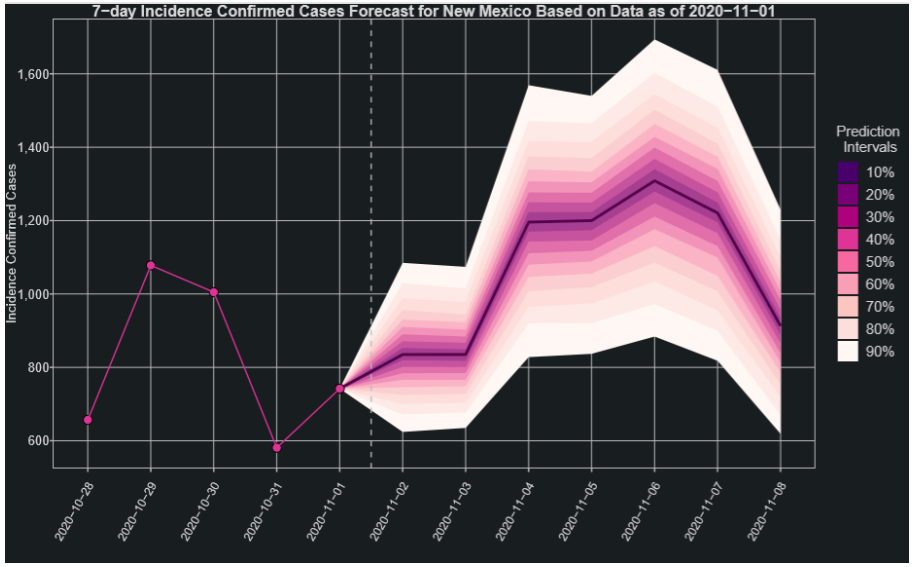
# Modeling & Forecasting COVID-19 in NM

November 3, 2020



NNSA
National Nuclear Security Administration

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




**6−Week Forecast of Confirmed Cases for New Mexico Based on Data as of 2020−11−01**

| Week | Best Case (5th Percentile) | Middle Case (50th Percentile) | Worst Case (95th Percentile) |
|---|---|---|---|
| 2020−11−01 | | 47,232* | |
| 2020−11−08 | 52,767 | 54,736 | 56,683 |
| 2020−11−15 | 58,283 | 63,492 | 69,016 |
| 2020−11−22 | 63,484 | 72,302 | 84,843 |
| 2020−11−29 | 68,171 | 80,560 | 104,079 |
| 2020−12−06 | 72,261 | 88,325 | 126,186 |
| 2020−12−13 | 76,078 | 96,230 | 147,886 |

*Last reported confirmed cases count

**6−Week Forecast of Daily Average of Confirmed Cases for New Mexico Based on Data as of 2020−11−01**

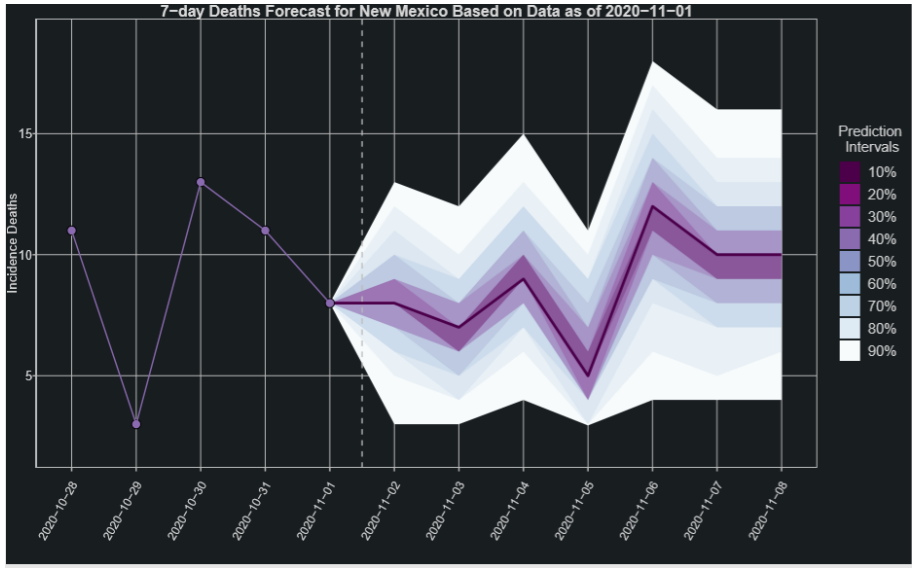
| Week | Best Case (5th Percentile) | Middle Case (50th Percentile) | Worst Case (95th Percentile) |
|---|---|---|---|
| 2020−11−01 | | 767* | |
| 2020−11−08 | 791 | 1,072 | 1,350 |
| 2020−11−15 | 788 | 1,251 | 1,762 |
| 2020−11−22 | 743 | 1,258 | 2,261 |
| 2020−11−29 | 670 | 1,180 | 2,748 |
| 2020−12−06 | 584 | 1,109 | 3,158 |
| 2020−12−13 | 545 | 1,129 | 3,100 |

*Last reported confirmed cases count

**So what?**

**The daily number of cases are expected to range between 791 and 1,760 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 2020-11-01**

| Week | Best Case (5th Percentile) | Middle Case (50th Percentile) | Worst Case (95th Percentile) |
|---|---|---|---|
| 2020-11-01 | | 1,026* | |
| 2020-11-08 | 1,052 | 1,090 | 1,115 |
| 2020-11-15 | 1,084 | 1,168 | 1,228 |
| 2020-11-22 | 1,120 | 1,257 | 1,372 |
| 2020-11-29 | 1,155 | 1,349 | 1,547 |
| 2020-12-06 | 1,190 | 1,439 | 1,756 |
| 2020-12-13 | 1,221 | 1,527 | 1,992 |

*Last reported deaths count

**6-Week Forecast of Daily Average of Deaths for New Mexico Based on Data as of 2020-11-01**

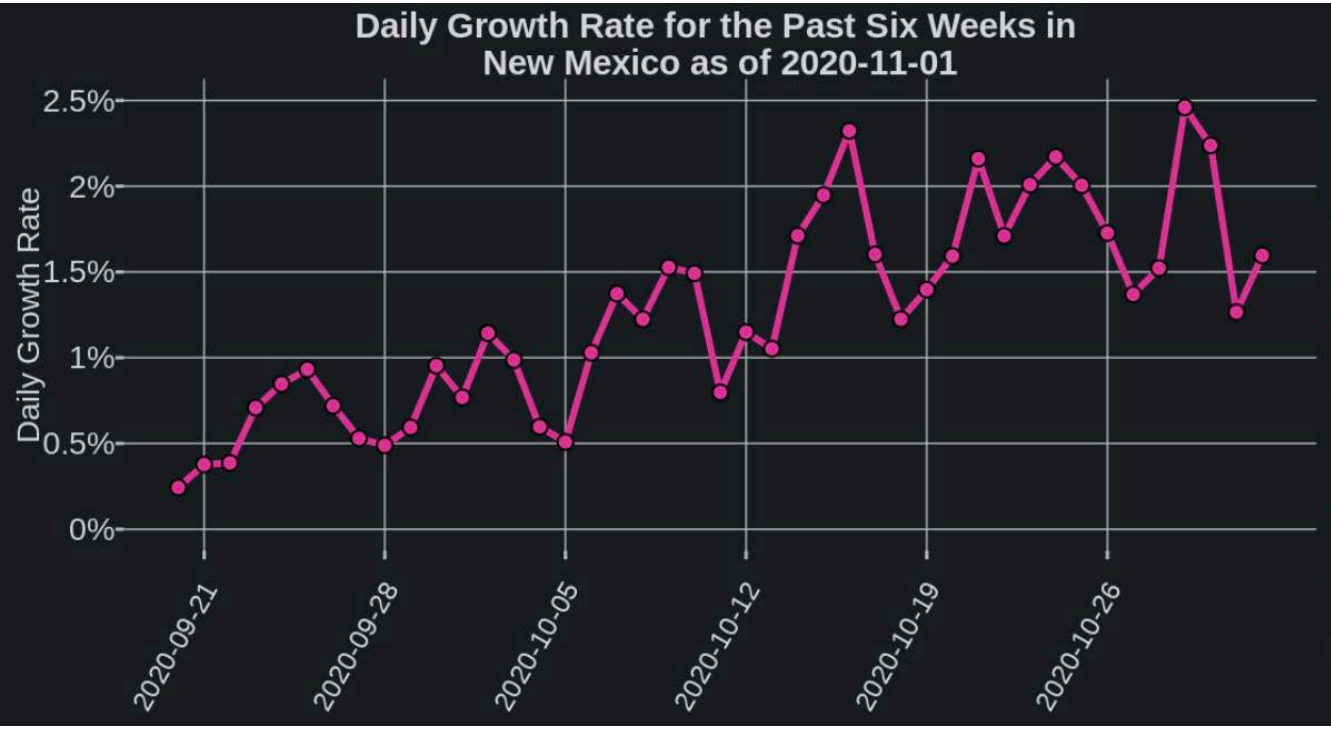
| Week | Best Case (5th Percentile) | Middle Case (50th Percentile) | Worst Case (95th Percentile) |
|---|---|---|---|
| 2020-11-01 | | 8* | |
| 2020-11-08 | 4 | 9 | 13 |
| 2020-11-15 | 5 | 11 | 16 |
| 2020-11-22 | 5 | 13 | 21 |
| 2020-11-29 | 5 | 13 | 25 |
| 2020-12-06 | 5 | 13 | 30 |
| 2020-12-13 | 4 | 13 | 34 |

*Last reported confirmed deaths

**So what?**

**The daily number of deaths are expected to range between 4 and 16 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 2020-11-01

| Week | Best Case (5th Percentile) | Middle Case (50th Percentile) | Worst Case (95th Percentile)^ |
|---|---|---|---|
| 2020-11-01 | | 1.7%* | |
| 2020-11-08 | 1.6% | 2.1% | 2.6% |
| 2020-11-15 | 1.4% | 2.1% | 2.9% |
| 2020-11-22 | 1.2% | 1.9% | 3.0% |
| 2020-11-29 | 1.0% | 1.6% | 3.0% |
| 2020-12-06 | 0.84% | 1.3% | 2.8% |
| 2020-12-13 | 0.74% | 1.2% | 2.3% |

*Last weekly mean daily growth rate

^Closest-matching scenario

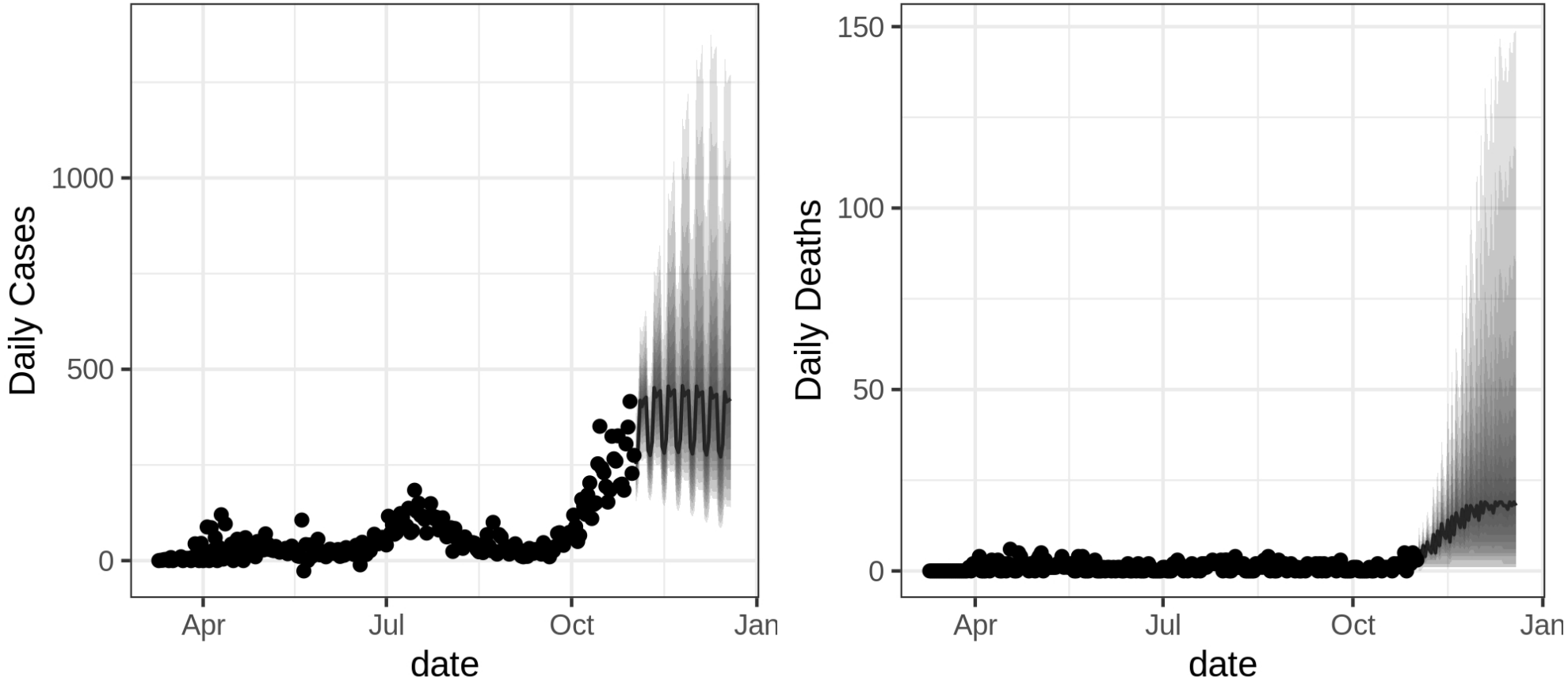
**So what?**

**As of November 10th, the average growth rate in NM is at 1.7% (down from 1.9%)**

# > Regional Forecasts, Growth Rates, & Hospitalizations

# Central Region Forecasts

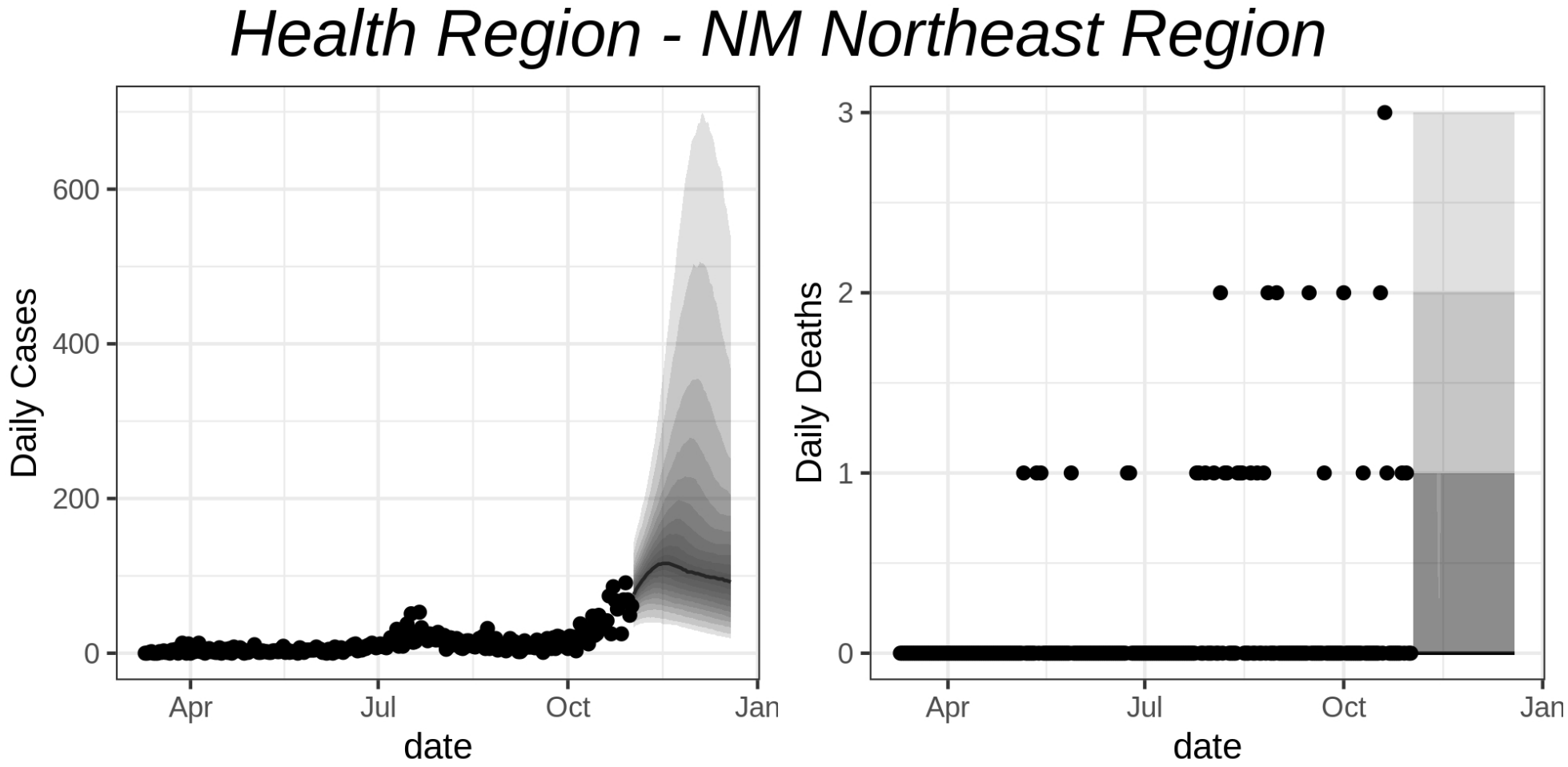
*Health Region - NM Central Region*




**So what?**

**The daily number of cases is expected to range between 350 and 380 in the next six weeks**

# Northeast Region Forecasts

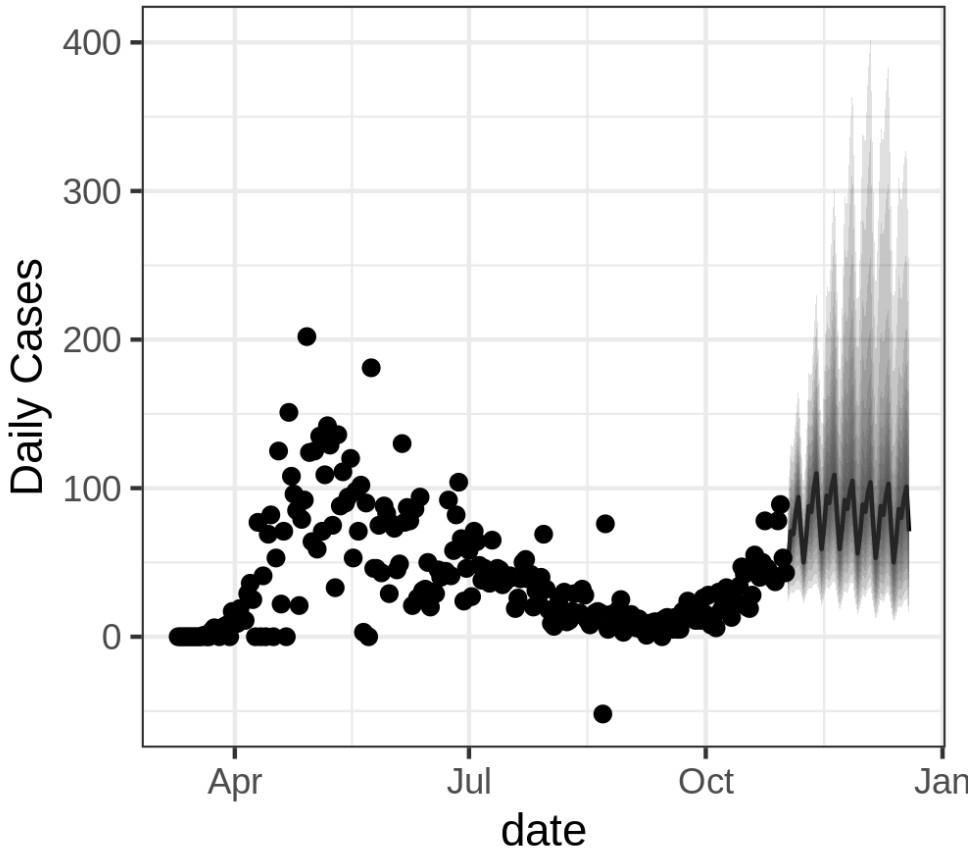


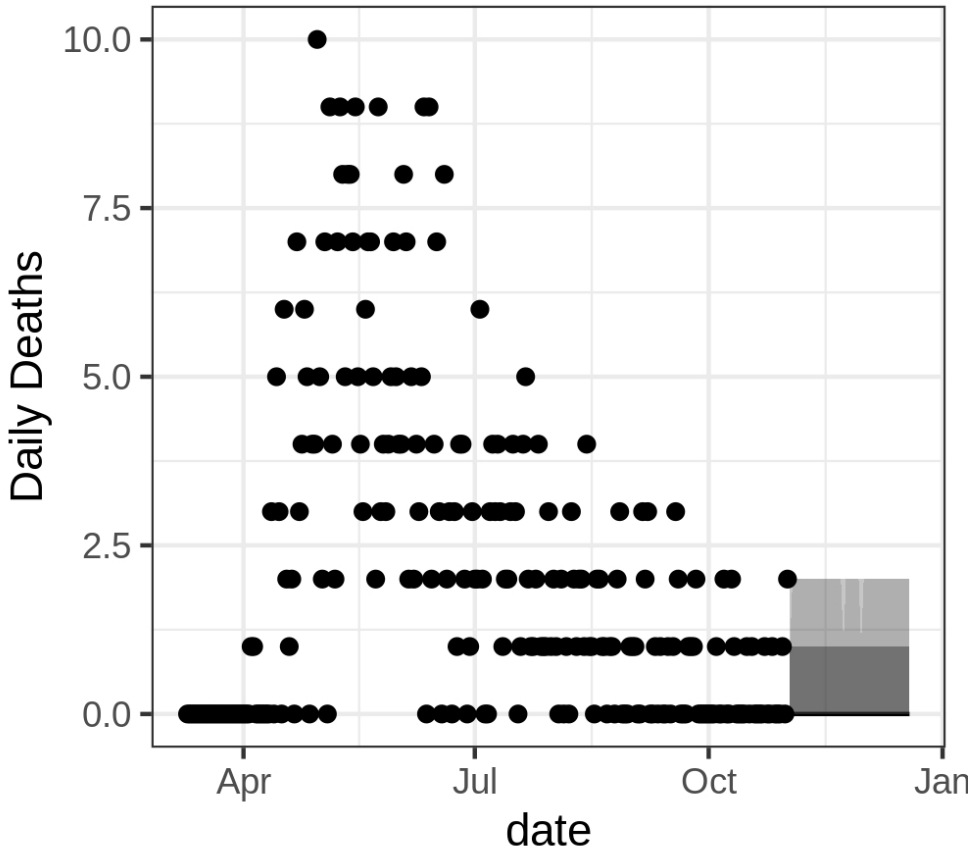

**So what?**

**The daily number of cases is expected to range between 80 and 115 in the next six weeks**

# Northwest Region Forecasts

*Health Region - NM Northwest Region*

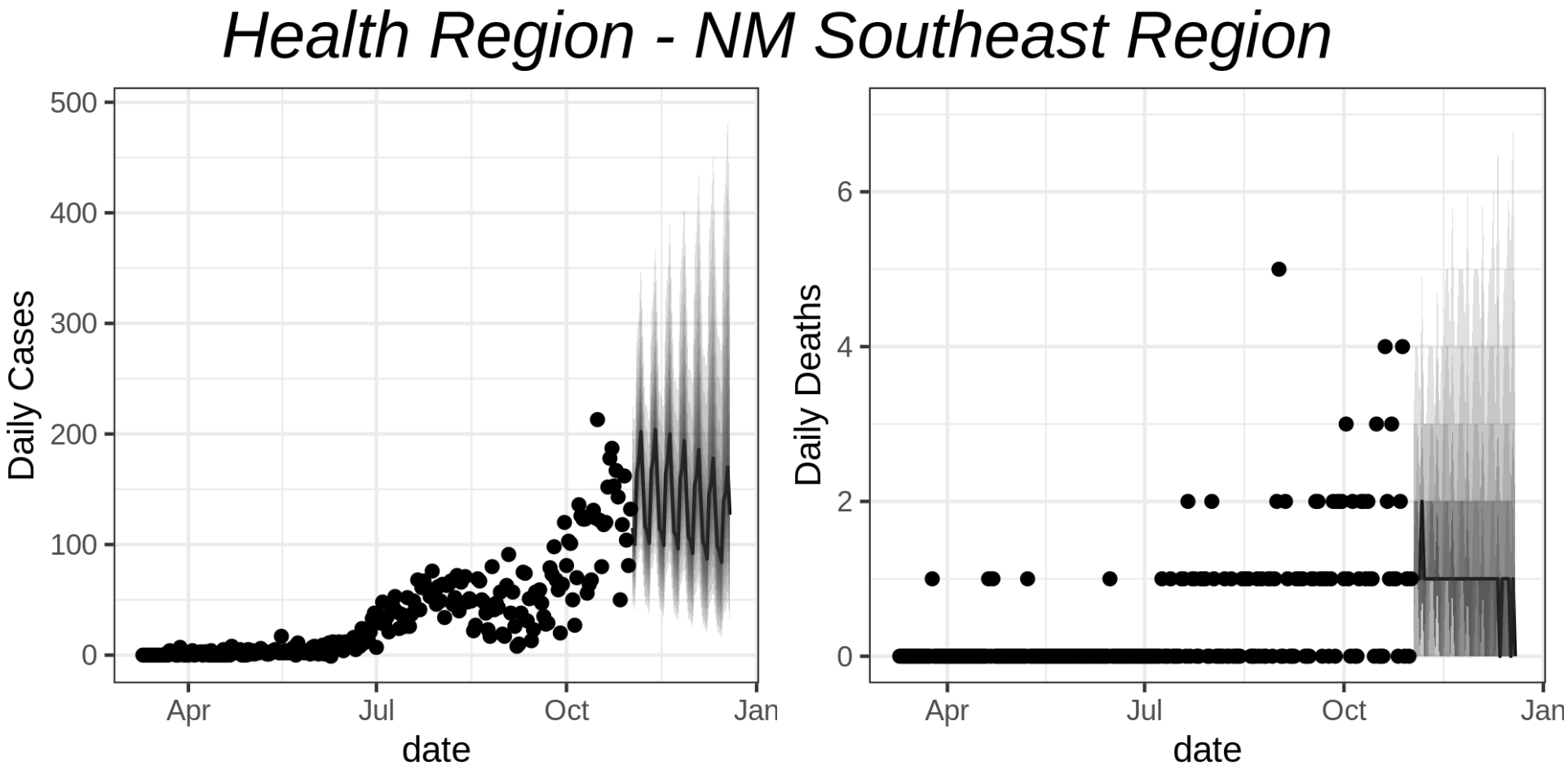



**So what?**

**The daily number of cases is expected to range between 70 and 90 in the next six weeks**

# Southeast Region Forecasts

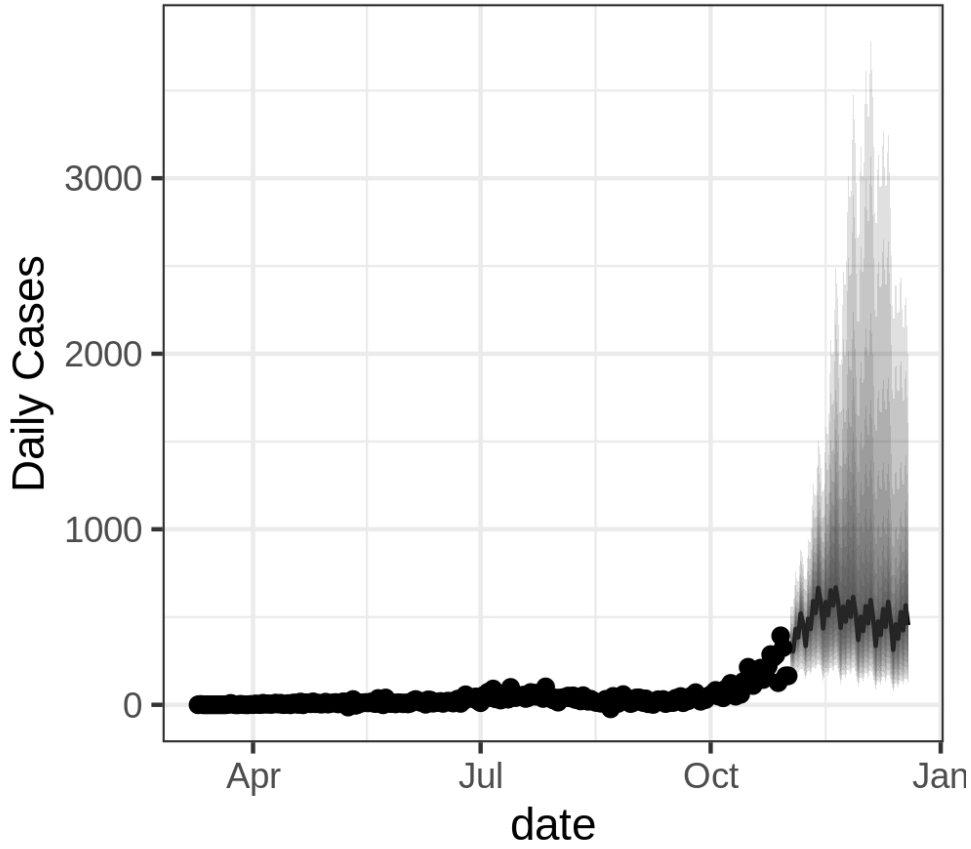


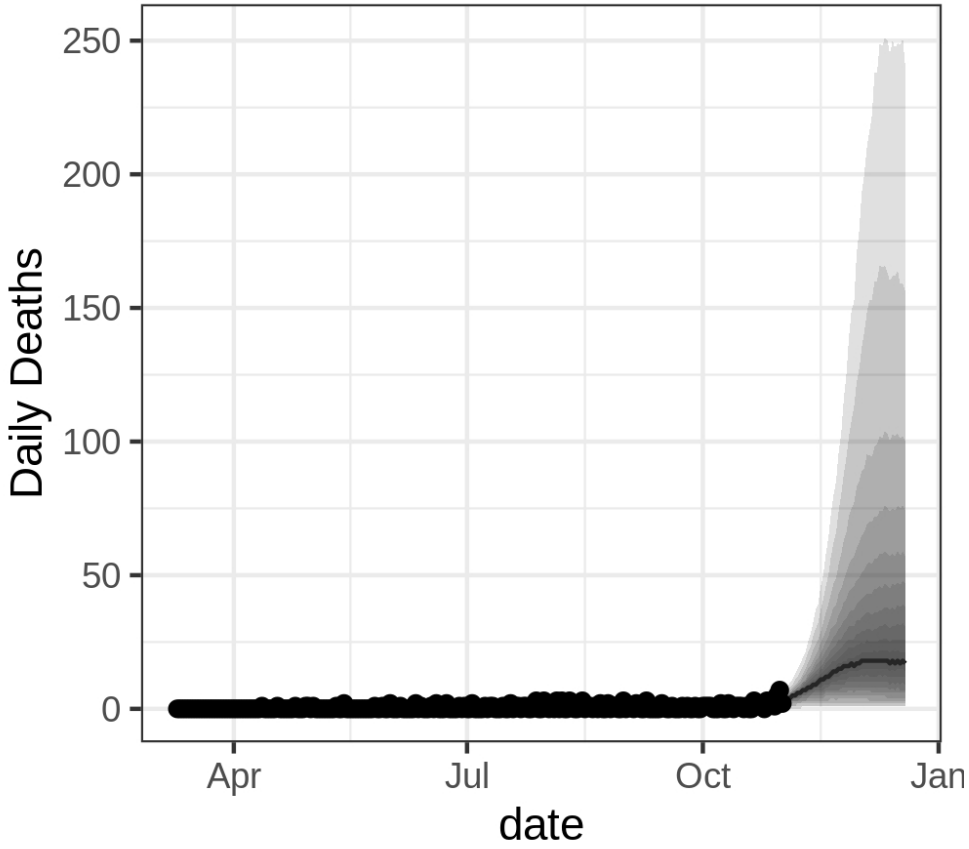

**So what?**

**The daily number of cases is expected to range between 130 and 150 in the next few weeks**

# Southwest Region Forecasts

*Health Region - NM Southwest Region*

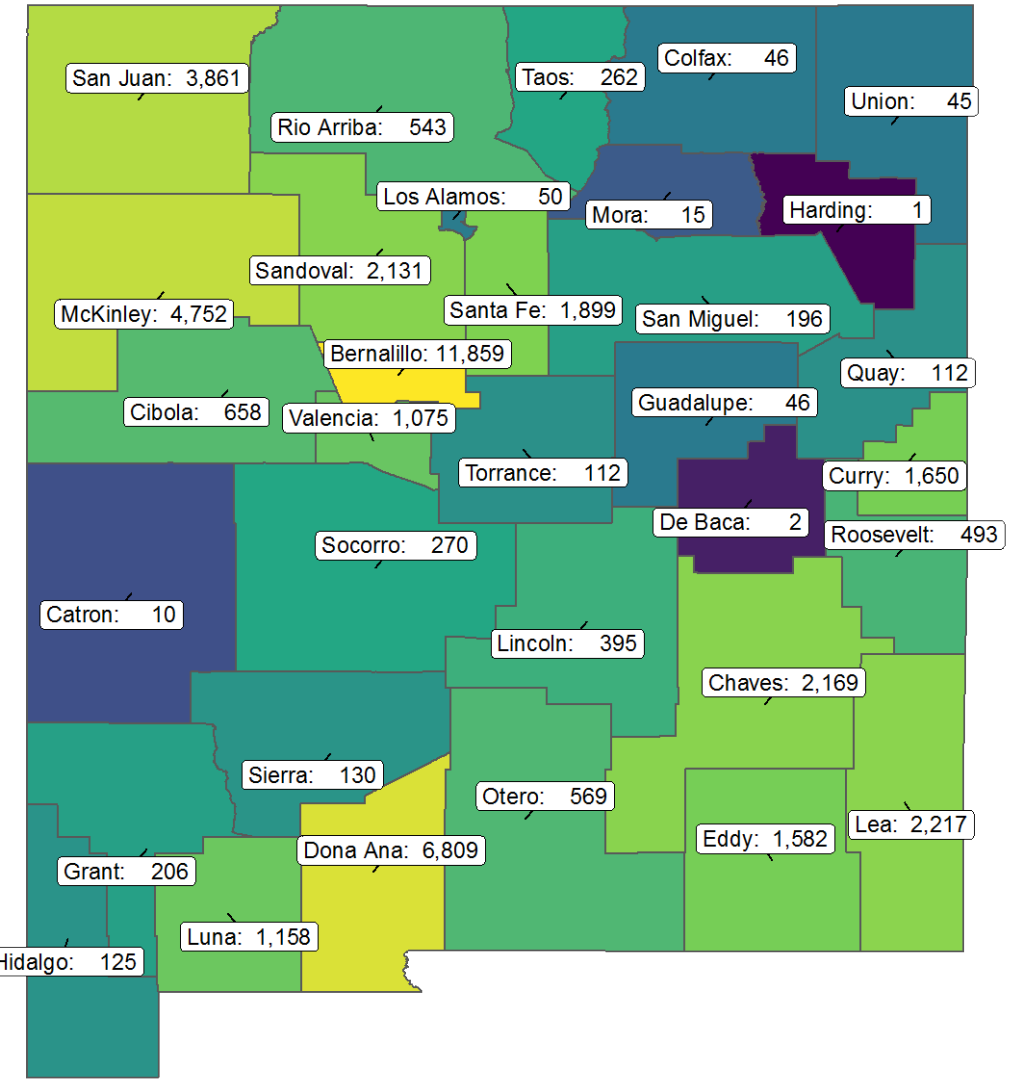


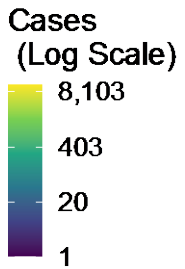



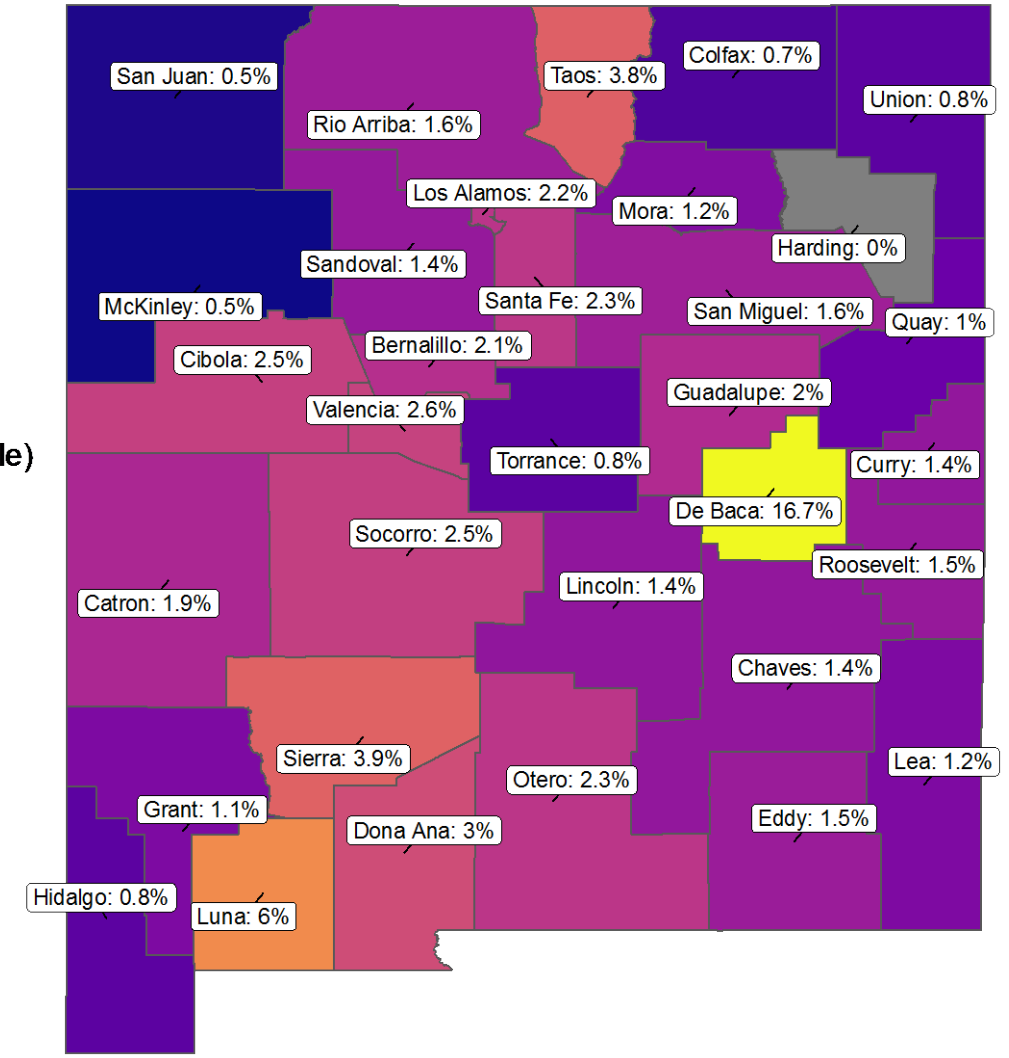

**So what?**

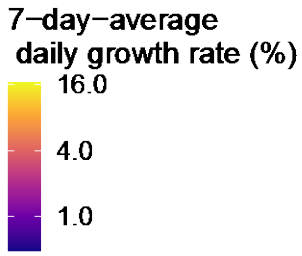
**The daily number of cases are expected to range between 370 and 600 for the middle case scenario**

# Cumulative Cases & Daily Growth Rate for NM: Nov 2

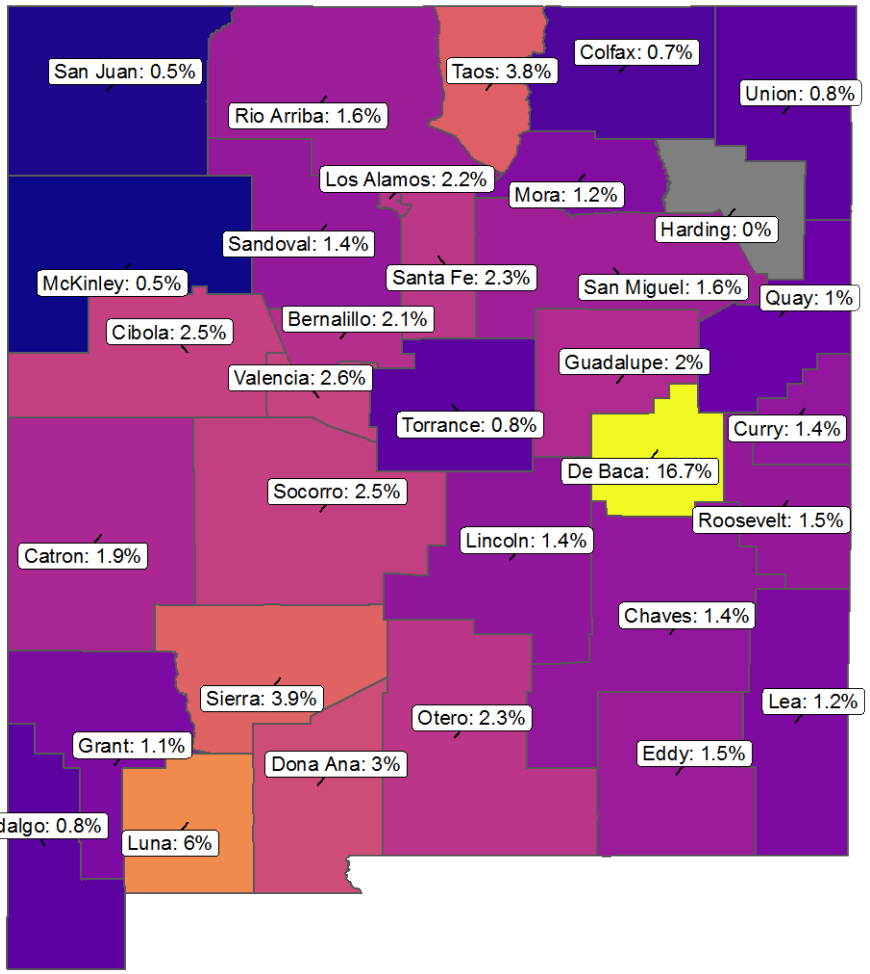


# Daily Growth Rate for NM Nov 2




Union 0.8% =
**Mora 1.2%** ↓
Colfax 0.7% ↓
Roosevelt **1.5%** ↓
Socorro **2.5%** ↓
Quay **1.0%** ↓

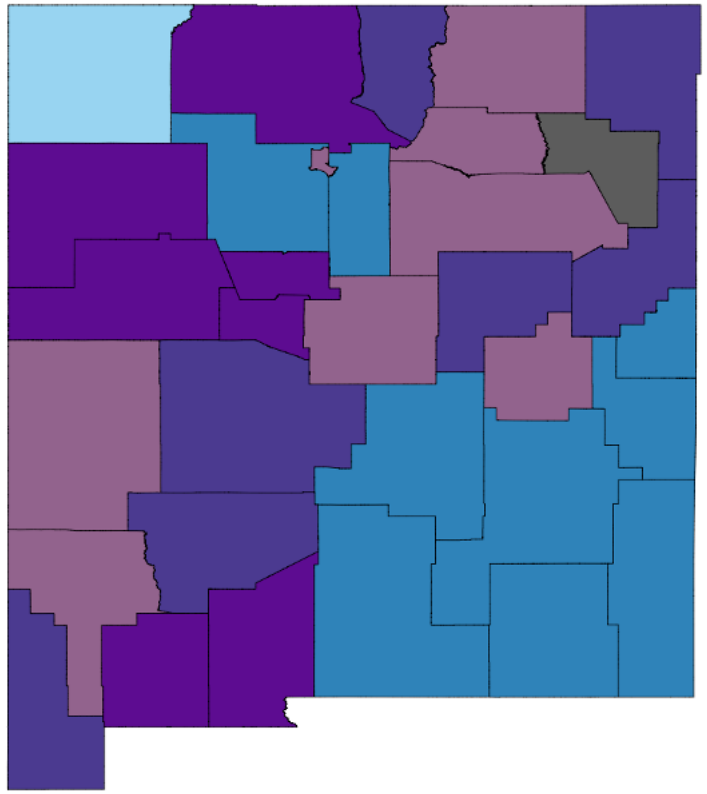
*arrows indicate more than 0.5% difference in growth rate from last week's analysis

Hidalgo 0.8% ↑
DeBaca 16.7% ↑
Catron 1.9% ↑
**Los Alamos 2.2%** ↑

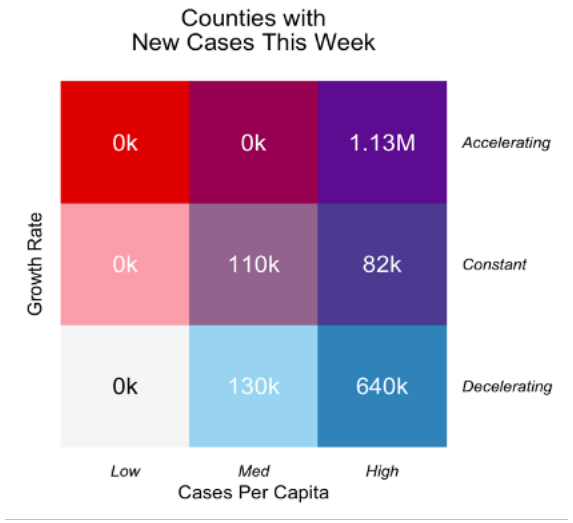
| County | Daily Growth Rate | Change |
|---|---|---|
| San Juan | 0.5% | = |
| Rio Arriba | **1.6%** | = |
| **Sierra** | **3.9%** | ↑ |
| McKinley | 0.5% | = |
| Sandoval | **1.4%** | = |
| Santa Fe | **2.3%** | = |
| **Cibola** | **2.5%** | ↑ |
| Bernalillo | **2.1%** | = |
| Valencia | **2.6%** | = |
| Torrance | 0.8% | = |
| Lincoln | **1.5%** | ↓ |
| San Miguel | **1.6%** | ↓ |
| Chaves | **1.4%** | = |
| Dona Ana | 3.0% | ↑ |
| Otero | **2.3%** | ↓ |
| Lea | **1.2%** | ↓ |
| Eddy | **1.5%** | ↓ |
| Curry | **1.4%** | ↓ |
| Grant | **1.1%** | ↓ |
| **Luna** | **6.0%** | ↑ |
| **Taos** | **3.8%** | ↑ |

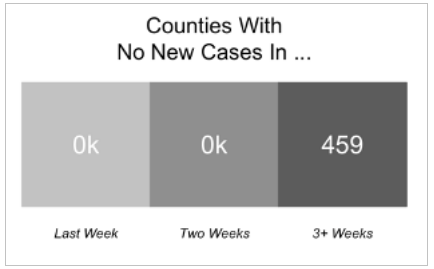
# Growth Rate for NM: Another View (Nov 2)

**COVID-19 across New Mexico**
*A 7-day moving window comparison*
*November 2, 2020*



Impacted New Mexicans



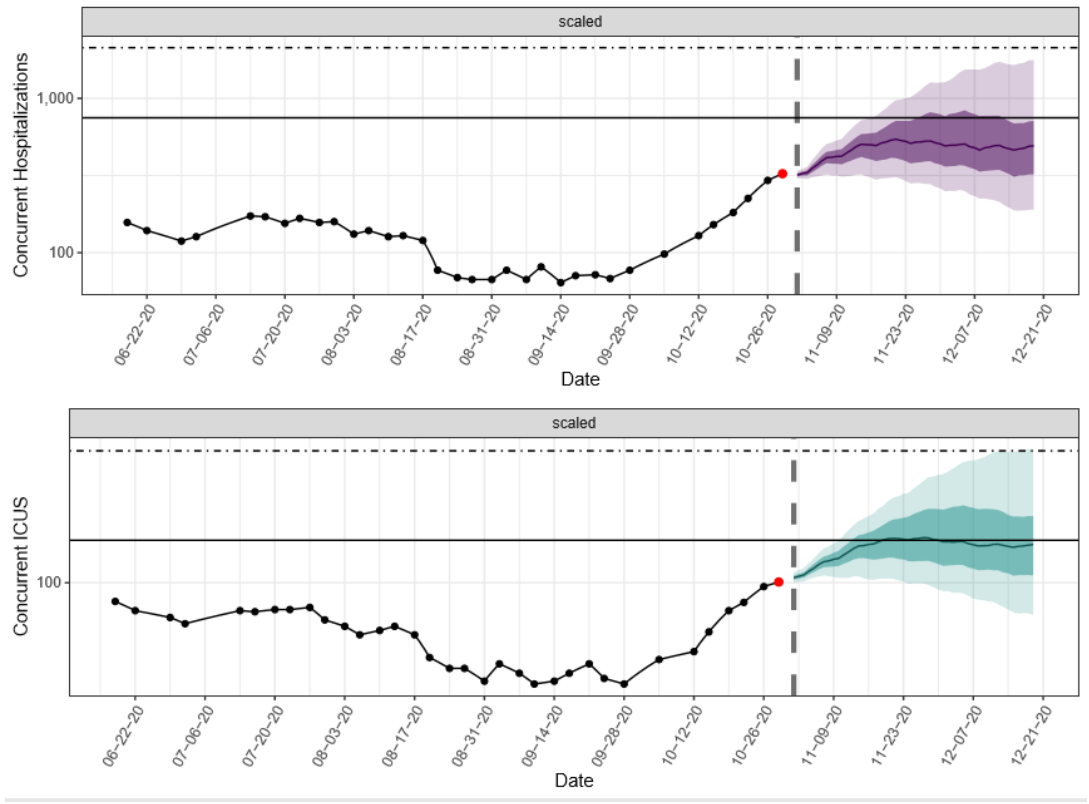

## So what?

- **MOST New Mexicans live in a county with currently <u>accelerating growth and high per-capita case counts</u>**
- **The rest of New Mexicans are living in a county with decelerating growth but high per-capita case counts**

Number of New Mexicans living in regions with particular combinations of per capita case counts and 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

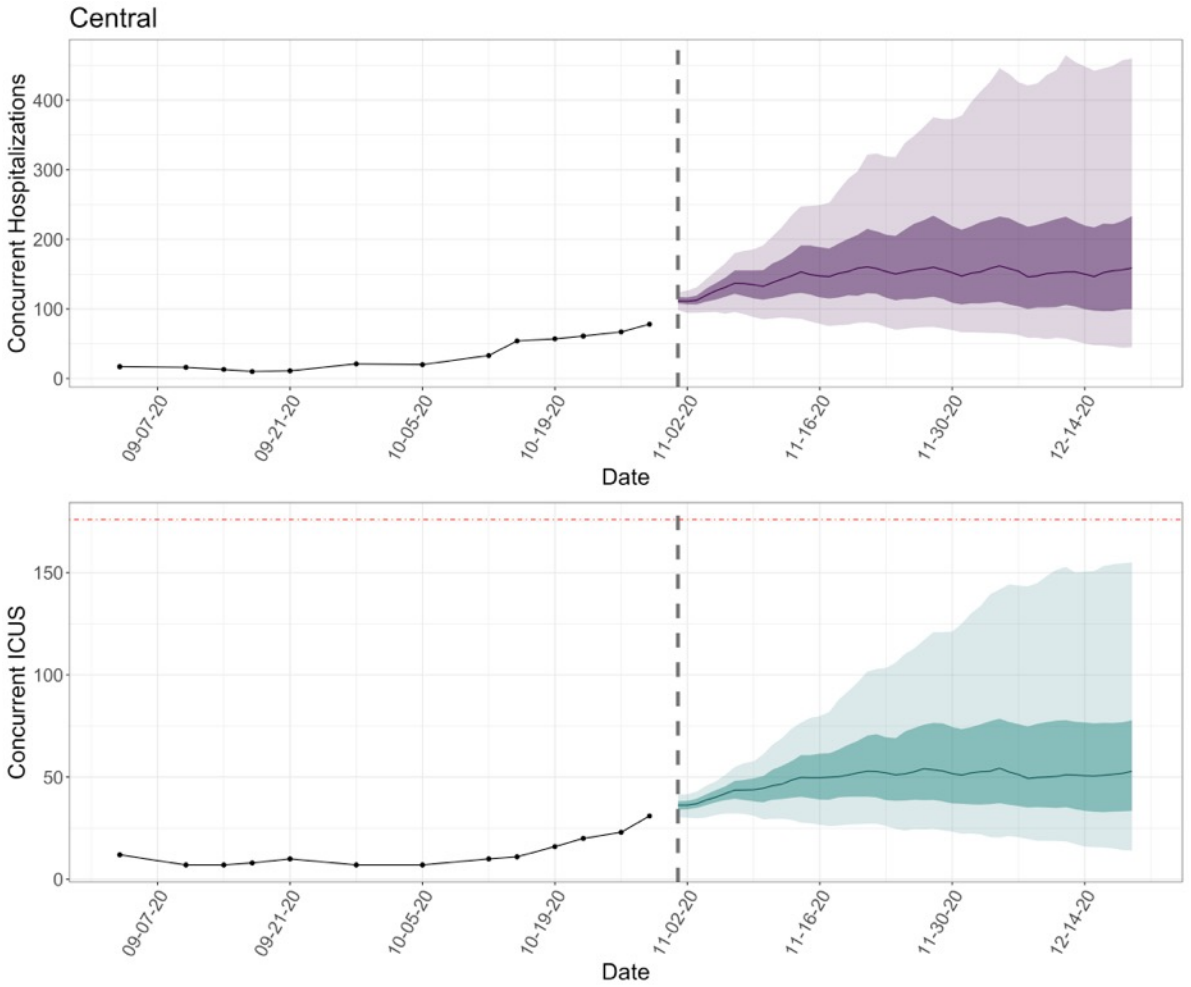
| Week | Qu. 5% (best case) | Qu. 50% (median) | Qu. 95% (worst case) |
|---|---|---|---|
| 11/8 | 108 | 133 | 161 |
| 11/15 | 105 | 163 | 233 |
| 11/22 | 102 | 179 | 315 |
| 11/29 | 93 | 177 | 410 |
| 12/6 | 83 | 167 | 504 |
| 12/13 | 72 | 163 | 569 |

"Scaled" Scenario

## So what?

**We are on track to *exceed ICU beds by mid-November.* We expect to be over for 2 weeks. This is using the updated LANL forecasting model COFFEE.**

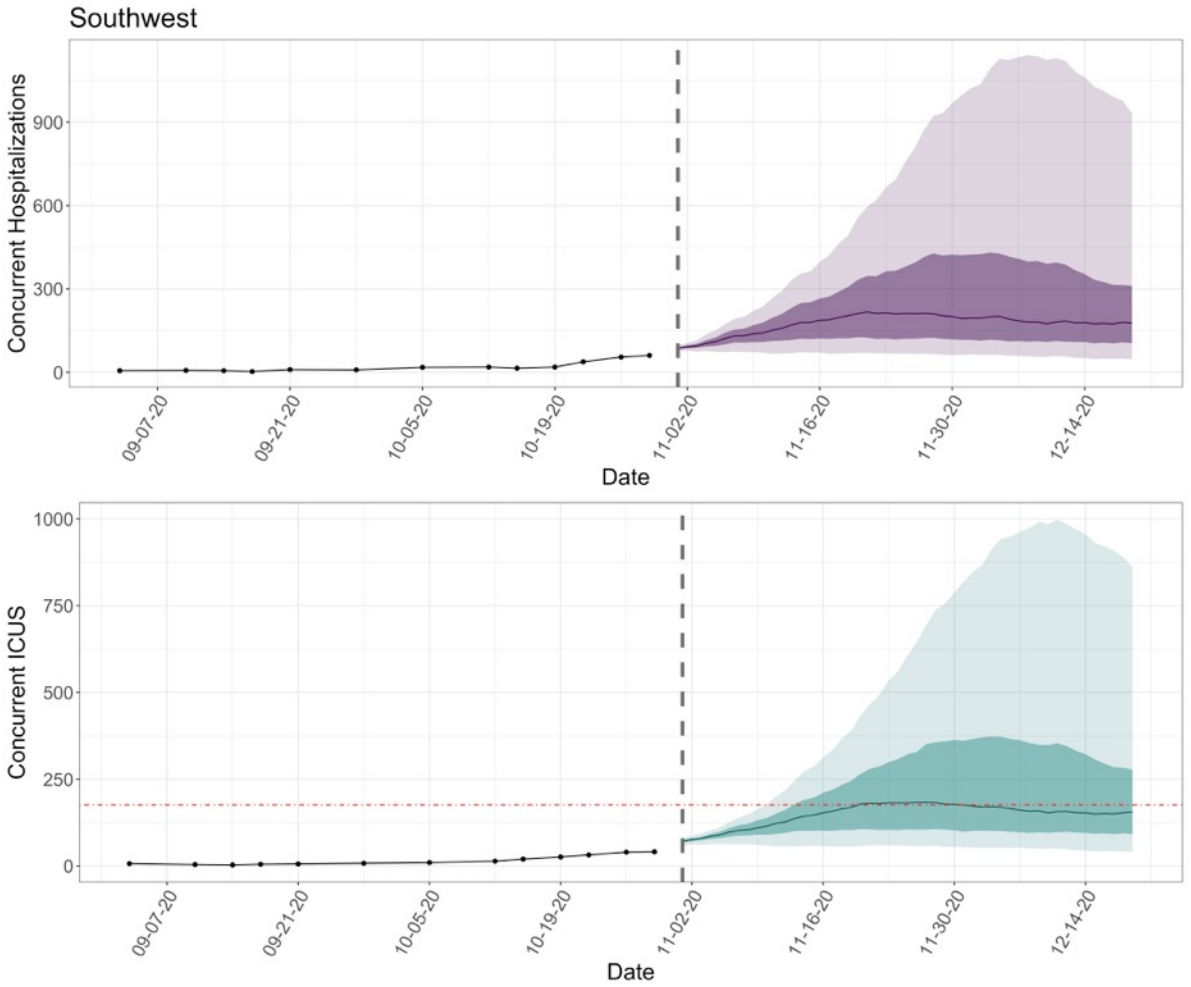
# Regional Hospitalization Forecasts: Central




## Concurrent COVID-19 ICUs beds: Central

| Week | Qu. 5% (best case) | Qu. 50% (median) | Qu. 95% (worst case) |
|---|---|---|---|
| 11/8 | 32 | 44 | 57 |
| 11/15 | 27 | 50 | 79 |
| 11/22 | 27 | 53 | 103 |
| 11/29 | 24 | 53 | 121 |
| 12/6 | 21 | 53 | 144 |
| 12/13 | 17 | 51 | 150 |

# Regional Hospitalization Forecasts: Southwest



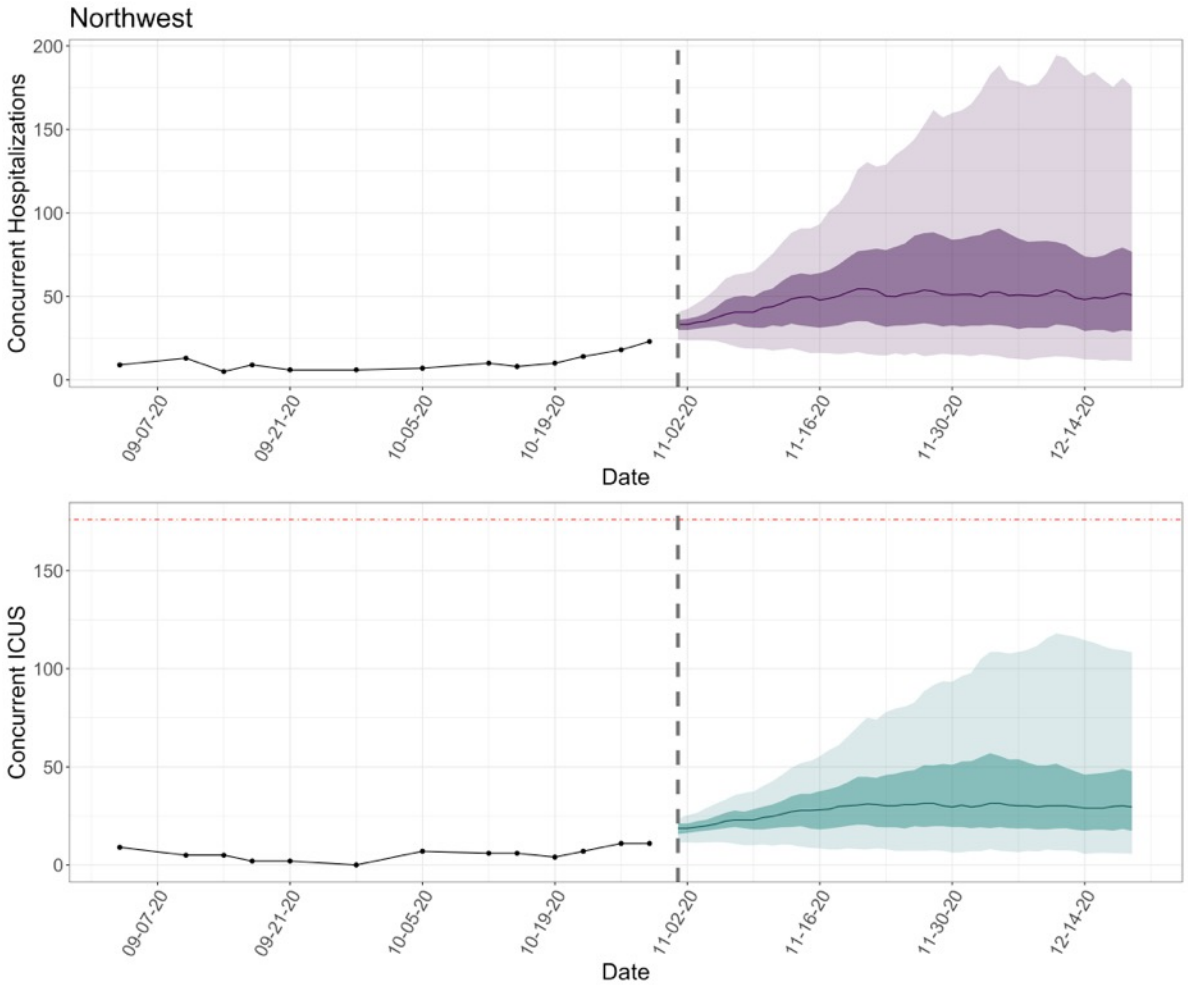

## Concurrent COVID-19 ICUs beds: Southwest

| Week | Qu. 5% (best case) | Qu. 50% (median) | Qu. 95% (worst case) |
|---|---|---|---|
| 11/8 | 63 | 105 | 149 |
| 11/15 | 59 | 147 | 287 |
| 11/22 | 60 | 180 | 493 |
| 11/29 | 55 | 178 | 756 |
| 12/6 | 52 | 166 | 948 |
| 12/13 | 45 | 154 | 970 |

## So what?

- **Southwest region has the most uncertainty in predicted hospitalizations; this depends on if the epidemic will slow down in the next week or two and the ongoing hospitalization rate**

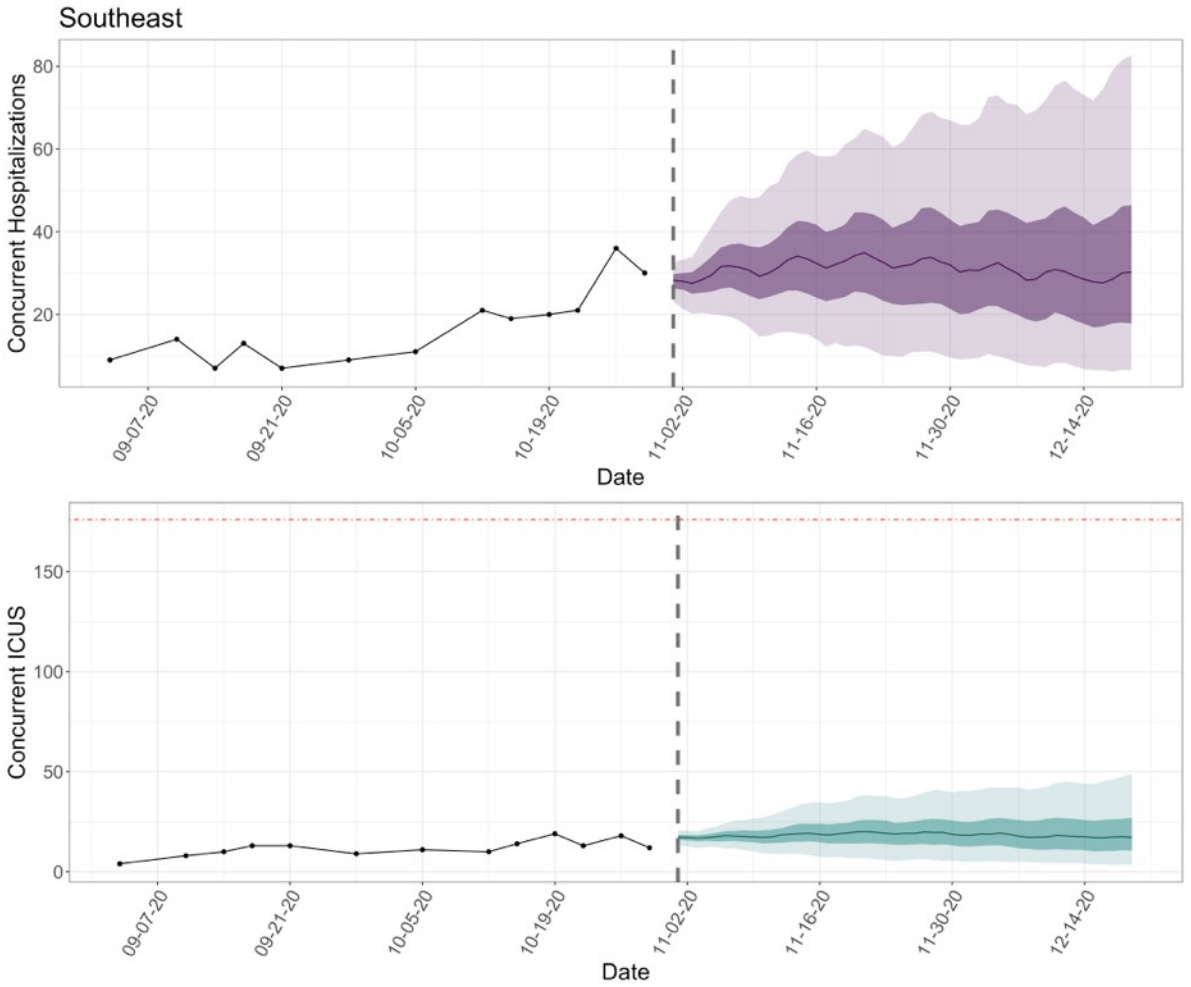
# Regional Hospitalization Forecasts: Northwest




## Concurrent COVID-19 ICUs beds: Northwest

| Week | Qu. 5% (best case) | Qu. 50% (median) | Qu. 95% (worst case) |
|---|---|---|---|
| 11/8 | 10 | 23 | 37 |
| 11/15 | 9 | 28 | 53 |
| 11/22 | 8 | 31 | 74 |
| 11/29 | 7 | 30 | 94 |
| 12/6 | 7 | 31 | 108 |
| 12/13 | 7 | 30 | 116 |

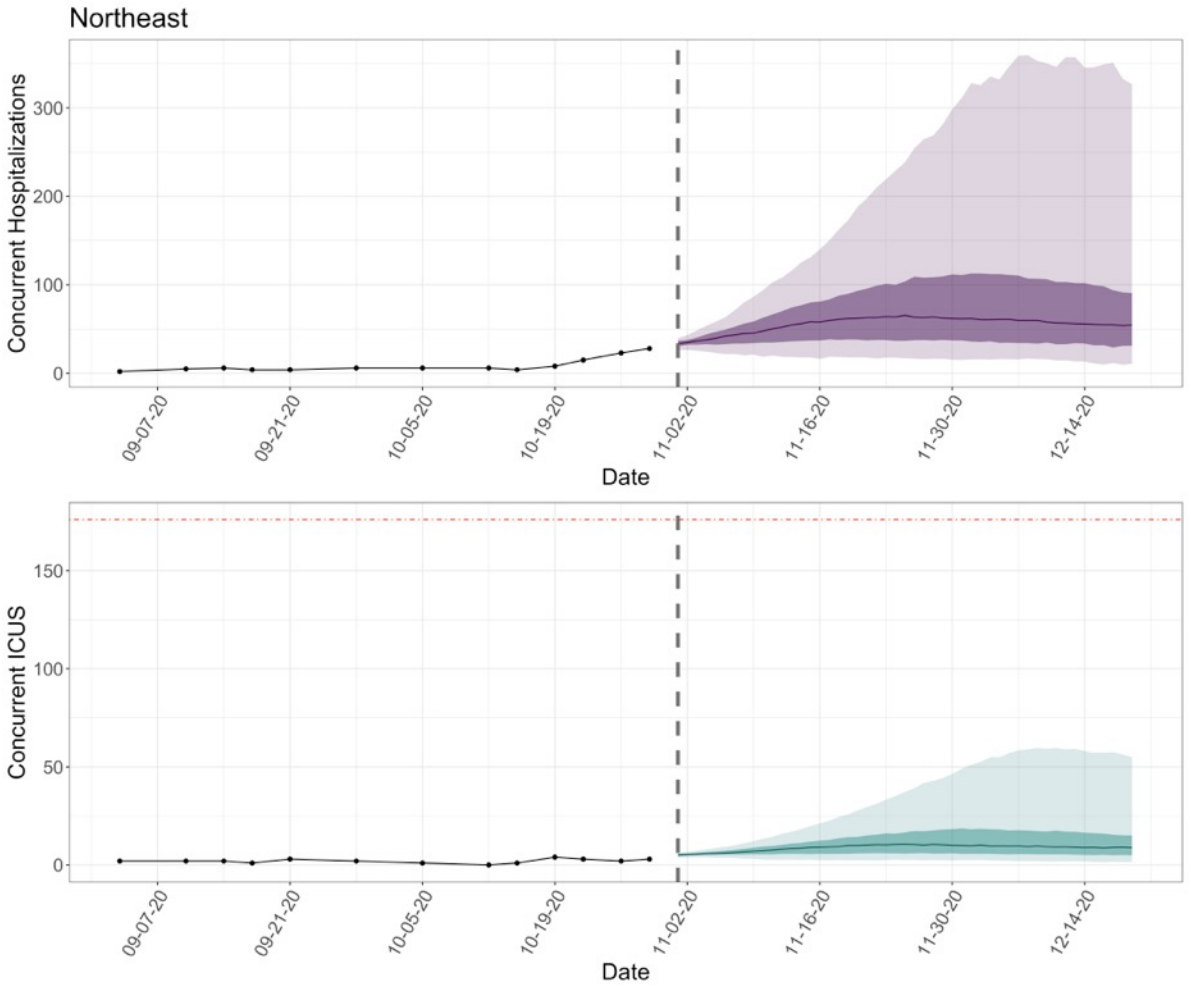
# Regional Hospitalization Forecasts: Southeast




## Concurrent COVID-19 ICUs beds: Southeast

| Week | Qu. 5% (best case) | Qu. 50% (median) | Qu. 95% (worst case) |
|---|---|---|---|
| 11/8 | 11 | 18 | 26 |
| 11/15 | 8 | 19 | 35 |
| 11/22 | 6 | 20 | 38 |
| 11/29 | 6 | 20 | 41 |
| 12/6 | 5 | 19 | 42 |
| 12/13 | 4 | 18 | 45 |

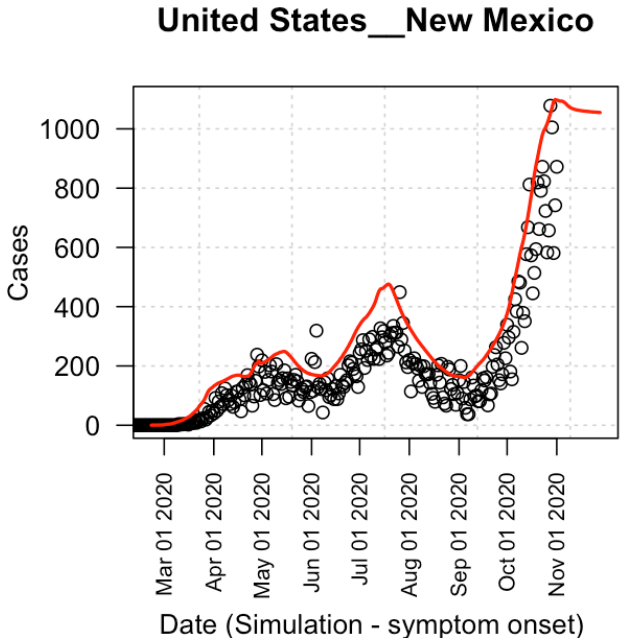
# Regional Hospitalization Forecasts: Northeast




## Concurrent COVID-19 ICUs beds: Northeast

| Week | Qu. 5% (best case) | Qu. 50% (median) | Qu. 95% (worst case) |
|---|---|---|---|
| 11/8 | 3 | 7 | 11 |
| 11/15 | 3 | 9 | 20 |
| 11/22 | 2 | 10 | 31 |
| 11/29 | 2 | 10 | 44 |
| 12/6 | 2 | 10 | 57 |
| 12/13 | 2 | 9 | 59 |

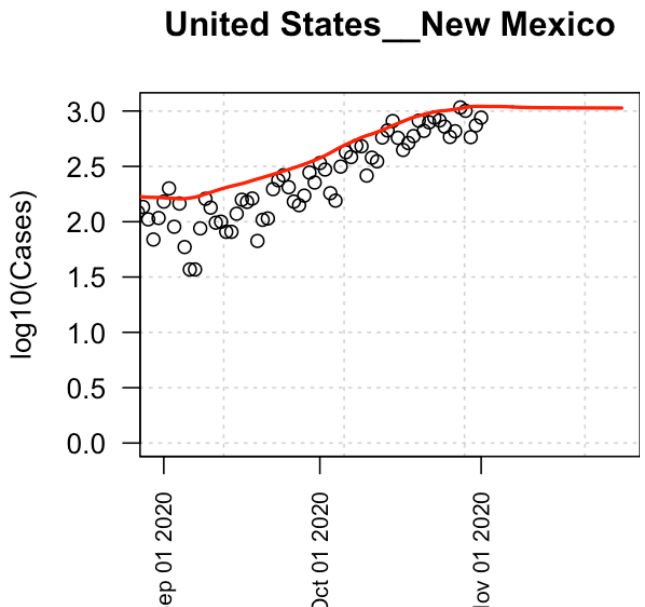
# 03 Nov 2020: EpiGrid modeling

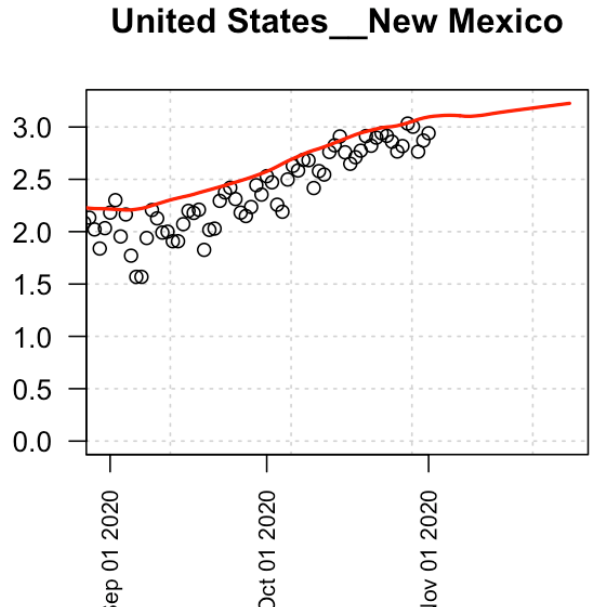


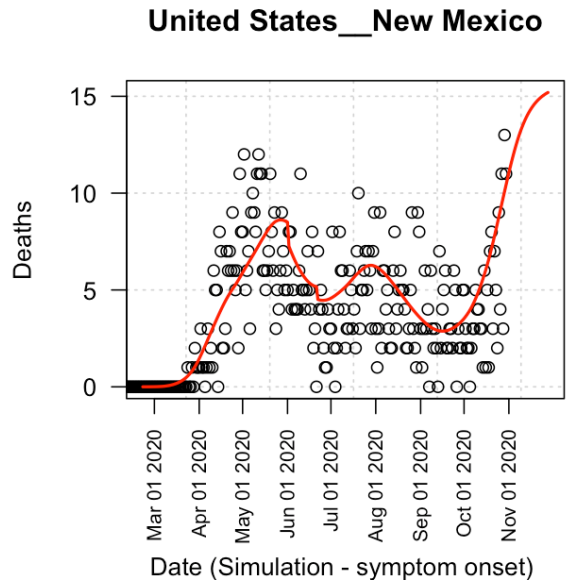

This model may be slightly optimistic about the future, because this week's low mobility continues.

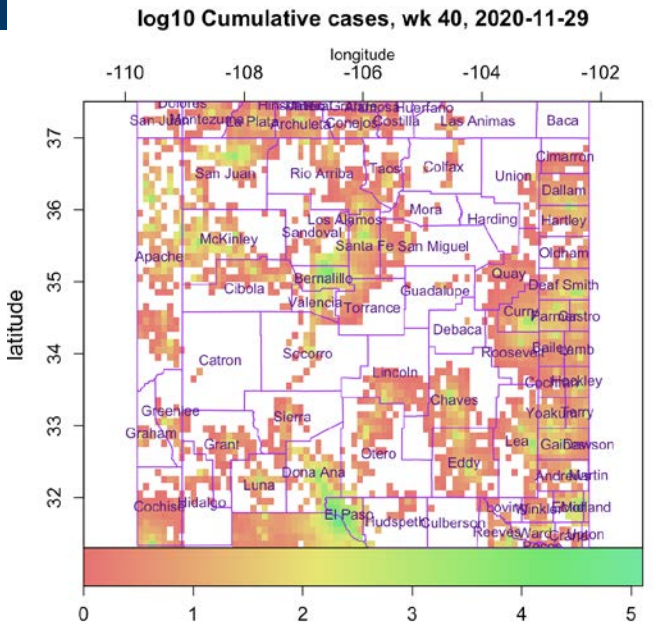
Thanksgiving is not yet being modeled.

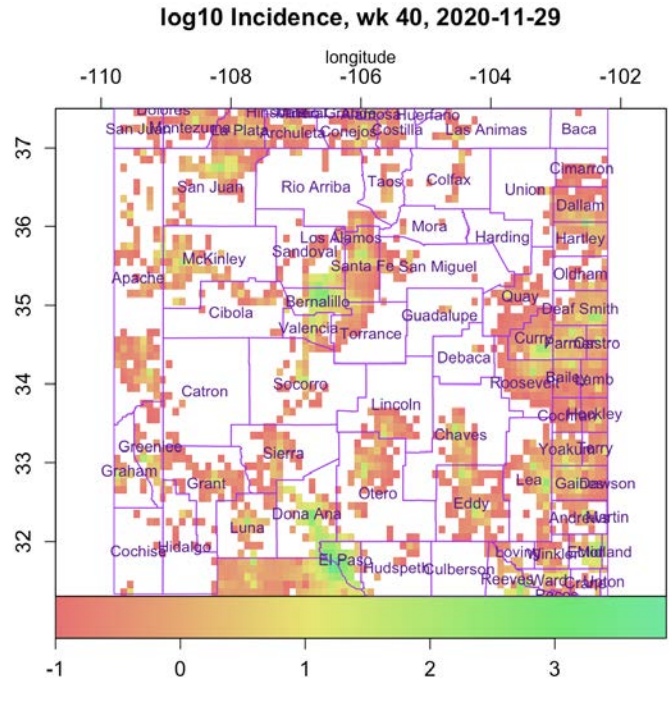
- Lower left is continued low mobility
- Lower middle time series is rebounding mobility
- Lower right time series is mortality with low mobility



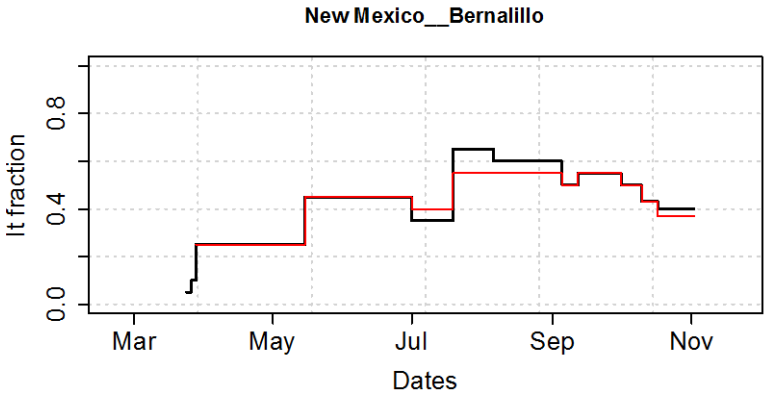



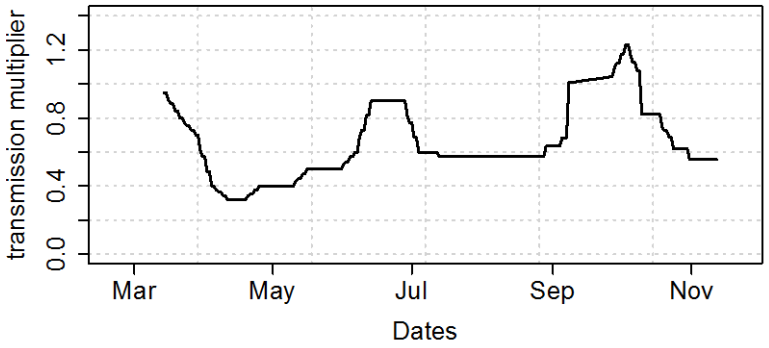
# This week's model is quite similar to last week

- **A significant model change is that the stay-at-home order in El Paso is taking longer to lower the force of infection that previously modeled.**
- **The observed state-wide drops in mobility – especially over the last week – have significant effects. This may be a consequence of the snow storm, October 25-27, 2020.**
- **Small model changes reduce the "unexplained" (i.e. behavioral) transmission increases in Bernalillo and Santa Fe counties.**
- **Modeling of public health orders is unchanged from last week.**
- **Isolation and quarantine rates are still assumed to be low as a consequence of tracing overload and testing rates being insufficient for excellent situational awareness.**
- **Deaths rates are adjusted over time and are geographically dependent (e.g. McKinley and San Juan have higher death rates, all change with time). ~4% in March, now 1.3%-3% by geography ("case-multiplier" in other models, differs from 2.2% CFR).**

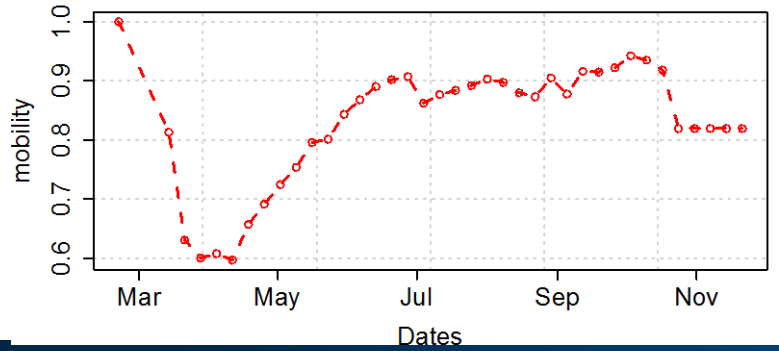
# Quarantine and transmission control the epidemic: Bernalillo




"$I_t$ fraction" is the fraction of contagious people early in their disease progression who are quarantining. Quarantine generally goes up with time, but decreases when (i) case counts are high and (ii) time from positivity to contact quarantine are long (NM State data). The Black curve shows Bernalillo. The red curve is the state-wide default.

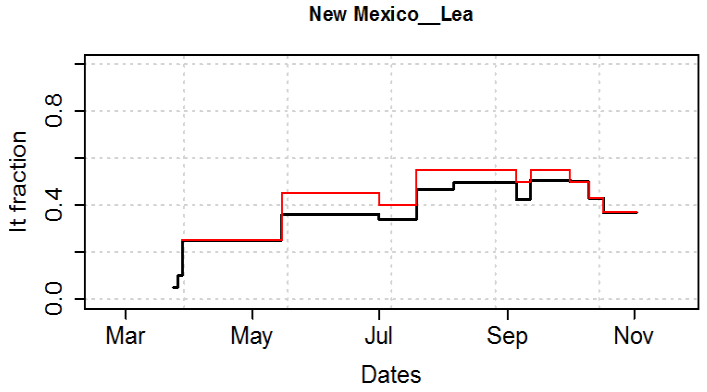



Smaller transmission multipliers result in less transmission. The transmission multiplier depends primarily on in-county mobility and varies due to other factors driven by, esp. public health orders (i.e. behavior).

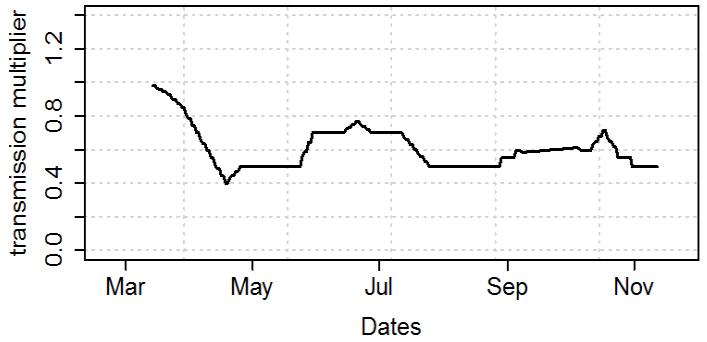



The red curve shows weekly averaged mobility for Bernalillo county, which is the primary model driver for the transmission multiplier above.

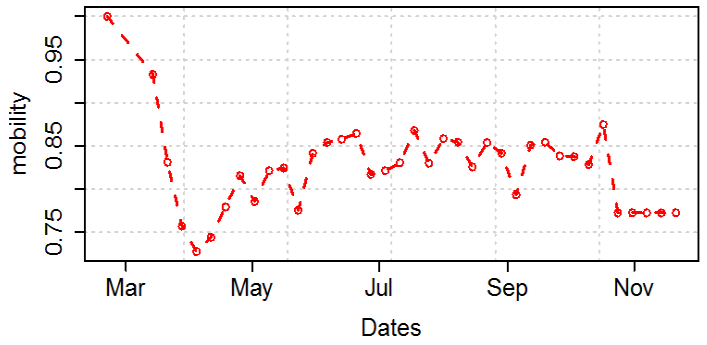
# Quarantine and transmission control the epidemic: Lea County




"$I_t$ fraction" is the fraction of contagious people early in their disease progression who are quarantining. The Black curve shows Lea County. The red curve is the state-wide default. Quarantine is modeled lower in Lea county to reflect high test positivity and associated degradation of situational awareness.



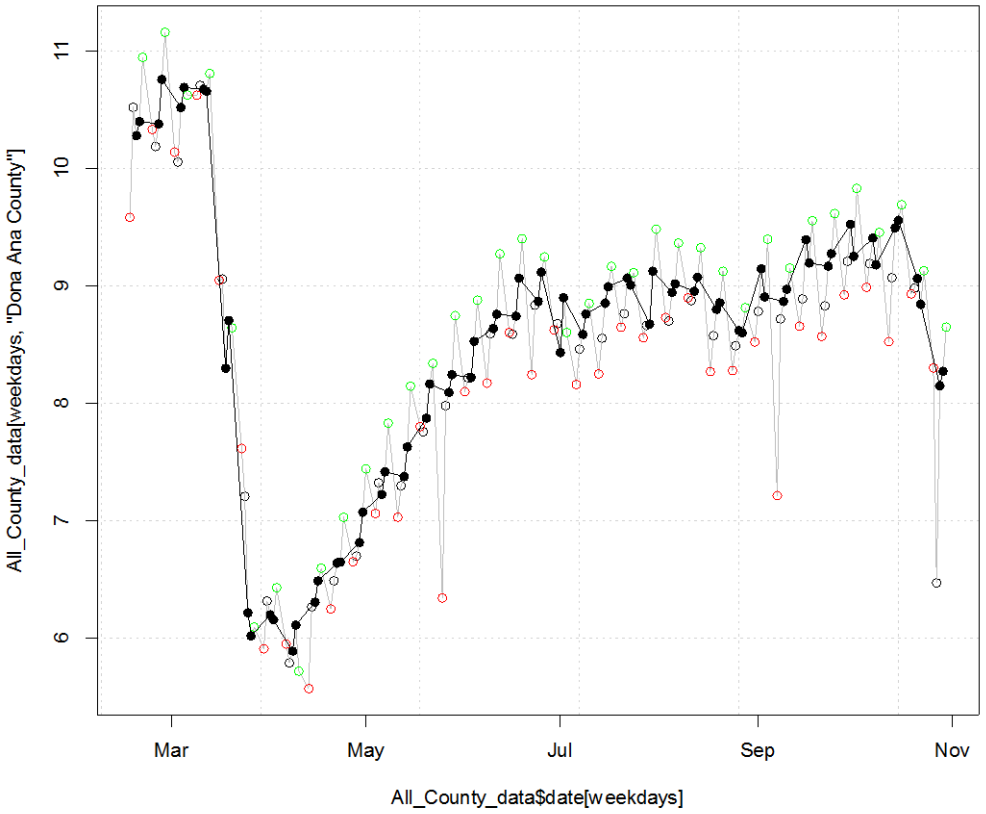

Transmission mostly tracks mobility, although there was a peek in transmission in early summer.




The red curve shows weekly averaged mobility for Lea County, which is the primary model driver for the transmission multiplier above.

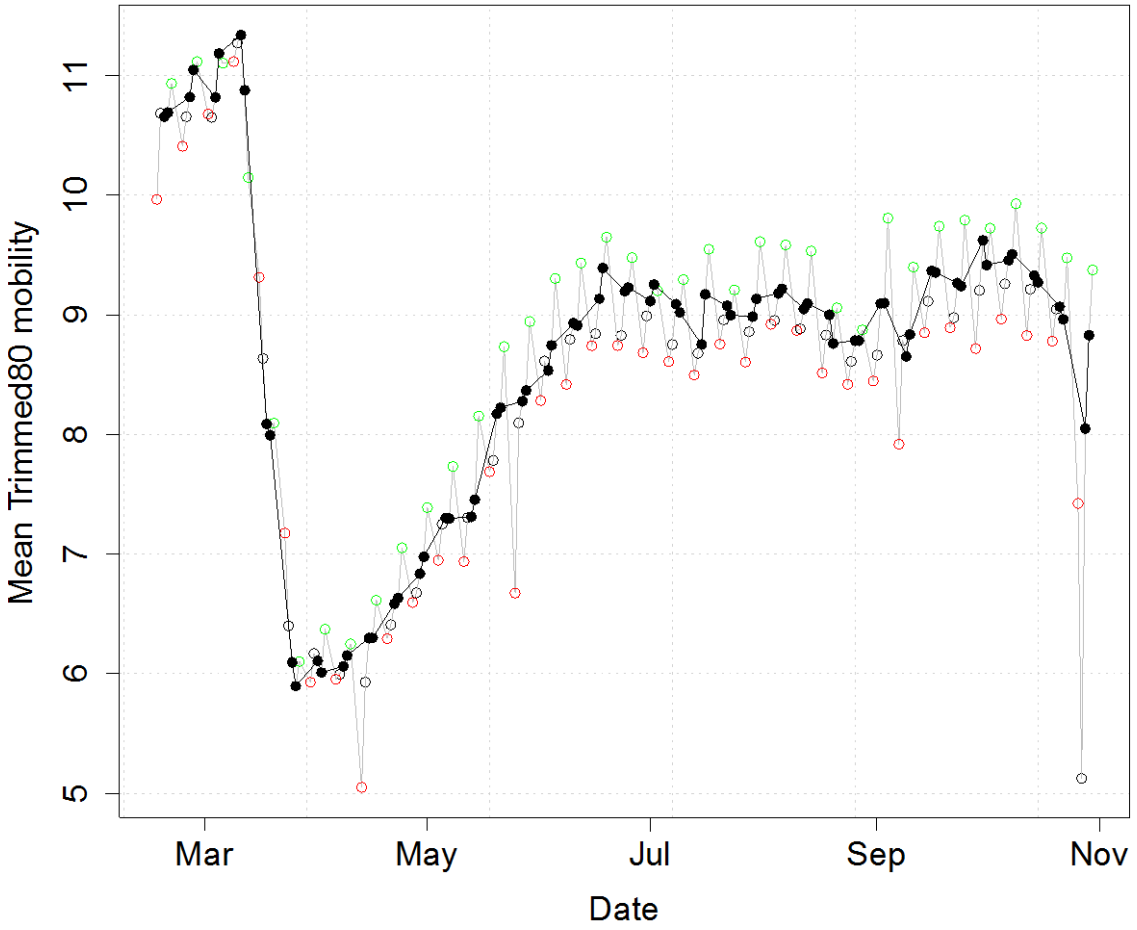
# October 25-27, 2020 snow storm lowered mobility

- Mobility in Dona Ana county stayed low.




Most other counties appear to be returning to pre-storm mobility; exception Taos

- Average mobility for the 4 most populous counties: Bernalillo, Dona Ana, Santa Fe, Sandoval.
  - Weekends NOT shown
  - Monday
  - Wednesday/Thursday
  - Friday



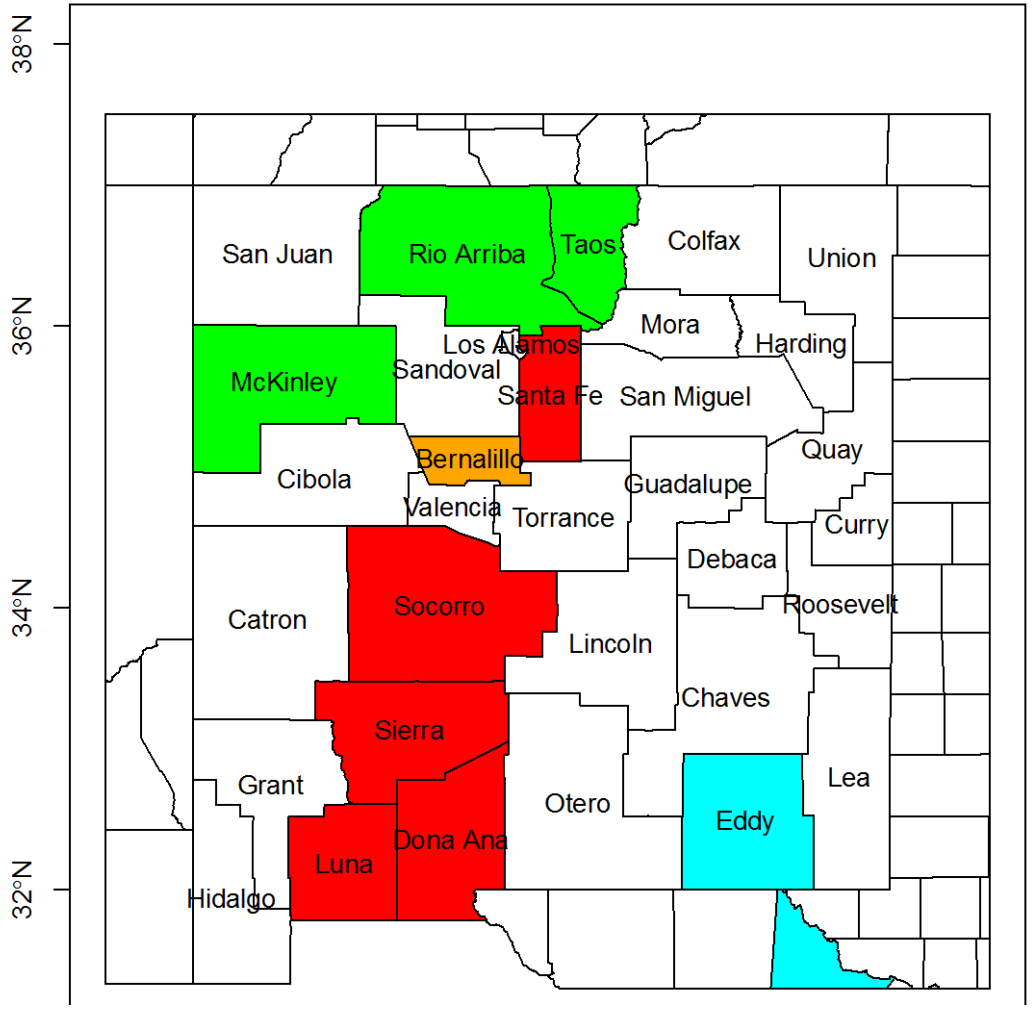
# Test positivity rates are very high in some counties

- **Positivity over the past week** **(from Covid ActNow https://www.covidactnow.org/us/new_mexico-nm?s=1170284)**
  - Luna ~ 21%
  - Lea ~ 16%
  - Dona Ana ~15%
  - Curry ~ 14%
  - Eddy ~ 13%
  - Roosevelt ~12%
  - Socorro ~11%
  - Chaves ~ 11%
  - Lincoln ~11%

- **Under-reporting/diagnosis of cases is very likely higher than expected in high-test positivity counties. (This creates the possibility of model bias toward less severe epidemics in the parameterization of those counties in EpiGrid with a >2 week lag until hospitalization and deaths are recorded.)**

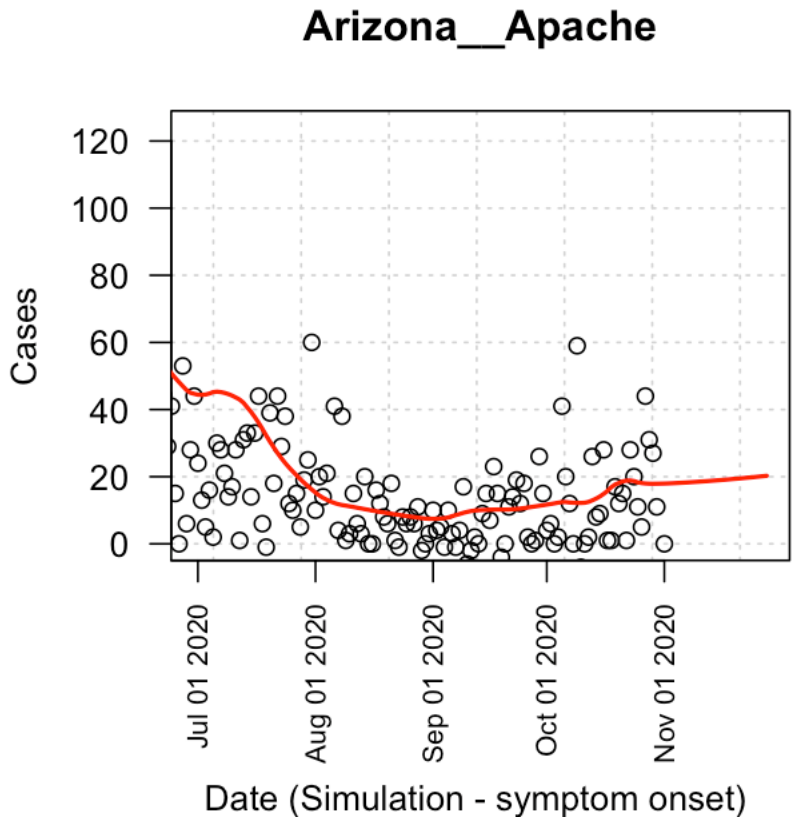
# Situational Awareness: Geographical heterogeniety is now likely less important

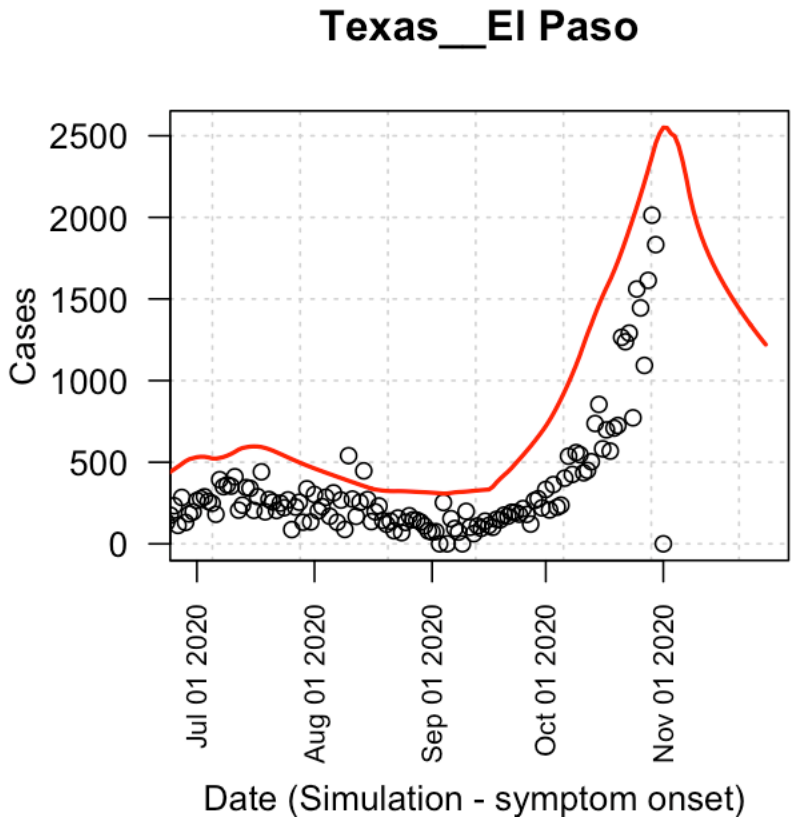
- Significant (unexplained) increases in transmission starting after Labor Day in Dona Ana, Santa Fe, Sierra and Socorro, Luna (October) are needed to match the model to the data.
- Transmission in Bernalillo is not currently increased as much as in earlier weeks.
- McKinley, Rio Arriba and Taos have recent increases in cases. McKinley appears to no longer have better isolation than the default values for the state. Rio Arriba has a history of unusually high case counts. Taos' mobility is low. Continuation of low T80 may result in control.
- Southeastern New Mexico still has high case counts due to high mobility; Eddy continues to have higher transmission relative to mobility than other non-urban counties in the state (as was true all summer).
- Thanksgiving is not currently modeled, and absent additional testing, tracing, and quarantine, these governmental capabilities are unlikely to compensate associated moderate increases in transmission in late November.



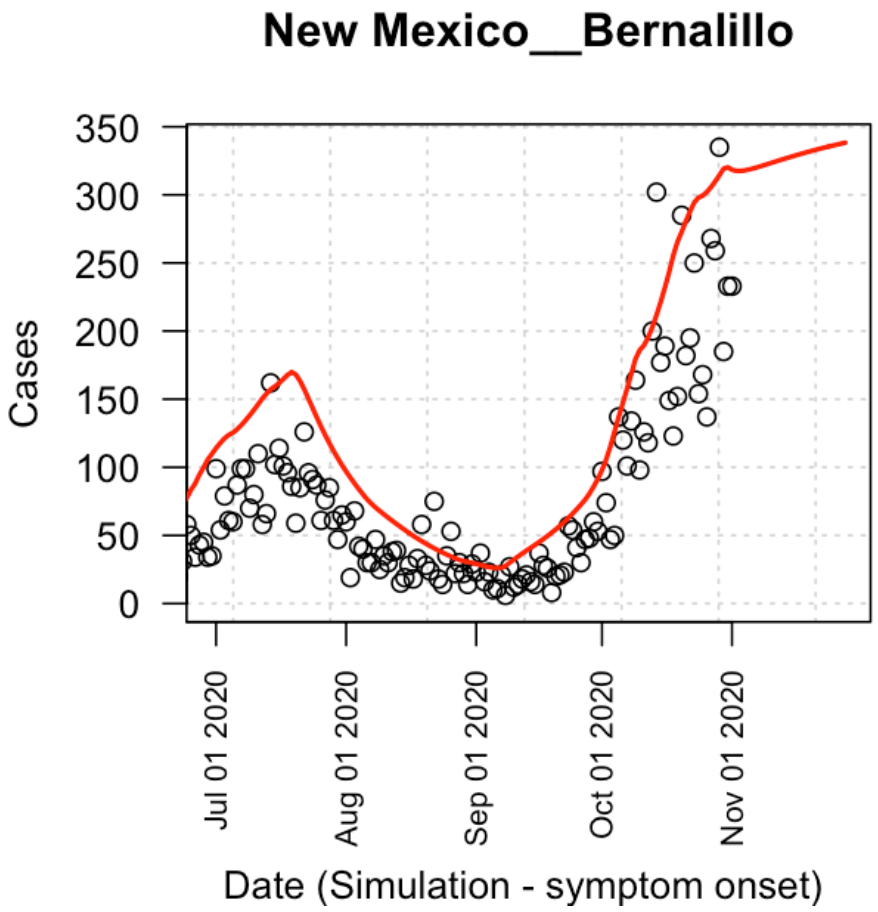
# Cases appear to be rising in border counties of importance

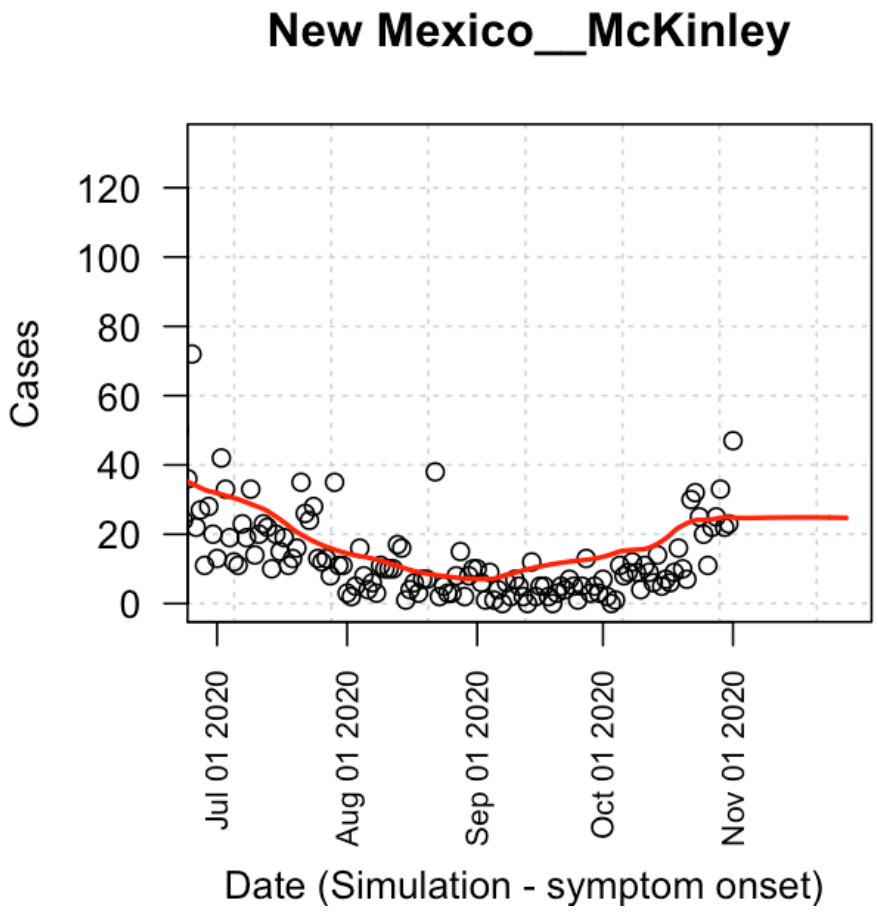
**(Zero cases for the last time point is an artifact.)**



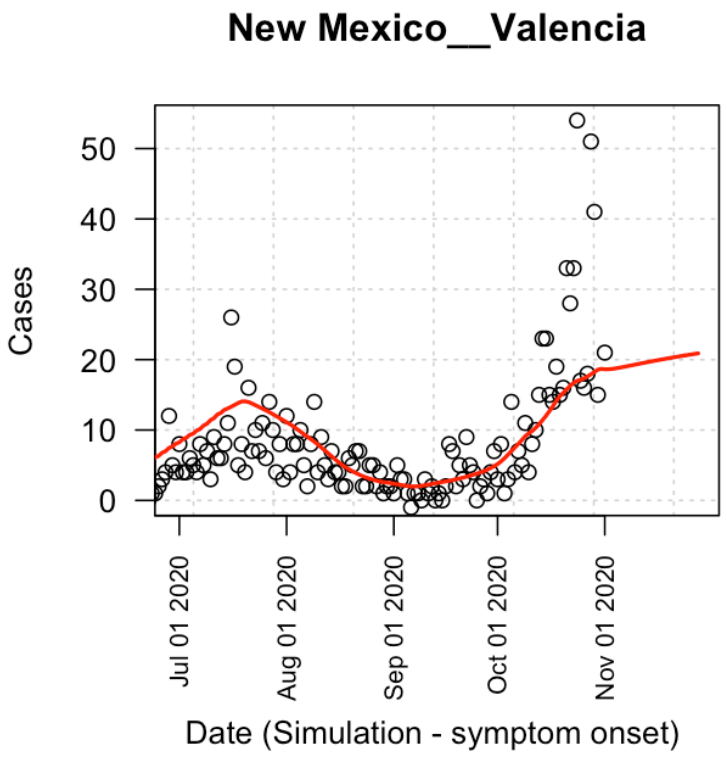
# Formerly, there was a diversity of controlling and non-controlling counties.

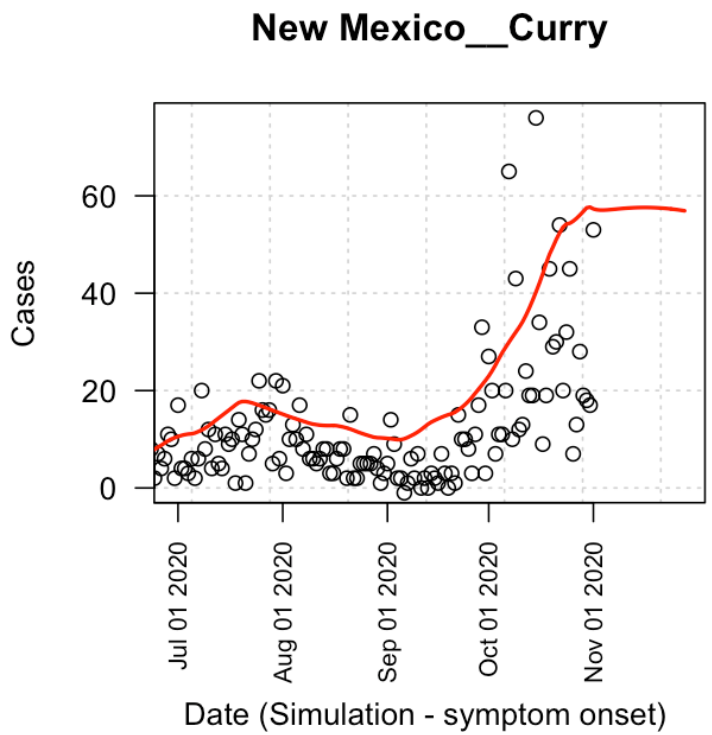


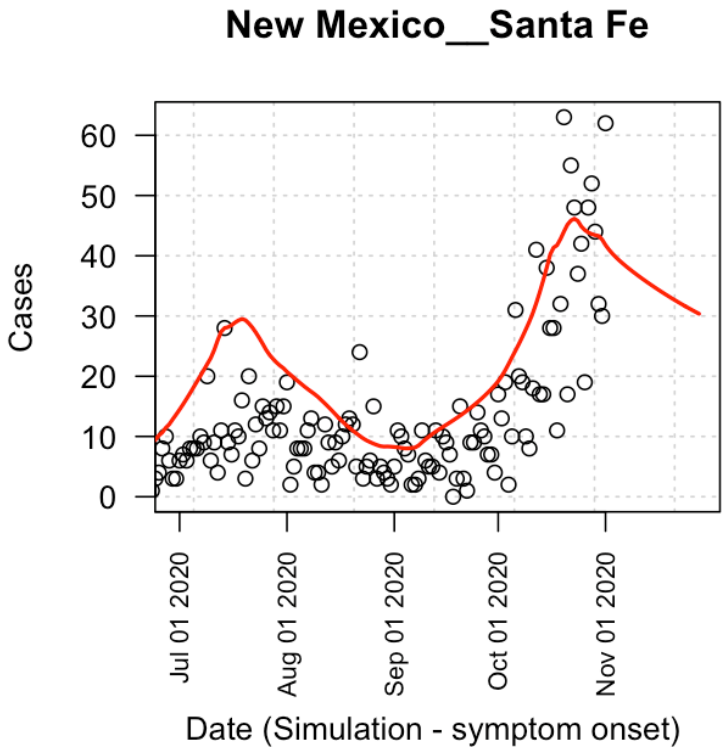




More counties seem to working in synchrony toward control than in the past.

# A few other counties: continued low mobility would lead to falling incidence

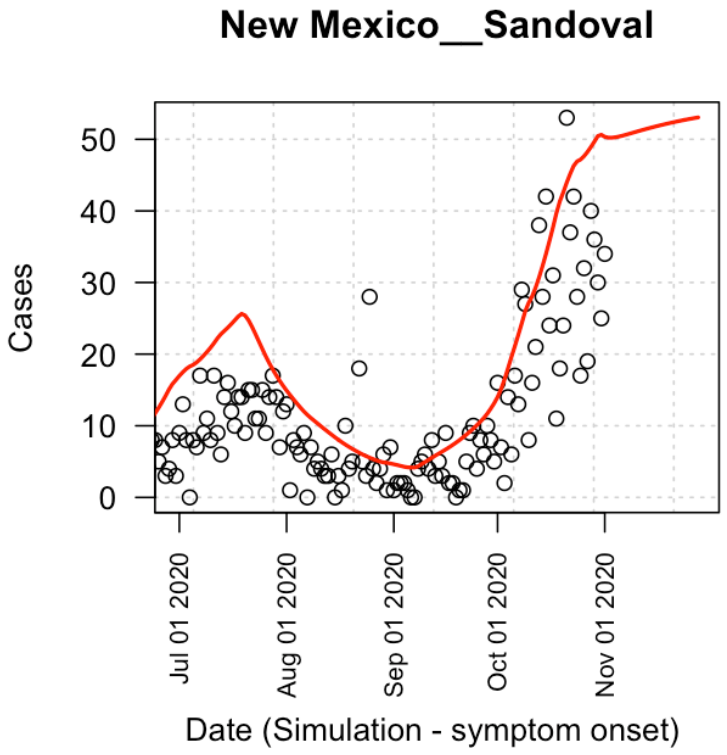


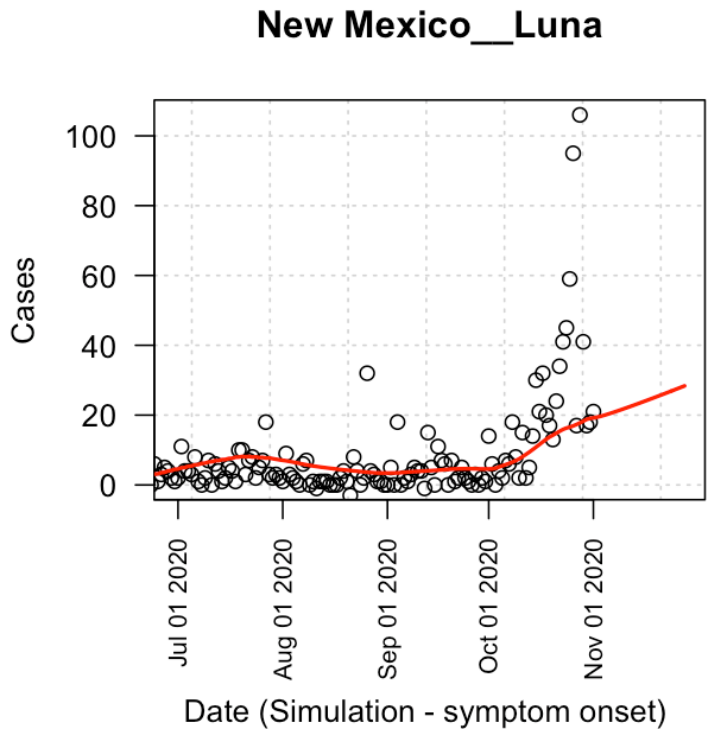



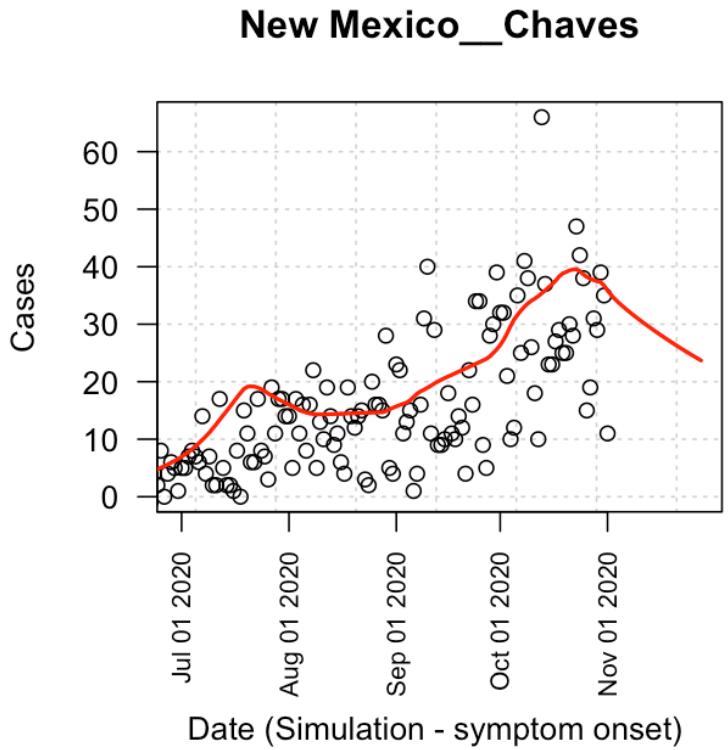




A rebound in mobility would suggests that these counties will continue to see rising cases

# Continuation of low mobility likely to lead to lead to heterogeneous recovery

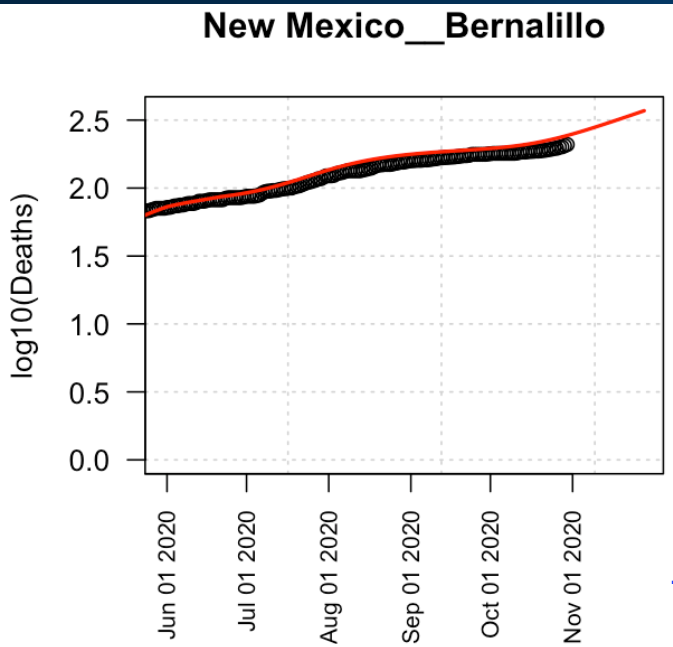


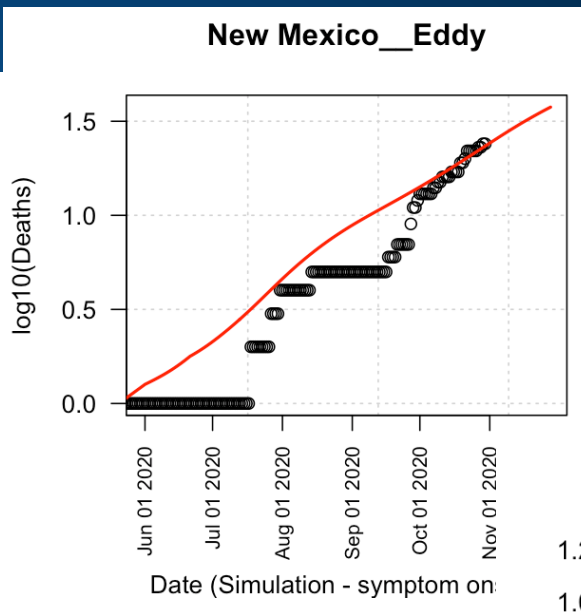




Recovery of higher mobility will make this a picture of uniformly and marginally growing incidence *in the near-term.*

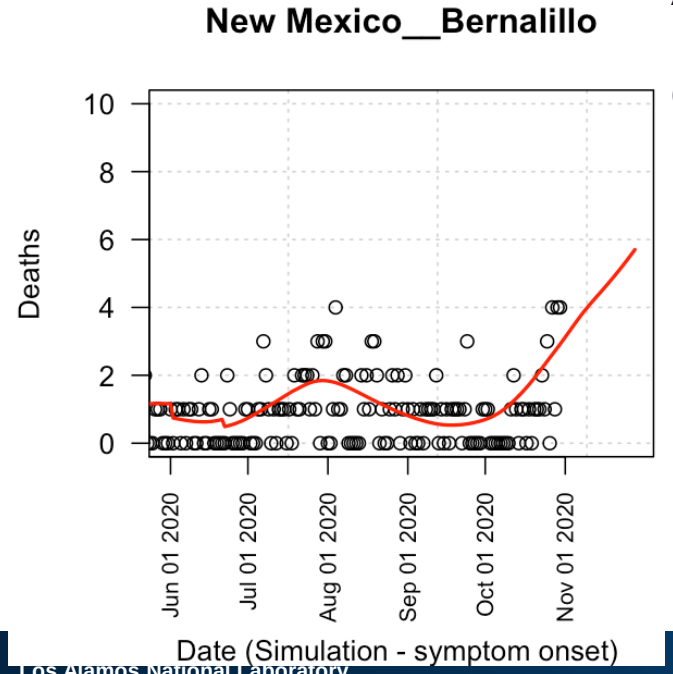
# Mortality trends

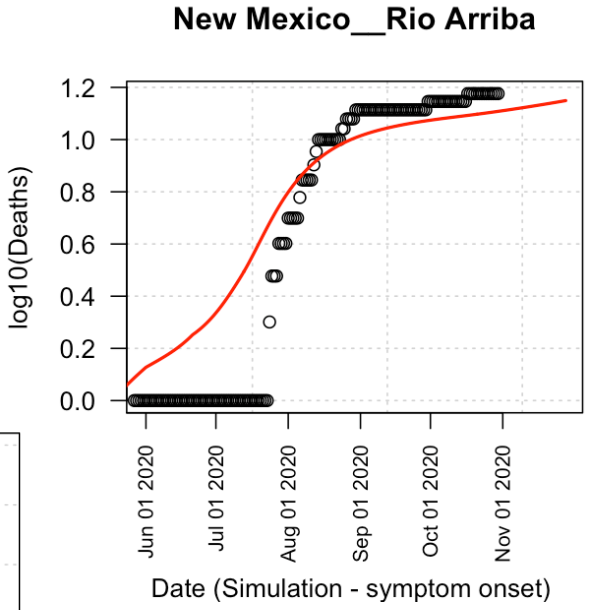



Death rates are decreasing in urban areas. EpiGrid is predicting slightly more of a rise in deaths than is occurring in Bernalillo county. The same trend is seen for El Paso county, Texas. This is beyond the drop in mortality already modeled.

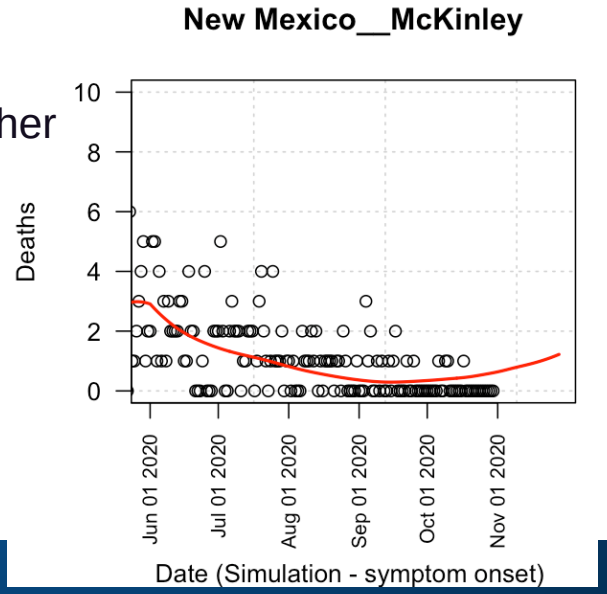



There is significant heterogeneity. Bernalillo, Eddy and Rio Arriba are modeled using common death rate parameters. The under-estimate of deaths in Rio Arriba is likely due to an outbreak in Dulce.




McKinley is modeled with higher death rates.



# Conclusions and Discussion

- **The New Mexico epidemic is now geographically dispersed.**
- **Geographical dispersion implies that state-to-state travel plays a significant role in high incidence.**
- **Large population centers continue to dominate the immediate consequence by virtue of their large population.**
- **Several smaller counties support local epidemics (Los Alamos, Sierra, Lincoln, etc.). Not Torrance.**
- **High test positivity is likely be degrading the response through sub-optimal situational awareness.**
- **Improving the currently degraded contact tracing operation is likely to require time even with additional resources. This limits the most-optimistic EpiGrid scenarios in New Mexico.**
- **Discussion:**
  - Further improvement in testing, tracing, quarantine possible?
  - Quarantine *support* along the lines of New Rochelle, NY in March to assist with optimal compliance?
  - Schools an opportunity for improved education? Presbyterian advertising campaign.
  - Increased enforcement probably needed. N.B. New York City.
  - Current infection control improvements will likely be offset by Thanksgiving before good control is achieved.
  - Continued, phased roll-back of high- and moderate-risk activities?
  - Qualitatively higher testing rates (i.e. 10x) can substantially offset local epidemics (i.e. South Korea). This will take time to plan and execute, but candidate technologies exist.
  - An example of starting the planning for high-throughput sequencing to provide diagnostics (NCGR in Santa Fe): https://docs.google.com/presentation/d/1hYVsGPZOX4N0CCoZdqyfLng_MDu17wcyo6XpsyxUWCQ/edit?usp=sharing