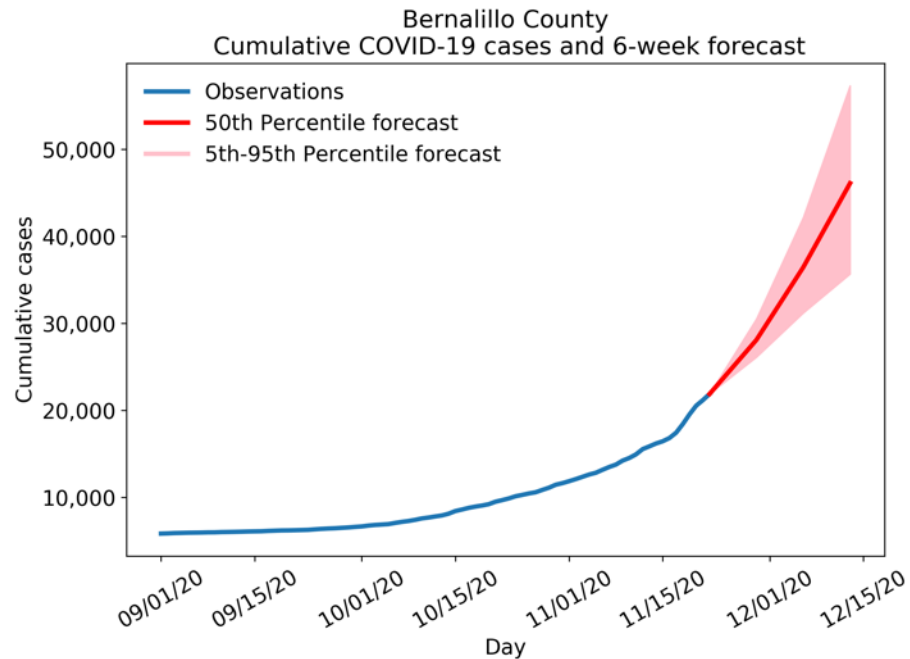
The 50th percentile forecast depicts the Bernalillo shelters will have 5 rooms available by the end of the week—this would be too few to support the 8 overflow rooms by the Santa Fe shelters.

# Non-Congregate Shelter Forecast: McKinley

Number of cases as of 11/22/20: **6,180**
Number of shelter rooms available: **160**
Total number of patients/medical workers (including specialty): **58**
Number of patients: **56**
Number of medical workers: **2**
2-week avg. new cases per day: **83**

|  | 11/29/20 | 12/6/20 | 12/13/20 |
|---|---|---|---|
| Total cases | 7,114 (6,723-7,646) | 8,487 (7,497-9,748) | 10,116 (8,188-12,650) |
| # of rooms needed | 92 (53-145) | 135 (77-208) | 161 (68-287) |
| Deficit (-) or surplus of rooms | 68 | 25 | -1 |
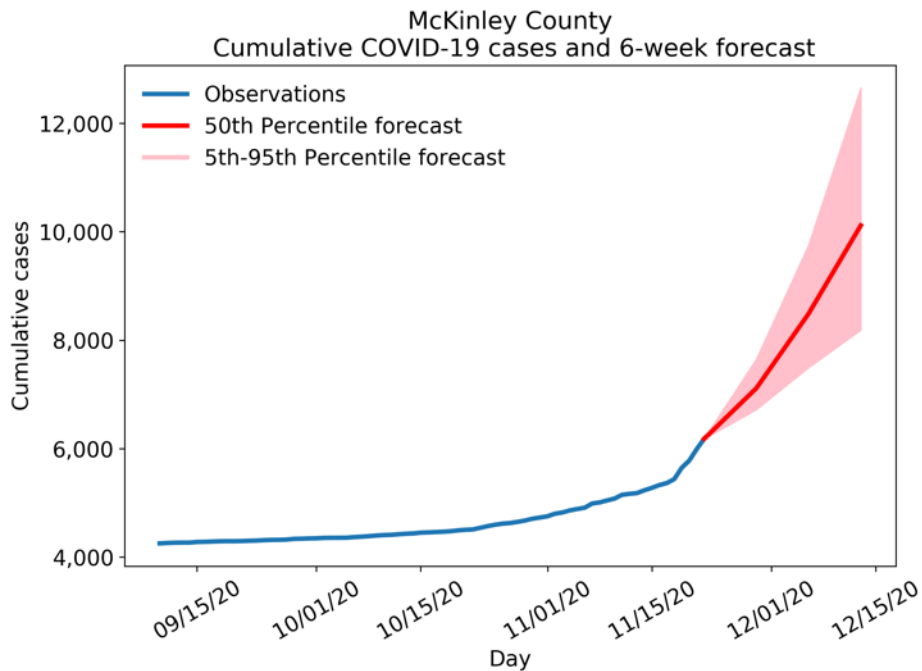
From the 50th percentile forecast, the need for available shelter rooms in McKinley County is met for the next two weeks and near capacity the third week.



McKinley County
Cumulative COVID-19 cases and 6-week forecast

# Non-Congregate Shelter Forecast: San Juan

Number of cases as of 11/22/20: **3,146**
Number of shelter rooms available: **25**
Total number of patients/medical workers (including specialty): **12**
Number of patients: **12**
Number of medical workers: **0**
2-week avg. new cases per day: **72**

| | 11/29/20 | 12/6/20 | 12/13/20 |
|---|---|---|---|
| Total cases | 5,808 (5,531-6,174) | 6,721 (6,056-7,571) | 7,757 (6,554-9,329) |
| # of rooms needed | 16 (10-25) | 22 (12-33) | 25 (12-42) |
| Deficit (-) or surplus of rooms (SJ) | 9 | 3 | 0 |
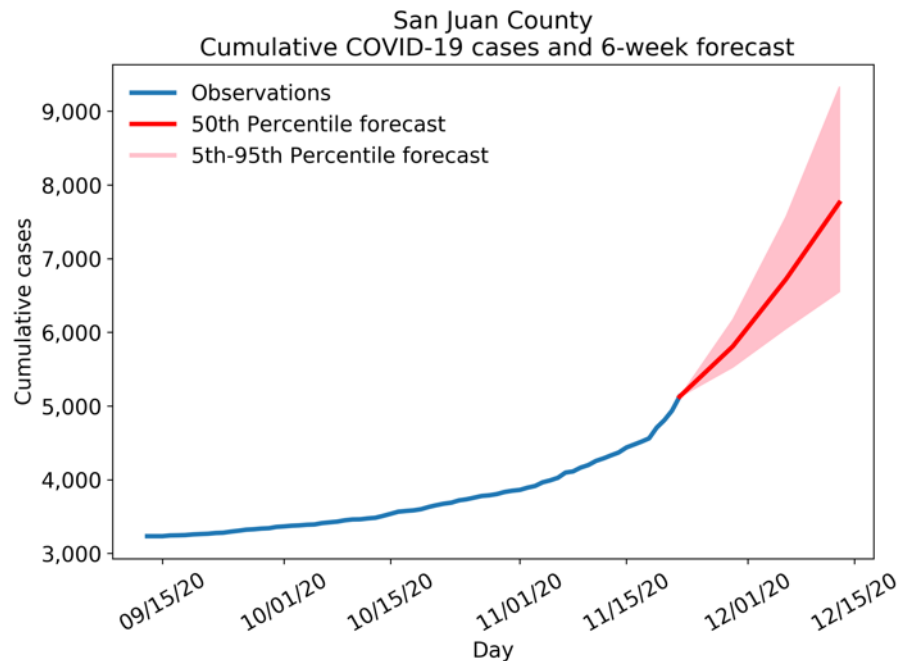
From the 50th percentile forecast, the need for available shelter rooms in San Juan County is met for the next three weeks.



San Juan County
Cumulative COVID-19 cases and 6-week forecast

- Observations
- 50th Percentile forecast
- 5th-95th Percentile forecast