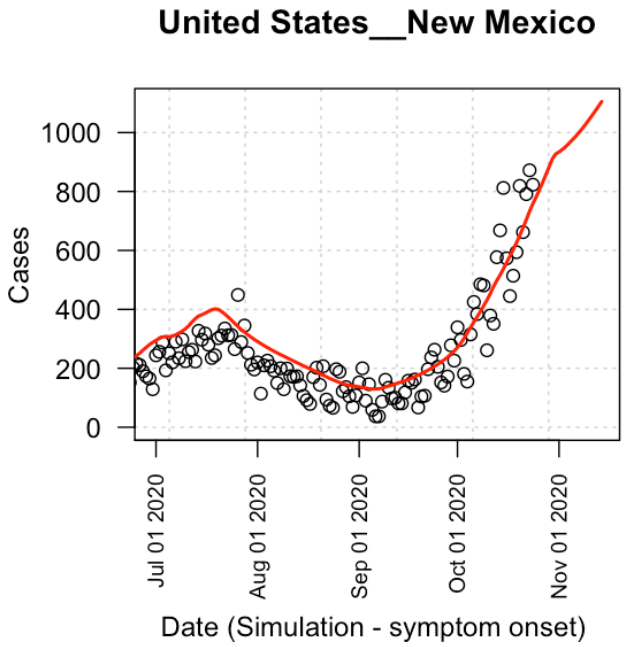
Modeling & Forecasting COVID-19 in NM

October 27, 2020

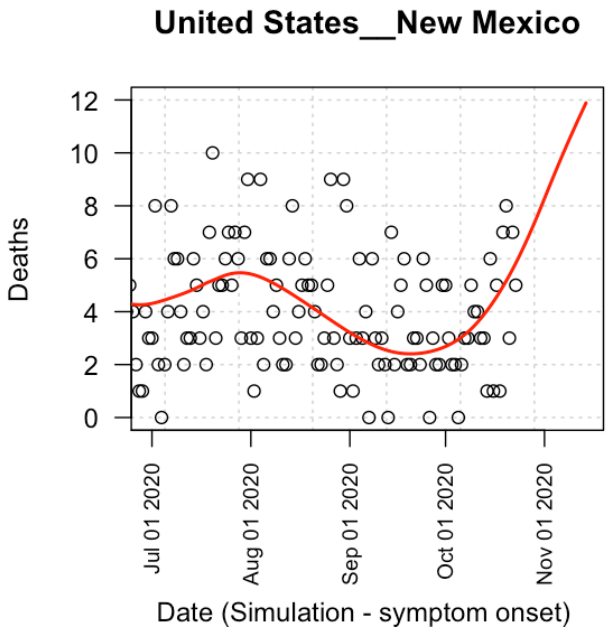
NNSA
National Nuclear Security Administration

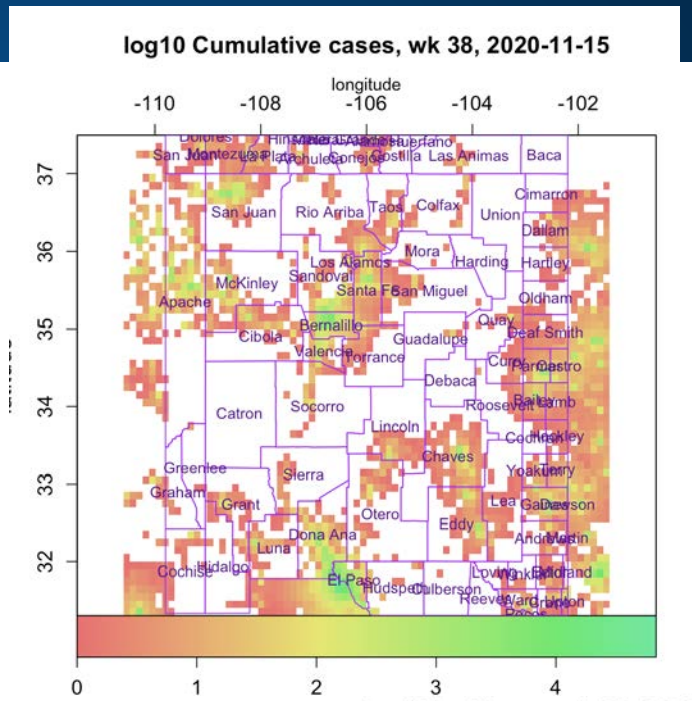
27 Oct 2020: EpiGrid modeling

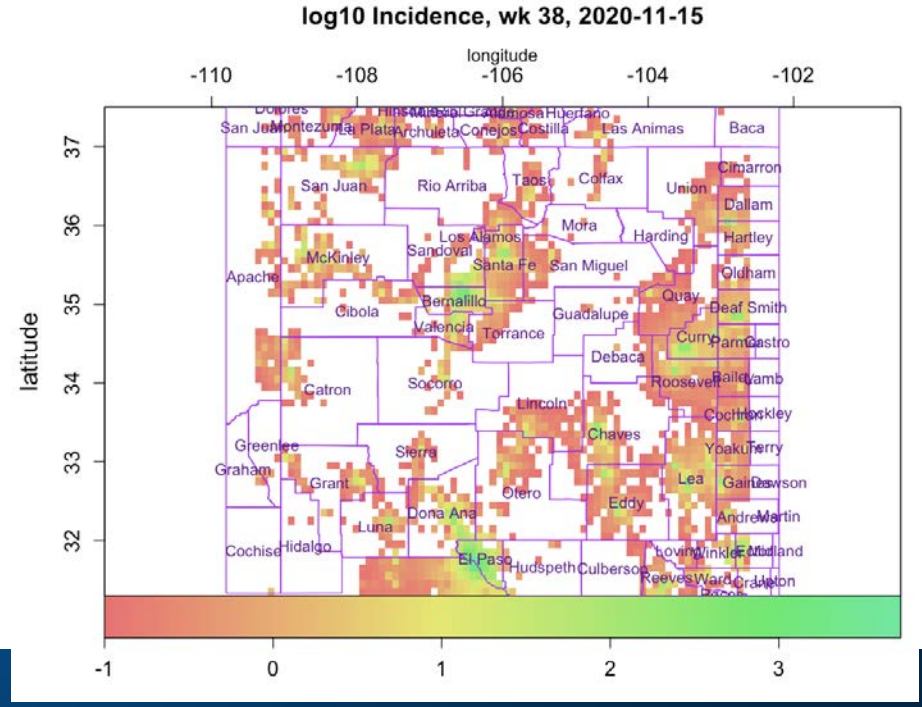


Significant spread out of urban centers has occurred creating a geographically-widespread epidemic.

Some areas slowing





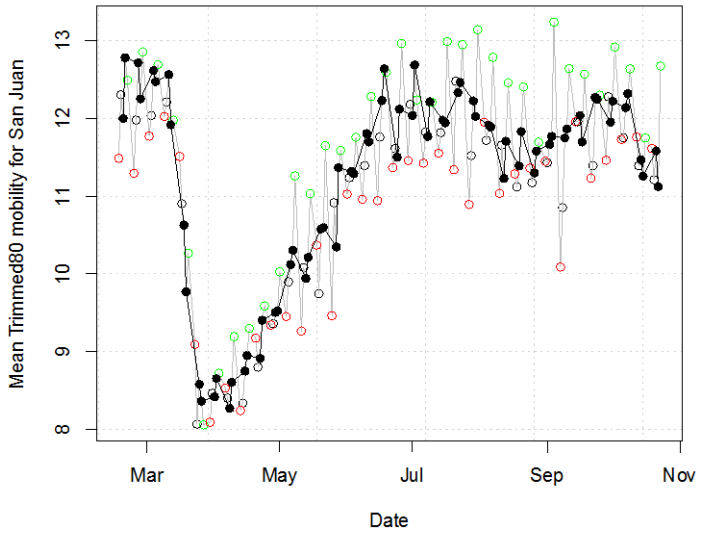


Factors that affect transmission and quarantine

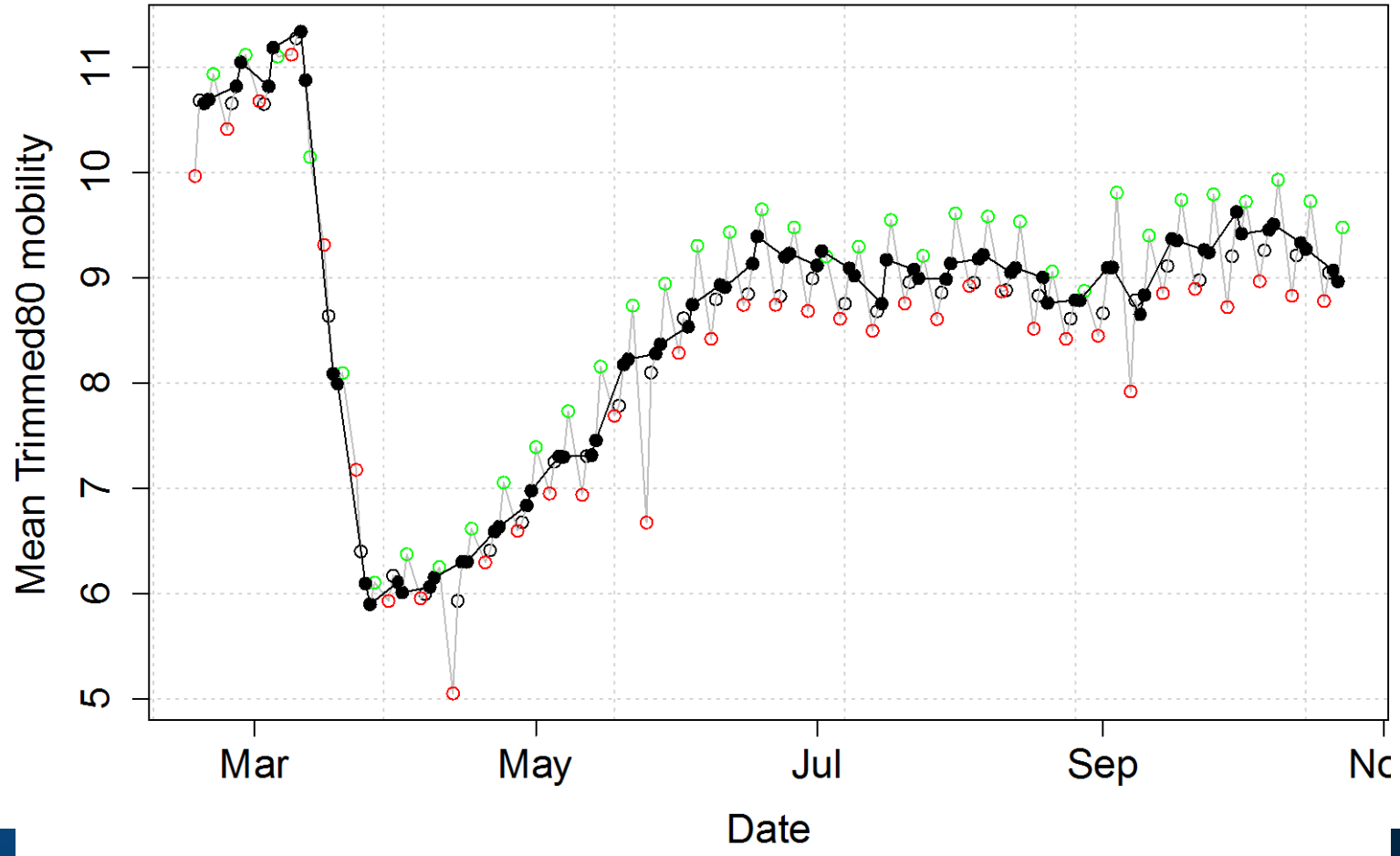
- **Transmission goes up when mobility goes up; transmission goes down when mobility goes down.**
- **Labor Day weekend increased transmission (Indigenous Peoples' Day shows no evidence of an increase).**
- **Public Health Orders (PHO's) modeled effects on transmission:**
  - Indoor dining, etc. raises transmission. (+10%)
  - Requirements for training and certification for hotels and restaurants lowers transmission (-7%).
  - 10 pm closing times modeled as lowering transmission only in Santa Fe, Dona Ana, and Bernalillo (-5%).
  - Masking requirements and mass gathering-limits lower transmission (-2%, -5%, -8%). This is compliance-limited.
    - Adherence to masking and mass gathering limits is estimated county-by-county (generalized from population polling data).
- **There are unexplained transmission increases in all urban counties (Bernalillo, Dona Ana, Santa Fe, El Paso) as well as some less-urban/frontier counties (e.g. Socorro, Sierra, Luna) starting in September. This presumably reflects travel introductions, sub-optimal behavior, and non-compliance (9/1/2020-10/27/2020; +10% to 30%, peaking at +50%, Socorro and Bernalillo high, Santa Fe low).**
- **Only the rapid response part of contact tracing appears to be working efficiently.** Case suppression=37%-45%.
  - 65 hours is the last reported median time for positive test result-to-quarantine of contacts. Suppression previously 40-60%.
- **El Paso shelter-in-place and curfew order is a major improvement in El Paso transmission,** ~-60%
- **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).**

Mobility in urban counties is declining; associated declines in transmission

- Mobility in San Juan county (5th most populous).



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



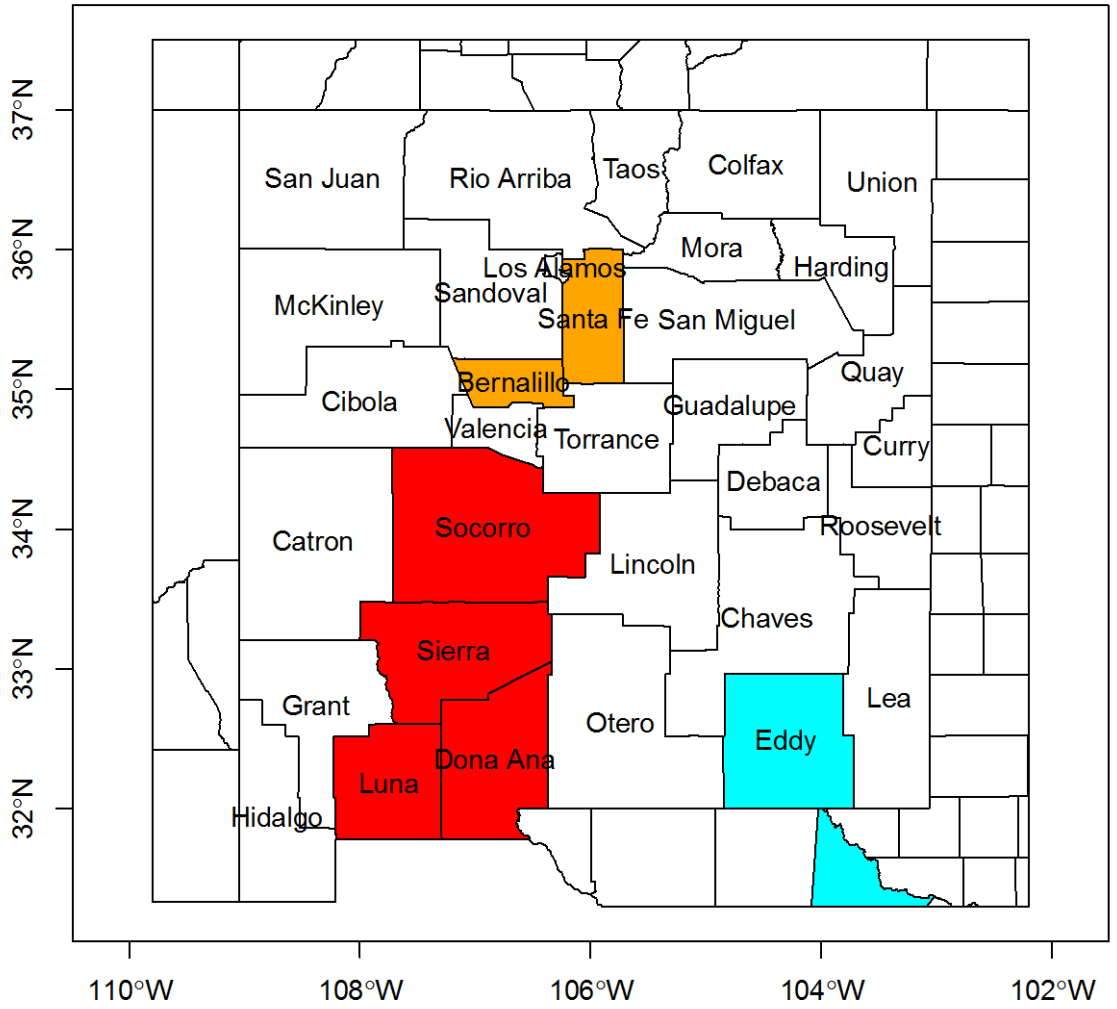
Positivity rates are quite high in some counties

- **Positivity over the past week (from Covid ActNow https://www.covidactnow.org/us/new_mexico-nm?s=1170284)**
  - Lea ~ 17%
  - Luna ~ 16%
  - Curry ~ 15%
  - Eddy ~ 13%
  - Roosevelt ~12%
  - Dona Ana ~12%
  - Socorro ~11%

- **Under-reporting of cases is likely higher than expected in these high-test positivity counties. (EpiGrid is not fully accounting for this.)**

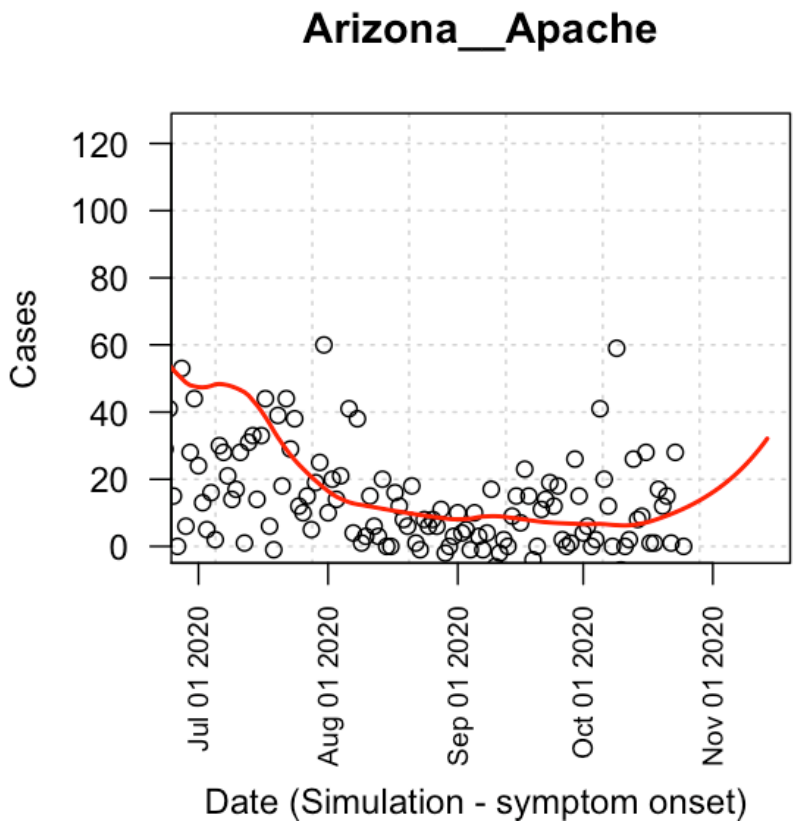
Situational Awareness: Heterogeneity, mostly urban vs. rural

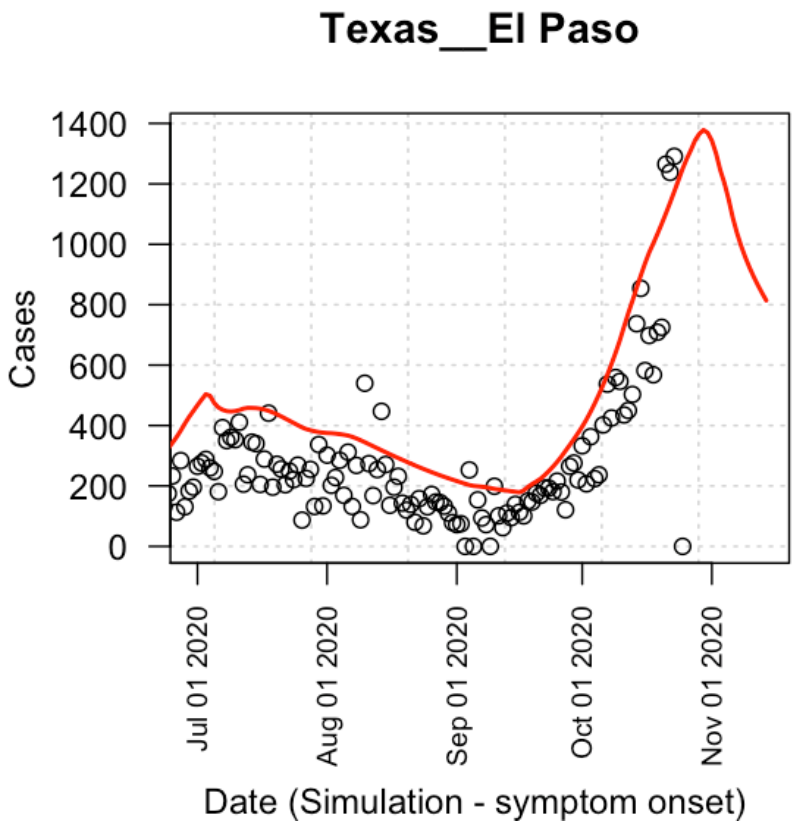
- Significant (unexplained) increases in transmission starting after Labor Day in Bernalillo, Dona Ana, Santa Fe, Sierra and Socorro, Luna (October) are needed to match the model to the data.
- Transmission in Bernalillo and Santa Fe is not currently increased as much as in earlier weeks.
- Spread along the Interstates is evident in data and the model.
- 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).
- Curry County has growth in-line with a rapidly-growing local epidemic and less like an uncontained Wuhan-like community transmission scenario (i.e. Wuhan doubled every 3 days in early- and mid-January). Valencia County's situation is unclear.
- High test-positivity means that many counties likely have disproportionately more cases than is currently known. Quantification of consequence is uncertain on the high-consequence side.
- EpiGrid results are not inconsistent with eventual control (weeks).
- Neither Halloween nor Thanksgiving are currently modeled, and absent additional testing, tracing, and quarantine, these capabilities are unlikely to compensate the expected increases in transmission.



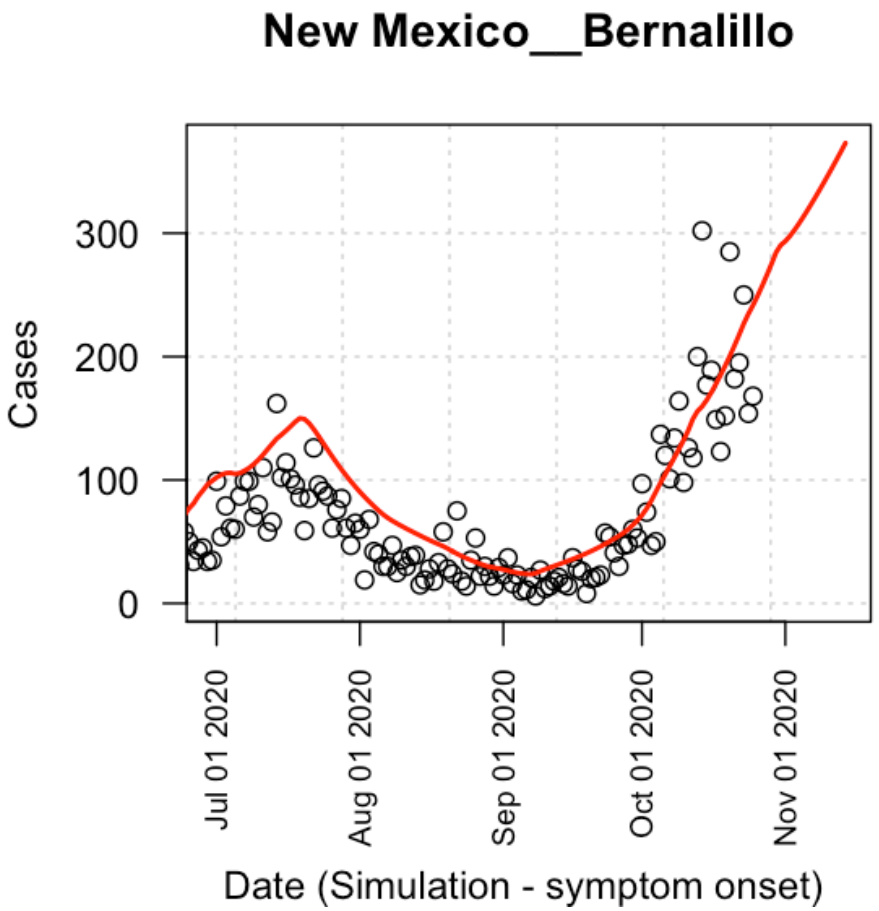
Cases appear to be rising in border counties of importance

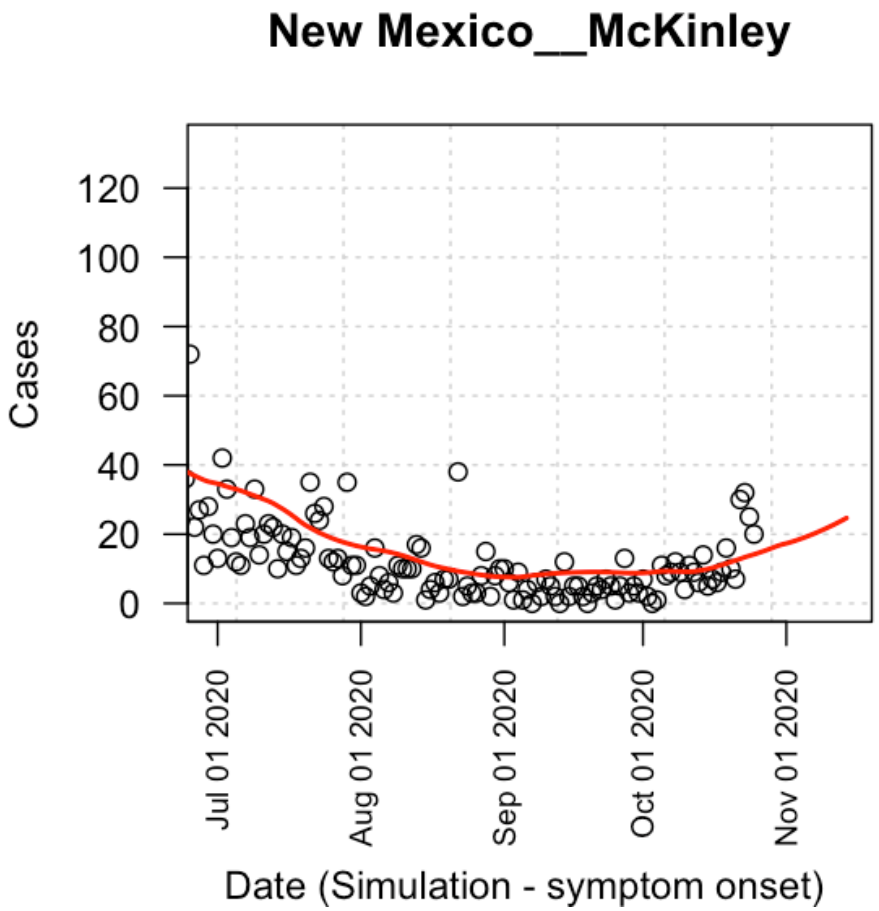
(Zero cases for the last time point is an artifact.)



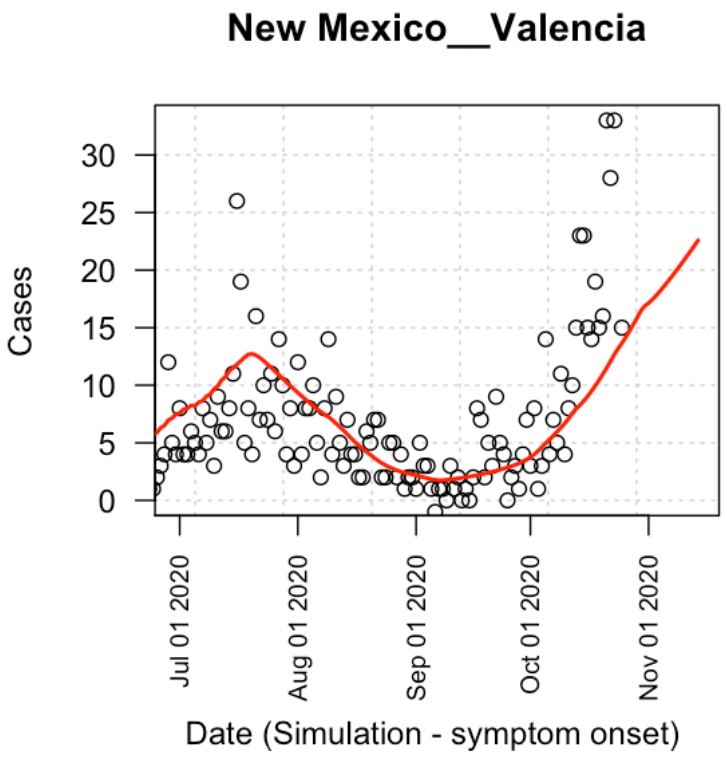


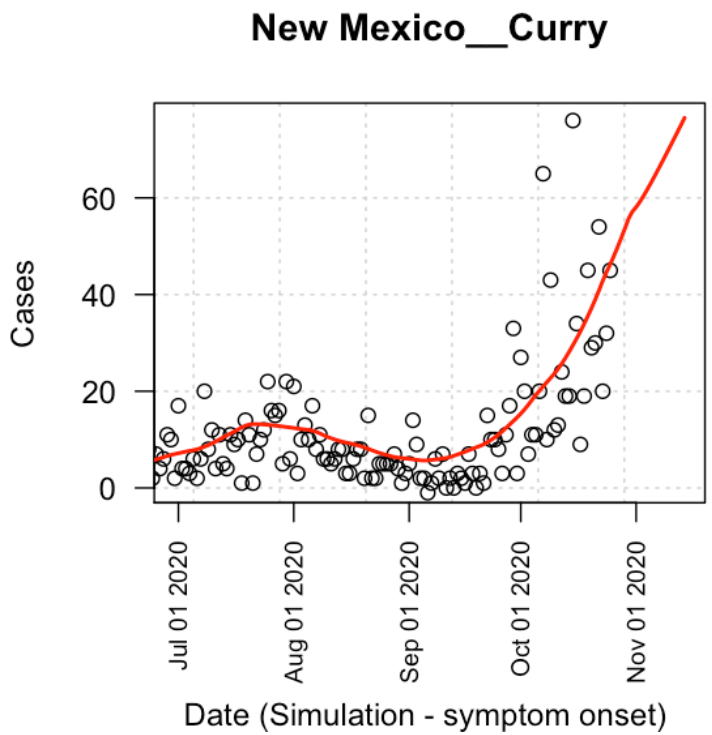
Diversity across the state

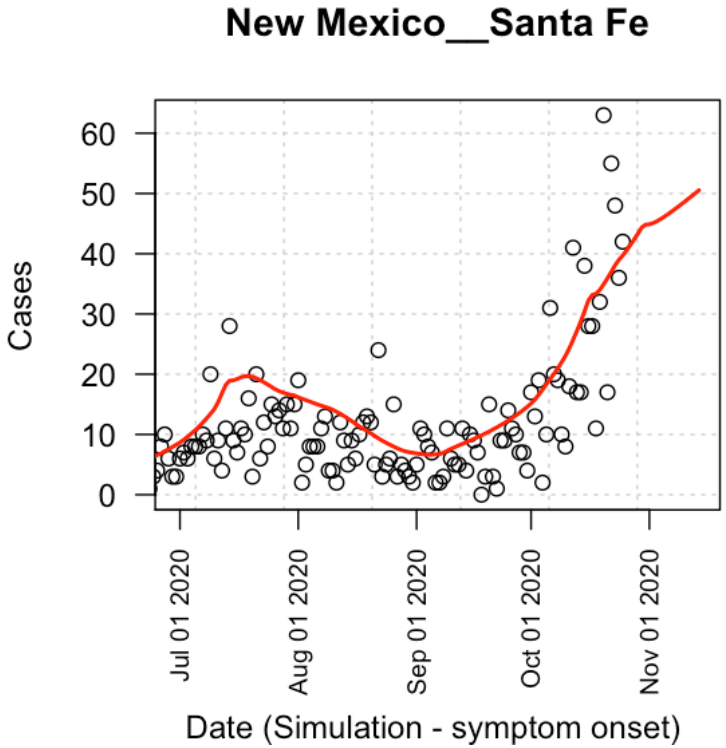




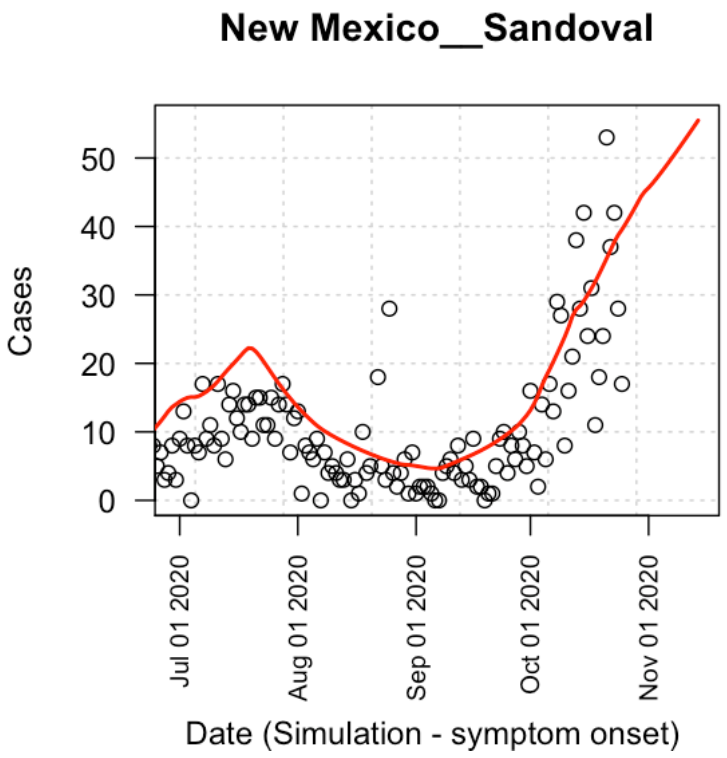
A few other counties

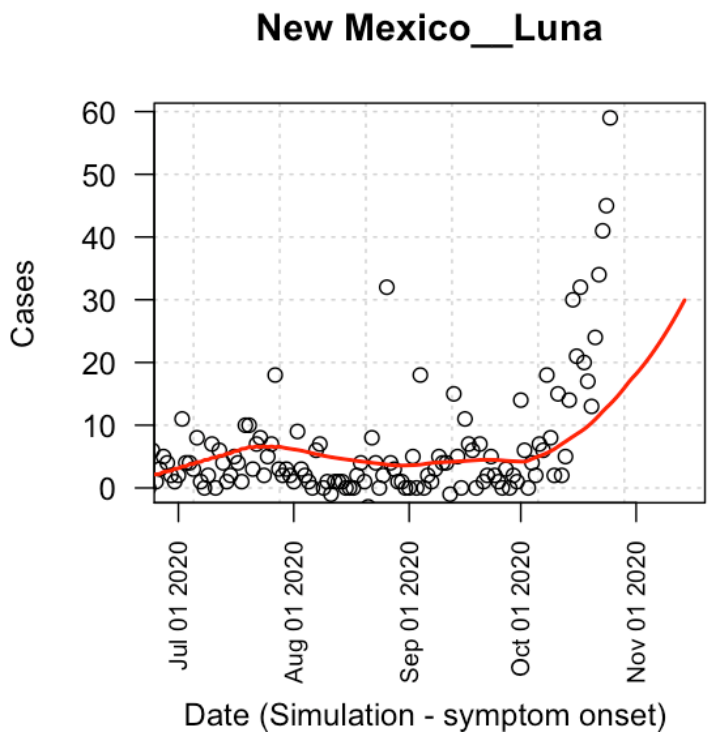


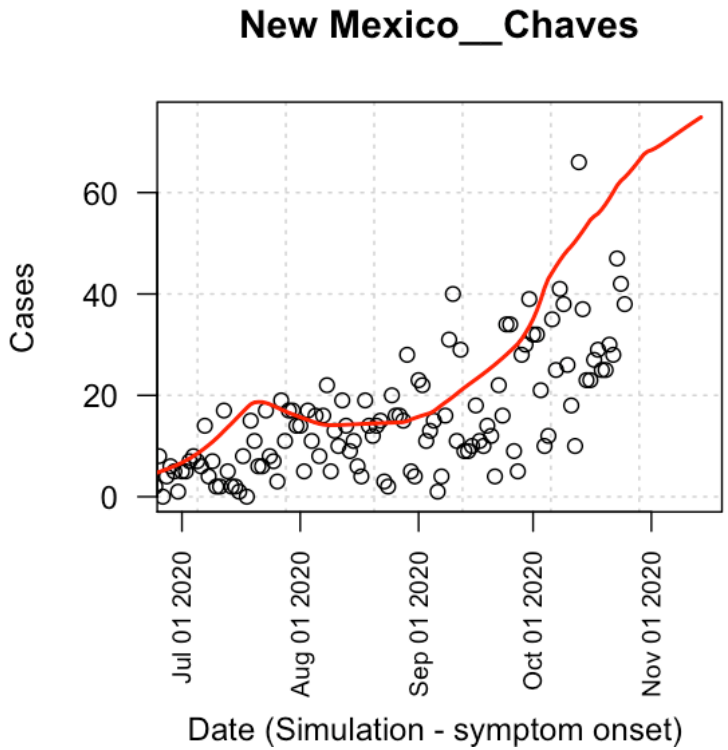




A few other counties







Conclusions and Discussion

- **The New Mexico epidemic is now geographically dispersed.**
- **Geographical dispersion implies that state-to-state travel plays a significant role.**
- **Large population centers dominate the immediate consequence by virtue of their large population.**
- **A significant number of non-urban and frontier counties now support local epidemics.**
- **High test positivity may be degrading the response through sub-optimal situational awareness.**
- **Improving the currently degraded contact tracing operation will likely weeks even with additional resources. This limits the most-optimistic EpiGrid scenarios in New Mexico.**
- **Some areas have slowing growth; responsive to PHO's. Further improvement is desirable/required.**
- **Discussion:**
  - Substantial room for improvement in testing, tracing, quarantine, all due to over-load because of high disease incidence.
  - Quarantine *support* along the lines of New Rochelle, NY in March to assist with optimal compliance?
  - Schools a venue for improved education? Presbyterian advertising campaign.
  - Increased enforcement likely needed. N.B. New York City. Current infection control improvements will likely be offset by Thanksgiving before good control is achieved.
  - Pooled testing in the short term? N.B. Qingdao, Kashgar in China. Substantially increased testing volumes?
  - 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. Bar-coded sequencing with high-through put sequencing of viral clinical samples. Multiple 10k/day approaching 100k/day?
  - Continued, phased roll-back of high- and moderate-risk activities? Plug the leaks quickly and proactively. Tracing data.

Short- & Long-Term Forecast for NM: Cases

Cumulative Cases Forecasts

6-Week Forecast of Confirmed Cases for New Mexico Based on Data as of 2020-10-25

Week	Best Case (5th Percentile)	Middle Case (50th Percentile)	Worst Case (95th Percentile)^
2020-10-25		41,863*	
2020-11-01	46,321	48,944	51,627
2020-11-08	51,089	57,570	65,571
2020-11-15	55,399	65,991	83,845
2020-11-22	58,786	73,954	104,811
2020-11-29	61,399	81,292	124,853
2020-12-06	63,366	87,524	141,526

*Last reported confirmed cases count

^Closest-matching scenario

Weekly Confirmed Cases Forecasts

Week	Best Case	Middle Case	Worst Case
2020-11-01	4,458	7,081	9,764
2020-11-08	4,768	8,626	13,944
2020-11-15	4,310	8,421	18,274
2020-11-22	3,387	7,963	20,966
2020-11-29	2,613	7,338	20,042
2020-12-06	1,967	6,232	16,673

So what?

The daily number of cases are expected to range between 1,000 and 1,250 for the middle case scenario in the next few weeks

Short- & Long-Term Forecast for NM: Deaths

Cumulative Cases Forecasts

6-Week Forecast of Deaths for
New Mexico Based on Data as of 2020-10-25

Week	Best Case (5th Percentile)	Middle Case (50th Percentile)^	Worst Case (95th Percentile)
2020-10-25		967*	
2020-11-01	981	996	1,026
2020-11-08	995	1,029	1,109
2020-11-15	1,005	1,062	1,216
2020-11-22	1,014	1,093	1,341
2020-11-29	1,020	1,119	1,463
2020-12-06	1,025	1,141	1,579

*Last reported deaths count
^Closest-matching scenario

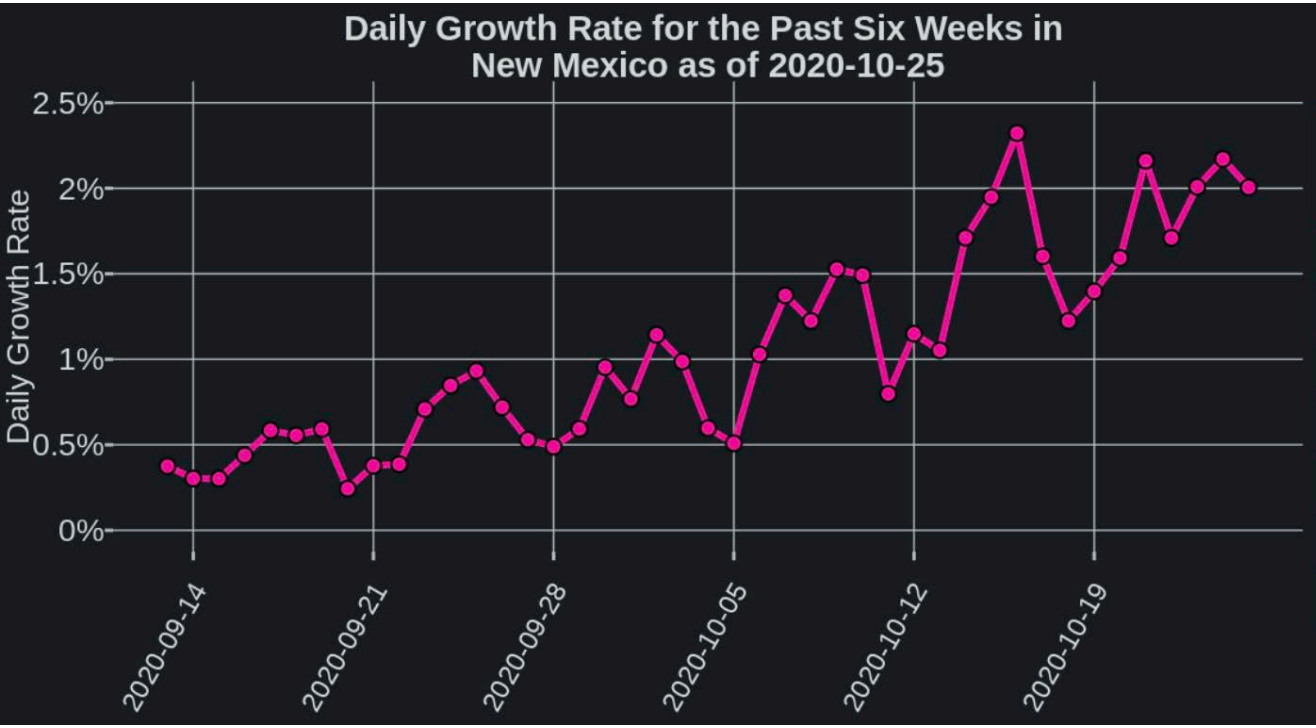
Weekly Deaths Forecasts

Week	Best Case	Middle Case^	Worst Case
2020-11-01	14	34	70
2020-11-08	12	28	65
2020-11-15	8	25	64
2020-11-22	8	22	67
2020-11-29	5	16	57
2020-12-06	4	16	65

So what?

The weekly number of deaths are expected to range between 22 and 34 for the middle case scenario

Growth Rate for NM



6-Week Forecast of the Average Weekly Growth Rate for New Mexico Based on Data as of 2020-10-25

Week	Best Case (5th Percentile)	Middle Case (50th Percentile)	Worst Case (95th Percentile)^
2020-10-25		1.9%*	
2020-11-01	1.5%	2.3%	3.0%
2020-11-08	1.4%	2.3%	3.5%
2020-11-15	1.2%	2.0%	3.6%
2020-11-22	0.85%	1.6%	3.2%
2020-11-29	0.62%	1.4%	2.5%
2020-12-06	0.45%	1.1%	1.8%

*Last weekly mean daily growth rate

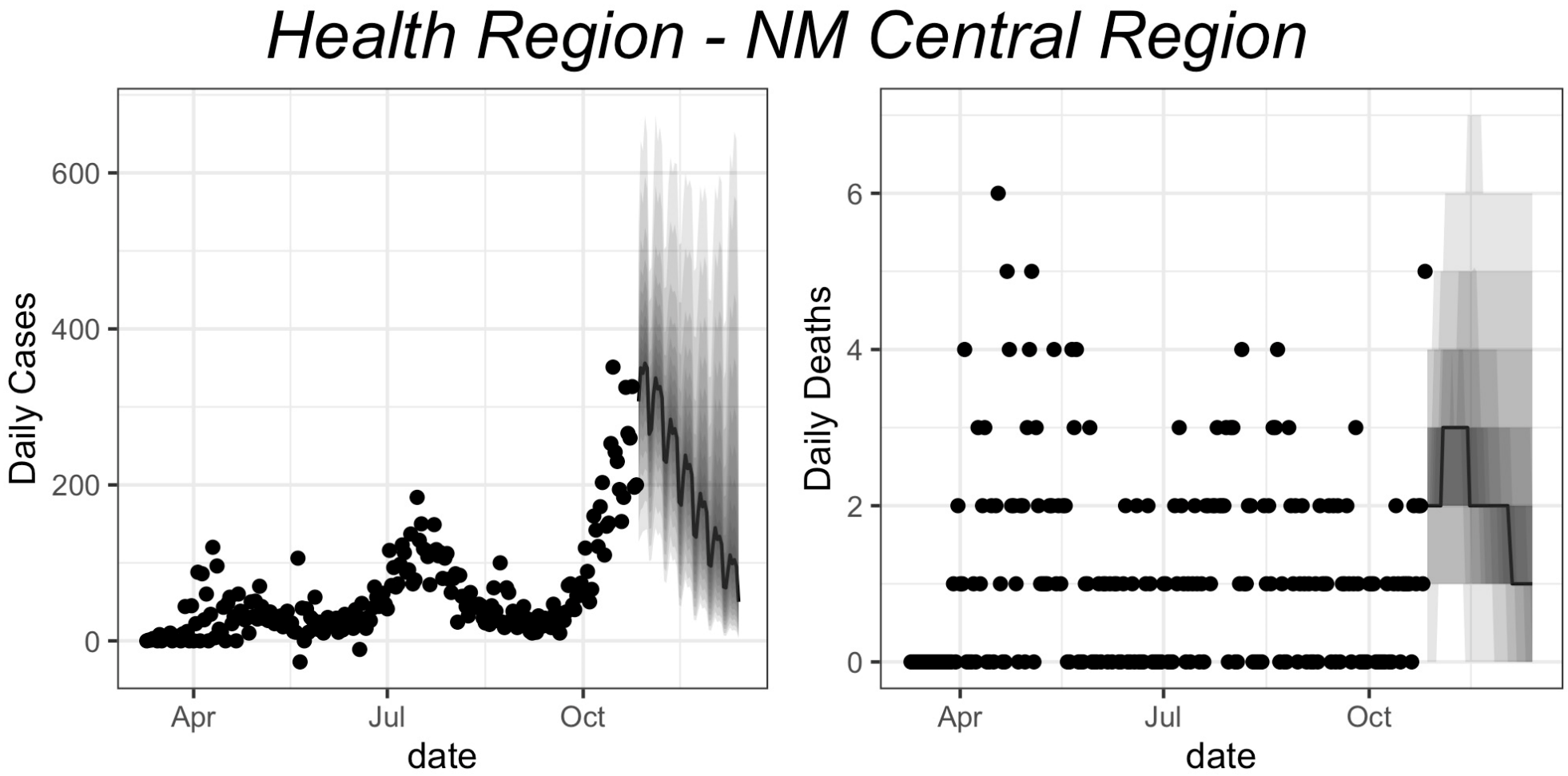
^Closest-matching scenario

So what?

As of October 27th, the average growth rate in NM is at 1.9% (up from 1.6%)

> Regional Forecasts, Growth Rates, & Hospitalizations

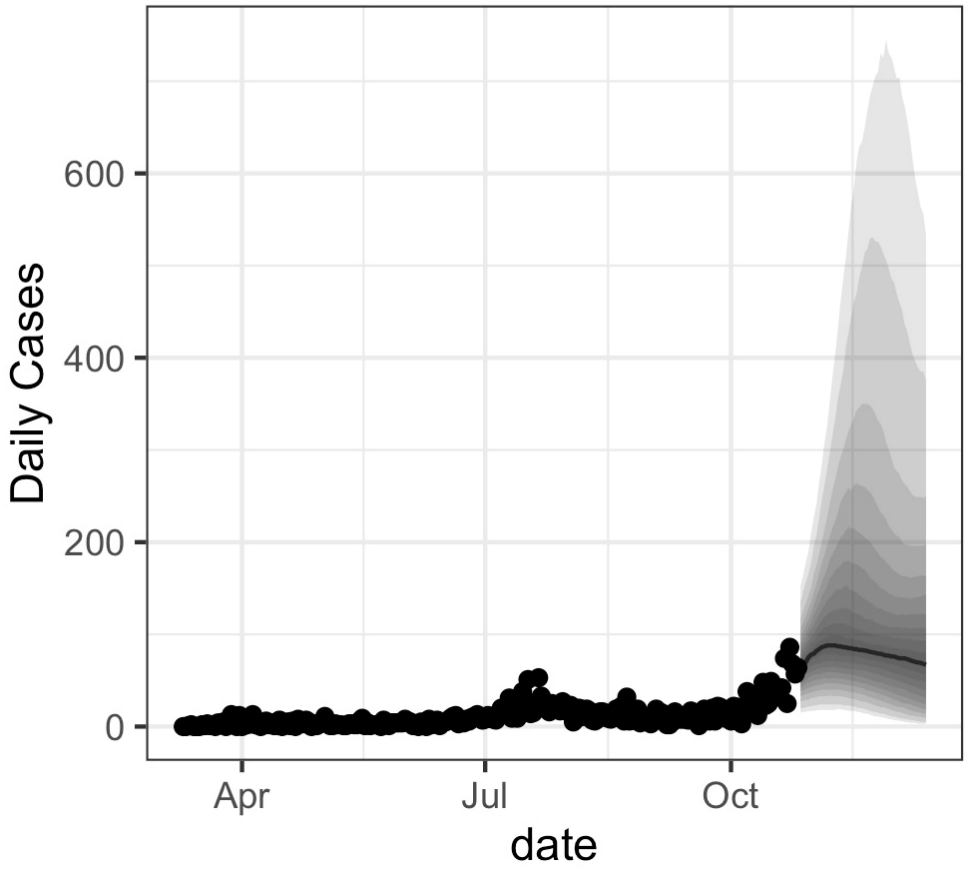
Central Region Forecasts

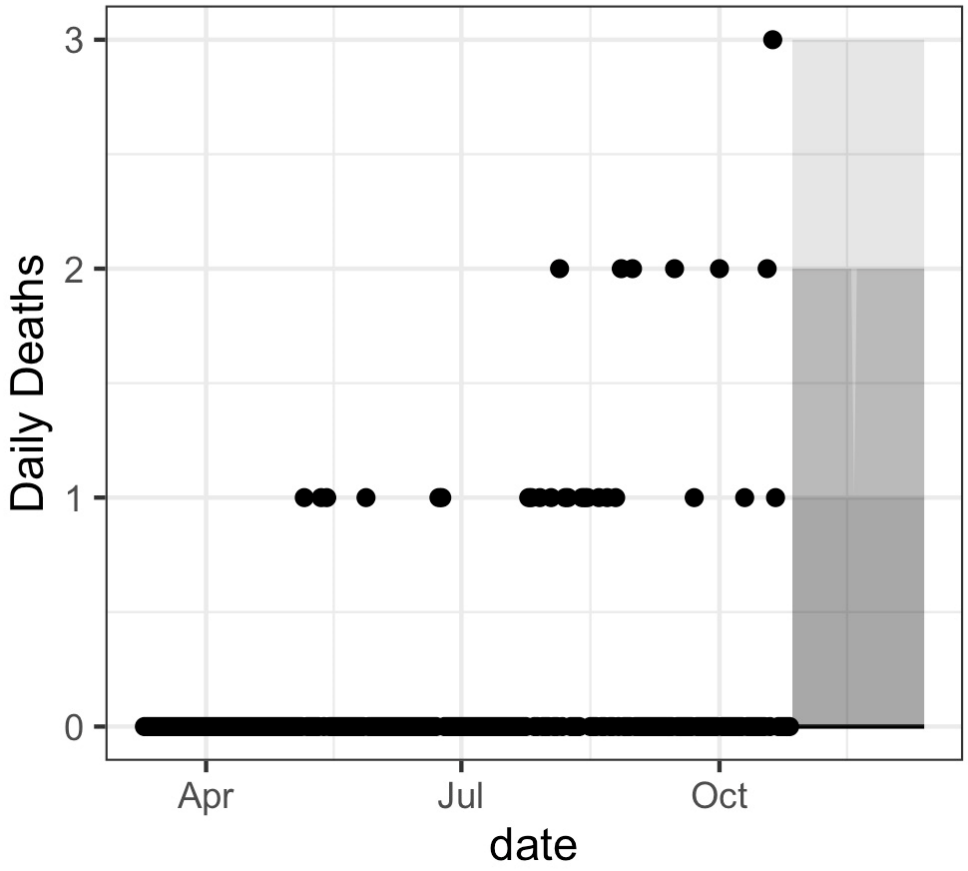


The daily number of cases is expected to range between 210 and 310 for the middle case scenario in the next few weeks

Northeast Region Forecasts

Health Region - NM Northeast Region

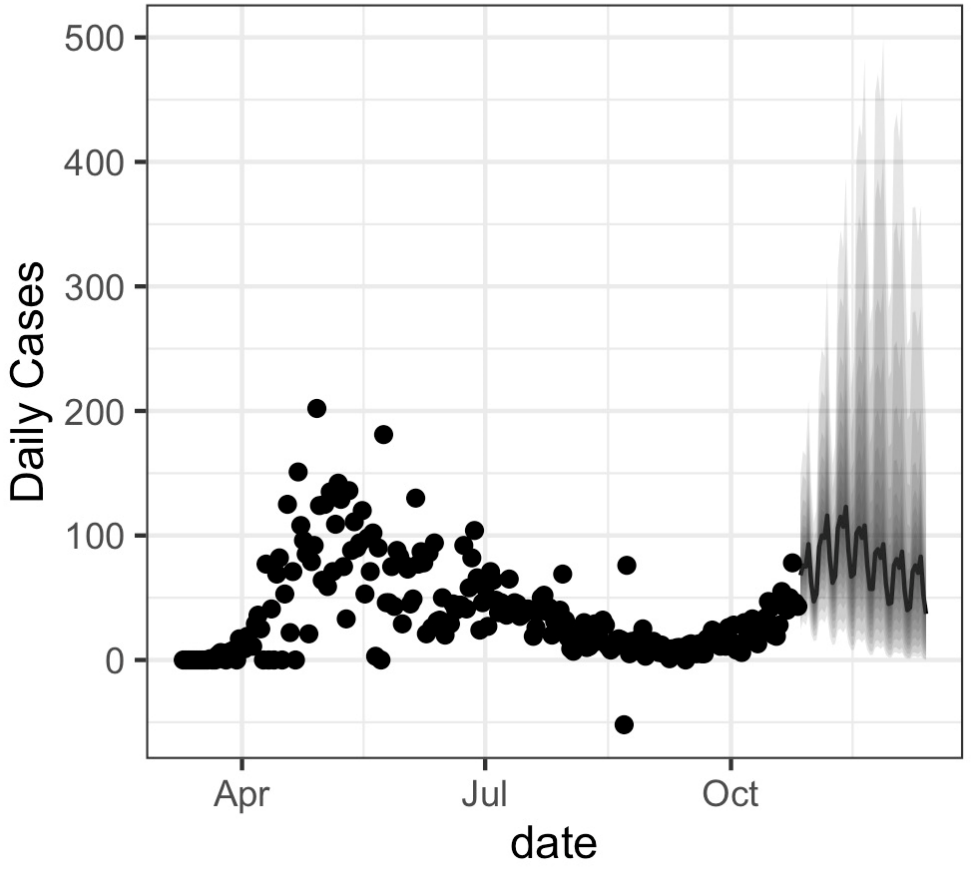


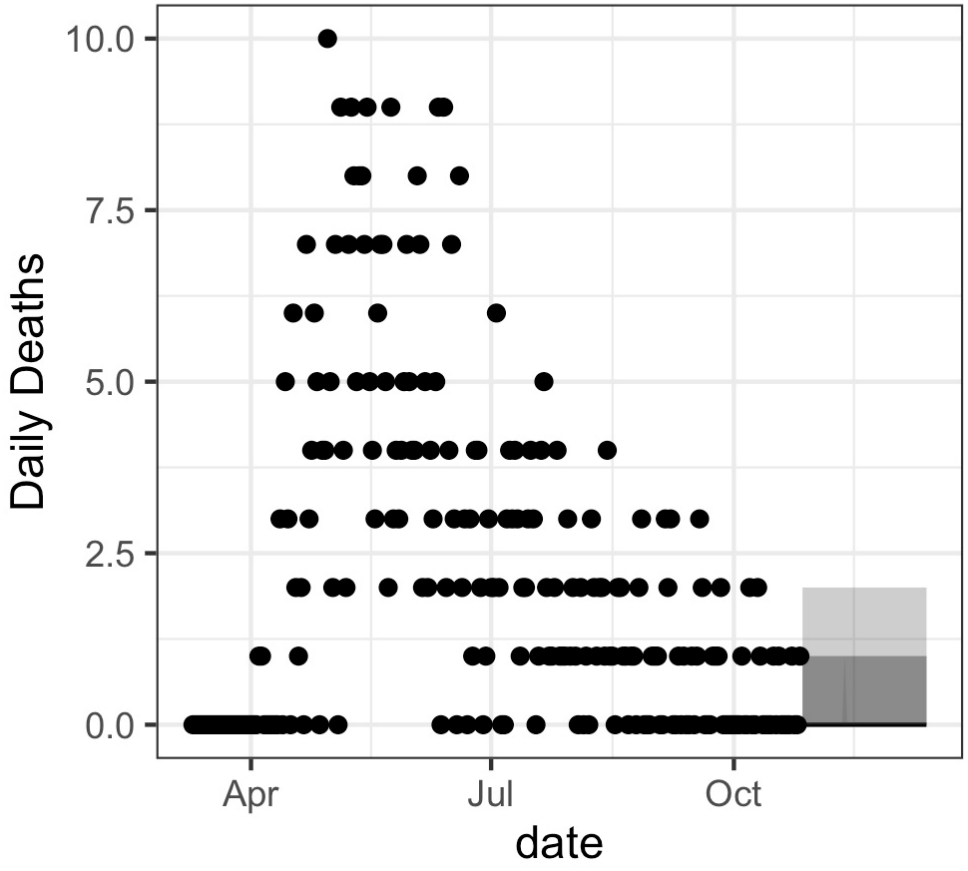


The daily number of cases is expected to range between 80 and 90 for the middle case scenario in the next few weeks

Northwest Region Forecasts

Health Region - NM Northwest Region

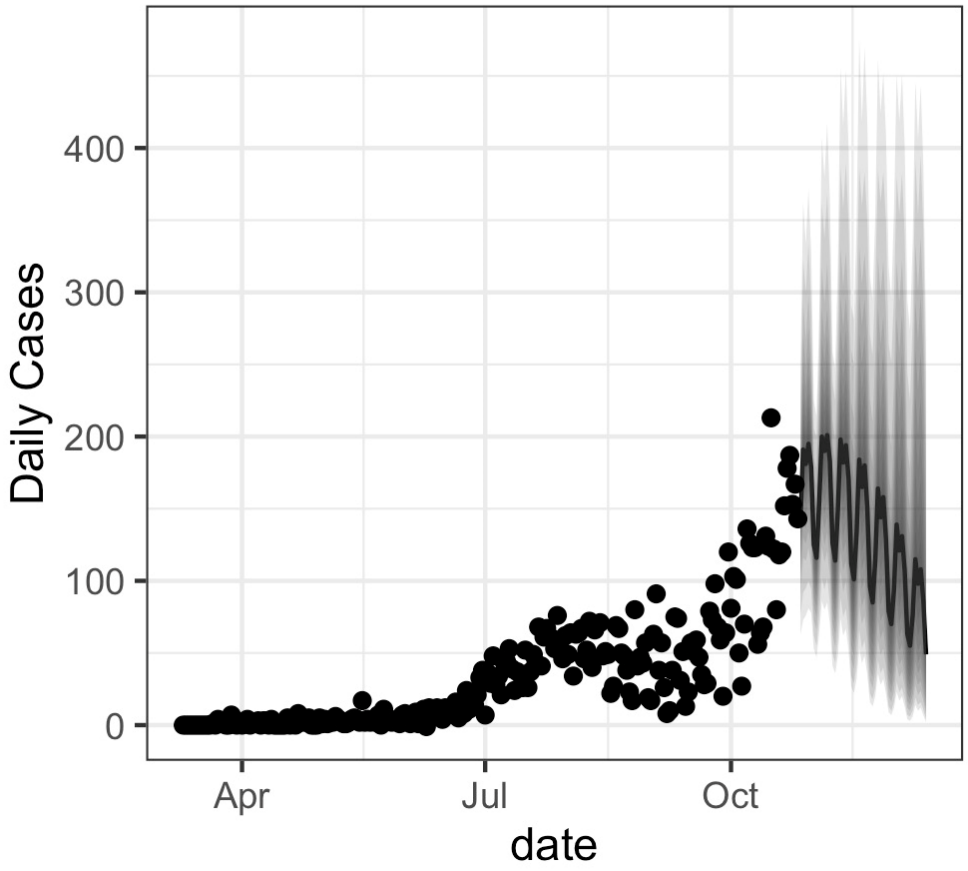


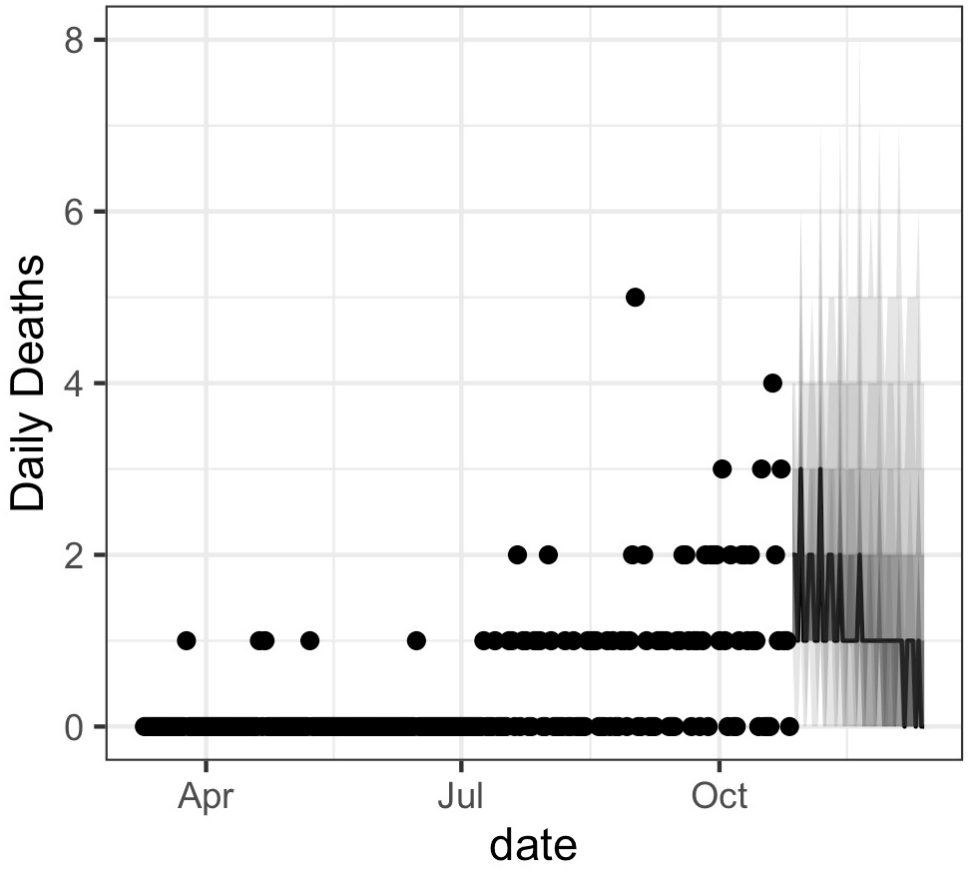


The daily number of cases is expected to range between 75 and 100 for the middle case scenario in the next few weeks

Southeast Region Forecasts

Health Region - NM Southeast Region

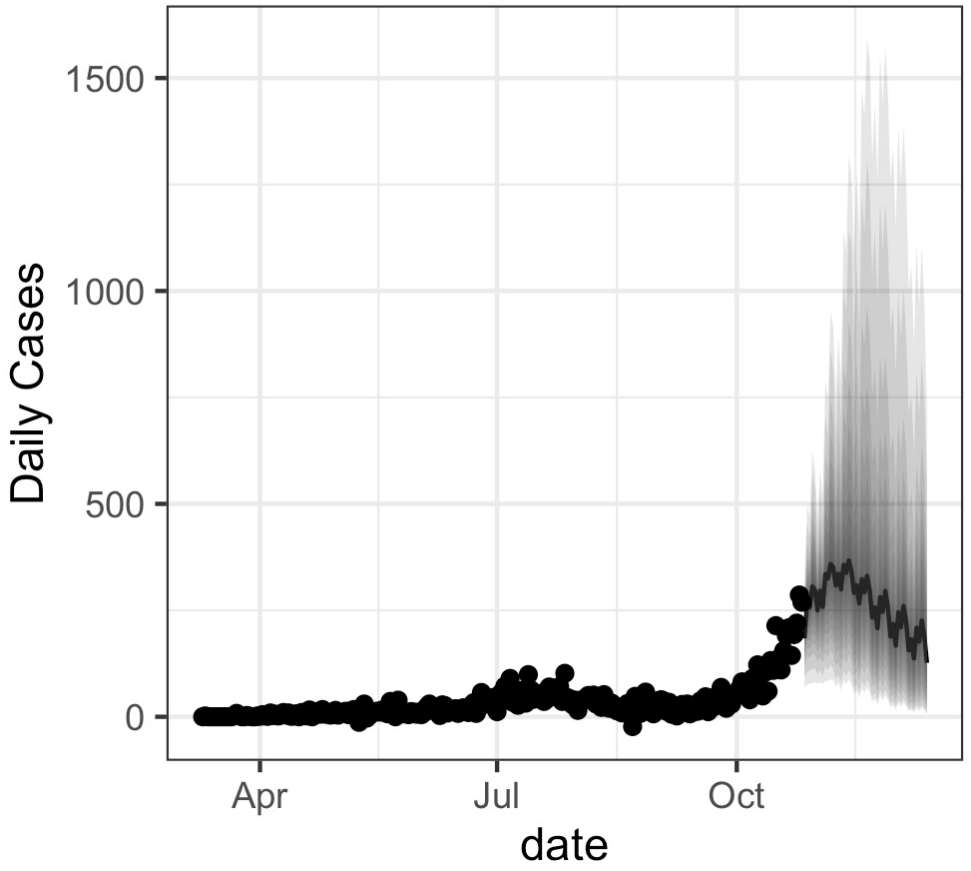


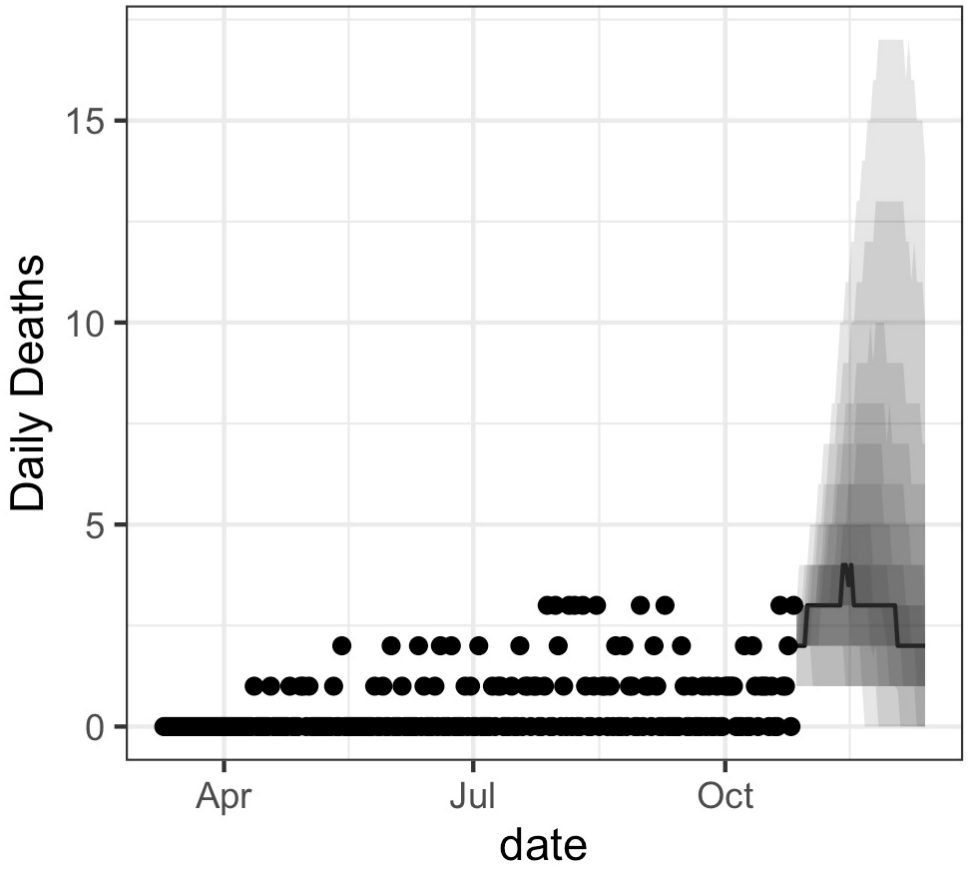


The daily number of cases is expected to range between 150 and 170 for the middle case scenario in the next few weeks

Southwest Region Forecasts

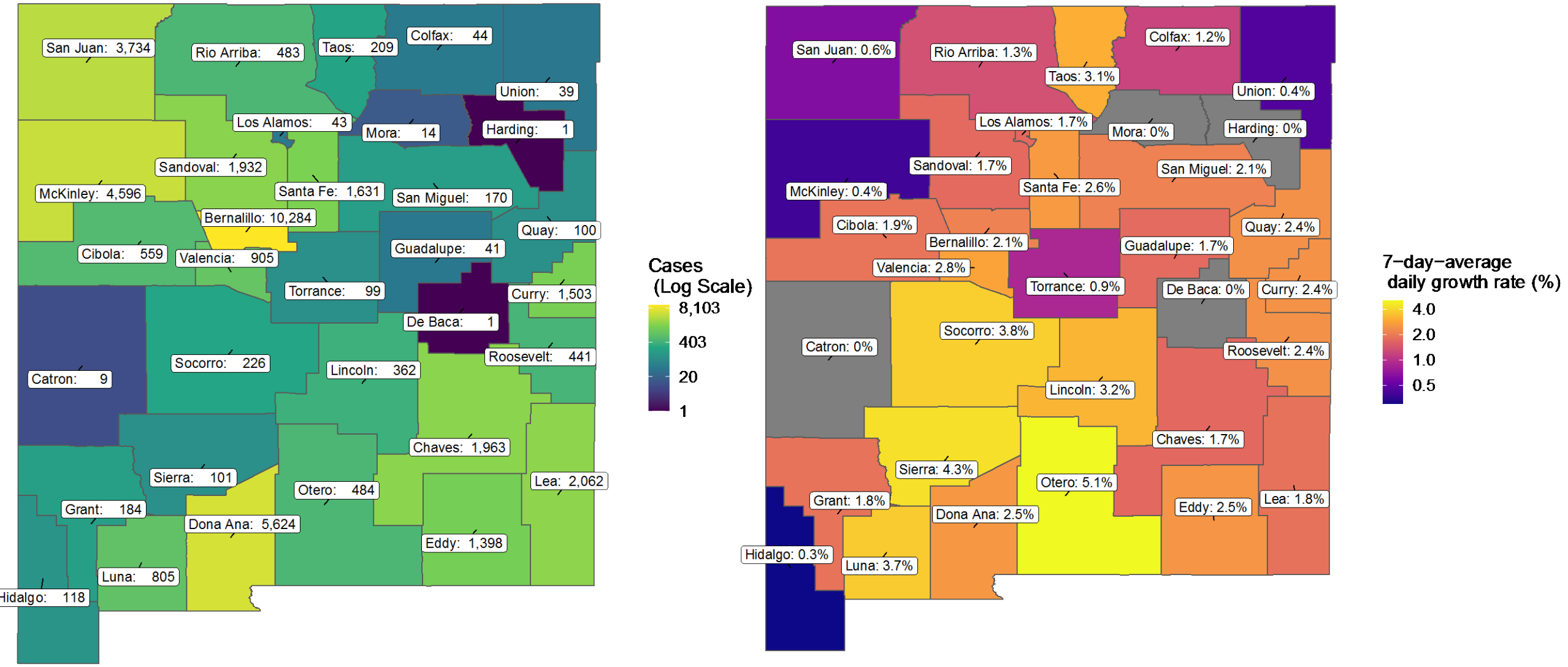
Health Region - NM Southwest Region



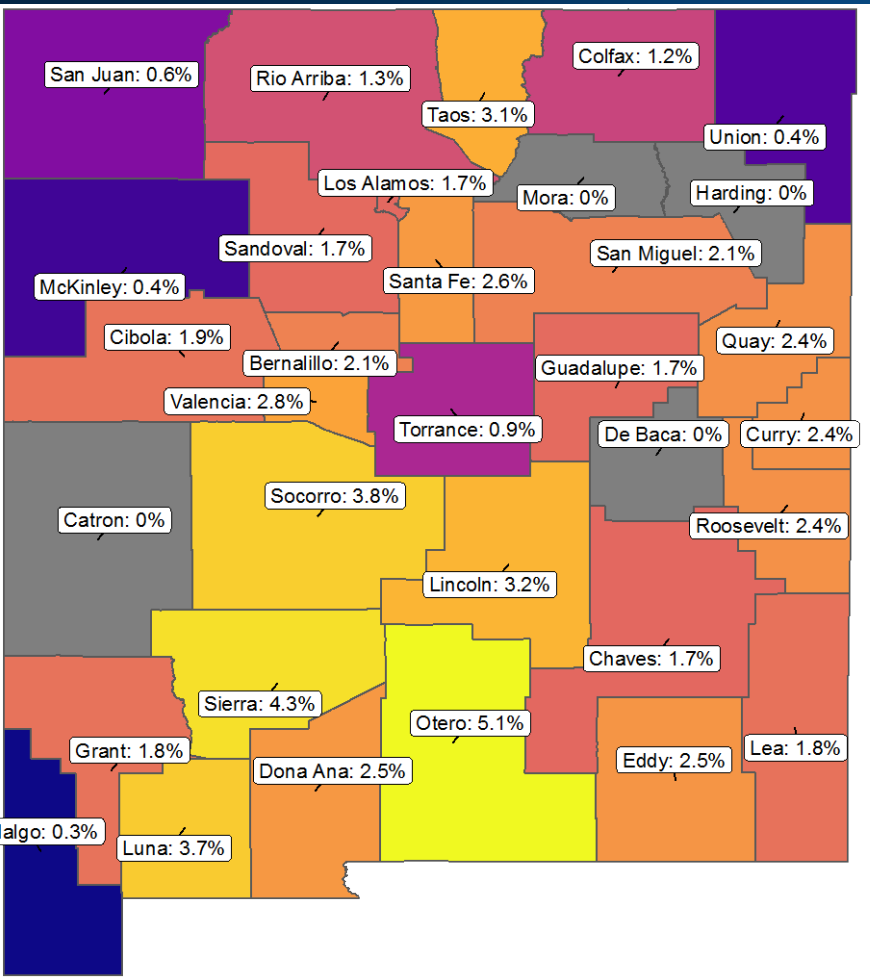


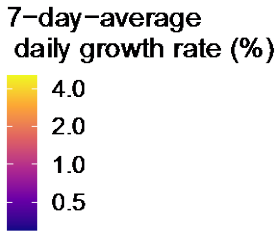
The daily number of cases is expected to range between 300 and 340 for the middle case scenario in the next few weeks

Cumulative Cases & Daily Growth Rate for NM: Oct 25



Daily Growth Rate for NM Oct 19





Hidalgo 0.3% =
DeBaca 0.0% =
Catron 0.0%=
Union 0.4% =

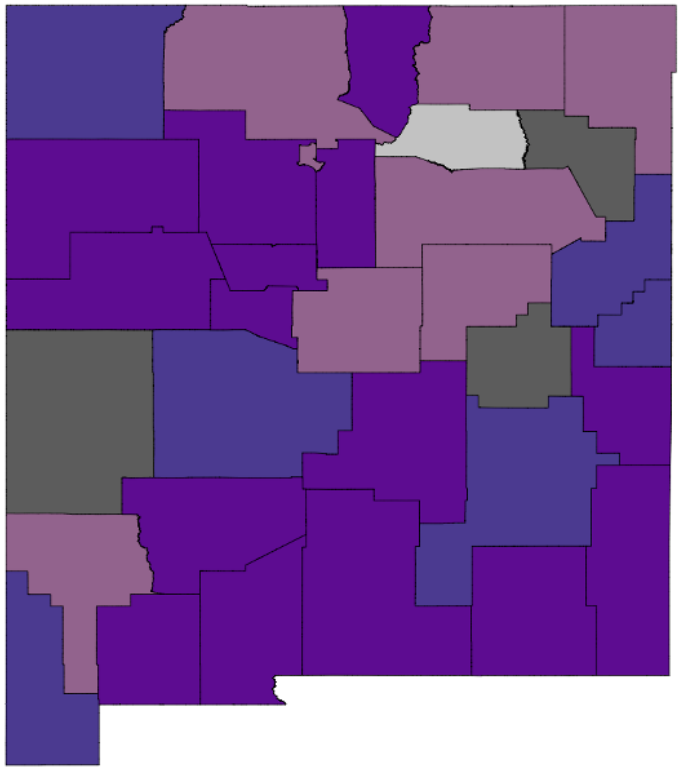
Mora 7.9% ↑
Los Alamos 1.7% ↑
Colfax 1.2% ↑
Roosevelt **2.4%** ↑
Socorro **3.8%** ↑
Quay **2.4%** ↑

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

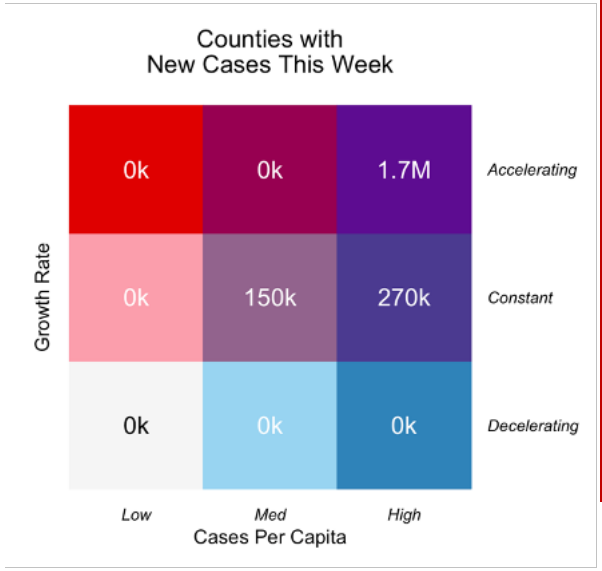
County	Daily Growth Rate	Change
San Juan	0.6%	=
Rio Arriba	1.3%	=
Sierra	1.9%	↑
McKinley	0.4%	=
Sandoval	**1.7%**	=
Santa Fe	**2.6%**	=
Cibola	1.9%	↑
Bernalillo	**2.1%**	=
Valencia	**2.8%**	↑
Torrance	0.9%	=
Lincoln	3.2%	↑
San Miguel	2.1%	↓
Chaves	**1.7%**	=
Dona Ana	2.5%	=
Otero	**5.1%**	↑
Lea	**1.8%**	=
Eddy	**2.5%**	↑
Curry	**2.4%**	=
Grant	**1.8%**	=
Luna	**3.7%**	↑
Taos	**3.1%**	↑

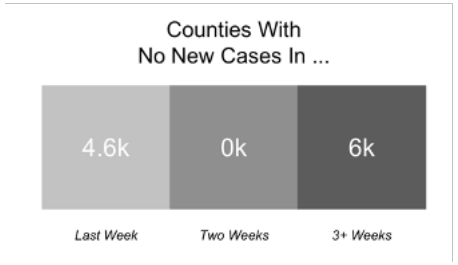
Growth Rate for NM: Another View (Oct 26)

COVID-19 across New Mexico
A 7-day moving window comparison
October 26, 2020



Impacted New Mexicans





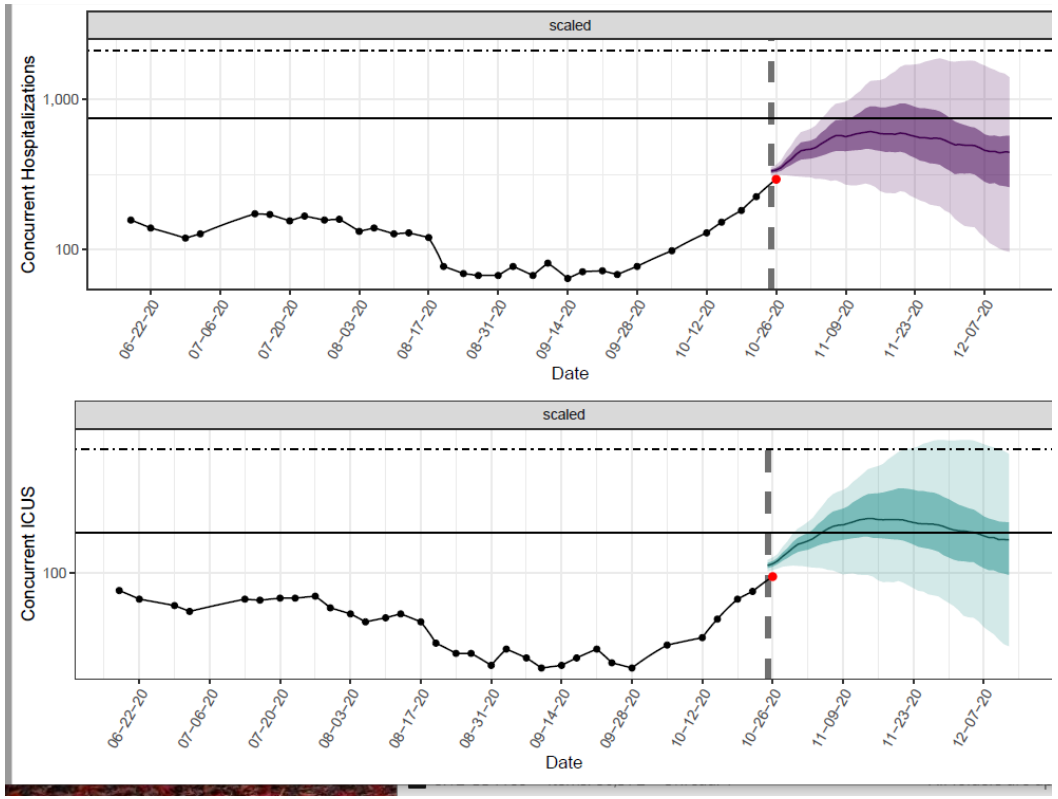
So what?

- **MOST New Mexicans live in a county with currently accelerating growth and high per-capita case counts**
- **No counties are decelerating right now**

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

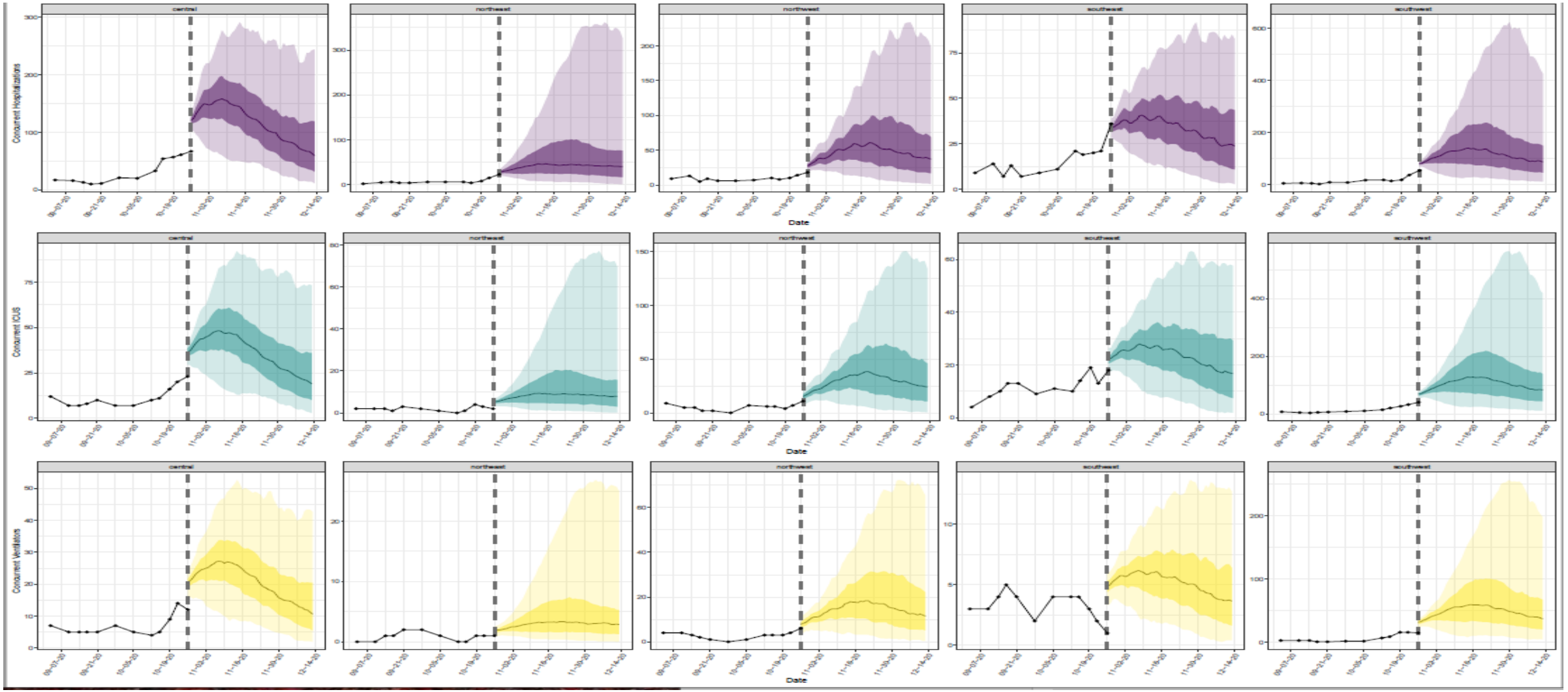
Week	Qu. 5% (best case)	Qu. 50% (median)	Qu. 95% (worst case)
11/1	109	152	194
11/8	100	196	315
11/15	94	215	444
11/22	83	207	580
11/29	68	192	657
12/6	49	173	635

"Scaled" Scenario

So what?

We are on track to *exceed ICU beds by November 8.* We expect to be over for 4 weeks. This is using the updated LANL forecasting model COFFEE.

Regional Hospitalization Forecasts



Central Northeast Northwest Southeast Southwest

Regional Hospitalization Forecasts

Concurrent COVID-19 ICUs beds: Southwest

Week	Qu. 5% (best case)	Qu. 50% (median)	Qu. 95% (worst case)
11/1	46	95	135
11/8	28	115	236
11/15	25	128	362
11/22	21	119	479
11/29	17	103	565
12/6	13	89	515

Concurrent COVID-19 ICUs beds: Central

Week	Qu. 5% (best case)	Qu. 50% (median)	Qu. 95% (worst case)
11/1	24	45	62
11/8	16	47	84
11/15	14	43	90
11/22	13	35	82
11/29	9	28	77
12/6	5	23	72

So what?

We are tracking with the WORST CASE scenario for cases right now

Regional Hospitalization Forecasts

Concurrent COVID-19 ICUs beds: Southeast

Week	Qu. 5% (best case)	Qu. 50% (median)	Qu. 95% (worst case)
11/1	16	25	35
11/8	10	27	44
11/15	8	26	52
11/22	6	24	58
11/29	4	21	58
12/6	2	18	58

Concurrent COVID-19 ICUs beds: Northwest

Week	Qu. 5% (best case)	Qu. 50% (median)	Qu. 95% (worst case)
11/1	12	23	36
11/8	9	31	59
11/15	6	35	84
11/22	4	36	118
11/29	3	30	138
12/6	1	27	144

So what?

We are tracking with the WORST CASE scenario for cases right now

Regional Hospitalization Forecasts

Concurrent COVID-19 ICUs beds: Northeast

Week	Qu. 5% (best case)	Qu. 50% (median)	Qu. 95% (worst case)
11/1	3	7	13
11/8	2	9	26
11/15	1	9	44
11/22	1	9	61
11/29	1	9	73
12/6	0	8	75

So what?

We are tracking with the WORST CASE scenario for cases right now