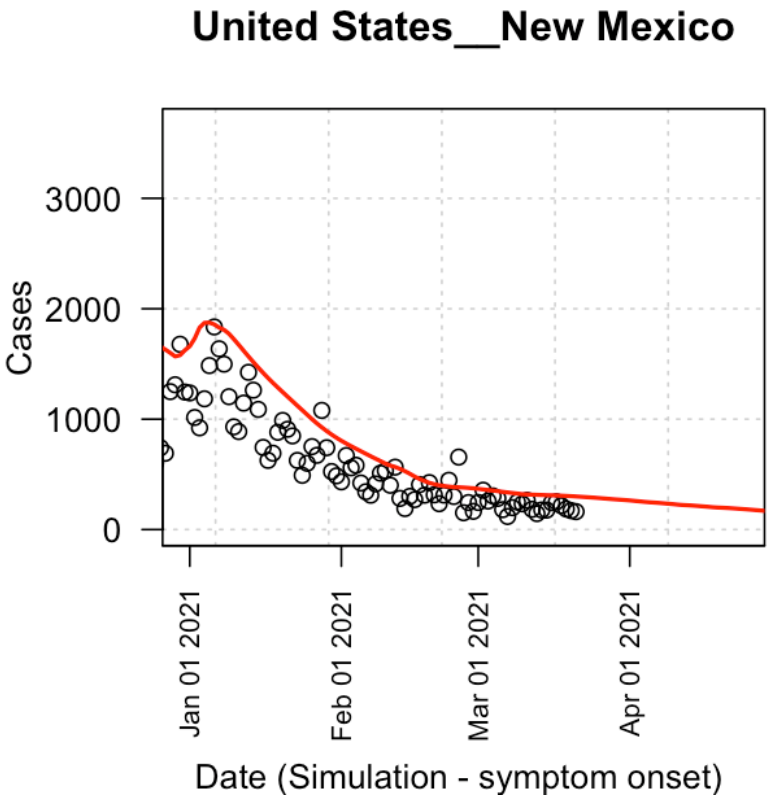
Modeling & Forecasting COVID-19 in NM

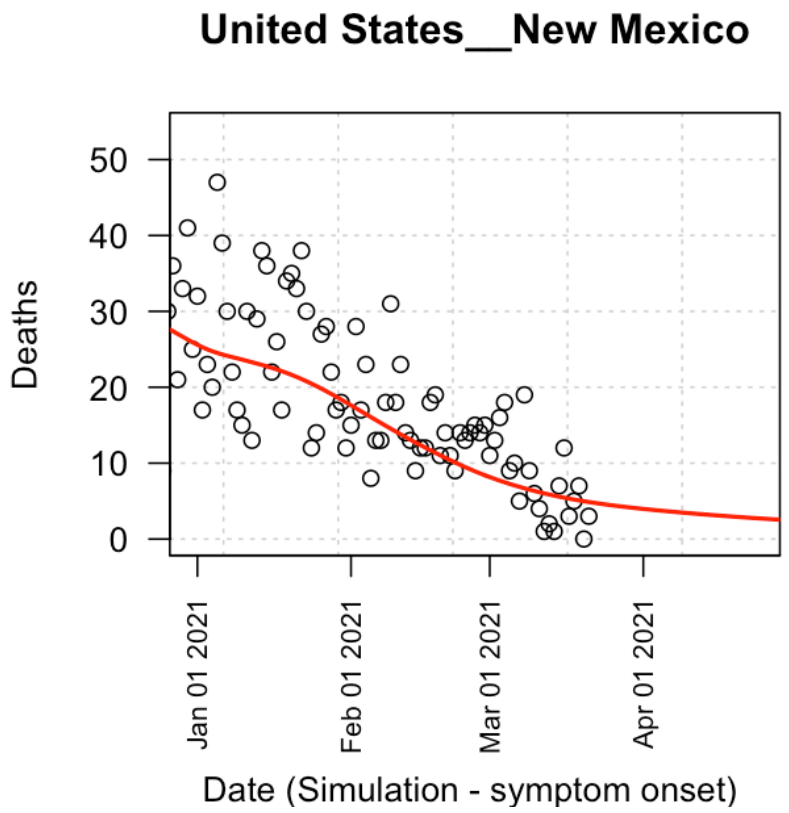
March 23, 2021

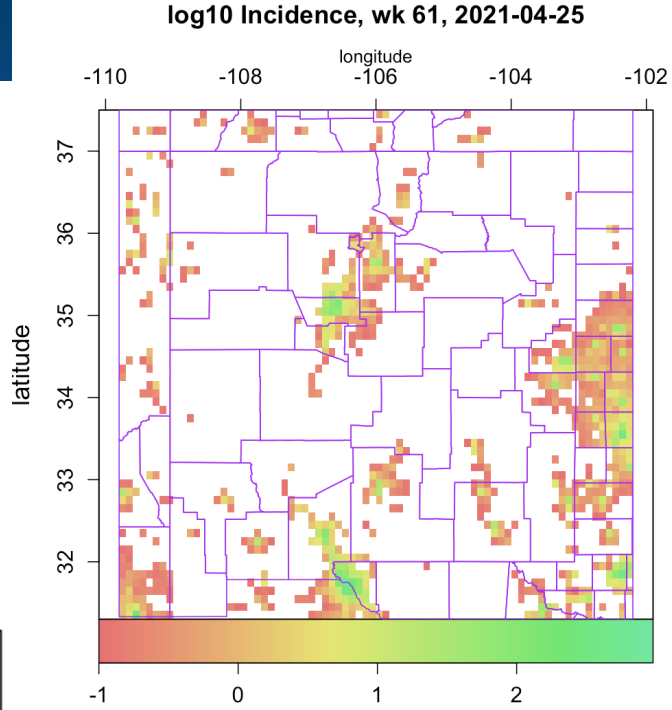
NNSA
National Nuclear Security Administration

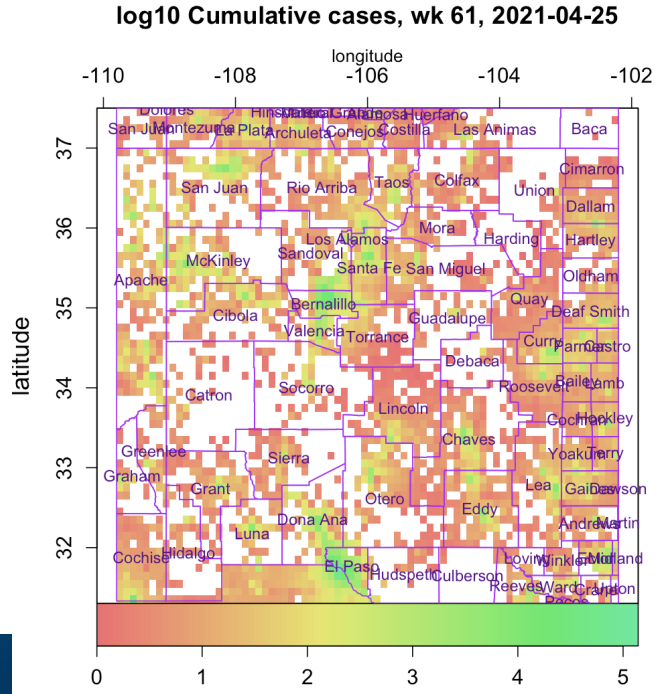
23 Mar 2021: EpiGrid modeling

- NM daily incidence is nearly flat.
- NM deaths are now below the model.
  - Model does not yet account for vaccination of cohorts with higher death rates.
- This model does not include in-person school opening.







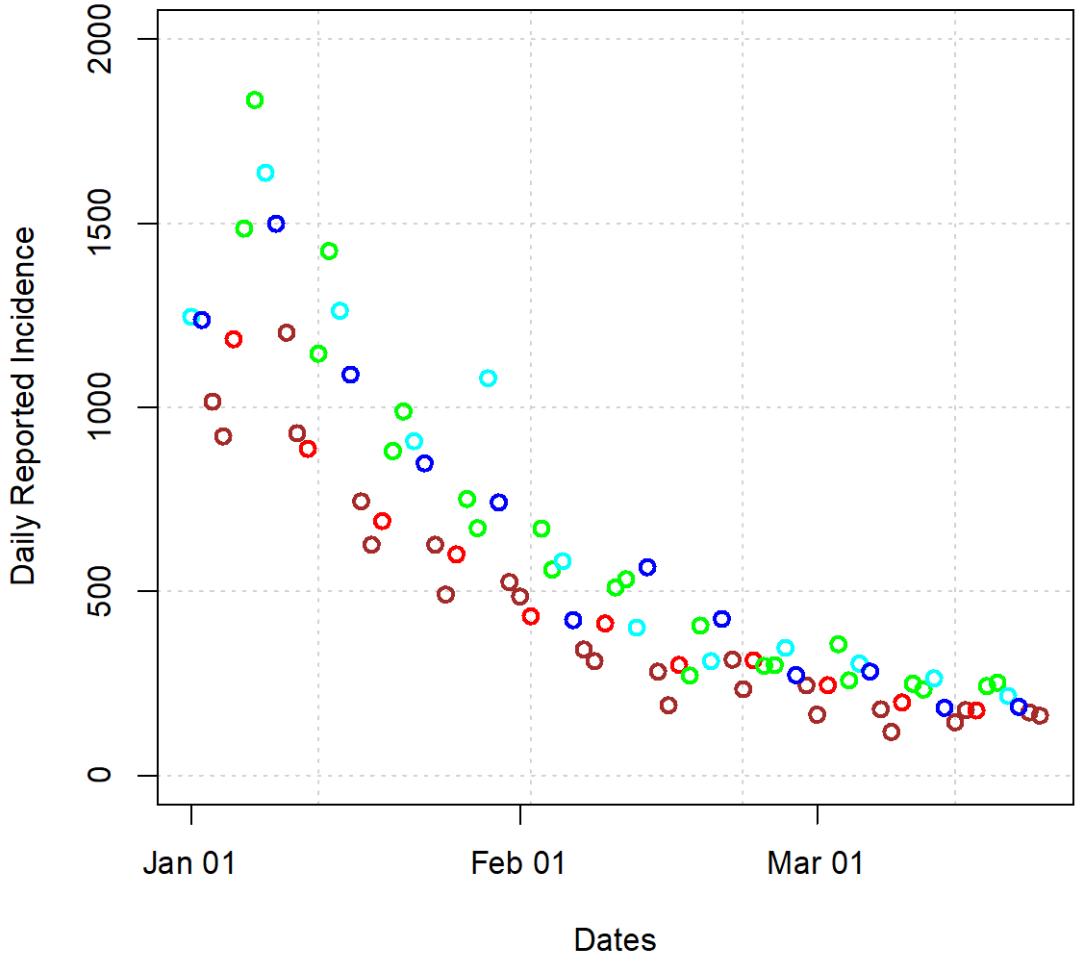


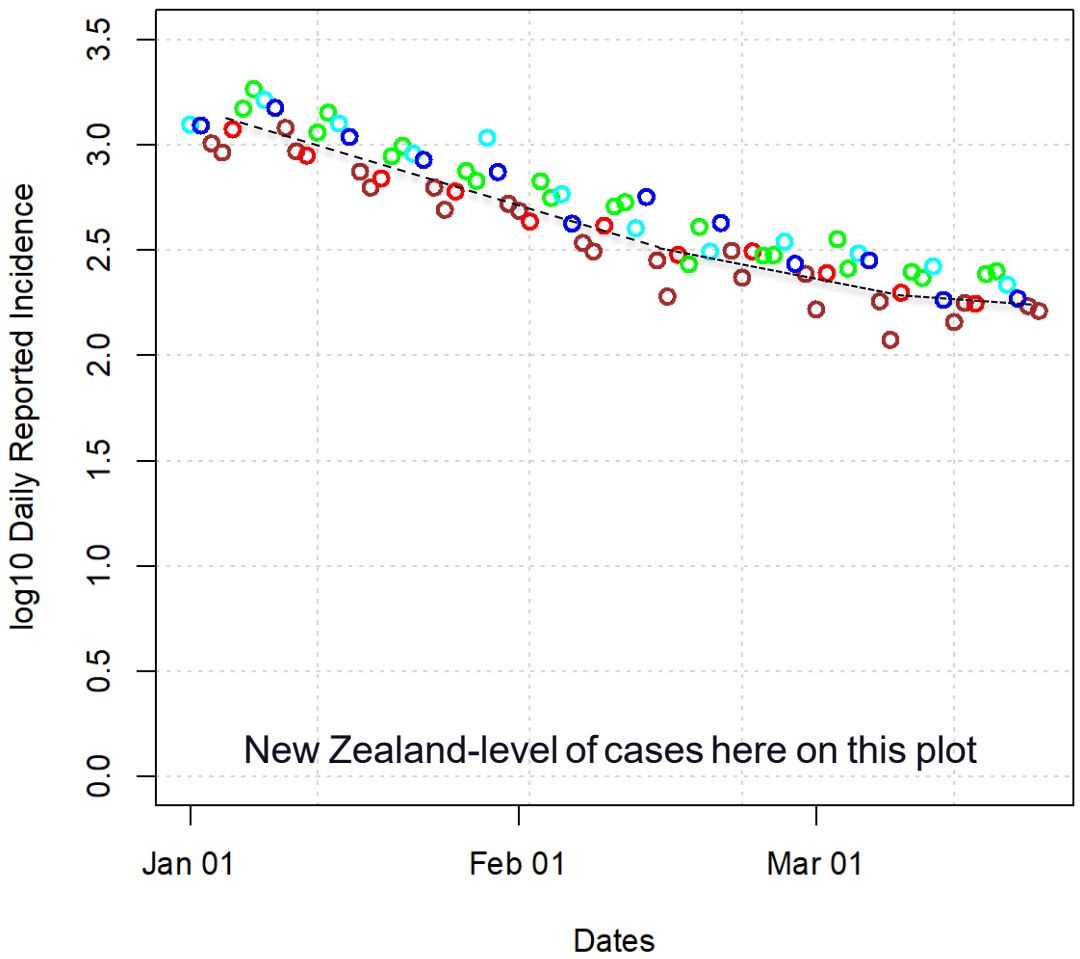
A look at the raw incidence data

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

Possibly still slowing, but not nearly as rapidly as in January and early February: Incidence may be flat.

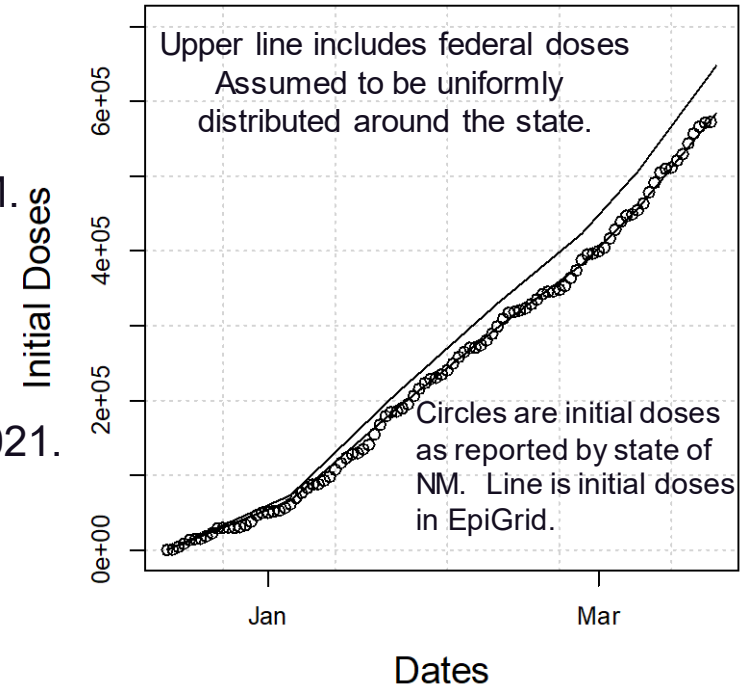
The 190 cases in the Lea county correctional facility are removed from data reported on the 26th. The 1/3 of reported cases that were > 2 weeks prior were removed from the 24th.





23 March 2021 Model (Mechanistic) – more details and information

- **See Figure for historical prime-dose vaccinations.**
  - Some Federal doses are uniformly distributed around the state, the rest are in McKinley, Cibola, and San Juan.
  - State vaccination rate is at a new high. 652,410 first doses have been administered in NM.
- **Transmission is based on mobility with modifications due to PHO's and the red/yellow/green/turquoise (RYGT) framework.**
  - Public health orders (PHO) and public behavior similar to previous models.
  - Small changes to current RYGT assignments are assumed starting Wednesday, 24Mar2021.
- **Daily reported cases in El Paso are steady or declining.**

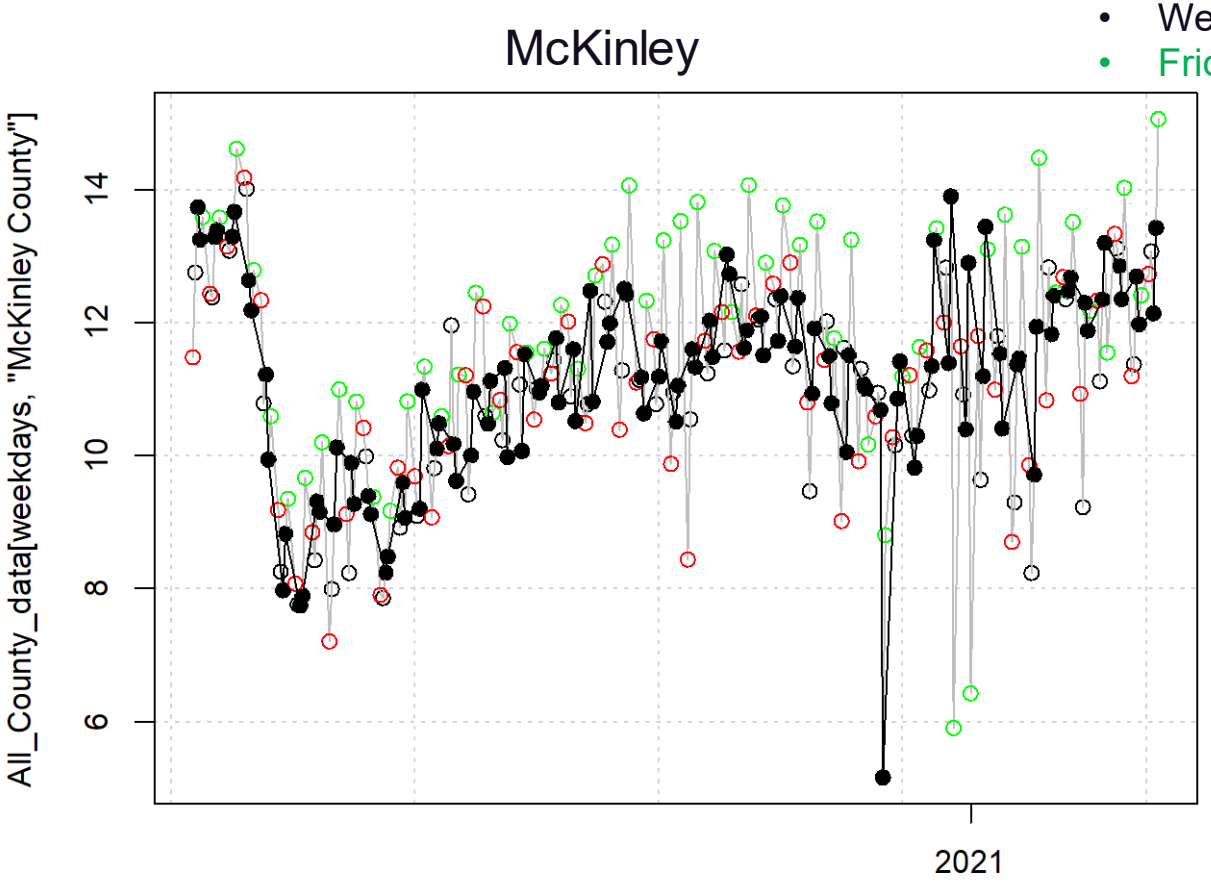


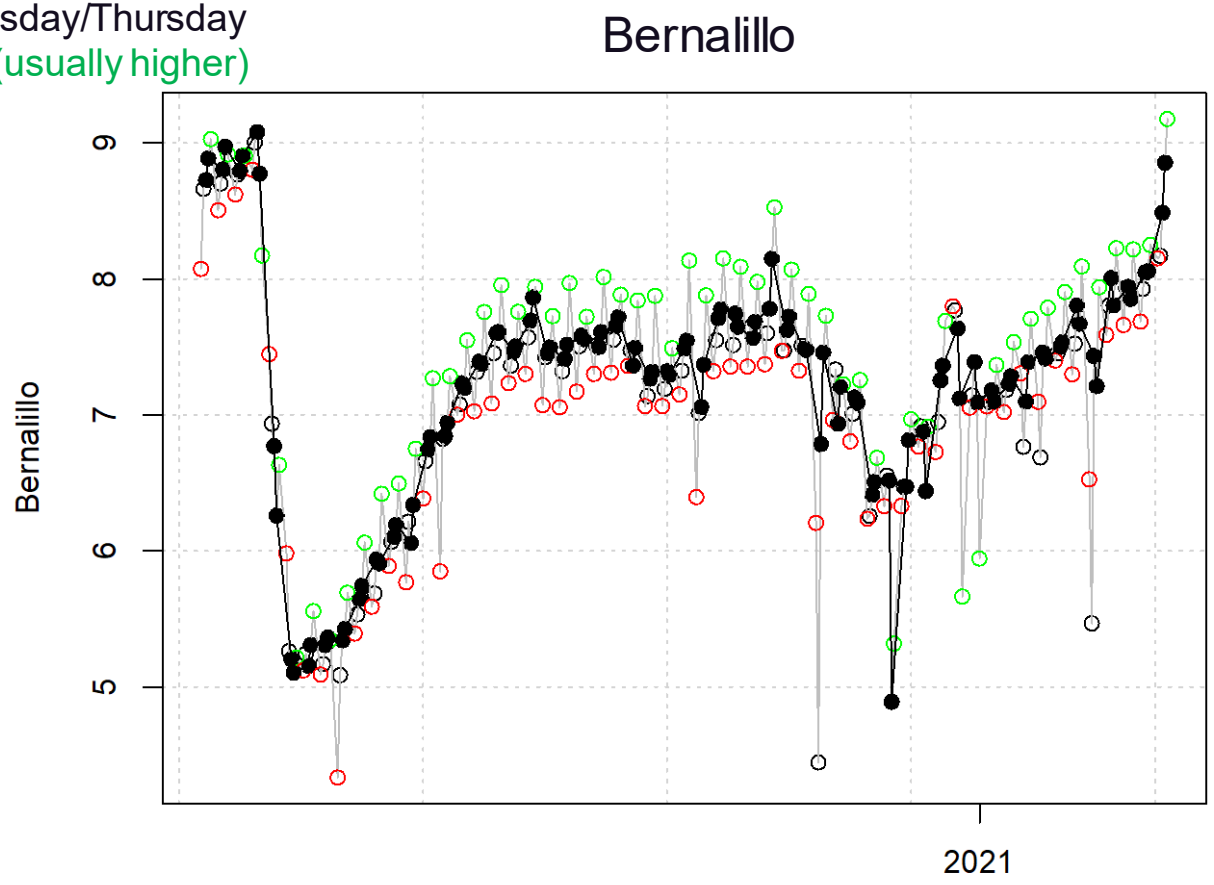
- **Isolation and quarantine rates are assumed to be stable based on state-reported quarantine times.**
  - Base isolation rates mostly modeled as 50% Dec. 8th-22nd,45% until Jan 10th then are increased to 55%.
- **Baseline results reflect novel variants of SARS-CoV-2. The effect may be detectable in the near future.**
  - Potential for a 50% increase in contagion/force of infection.
  - Epidemiological evidence does not discount strain replacement in New Mexico.
  - Without vaccination and with the current state of PHO opening, an increased daily incidence would be occurring.

T-80 Mobility – northern counties (Data only)

- Los Alamos, McKinley, Taos, had stable or slightly decreasing mobility
- Rio Arriba had slightly increasing mobility
- Bernalillo, Sandoval, San Juan, Santa Fe, and Valencia had rapidly increasing mobility

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



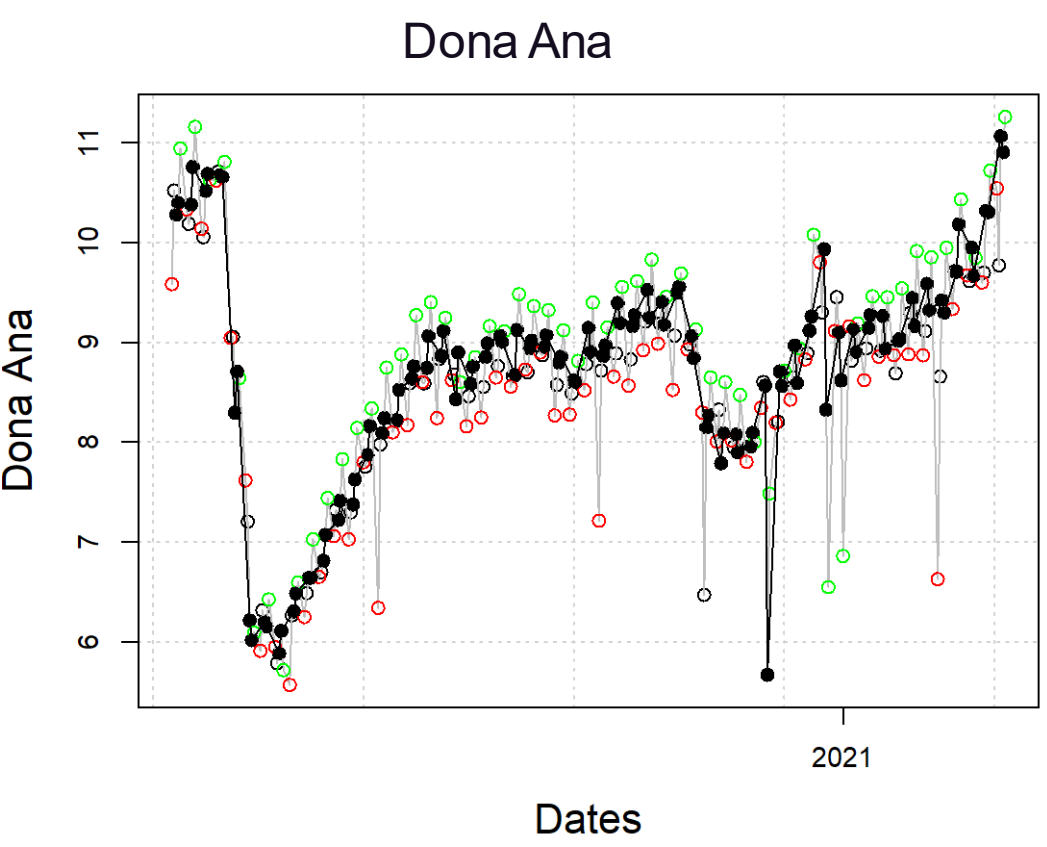


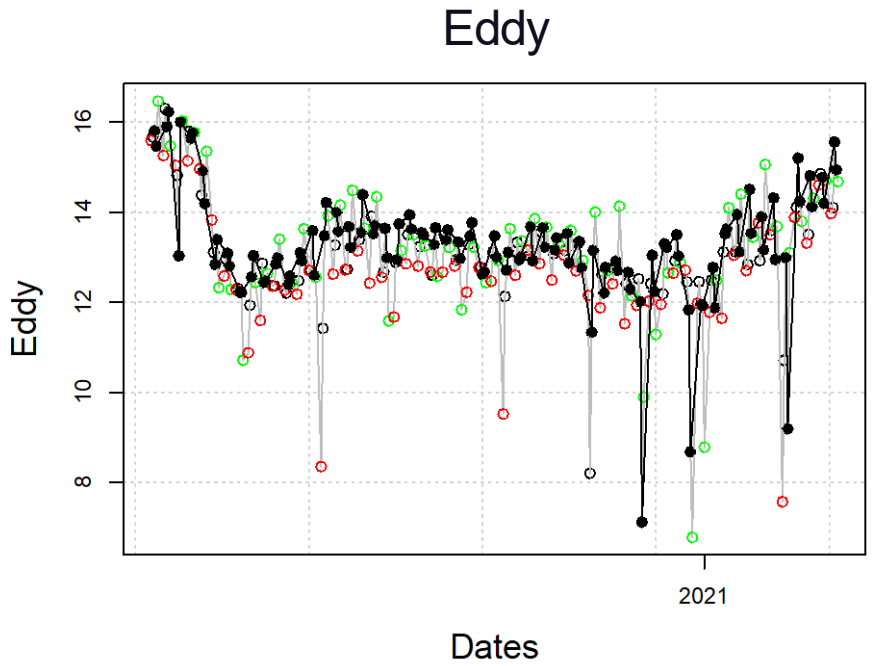
T-80 Mobility – southern counties and Curry (Data only)

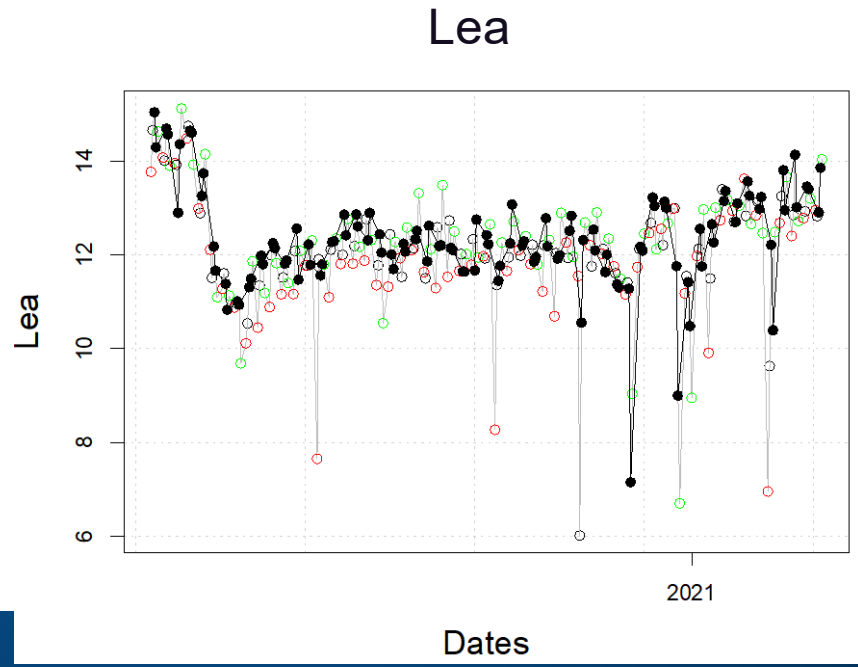
- Chaves, Curry, Grant, Lea, Luna, Otero, had stable or decreasing mobility.
- Eddy and Lincoln had increasing mobility.
- Dona Ana, Roosevelt, Socorro had rapidly increasing mobility.

Heterogeniety dominates

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

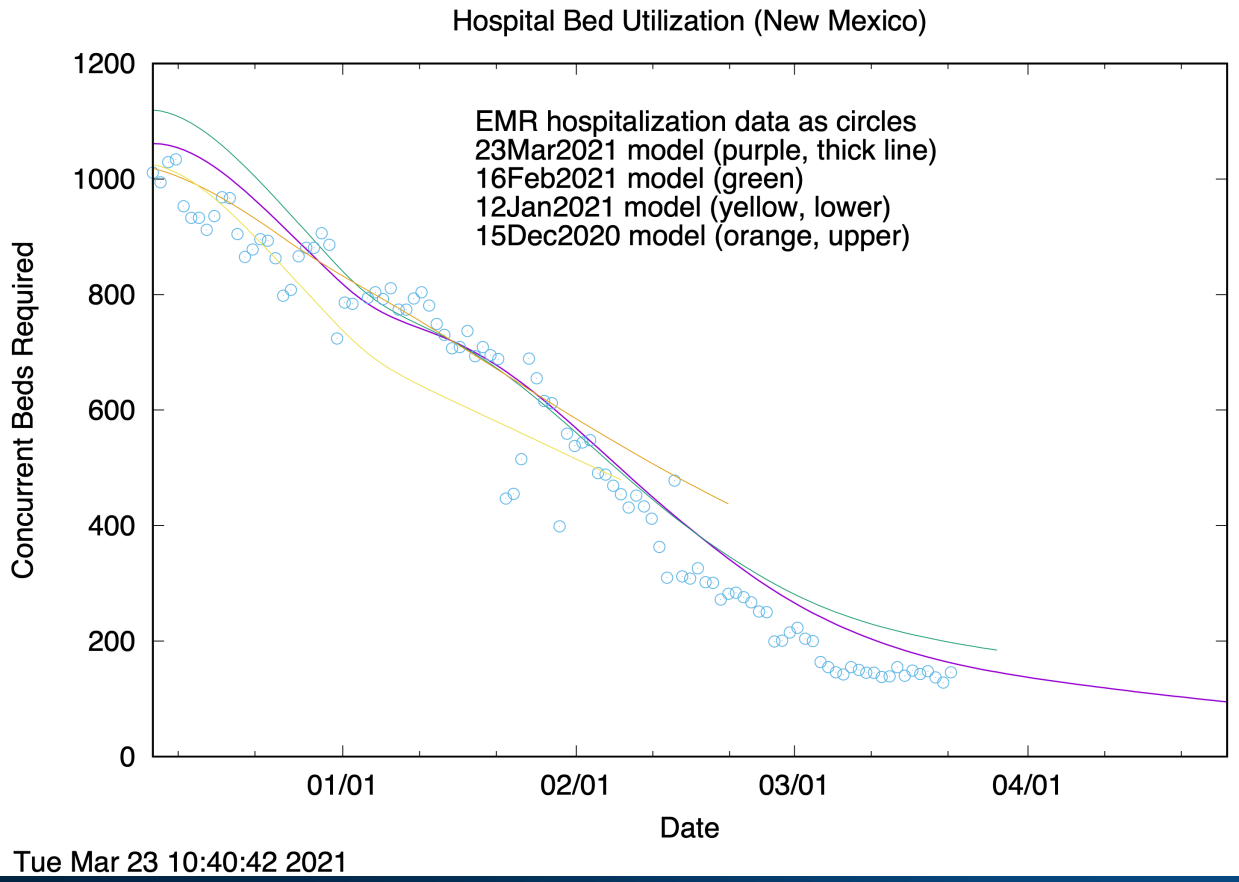


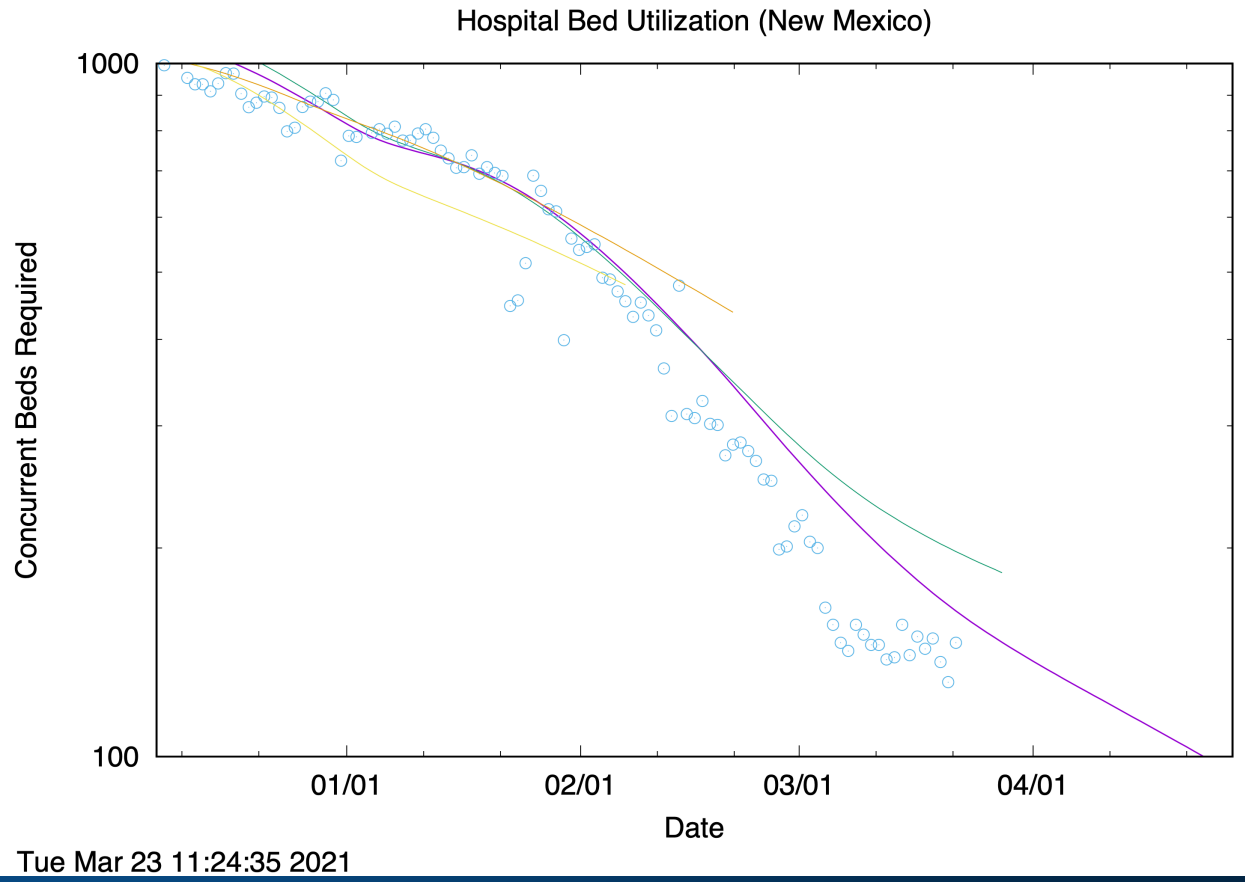




Hospital bed concurrent usage by COVID-19 patients (Statewide)

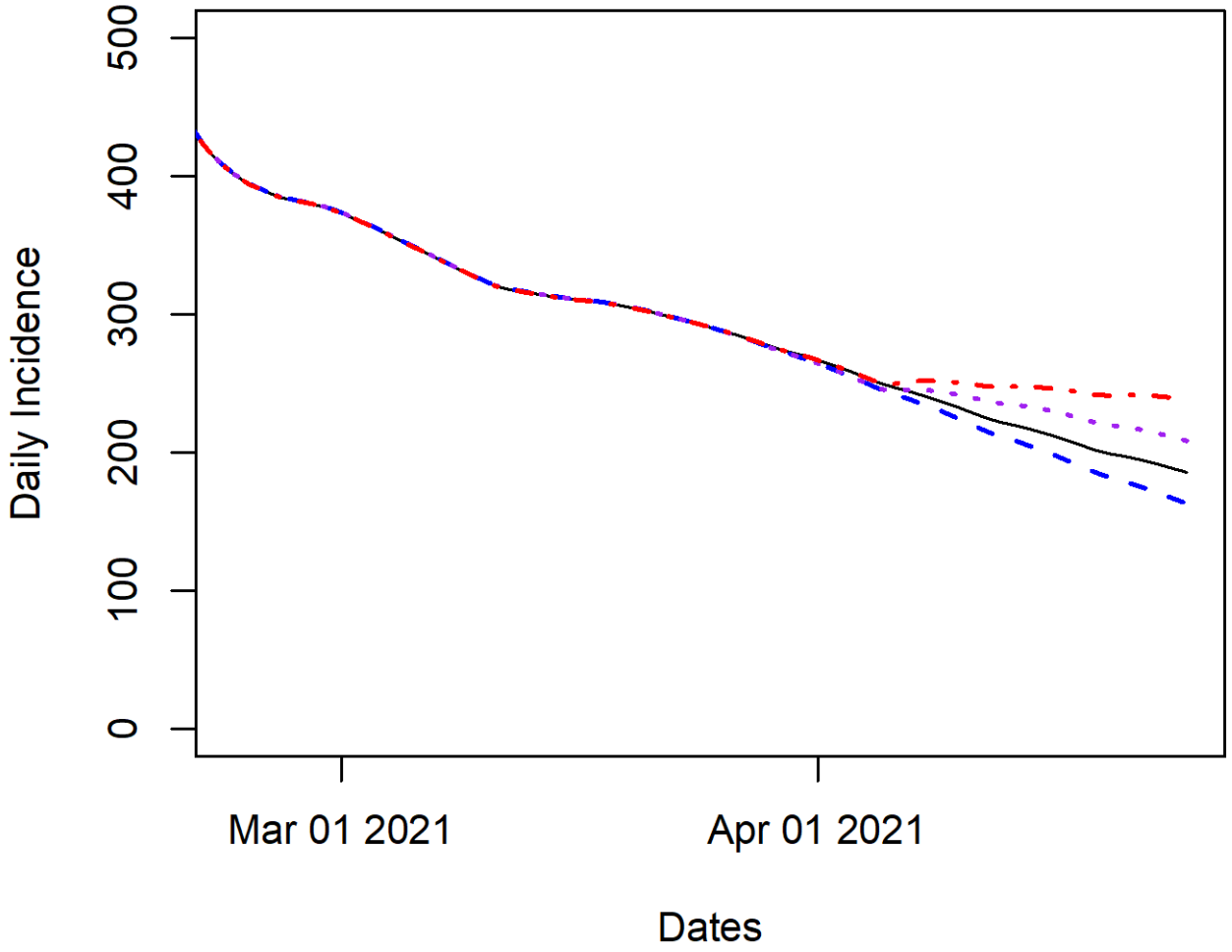
- Left panel: Linear vs. time (y-scale=0:1200) shows hospital beds.
- Right panel: Log vs. time, same data and models (y-scale = 100:1000, 10x).
- Divergence between 15Dec2020 model, subsequent EMR data, and later EG models reflects the impact of vaccination.
- EMR hospitalization as circles, 23Mar21 model (purple, thick line), 16Feb21 (green), 12Jan21 (yellow, lower), 15Dec20 (orange, upper)





Is New Mexico's Progress Stable? Several factors to consider.

What about schools? What if first doses are accelerated by delaying second doses now that the most vulnerable populations are largely vaccinated?



Schools effectively increase statewide transmission by 10%. Higher than previous estimates --- more parents are now free to work on-site. (dash – dot).

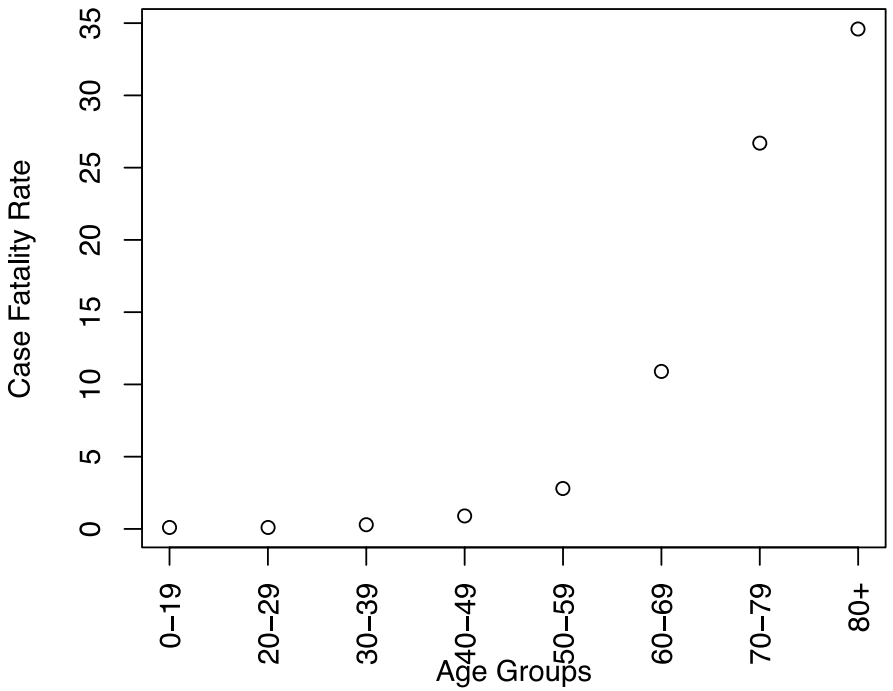
Schools and single doses (dots)

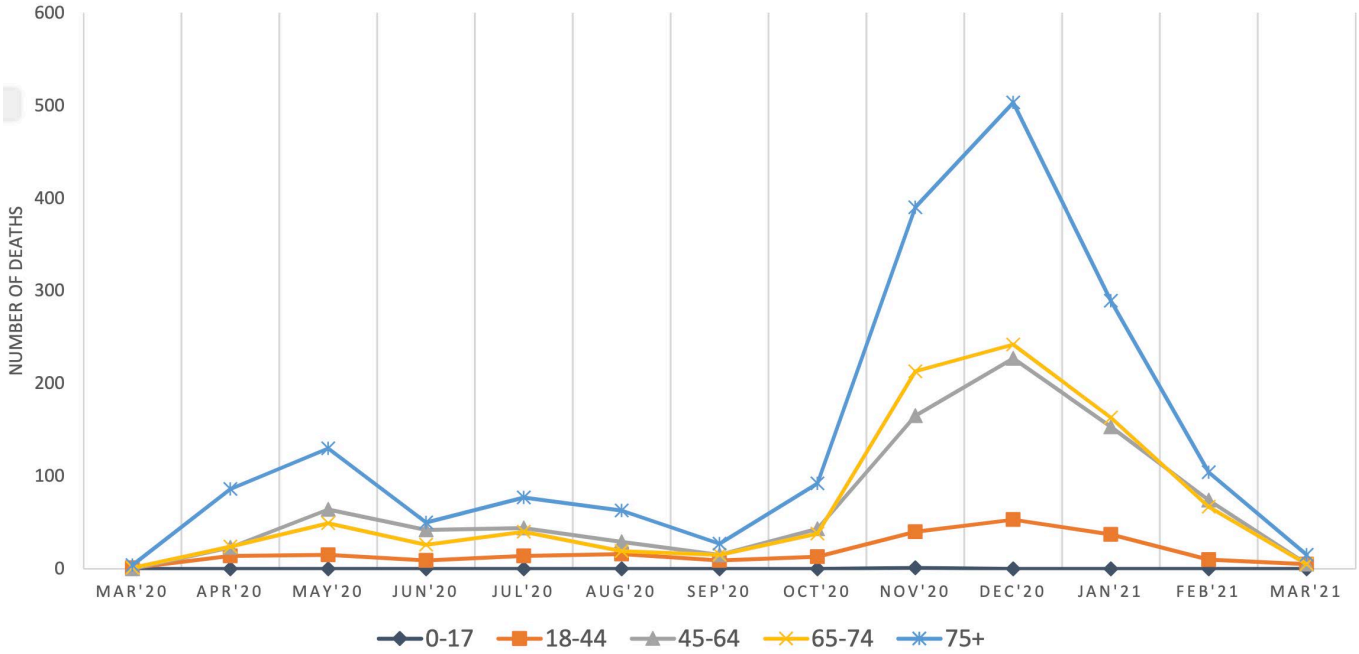
Base simulation

Speed first doses by delaying second doses per the UK's strategy (dashes).

A 12 week delay in second doses is comparable to the time to complete first doses for >=16 yr-olds in NM.

Case Fatality Rates and Deaths as a function of age (relevance to vaccination)?





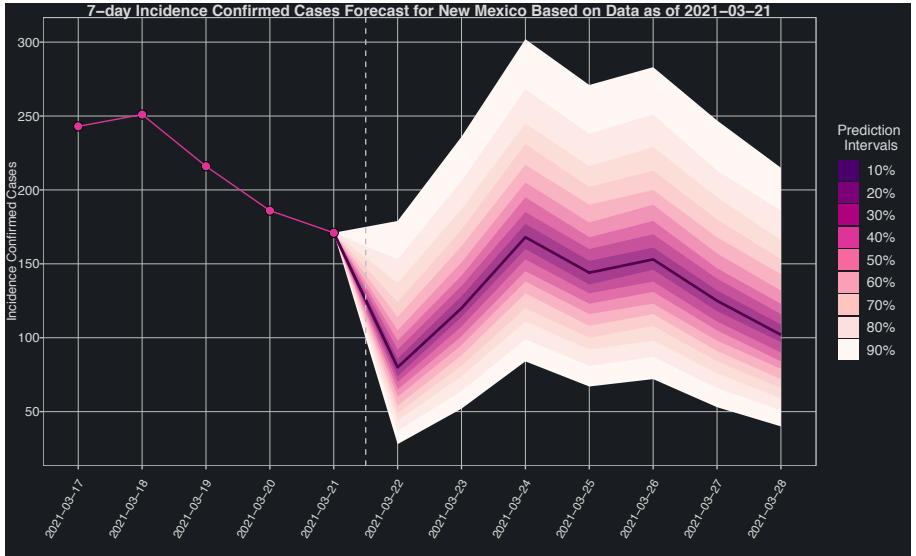
So far in 2021, 20 – 30% of deaths are people without comorbidities.

Excess mortality also addressable via accelerated first-doses?

Conclusions and Discussion

- **New Mexico's daily incidence is nearly flat, possibly slowly declining. Sustained rapid or accelerating vaccination is crucial to this success given reopening. Reopening continuing to affect mobility. Secondary effects of schools too?**
- **NM might be above at the "speed limit" for re-opening/relaxation. Might take 1-2 weeks to notice.**
- **Increased vaccine supply, delayed second-doses, and improved effectiveness of investigation and quarantine would all likely restore a more rapid decline in daily incidence in New Mexico. Reference UK success, compare France, Germany.**
- **This model *assumes* about 1:1000 variant cases in late January in NM. This implies that currently variants *might* be 1-10% of new cases. This should be apparent in sequences during April if contagious-variant replacement is happening.**
- **Begin shifting the vaccination strategy toward contagion-control, and transmission-chain termination?**
- **Quarantine plays a comparable role to vaccination in New Mexico's epidemic control.**
- **Grant may be having an outbreak.**
- **El Paso's daily incidence is consistent with a slow decline in incidence.**
- **Texas' change in public-health regulations *might* soon increase the introduction rate into New Mexico.**
- **Nationwide geographical dispersion is seeding some local transmission and variants.**
- **Discussion:**
  - Good infection control in schools appears to be well-correlated with improved outcomes. Improved PPE may be required in response to viral variant emergence (surgical masks). Meal times, busses, and passing periods are likely the riskiest school-related activities.
  - Epidemiological evidence is consistent with at-risk vaccination having significantly reduced hospitalizations and mortality in New Mexico.
  - *Epidemiological* evidence does not rule out a more contagious variant of SARS-CoV-2 in New Mexico (as compared with Milan-like variants).
  - Daily incidence is low enough that testing may soon be qualitatively larger than incidence. New Zealand, test-positivity << 1% .
  - The importance of case investigation and quarantine might *rise* in reaction to vaccine-associated control (See New Zealand).
  - Geographical or ring-like vaccination might be feasible. Tenth-highest NM ZIP code for incidence had 5 cases on Monday 22 March 2021.
  - Elimination of COVID-19 removes or reduces the risk of novel variant emergence.

Short- & Long-Term Forecast for NM: Cases



6–Week Forecast of Confirmed Cases for New Mexico Based on Data as of 2021–03–21

Week	Best Case (5th Percentile)	Middle Case (50th Percentile)^	Worst Case (95th Percentile)
2021–03–21		189,731*	
2021–03–28	190,128	190,624	191,458
2021–04–04	190,463	191,457	193,156
2021–04–11	190,804	192,353	195,027
2021–04–18	191,184	193,355	197,090
2021–04–25	191,593	194,495	199,564
2021–05–02	192,017	195,707	202,627

*Last reported confirmed cases count
^Closest–matching scenario

6–Week Forecast of Daily Average of Confirmed Cases for New Mexico Based on Data as of 2021–03–21

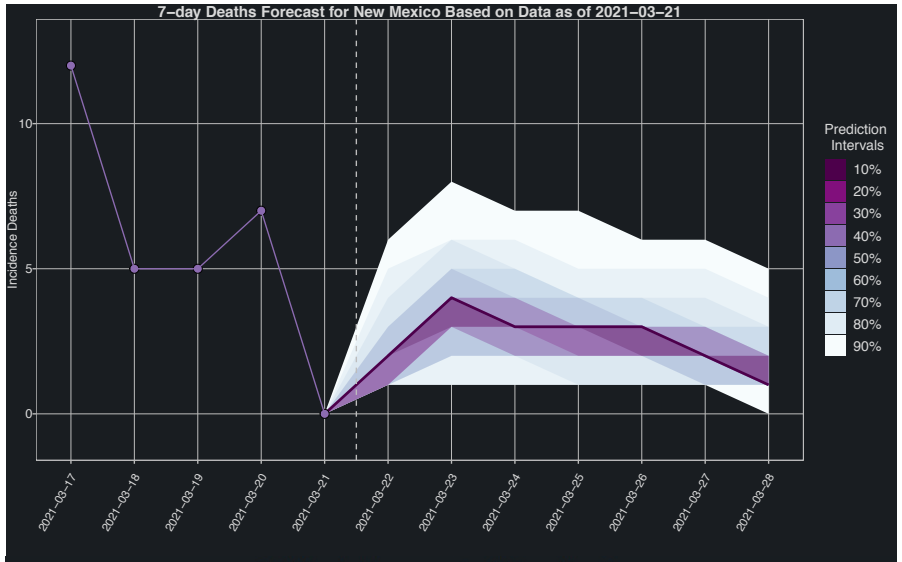
Week	Best Case (5th Percentile)	Middle Case (50th Percentile)^	Worst Case (95th Percentile)
2021–03–21		203*	
2021–03–28	57	128	247
2021–04–04	48	119	243
2021–04–11	49	128	267
2021–04–18	54	143	295
2021–04–25	58	163	353
2021–05–02	61	173	438

*Last reported confirmed cases count
^Closest–matching scenario

So what?

The <u>daily</u> number of cases are expected to range between 48 and 267 in the next few weeks

Short- & Long-Term Forecast for NM: Deaths



6–Week Forecast of Deaths for New Mexico Based on Data as of 2021–03–21

Week	Best Case (5th Percentile)	Middle Case (50th Percentile)^	Worst Case (95th Percentile)
2021–03–21		3,889*	
2021–03–28	3,895	3,907	3,931
2021–04–04	3,896	3,918	3,966
2021–04–11	3,896	3,926	3,997
2021–04–18	3,897	3,933	4,029
2021–04–25	3,898	3,938	4,059
2021–05–02	3,898	3,944	4,092

*Last reported deaths count
^Closest–matching scenario

6–Week Forecast of Daily Average of Deaths for New Mexico Based on Data as of 2021–03–21

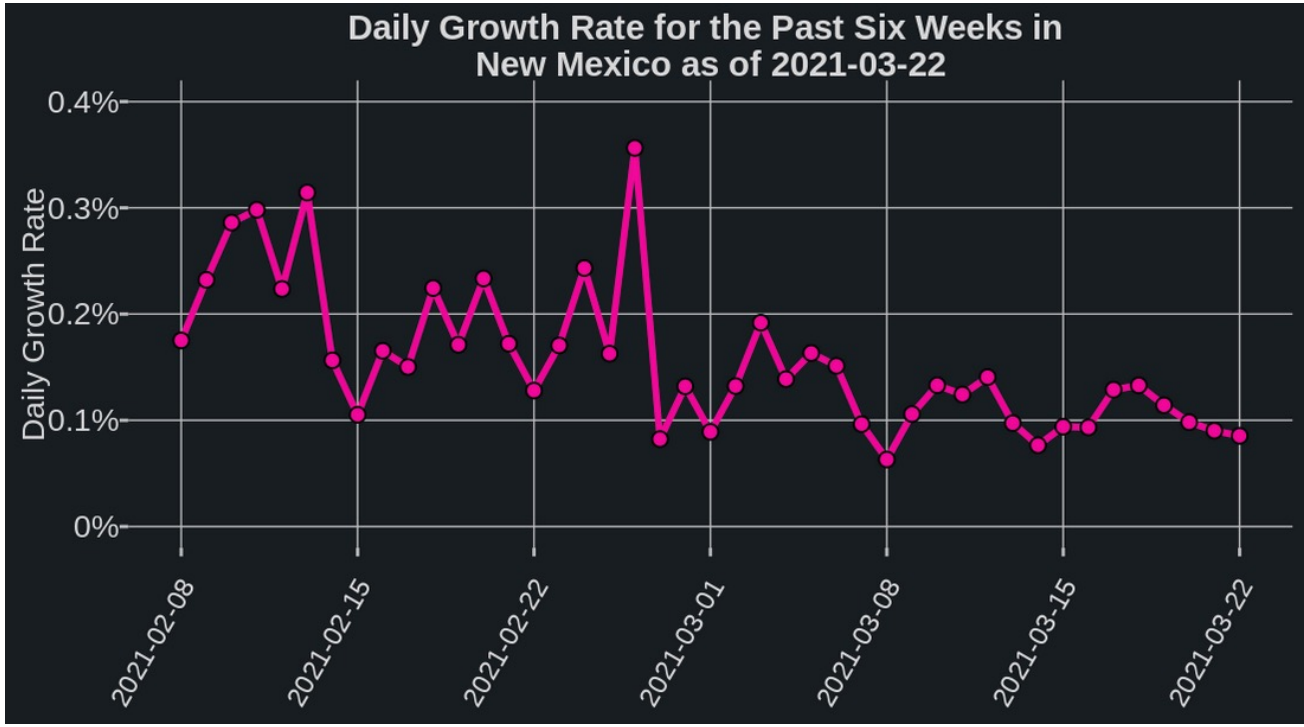
Week	Best Case (5th Percentile)	Middle Case (50th Percentile)^	Worst Case (95th Percentile)
2021–03–21		5*	
2021–03–28	1	3	6
2021–04–04	0	2	5
2021–04–11	0	1	4
2021–04–18	0	1	5
2021–04–25	0	1	4
2021–05–02	0	1	5

*Last reported confirmed deaths
^Closest–matching scenario

So what?

The <u>daily</u> number of deaths are expected to range between 0 and 6 in the next few weeks

Growth Rate for NM



6-Week Forecast of the Average Weekly Growth Rate for New Mexico Based on Data as of 2021-03-22

Week	Best Case (5th Percentile)	Middle Case (50th Percentile)^	Worst Case (95th Percentile)
2021-03-22		0.11%*	
2021-03-29	0.031%	0.071%	0.13%
2021-04-05	0.029%	0.069%	0.13%
2021-04-12	0.028%	0.072%	0.14%
2021-04-19	0.030%	0.082%	0.16%
2021-04-26	0.033%	0.092%	0.18%
2021-05-03	0.032%	0.099%	0.22%

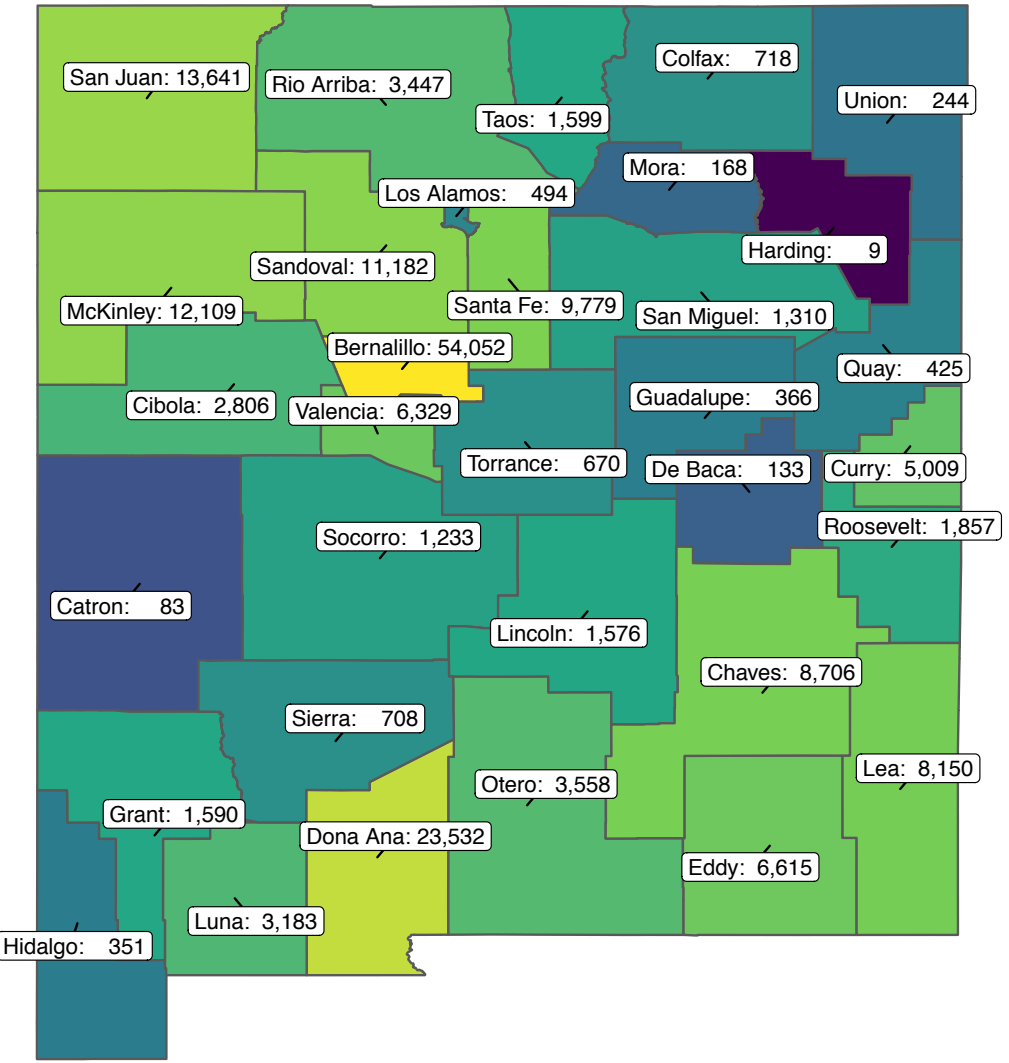
*Last weekly mean daily growth rate

^Closest-matching scenario

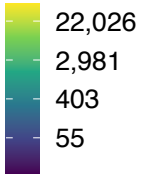
So what?

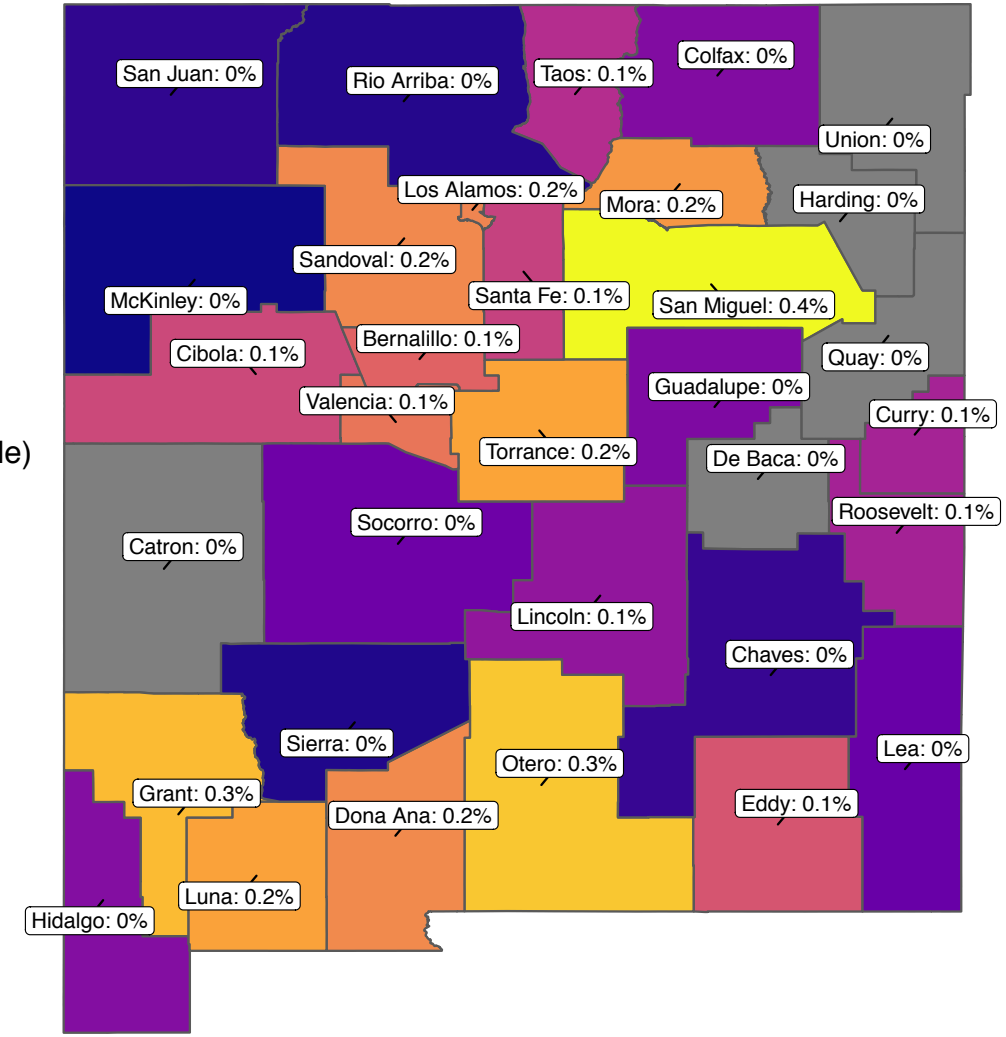
As of March 15th, the average growth rate in NM is at 0.11% (same as last week)

Cumulative Cases & Daily Growth Rate for NM: March 22

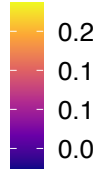


Cases (Log Scale)



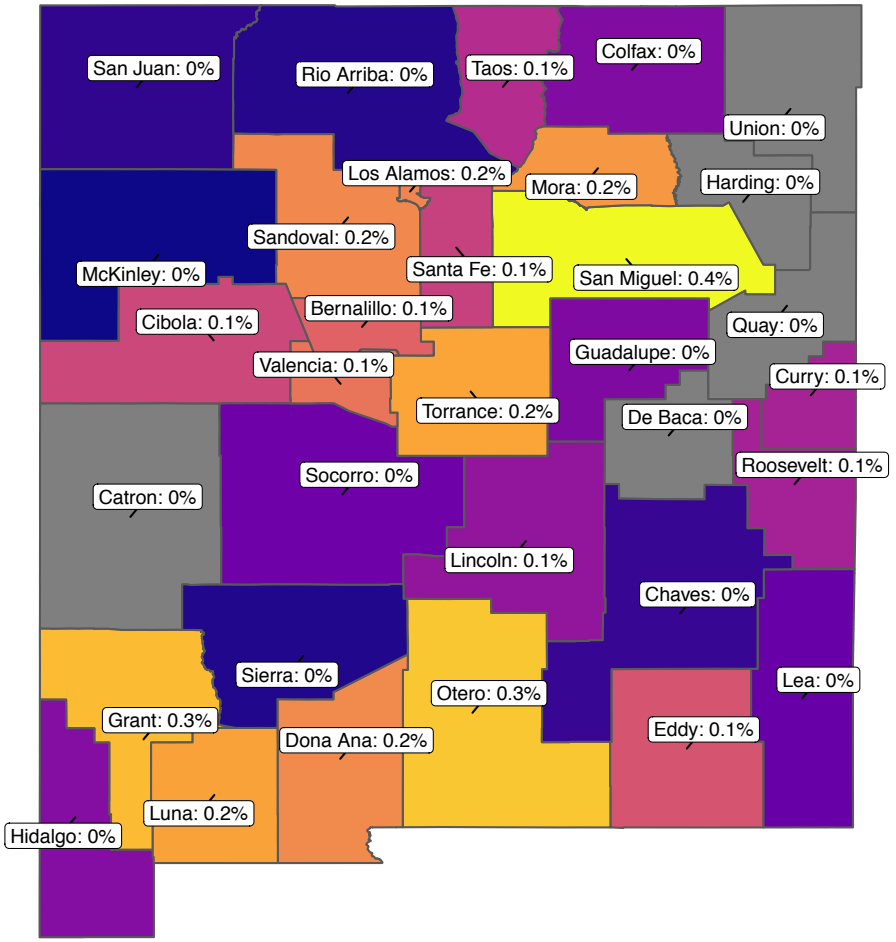


7–day–average daily growth rate (%)



*Growth rate is in cumulative cases

Daily Growth Rate for NM Mar 22



7–day–average
daily growth rate (%)

0.2
0.1
0.1
0.0

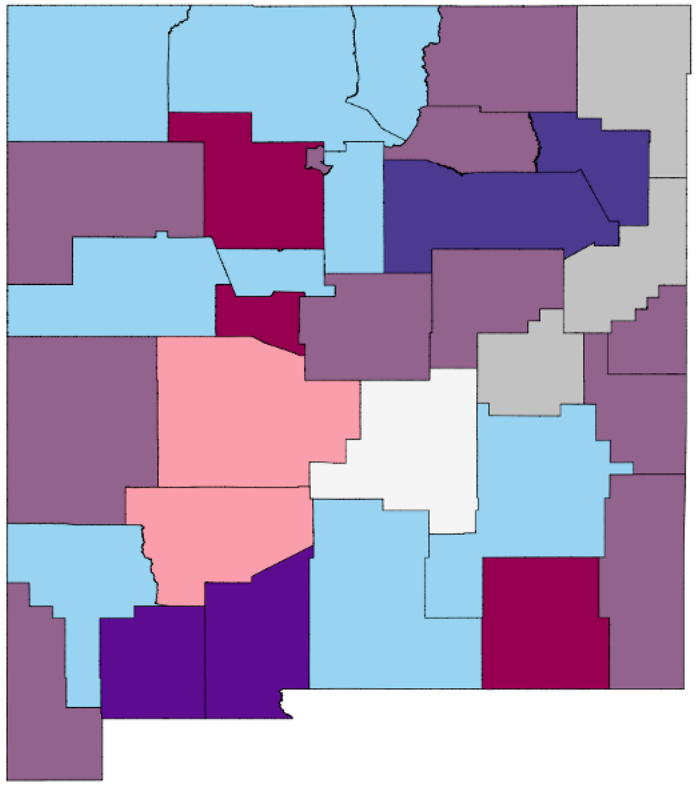
*arrows indicate more than 0.5% difference in growth rate from last week's analysis; growth rate is in cumulative cases

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

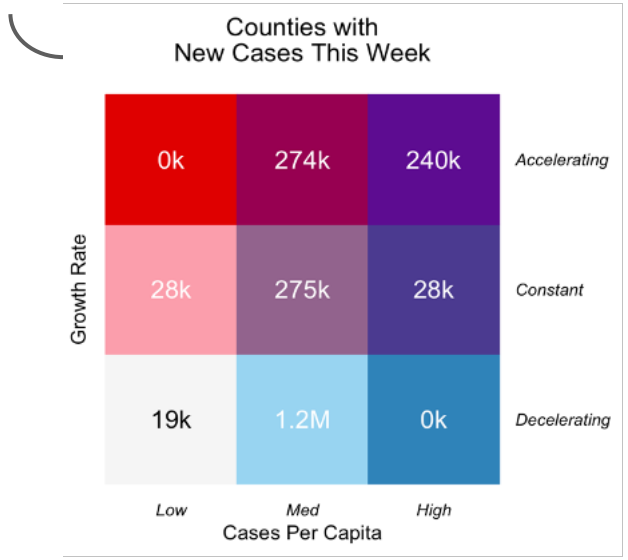
County	Daily Growth Rate	Change
San Juan	0.0%	=
Rio Arriba	0.0%	=
Sierra	0.0%	=
McKinley	0.0%	=
Sandoval	0.2%	=
Santa Fe	0.1%	=
Cibola	0.1%	=
Bernalillo	0.1%	=
Valencia	0.1%	=
Torrance	0.2%	=
Lincoln	0.1%	=
San Miguel	0.4%	=
Chaves	0.0%	=
Dona Ana	0.2%	=
Otero	0.3%	=
Lea	0.0%	=
Eddy	0.1%	=
Curry	0.1%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

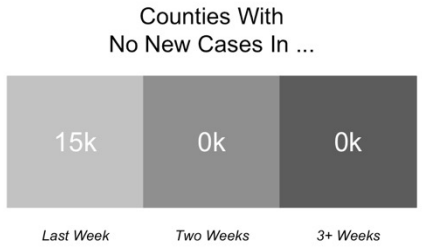
Weekly Growth Rate for NM: Another View (Mar 22)

COVID-19 across New Mexico
A 7-day moving window comparison
March 22, 2021



Impacted New Mexicans





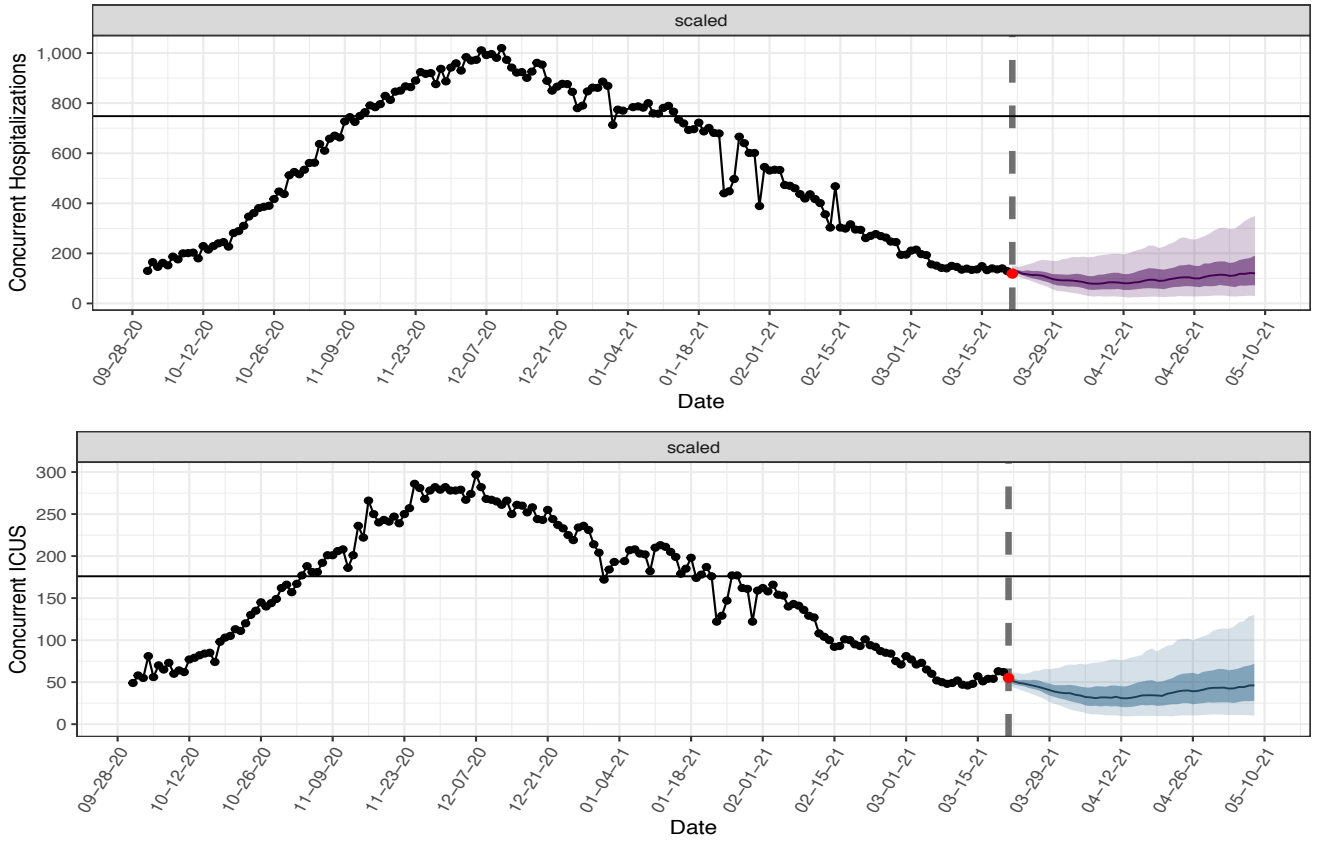
Number of New Mexicans living in regions with particular combinations of per capita case counts and 7-day growth rates

So what?

- Most people in New Mexico are living in a county that is decelerating with medium per-capita case counts
- Counties with high per capita case counts: Dona Ana, San Miguel
- Luna, Dona Ana, Eddy, Sandoval and Valencia showed slight increases

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

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



Concurrent COVID-19 ICU beds

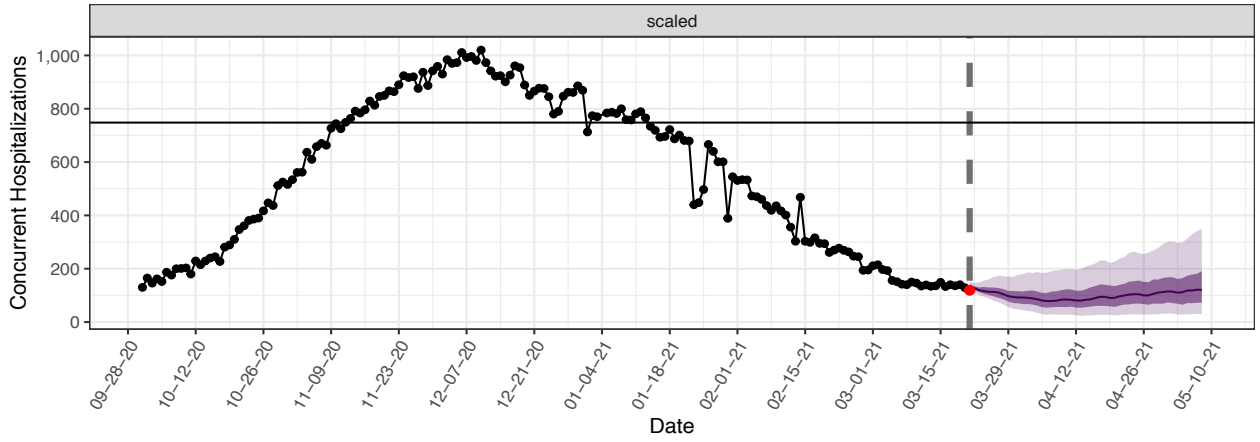
Week	Qu. 5% (best case)	Qu. 50% (median)	Qu. 95% (worst case)
3/28	30	42	66
4/4	15	34	72
4/11	10	33	77
4/18	10	34	90
4/25	10	40	102
5/2	11	44	114

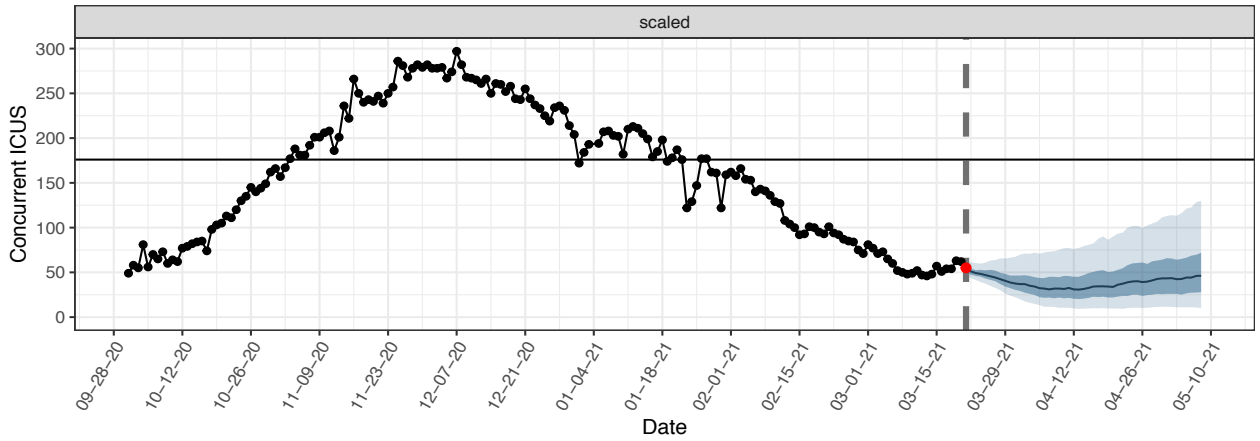
"Scaled" Scenario

So what?

We are below ICU bed capacity for concurrent COVID-19 patients. Model is predicting a decrease over the next 3 weeks. It is tracking closer to best case scenario.

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





Concurrent COVID-19 non-ICU "med-surge" beds

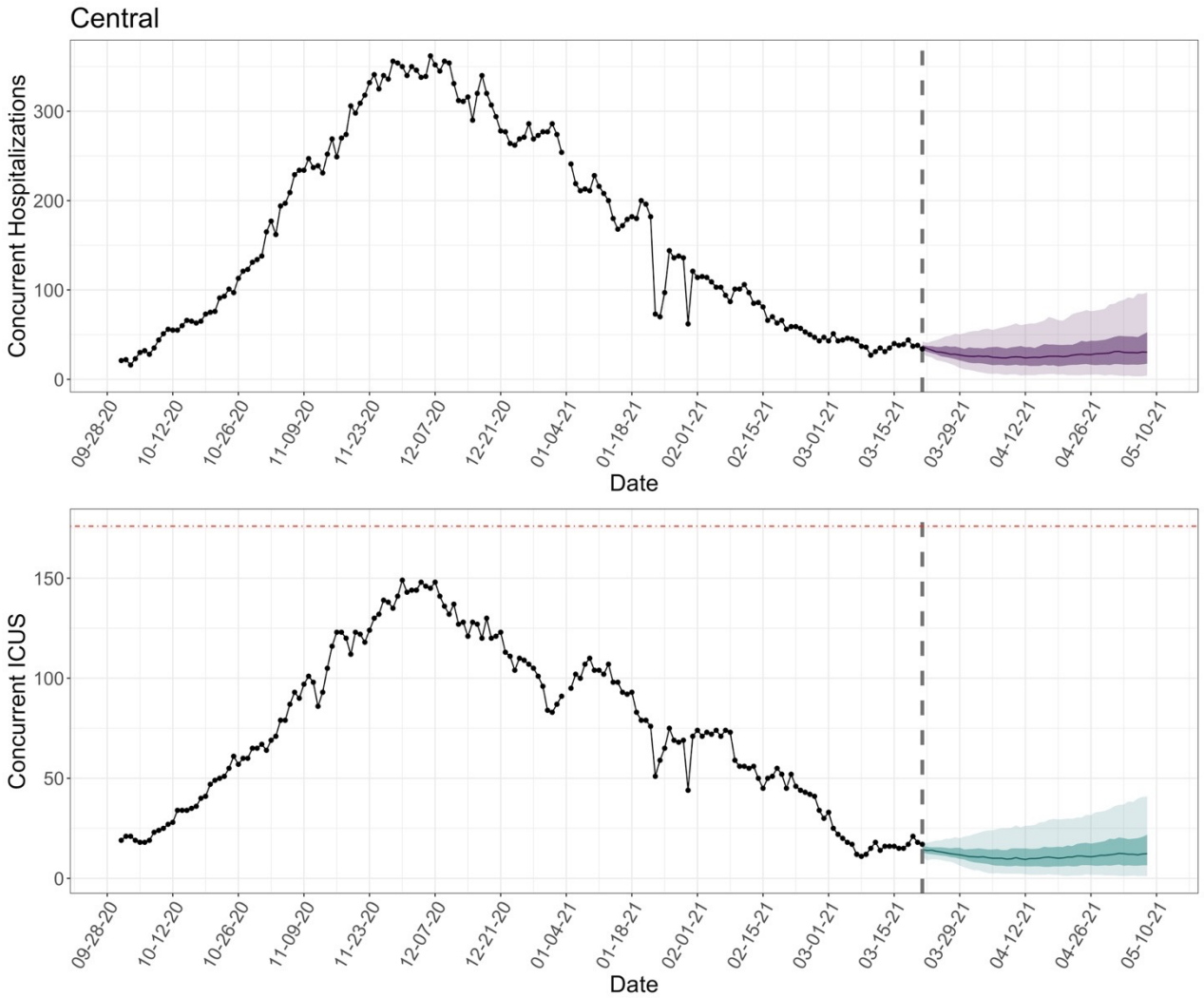
Week	Qu. 5% (best case)	Qu. 50% (median)	Qu. 95% (worst case)
3/28	36	62	107
4/4	19	51	116
4/11	17	51	121
4/18	17	60	141
4/25	18	64	156
5/2	20	71	188

"Scaled" Scenario

So what?

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

Regional Hospitalization Forecasts: Central



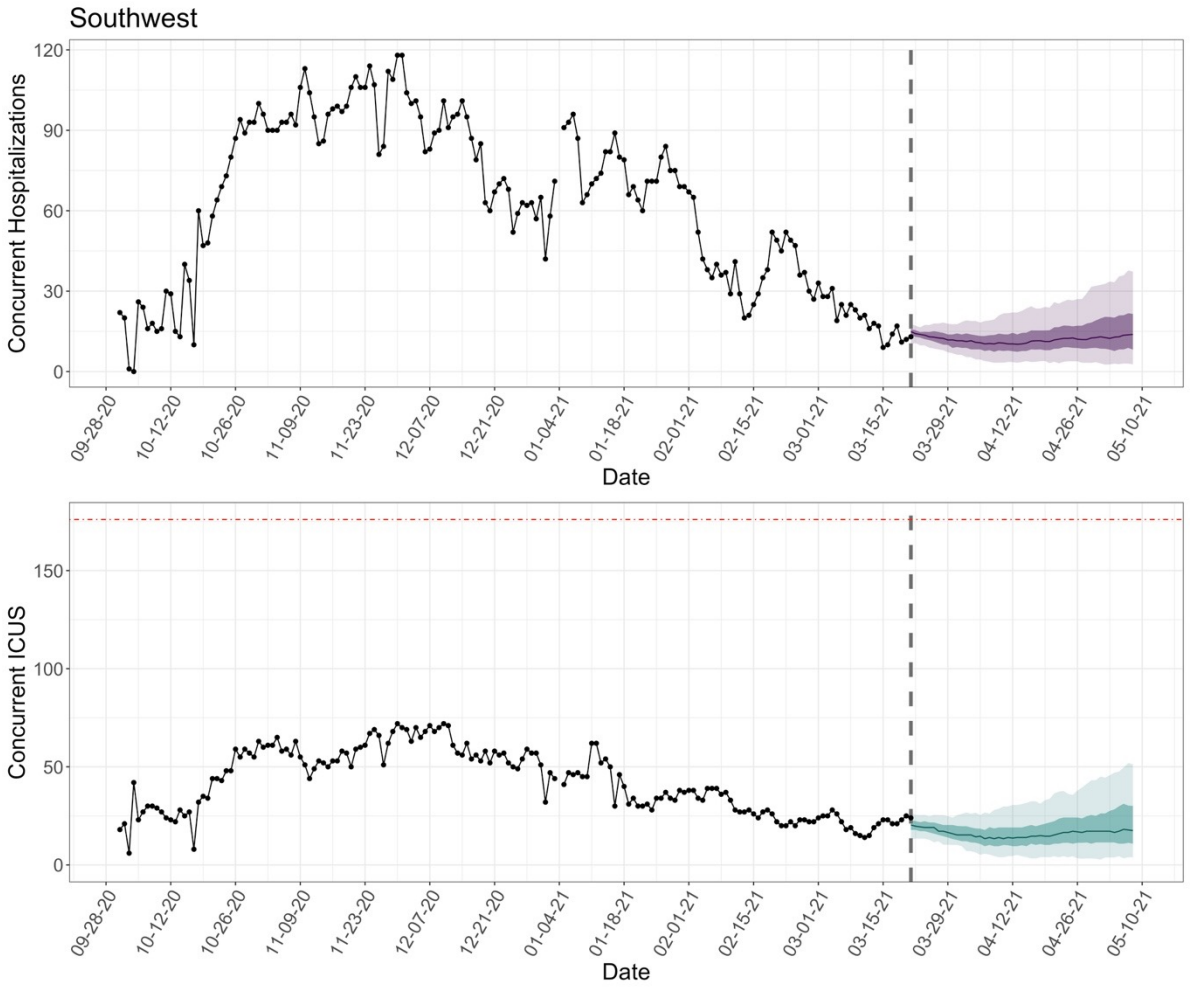
Concurrent COVID-19 ICUs beds: Central

Week	Qu. 5% (best case)	Qu. 50% (median)	Qu. 95% (worst case)
3/28	8	12	21
4/4	3	10	24
4/11	2	10	25
4/18	2	10	30
4/25	2	11	32
5/2	1	12	37

So what?

ICU bed usage is expected to <u>decrease.</u>

Regional Hospitalization Forecasts: Southwest



Concurrent COVID-19 ICUs beds: Southwest

Week	Qu. 5% (best case)	Qu. 50% (median)	Qu. 95% (worst case)
3/28	10	17	25
4/4	6	14	27
4/11	4	14	30
4/18	4	15	31
4/25	4	17	36
5/2	4	17	44

So what?

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