Network Systems Science & Advanced Computing

Biocomplexity Institute & Initiative

University of Virginia

Foresight and Analysis of Infectious Disease Threats to Virginia's Public Health

May 25th, 2023

(data current to May 18th – May 24th)

Biocomplexity Institute Technical report: TR BI-2023-86

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About Us

- Biocomplexity Institute at the University of Virginia
  - Using big data and simulations to understand massively interactive systems and solve societal problems
- Over 20 years of crafting and analyzing infectious disease models
  - Pandemic response for Influenza, Ebola, Zika, and others

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Overview

- **Goal**: Understand impact of current and emerging Infectious Disease threats to the Commonwealth of Virginia using modeling and analytics

- **Approach:**
  - Provide analyses and summaries of current infectious disease threats
  - Survey existing forecasts and trends in these threats
  - Analyze and summarize the current situation and trends of these threats in the broader context of the US and world
  - Provide broad overview of other emerging threats

Key Takeaways

Projecting future cases precisely is impossible and unnecessary.
Even without perfect projections, we can confidently draw conclusions:

- Case rates and hospitalizations have entered a plateau at a steady low level
- Nearly all indicators point to this trend continuing in near term
- Long term projections that assume a seasonal trend in the winter show impact of vaccine coverage and slow vs. fast evolution of immune escape
    - Broad annual vaccination campaign reduces hospitalizations by 27% over 2 years

Model Updates

- Projected Trajectories from previous rounds remain on target, no new projections made this round

Public Health Emergency Expired

May 11, 2023, marks the end of the federal COVID-19 PHE declaration. After this date, CDC's authorizations to collect certain types of public health data will expire.

- This expiration shifts elements of the COVID-19 pandemic response towards a monitoring and evaluation approach
- Changes data availability and cadence of updates

End of the Federal COVID-19 Public Health Emergency (PHE) Declaration

Updated May 5, 2023 Español | Other Languages Print

Vaccines will remain available.
Access to COVID-19 vaccines will generally not be affected for now. The U.S. government is currently distributing free COVID-19 vaccines for all adults and children. To help keep communities safe from COVID-19, HHS remains committed to maximizing continued access to COVID-19 vaccines.

COVID-19 at-home tests may not be covered by insurance.
Insurance providers will no longer be required to waive costs or provide free COVID-19 tests. CDC's No Cost COVID-19 Testing Locator can help people find current community and pharmacy partners participating in the Increasing Community Access to Testing (ICATT) program.

Treatments will remain available.
Medication to prevent severe COVID-19, such as Paxlovid, will remain available for free while supplies last. After that, the price will be determined by the medication manufacturer and your health insurance coverage. Check with your healthcare provider if you need early treatment to prevent severe COVID-19.

National reporting of COVID-19 may change.
We have the right data for this phase of COVID-19 that will allow us to understand what's happening with the virus in America in real-time. Simply put, while what we have going forward will be different, it will still allow CDC, local public health officials, and the members of the public to understand COVID-19 dynamics at the community level.

The following metrics remain available:

COVID-19 hospital admissions.
All hospitals are required to report data through the end of April 2024. This provides a consistent and comprehensive way for weekly tracking of severe COVID-19 at the county level. These data will shift from daily to weekly reporting shortly after May 11.

COVID-19 deaths will remain, but the source of data has changed.
The National Vital Statistics System (NVSS) is the most accurate and complete source of death data, and timeliness of death certificate reporting has improved over the course of the pandemic. A new metric, the percent of deaths that are COVID-19-associated, and other metrics from NVSS will be reported weekly.

Emergency department patient visits with diagnosed COVID-19 will continue to be posted on a weekly basis.
These data cover about three-quarters of the nation's emergency departments and provide information about COVID-19 trends in most states. This is one of the fastest ways to spot changing trends in COVID-19 transmission.

COVID-19 test positivity will remain, but the source of data has changed.
After May 25, CDC will report regional-level test positivity data from the National Respiratory and Enteric Virus Surveillance System (NREVSS), a longstanding system with over 450 labs from across the country that voluntarily submit data. These data can provide early indications of COVID-19 transmission.

Wastewater surveillance and genomic surveillance will remain in place.
This will allow the CDC to track transmission and how the virus is mutating.

Count of COVID-19 vaccines administered will remain for jurisdictions who continue to submit data, but frequency will change.
These data will be updated monthly, instead of weekly.

The following data have been removed:

COVID-19 case and death data are no longer highlighted on COVID Data Tracker.
Throughout the pandemic, case and death counts were reported weekly to the CDC by states. Case data has become increasingly unreliable as some states and jurisdictions may no longer collect case data, testing results are sometimes not reported, or some individuals skip testing all together. CDC continues to receive line-level data on COVID-19 cases through the National Notifiable Disease Surveillance System—a system that CDC uses to regularly collect case data for around 120 notifiable diseases. These data are available to the public for analysis at data.cdc.gov.

National, county-level test positivity data from COVID-19 Electronic Reporting (CELR) are no longer available.
This is because after May 11th laboratories are no longer required to report results.

The V-safe tracking system for health check-ins after vaccination health check-ins is ending.
CDC will continue to monitor COVID-19 vaccines through its other established vaccine safety monitoring systems. V-safe users or others who get vaccinated can report any possible health problems or adverse events following vaccination to the Vaccine Adverse Event Reporting System.

OIG's COVID-19 Public Health Emergency Flexibilities End on May 11, 2023 Upon Expiration of the COVID-19 Public Health Emergency Declaration

Important
This notice reminds the health care community that OIG flexibilities, described further below, end upon the expiration of the COVID-19 Declaration on May 11, 2023.

In connection with the COVID-19 public health emergency declaration (COVID-19 Declaration) first issued by the Secretary of Health and Human Services (HHS) under Section 319 of the Public Health Service Act on January 31, 2020, and subsequently renewed, the Office of Inspector General (OIG) issued two Policy Statements and answered a series of frequently asked questions (FAQs). The Policy Statements and FAQs were designed to provide flexibility and minimize burdens for the health care industry as it faced the challenges of the COVID-19 pandemic. Based on current COVID-19 trends, HHS plans to let the COVID-19 Declaration expire at the end of the day on May 11, 2023.

U.S. Department of Health and Human Services
Office of Inspector General

[CDC Announcement]

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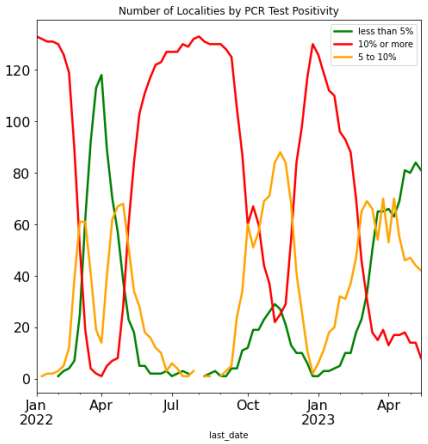
COVID-19 Surveillance

Case Rates (per 100k) and Test Positivity



County level RT-PCR test positivity

Green: <5.0% (or <20 tests in past 14 days)

Orange: 5.0%-10.0% (or <500 tests and <2000 tests/100k and >10% positivity over 14 days)

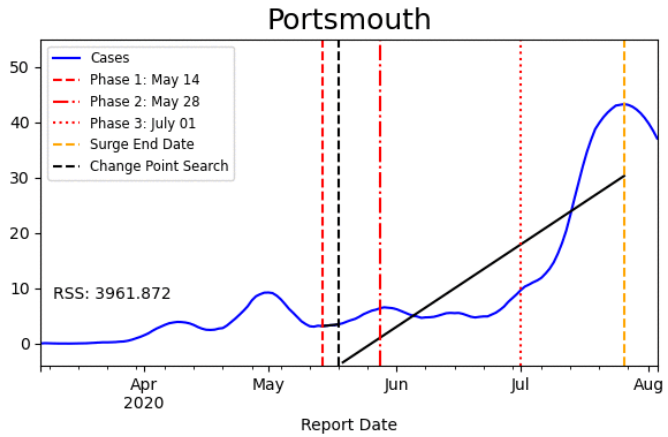
Red: >10.0% (and not "Green" or "Yellow")

District Trajectories

Goal: Define epochs of a Health District's COVID-19 incidence to characterize the current trajectory

Method: Find recent peak and use hockey stick fit to find inflection point afterwards, then use this period's slope to define the trajectory

Hockey stick fit

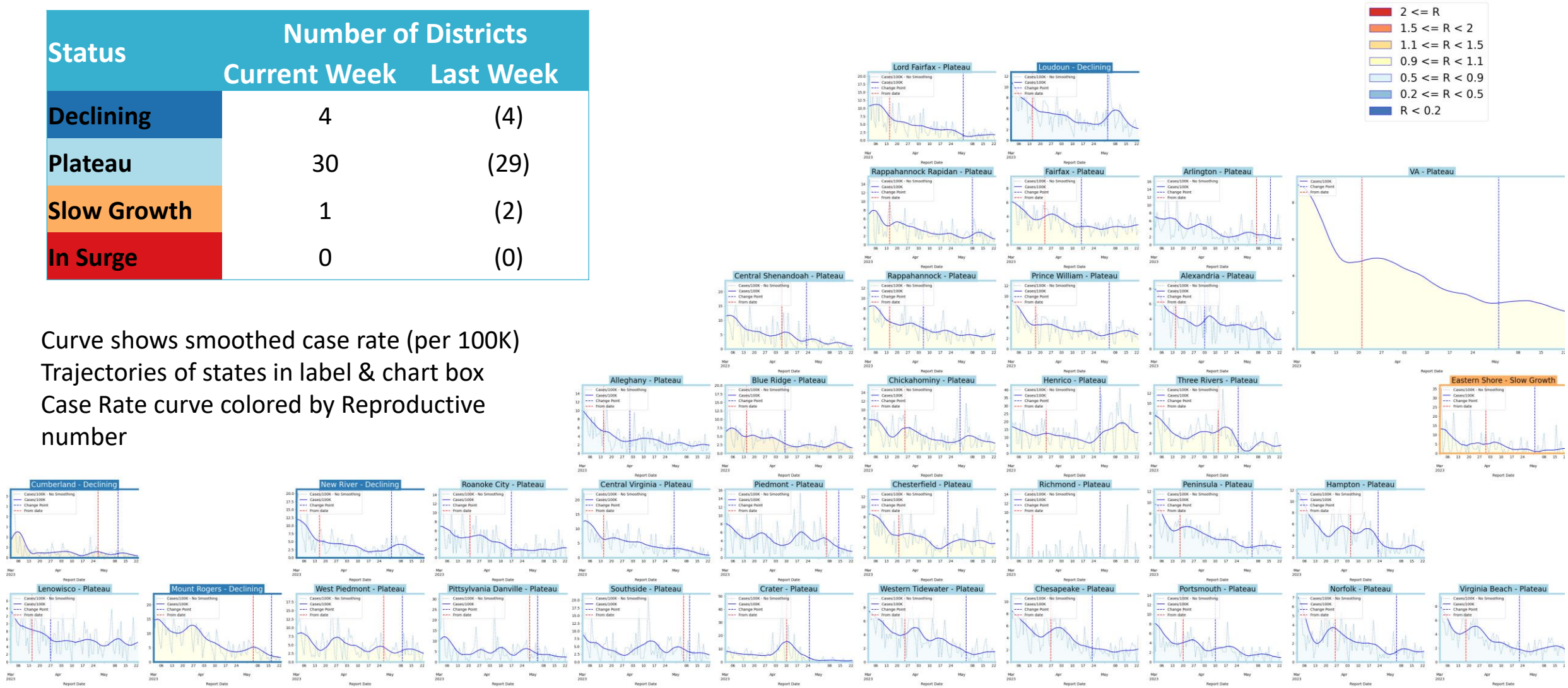


Trajectory	Description	Weekly Case Rate Slope (per 100k)	Weekly Hosp Rate Slope (per 100k)
Declining	Sustained decreases following a recent peak	slope < -0.88/day	slope < -0.07/day
Plateau	Steady level with minimal trend up or down	-0.88/day < slope < 0.42/day	-0.07/day < slope < 0.07/day
Slow Growth	Sustained growth not rapid enough to be considered a Surge	0.42/day < slope < 2.45/day	0.07/day < slope < 0.21/day
In Surge	Currently experiencing sustained rapid and significant growth	2.45/day < slope	0.21/day < slope

District Case Trajectories – last 10 weeks

Status	Number of Districts	
	Current Week	Last Week
Declining	4	(4)
Plateau	30	(29)
Slow Growth	1	(2)
In Surge	0	(0)

Curve shows smoothed case rate (per 100K)
Trajectories of states in label & chart box
Case Rate curve colored by Reproductive number



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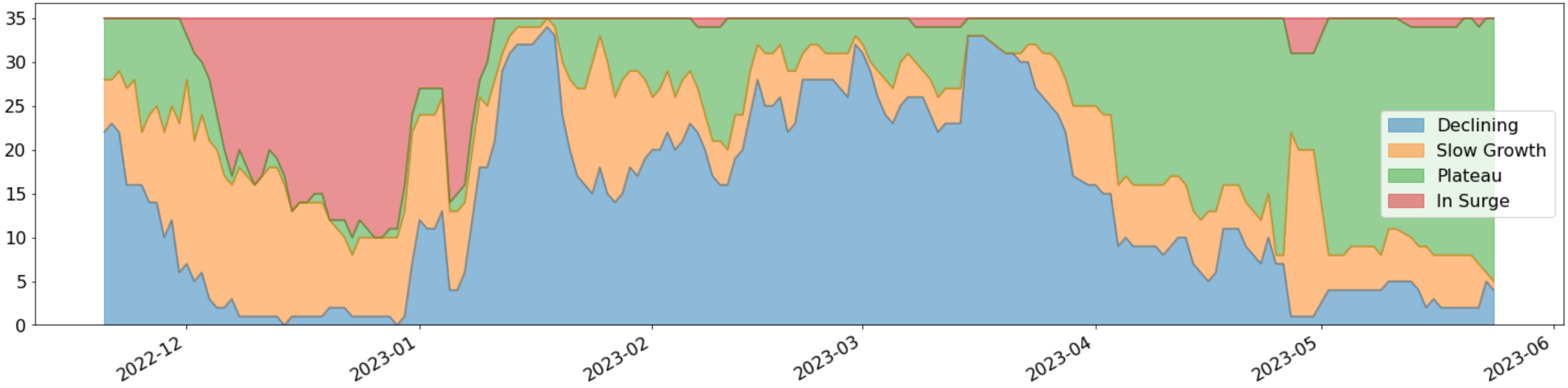
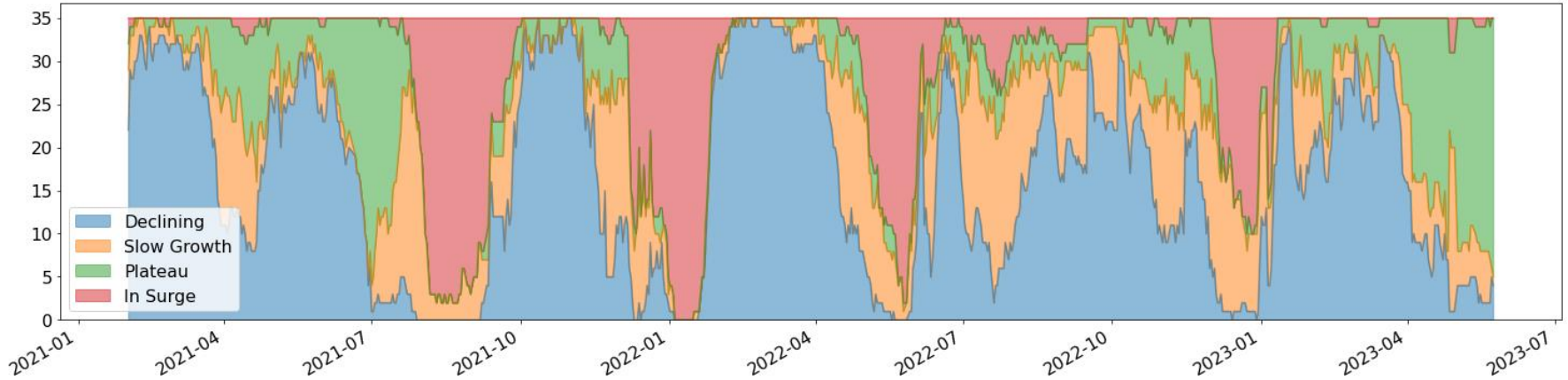
District Case Trajectories – Recent 6 months





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District Hospital Trajectories – last 10 weeks

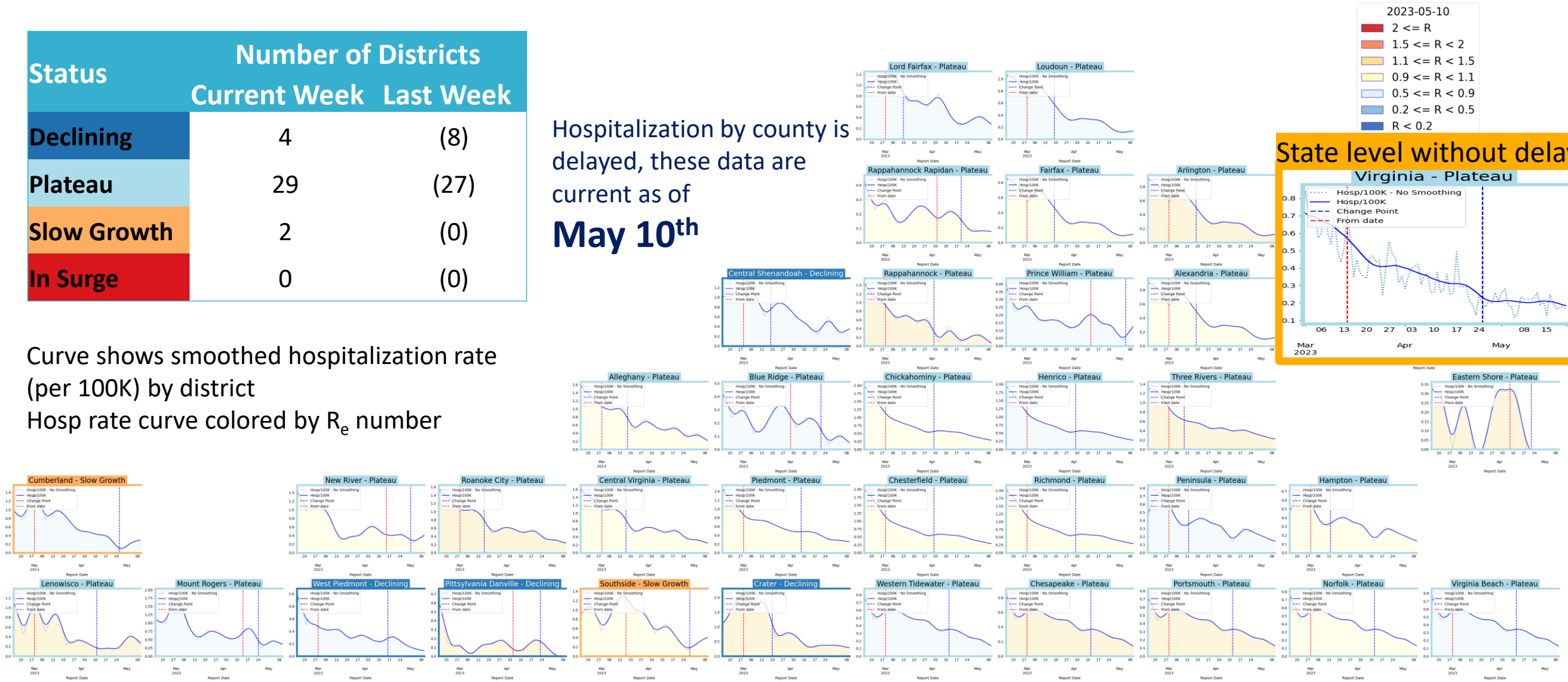
Status	Number of Districts	
	Current Week	Last Week
Declining	4	(8)
Plateau	29	(27)
Slow Growth	2	(0)
In Surge	0	(0)

Hospitalization by county is delayed, these data are current as of

May 10th

Curve shows smoothed hospitalization rate (per 100K) by district

Hosp rate curve colored by R_e number

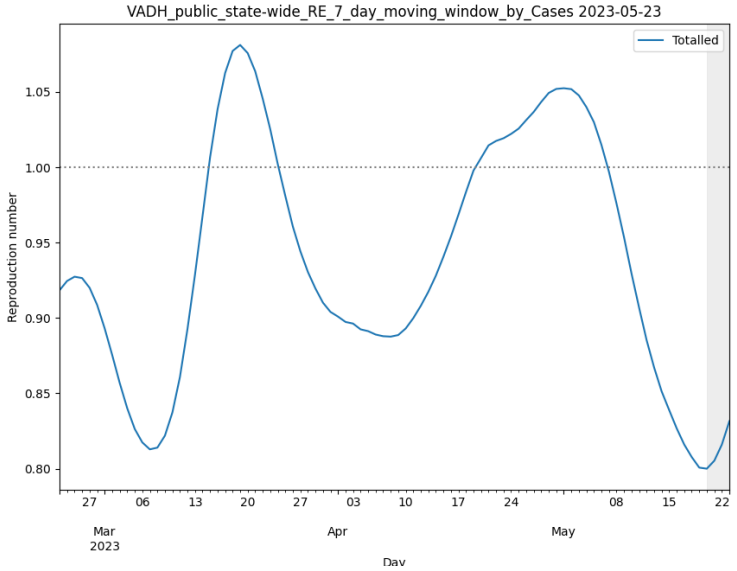


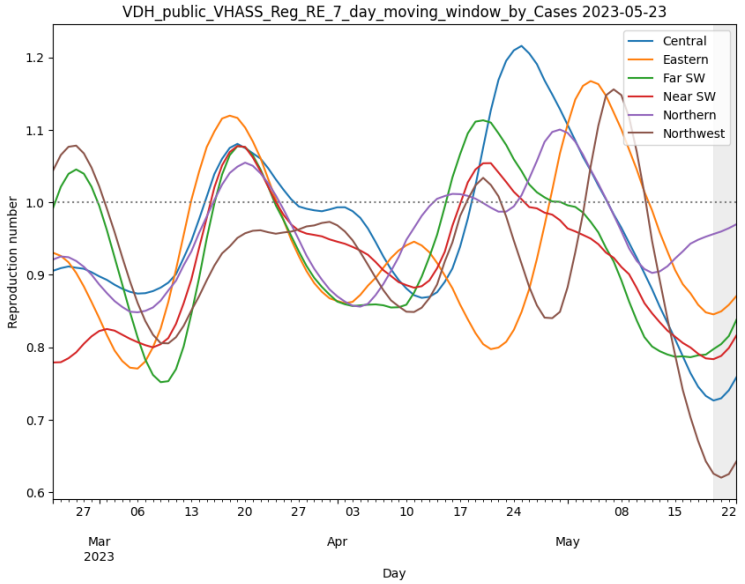
COVID-19 Growth Metrics

Estimating Daily Reproductive Number –
VDH report dates

May 23rd Estimates

Region	Date Confirmed R_e	Date Confirmed Diff Last Week
State-wide	0.827	-0.074
Central	0.773	-0.102
Eastern	0.890	-0.163
Far SW	0.781	0.022
Near SW	0.806	-0.071
Northern	0.949	0.054
Northwest	0.683	-0.378



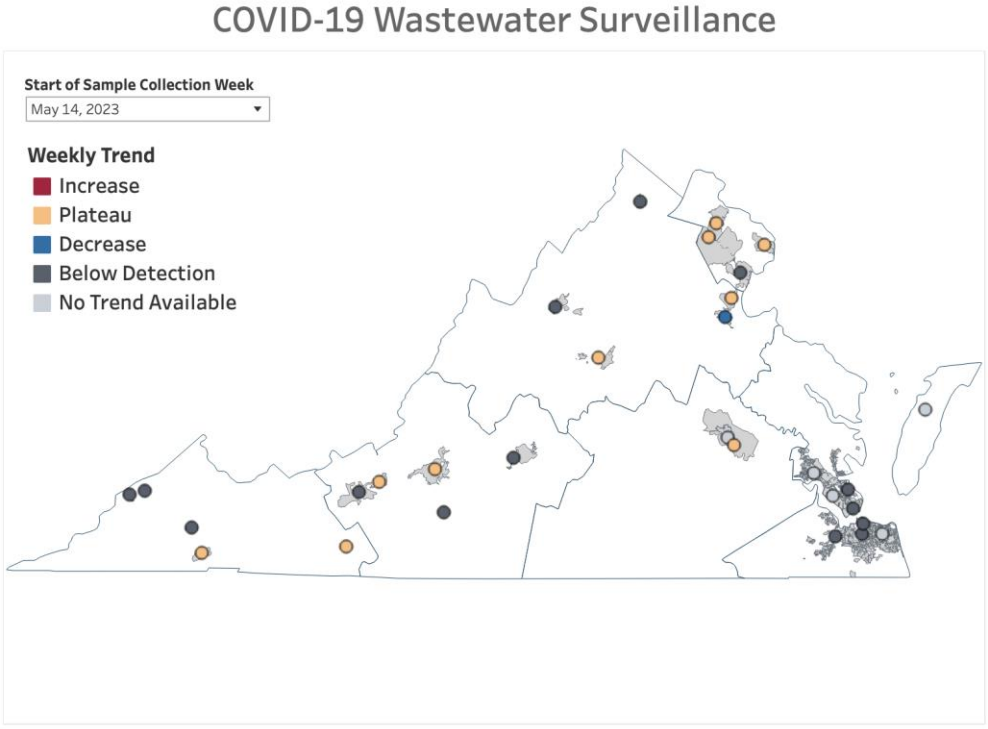


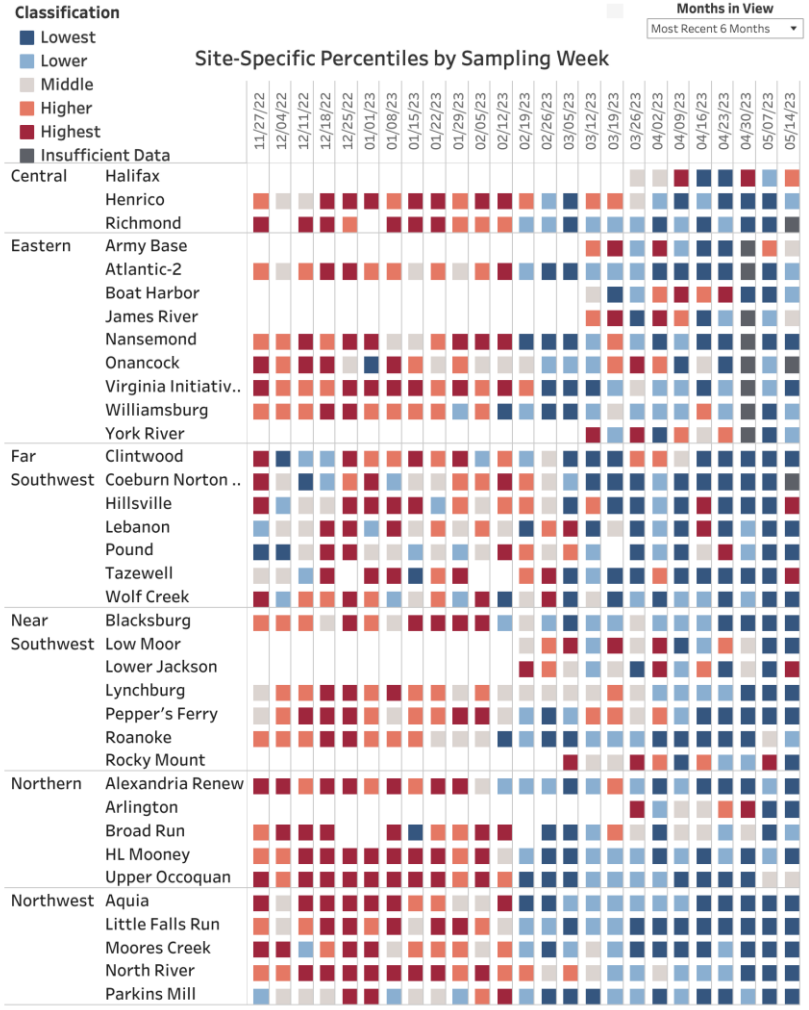
Methodology

- Wallinga-Teunis method (EpiEstim[1]) for cases by **confirmation date**
- Serial interval: updated to discrete distribution from observations (mean=4.3, Flaxman et al, Nature 2020)
- Using Confirmation date since due to increasingly unstable estimates from onset date due to backfill

1. Anne Cori, Neil M. Ferguson, Christophe Fraser, Simon Cauchemez. A New Framework and Software to Estimate Time-Varying Reproduction Numbers During Epidemics. American Journal of Epidemiology, Volume 178, Issue 9, 1 November 2013, Pages 1505–1512, https://doi.org/10.1093/aje/kwt133

VA Wastewater Data Update





[VDH COVID-19 Wastewater Surveillance]

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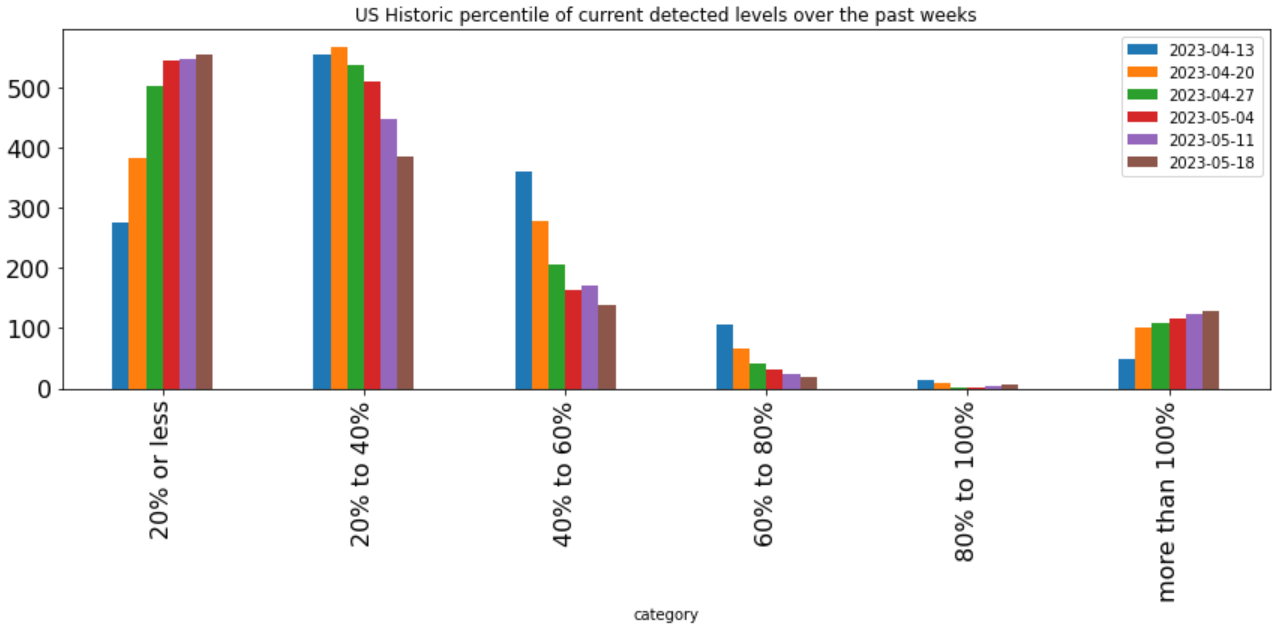
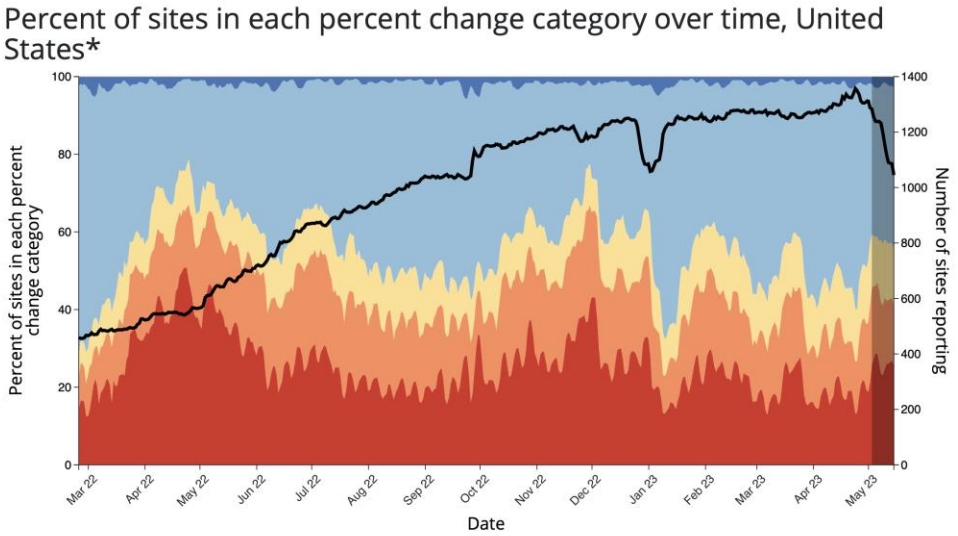
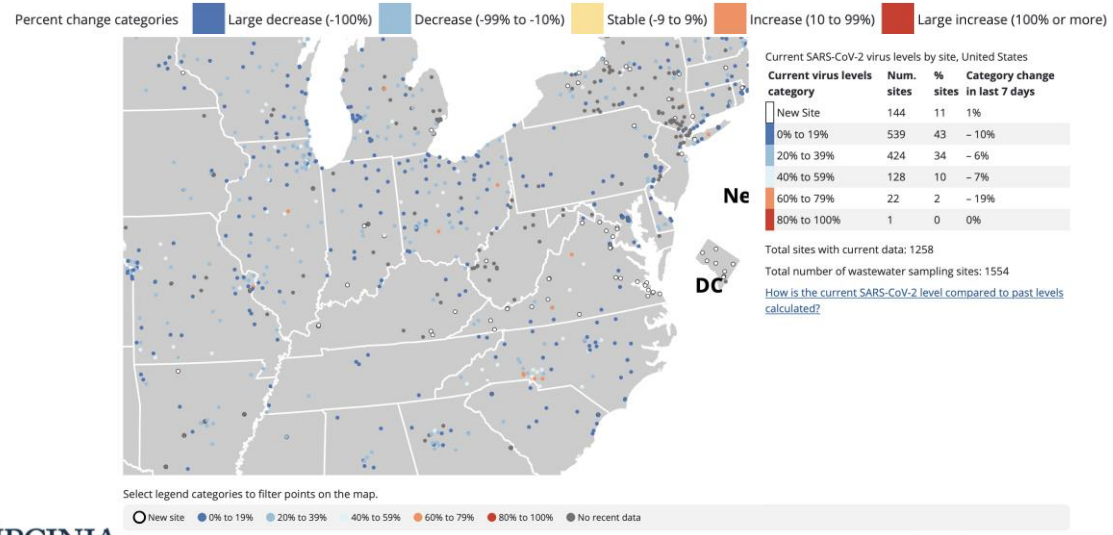
US Wastewater Monitoring

Wastewater provides a coarse estimate of COVID-19 levels in communities and can be a good indicator of activity levels



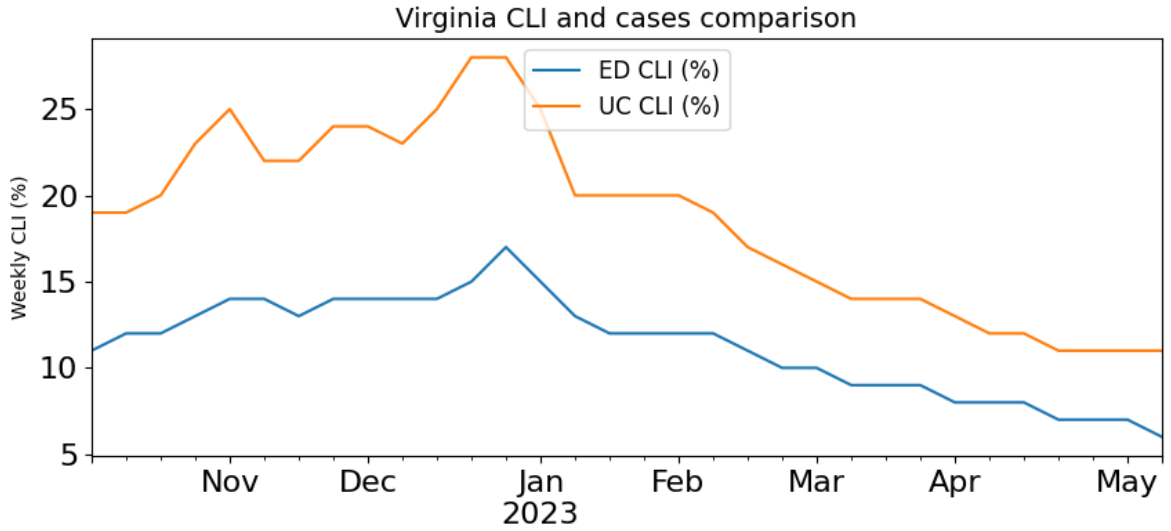


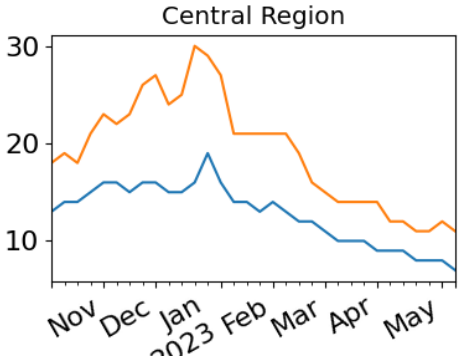


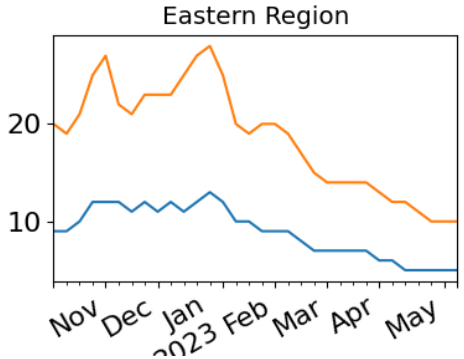
COVID-like Illness Activity

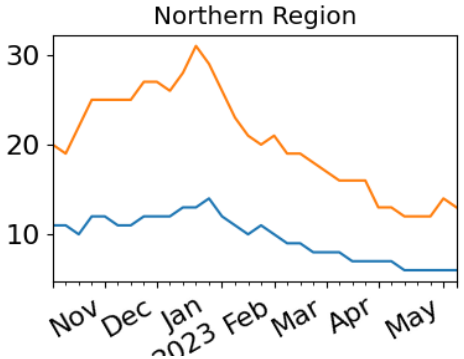
COVID-like Illness (CLI) gives a measure of COVID transmission in the community

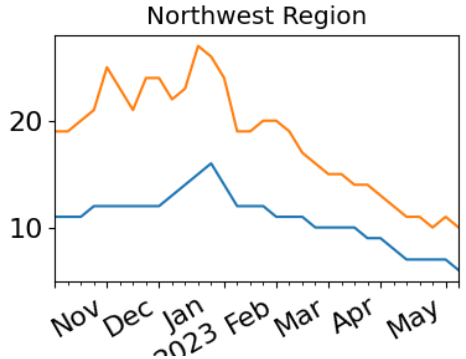
- Emergency Dept (ED) based CLI is more correlated with case reporting
- Urgent Care (UC) is a leading indicator but may be influenced by testing for other URIs
- **Levels continue to decline into lowest levels in past 8 months**

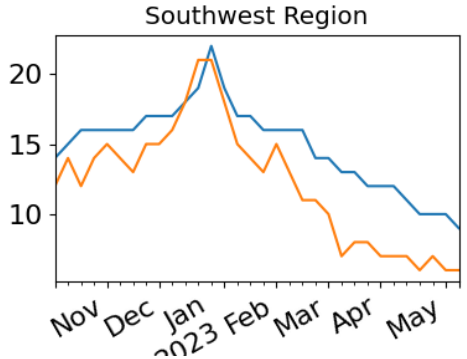












COVID-19 Severity Metrics

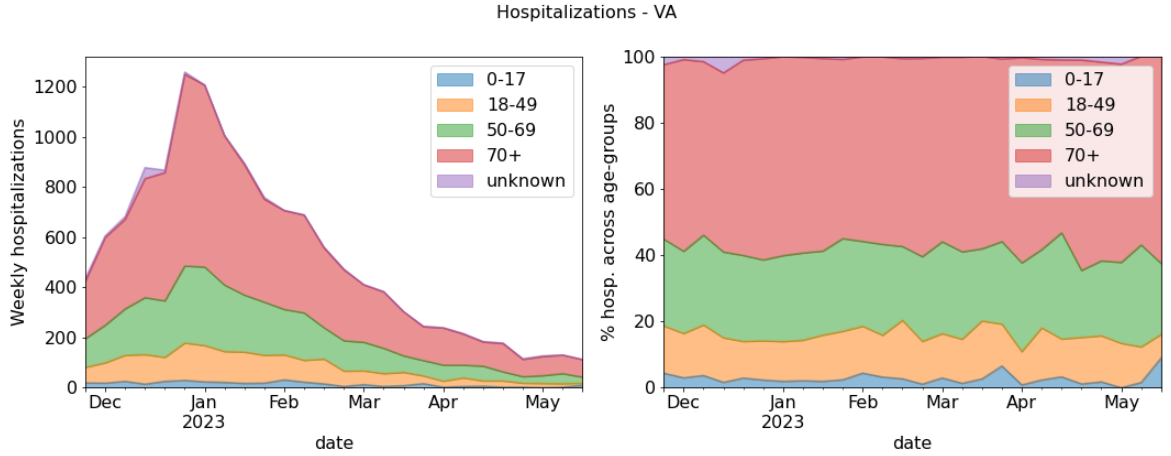
Hospitalizations in VA by Age

Age distribution in hospitals relatively stable

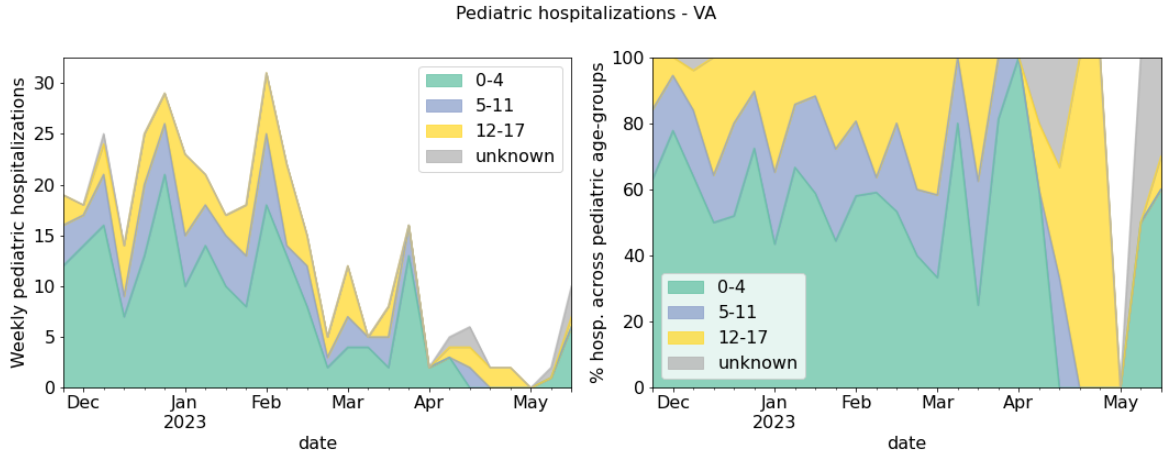
- Uptick in hospitalizations mostly fueled by 70+ age group
- Pediatric hospitalizations level off after uptick last week

Note: These data are lagged and based on HHS hospital reporting

Virginia Hospitalizations by Age (all ages)



Pediatric Hospitalizations by Age (0-17yo)



Data Source: Delphi and HHS

COVID-19 Spatial Epidemiology

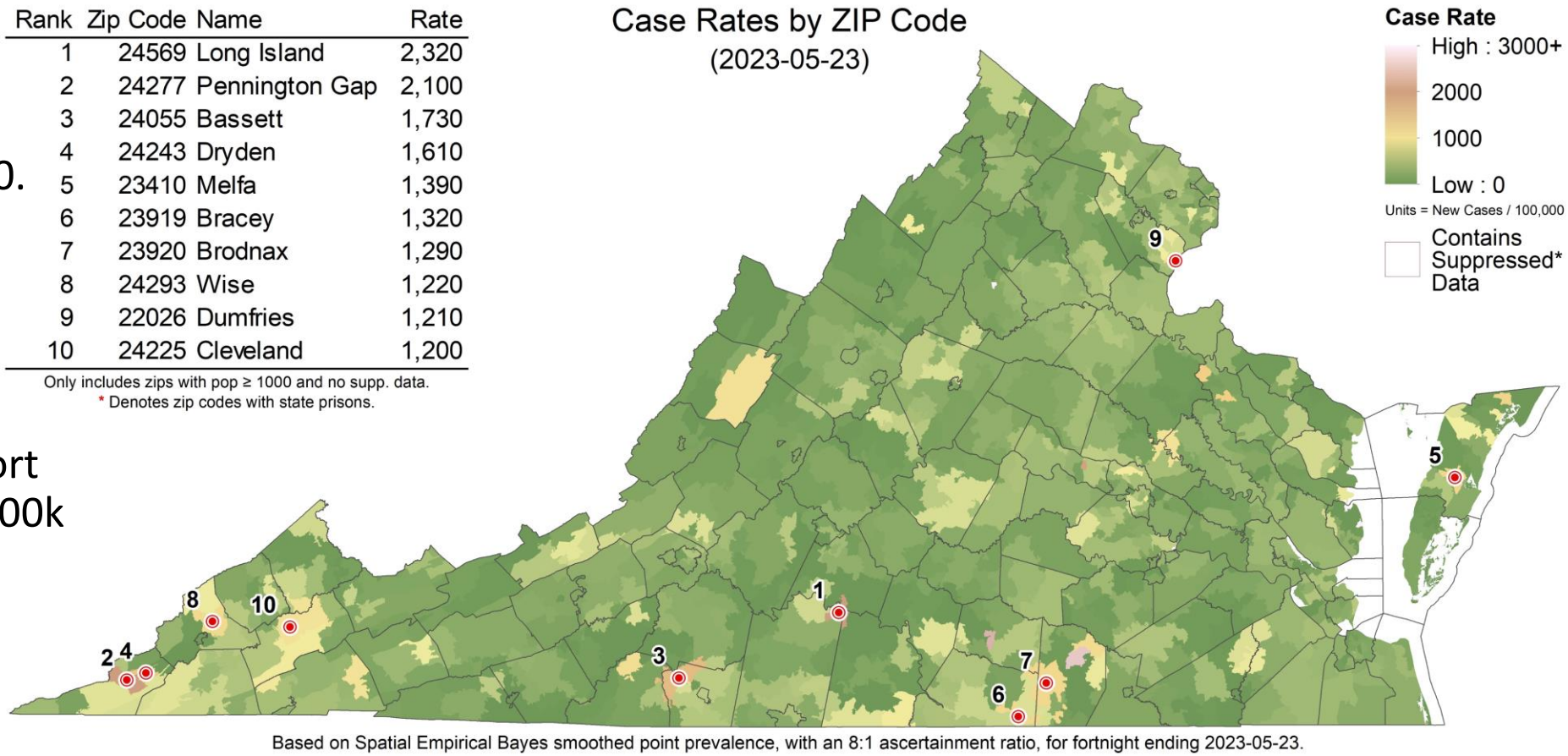
ZIP Code level fortnightly case rate (per 100K)

New cases per 100k in the last fortnight by ZIP code

- Statewide COVID19 case rates remain at near historic lows.
- No zip codes with prisons are currently in the top 10.
- Areas with high case rates are sporadic; with slight clustering in Far SW and Southside.
- 794 of 896 ZIP codes report <500 fortnightly cases / 100k
- Some counts are low and suppressed to protect anonymity. They are shown with a red outline.

Rank	Zip Code	Name	Rate
1	24569	Long Island	2,320
2	24277	Pennington Gap	2,100
3	24055	Bassett	1,730
4	24243	Dryden	1,610
5	23410	Melfa	1,390
6	23919	Bracey	1,320
7	23920	Brodnax	1,290
8	24293	Wise	1,220
9	22026	Dumfries	1,210
10	24225	Cleveland	1,200

Only includes zips with pop ≥ 1000 and no supp. data.
* Denotes zip codes with state prisons.



Based on Spatial Empirical Bayes smoothed point prevalence, with an 8:1 ascertainment ratio, for fortnight ending 2023-05-23.

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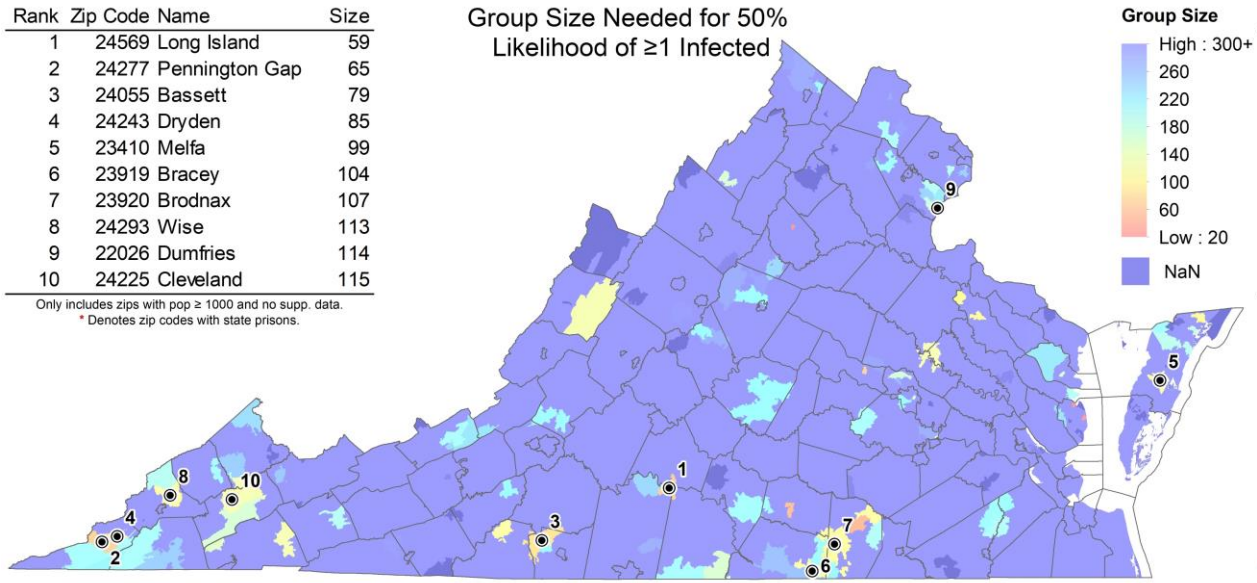
Risk of Exposure by Group Size and HCW prevalence

Case prevalence in the last fortnight by zip code used to calculate risk of encountering someone infected in a gathering of randomly selected people

- **Group Size**: Assumes **8 undetected infections** per confirmed case (ascertainment rate from recent seroprevalence survey) and shows minimum size of a group with a 50% chance an individual is infected by zip code (e.g., in a group of 59 in Long Island, there is a 50% chance someone will be infected).
- **HCW ratio**: Case rate among health care workers (HCW) in the last fortnight using patient facing health care workers as the numerator / population's case prevalence. High HCW ratios are concentrated in Southwest.

Rank	Zip Code	Name	Size
1	24569	Long Island	59
2	24277	Pennington Gap	65
3	24055	Bassett	79
4	24243	Dryden	85
5	23410	Melfa	99
6	23919	Bracey	104
7	23920	Brodnax	107
8	24293	Wise	113
9	22026	Dumfries	114
10	24225	Cleveland	115

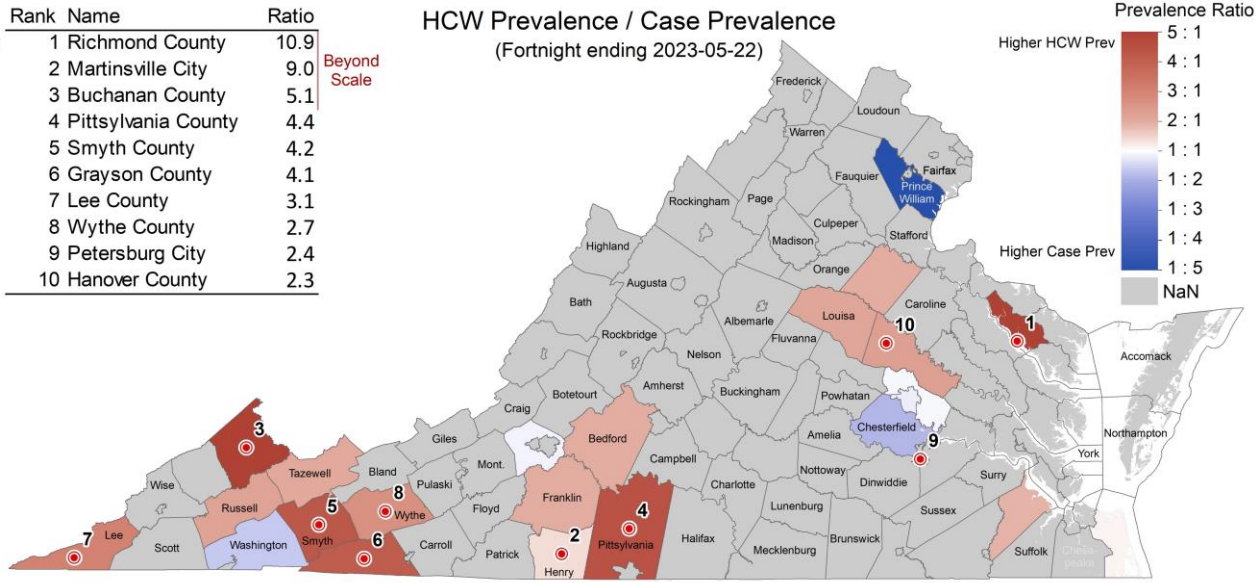
Only includes zips with pop ≥ 1000 and no supp. data.
* Denotes zip codes with state prisons.



Based on Spatial Empirical Bayes smoothed point prevalence, with an 8:1 ascertainment ratio, for fortnight ending 2023-05-23.

Rank	Name	Ratio
1	Richmond County	10.9
2	Martinsville City	9.0
3	Buchanan County	5.1
4	Pittsylvania County	4.4
5	Smyth County	4.2
6	Grayson County	4.1
7	Lee County	3.1
8	Wythe County	2.7
9	Petersburg City	2.4
10	Hanover County	2.3

Beyond Scale



Note: This assumes that the ascertainment rate of healthcare workers is double that of the public.

Current Hot-Spots

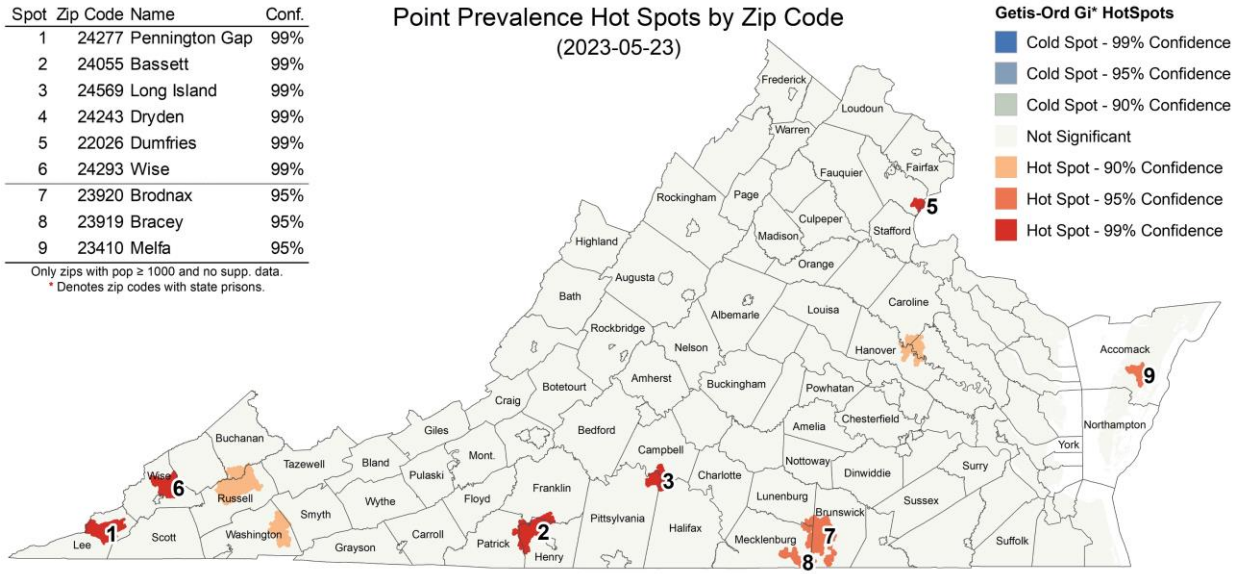
Case rates that are significantly different from neighboring areas or model projections

- **Spatial**: Getis-Ord Gi* based hot spots compare clusters of zip codes with fortnightly case prevalence higher than nearby zip codes to identify larger areas with statistically significant deviations
- **Temporal**: The weekly case rate (per 100K) projected last month compared to those observed by county, which highlights temporal fluctuations that differ from the model's projections.
- Low prevalence rates result in sporadic spatial hotspots. Minor model overpredictions seen in New River, Southside, and Crater; underpredictions in Henrico and Lenowisco. No residual autocorrelation detected.

Spatial Hotspots

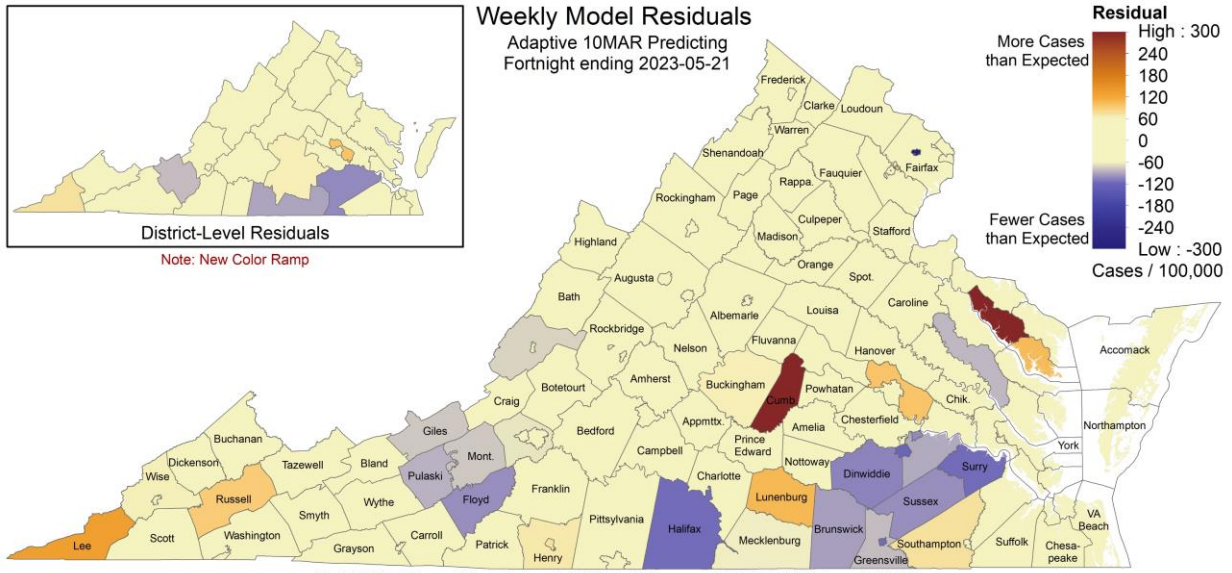
Spot	Zip Code	Name	Conf.
1	24277	Pennington Gap	99%
2	24055	Bassett	99%
3	24569	Long Island	99%
4	24243	Dryden	99%
5	22026	Dumfries	99%
6	24293	Wise	99%
7	23920	Brodnax	95%
8	23919	Bracey	95%
9	23410	Melfa	95%

Only zips with pop ≥ 1000 and no supp. data.
* Denotes zip codes with state prisons.



Based on Global Empirical Bayes smoothed point prevalence for fortnight ending 2023-05-23.

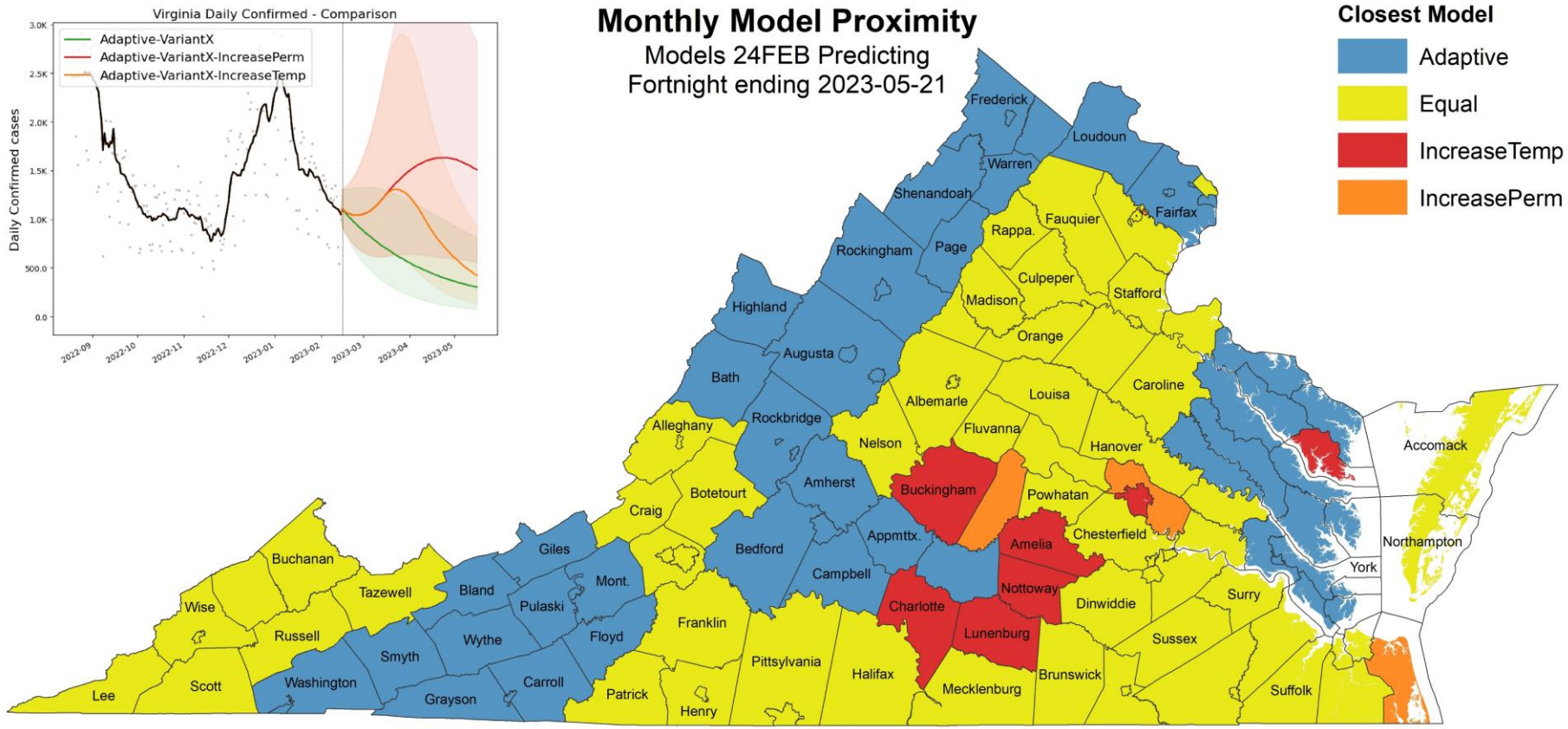
Clustered Temporal Hotspots



Health District Level Moran's I = -0.041676, Z-Score = -0.208908, P-Value = 0.83452
No Residual Autocorrelation Detected

Scenario Trajectory Tracking

Which scenario from three months ago did each county track closest?

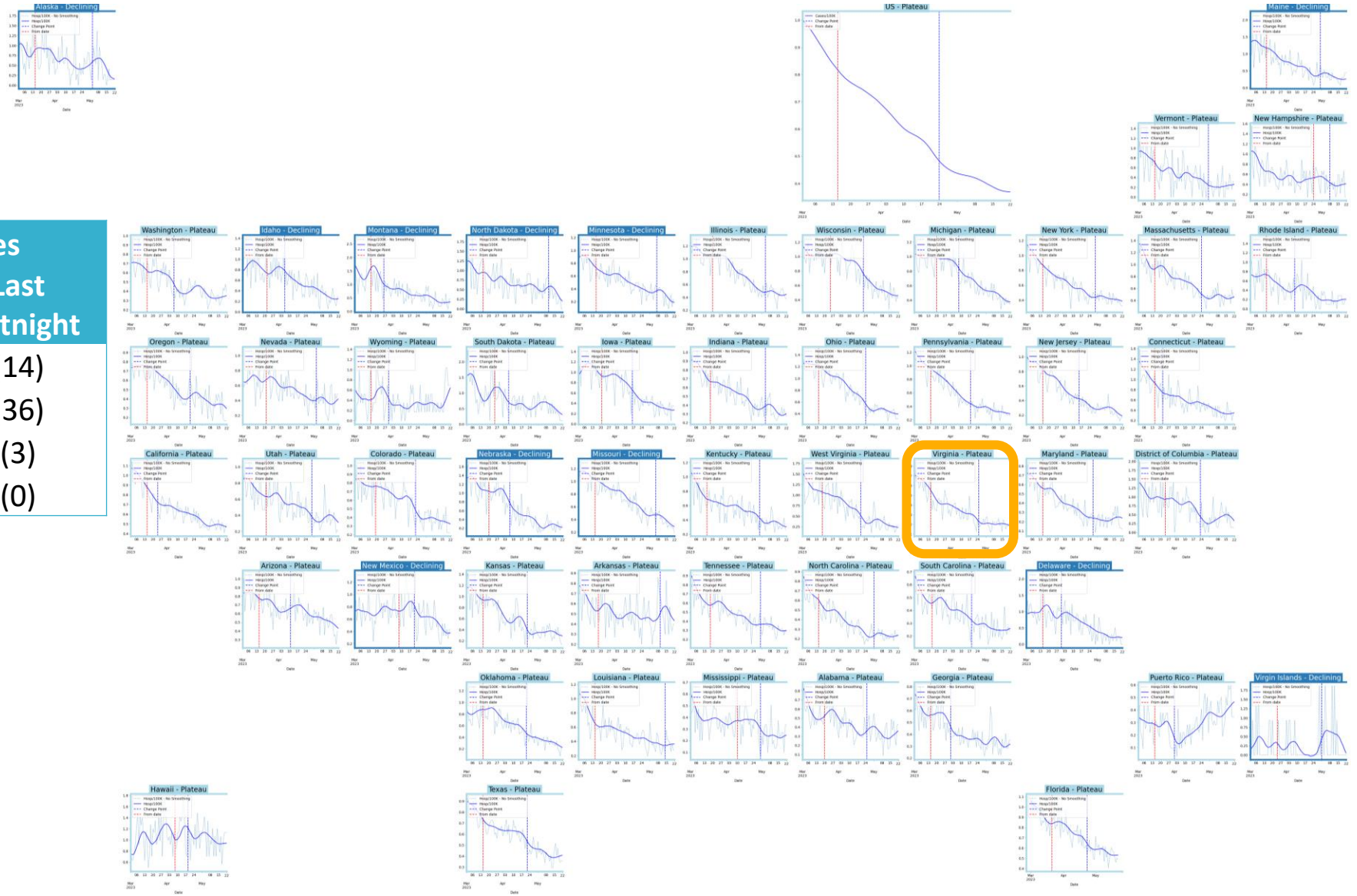


- Fortnightly projections separate the scenarios more clearly and reveal overall patterns.
- Most counties still track the Adaptive (current course) scenario from late February.
- As with last report – fewer than a dozen counties tracked the Increased Transmission scenarios.

COVID-19 Broader Context

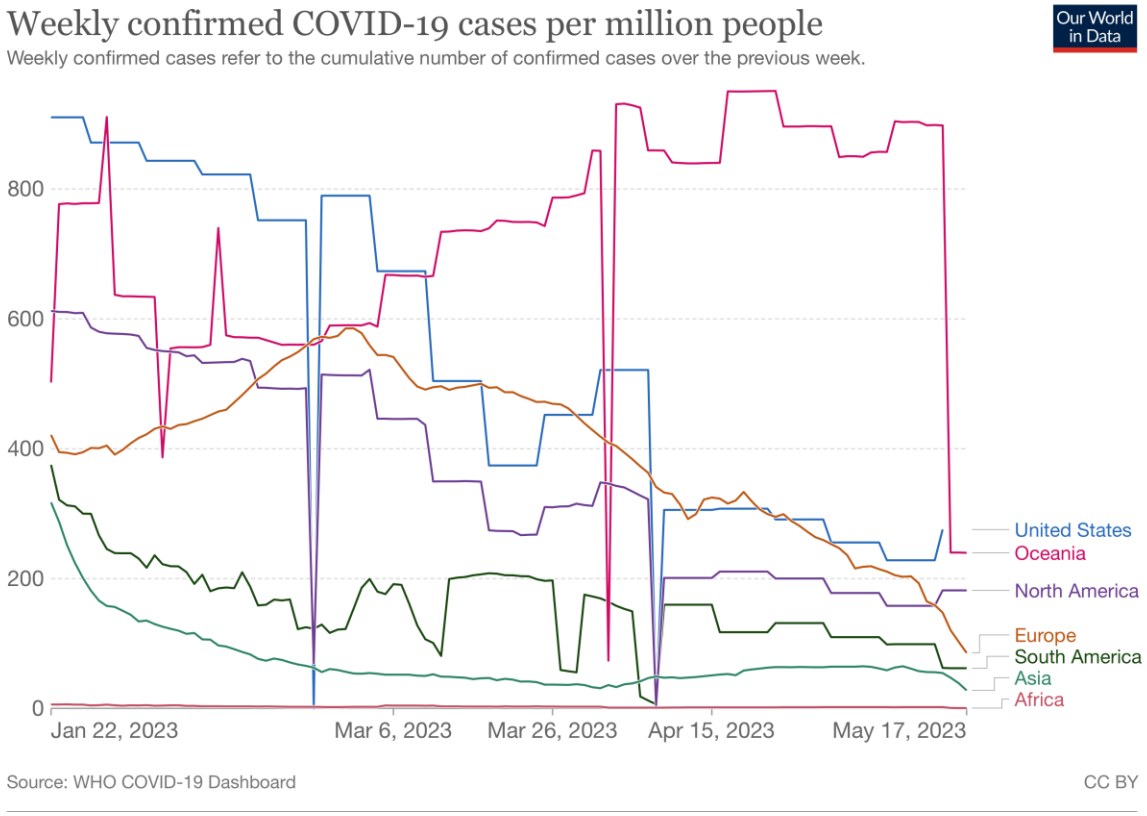
United States Hospitalizations

Status	Number of States	
	Current Week	Last Fortnight
Declining	11	(14)
Plateau	41	(36)
Slow Growth	1	(3)
In Surge	0	(0)

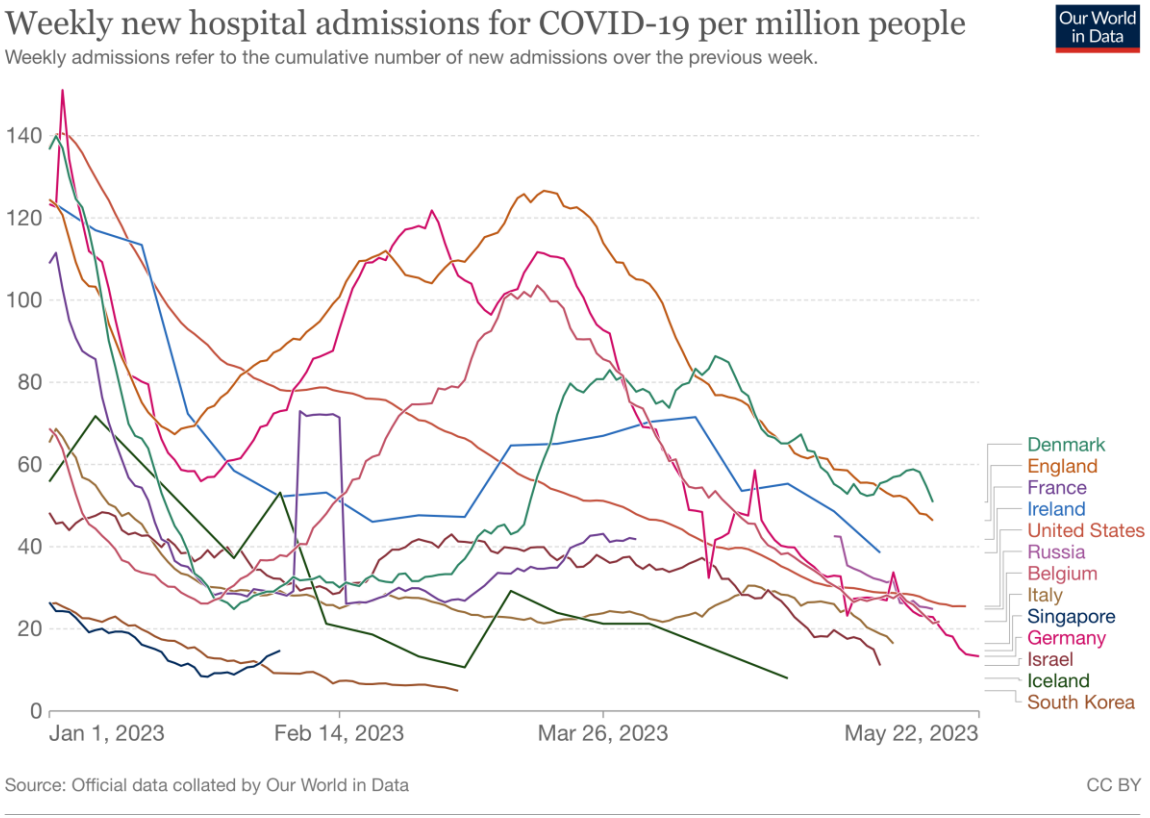


Around the World – Various trajectories

Confirmed cases



Hospitalizations



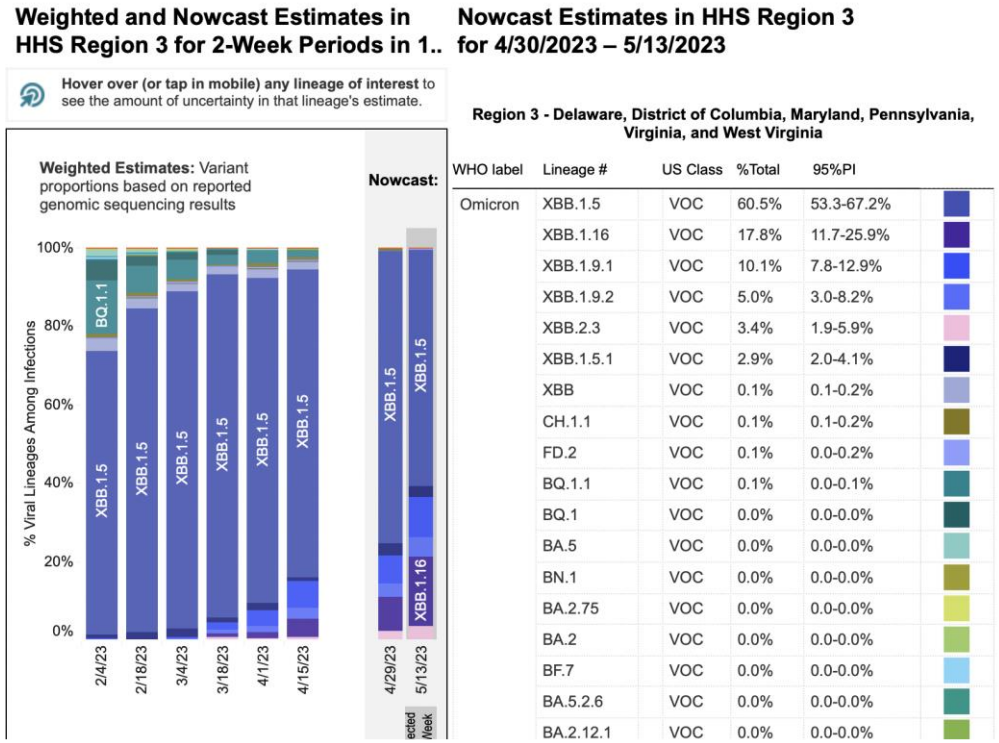
Our World in Data [Our World in Data]

COVID-19 Genomic Update

SARS-CoV2 Variants of Concern

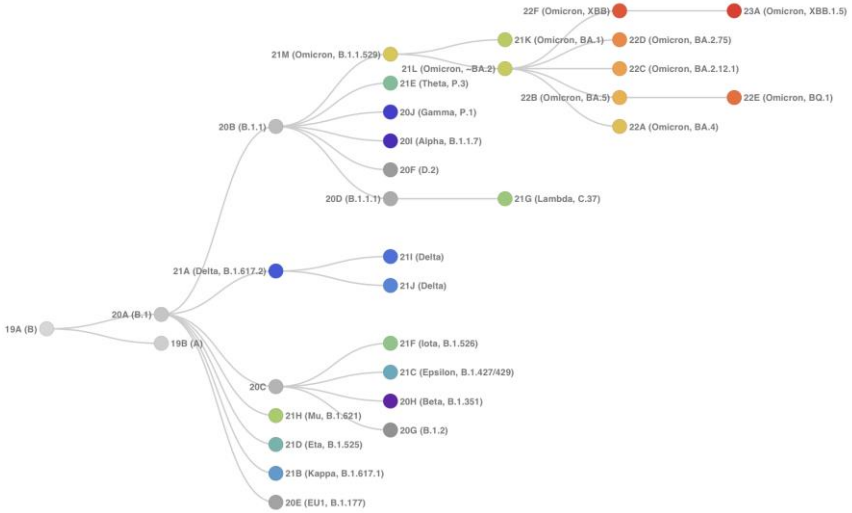
Emerging variants have potential to continue to alter the future trajectories of pandemic and have implications for future control

- **Variants have been observed to:** increase transmissibility, increase severity (more hospitalizations and/or deaths), and limit immunity provided by prior infection and vaccinations



Region 3 - Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia

WHO label	Lineage #	US Class	%Total	95%PI
Omicron	XBB.1.5	VOC	60.5%	53.3-67.2%
	XBB.1.16	VOC	17.8%	11.7-25.9%
	XBB.1.9.1	VOC	10.1%	7.8-12.9%
	XBB.1.9.2	VOC	5.0%	3.0-8.2%
	XBB.2.3	VOC	3.4%	1.9-5.9%
	XBB.1.5.1	VOC	2.9%	2.0-4.1%
	XBB	VOC	0.1%	0.1-0.2%
	CH.1.1	VOC	0.1%	0.1-0.2%
	FD.2	VOC	0.1%	0.0-0.2%
	BQ.1.1	VOC	0.1%	0.0-0.1%
	BQ.1	VOC	0.0%	0.0-0.0%
	BA.5	VOC	0.0%	0.0-0.0%
	BN.1	VOC	0.0%	0.0-0.0%
	BA.2.75	VOC	0.0%	0.0-0.0%
	BA.2	VOC	0.0%	0.0-0.0%
	BF.7	VOC	0.0%	0.0-0.0%
	BA.5.2.6	VOC	0.0%	0.0-0.0%
	BA.2.12.1	VOC	0.0%	0.0-0.0%



https://clades.nextstrain.org

Omicron Updates*

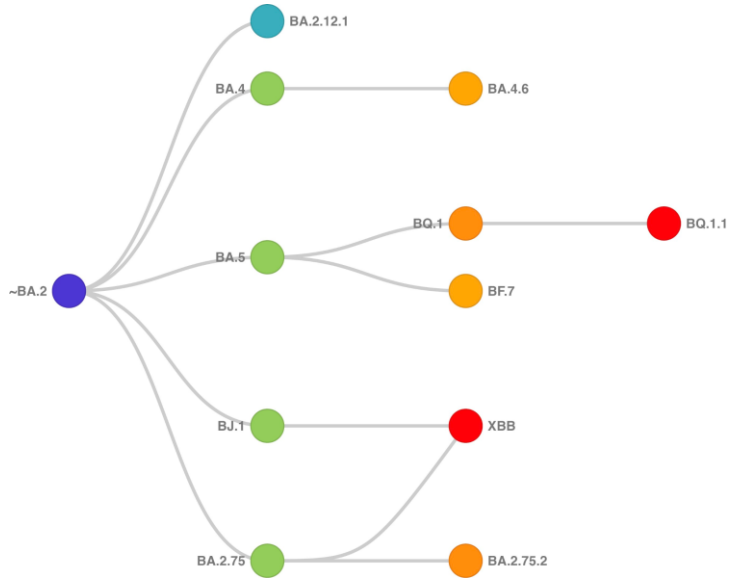
- XBB.1.5 proportions have fallen to 60% from 65%
- XBB.1.16.1 continues to grow to 18% from 15% last week
- XBB.1.9.X now at 15% up from 13% last week
- XBB.1.5.1 steady at ~3%
- XBB.2.3 now at 3.4% up from 2.8% after first being tracked

*percentages are CDC NowCast Estimates

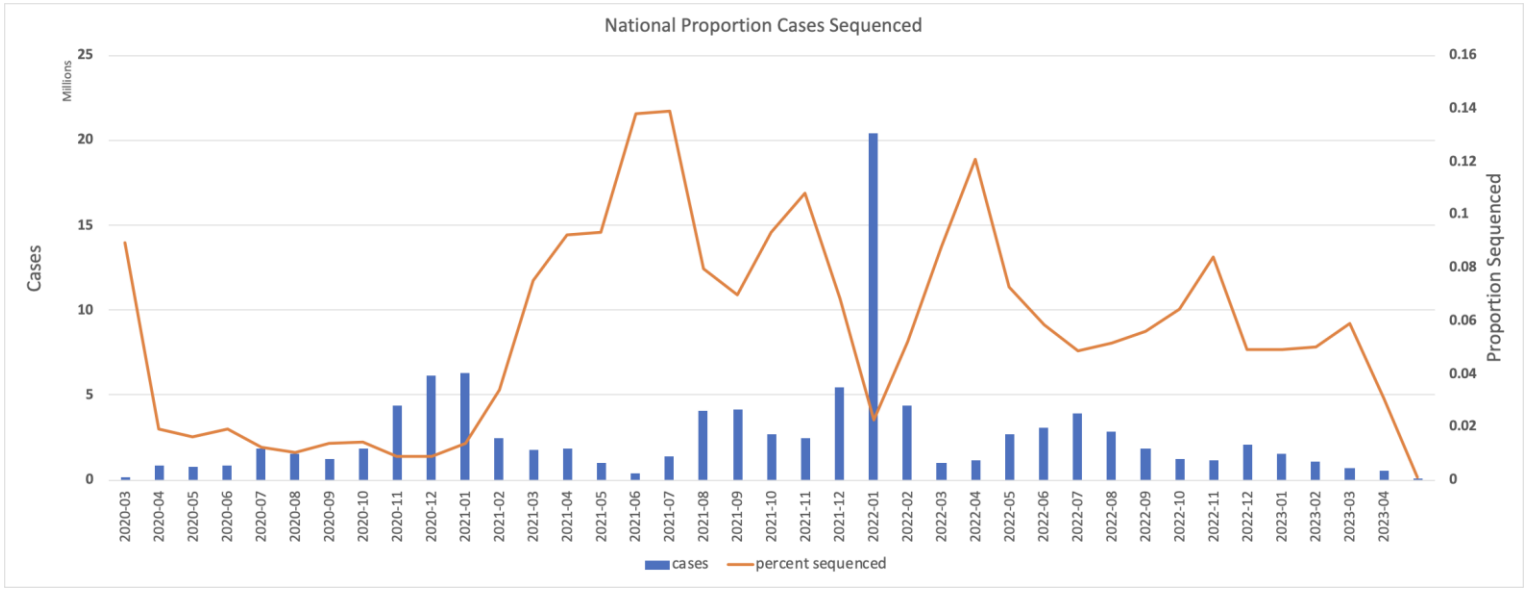
SARS-CoV2 Sequencing

Emerging variants have potential to continue to alter the future trajectories of pandemic and have implications for future control

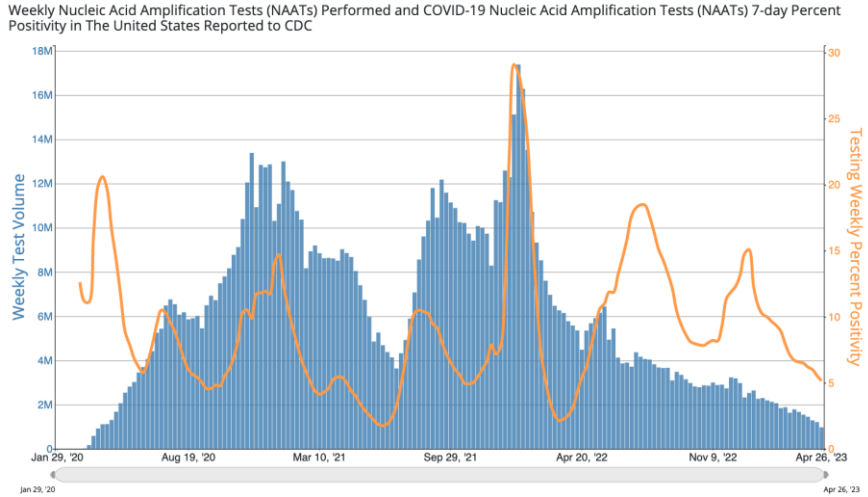
- Current proportion of cases being sequenced is on a downward trend nationally.
- Leveraging additional resources such as wastewater sequencing and adopting into existing infrastructure will be an important supplement



https://clades.nextstrain.org



United States



https://cov-spectrum.org/explore/United%20States/AllSamples/Past6M/sequencing-coverage

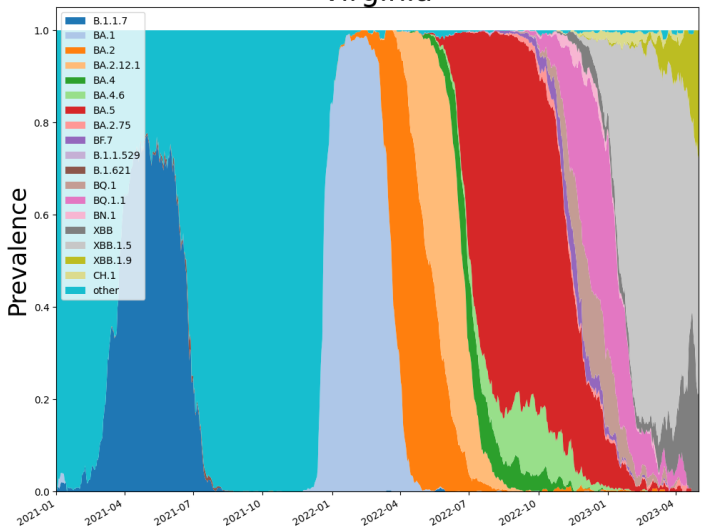
https://covid.cdc.gov/covid-data-tracker/#trends_7daytestresultsreported_7daytestingpositive_00

SARS-CoV2 Omicron Sub-Variants

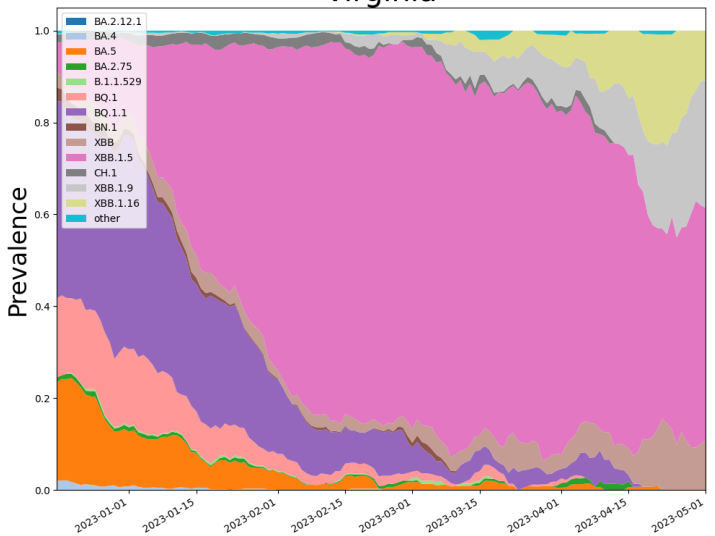
covSPECTRUM
Enabled by data from GISAID

As detected in whole Genomes in public repositories

Virginia

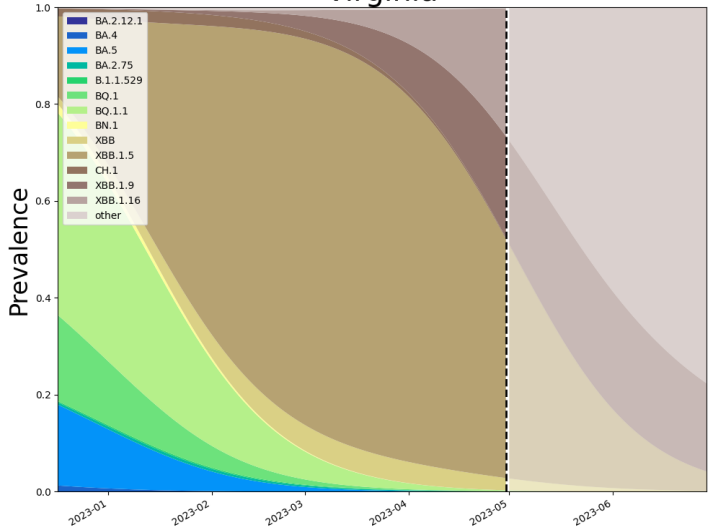


Virginia

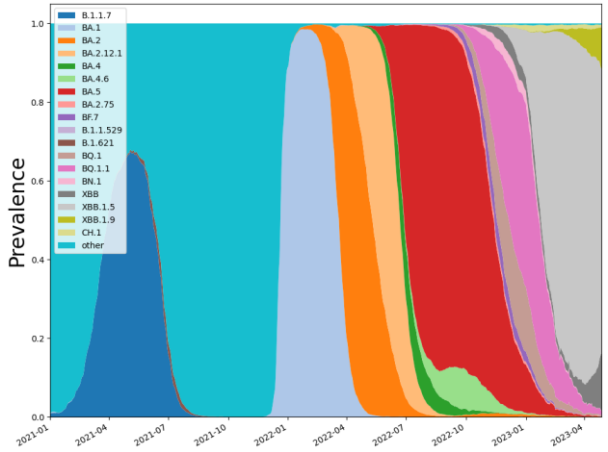


VoC Polynomial Fit Projections

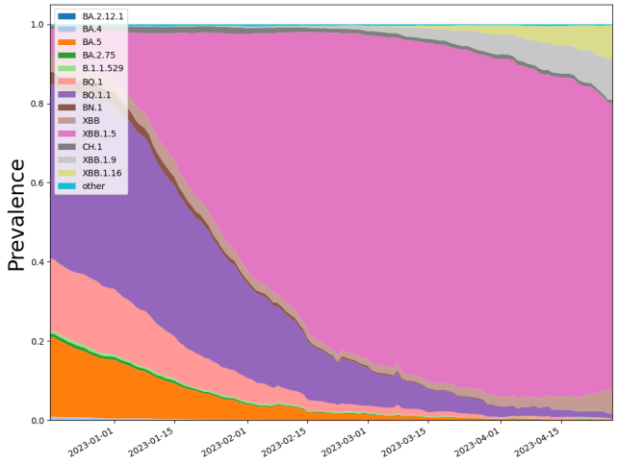
Virginia



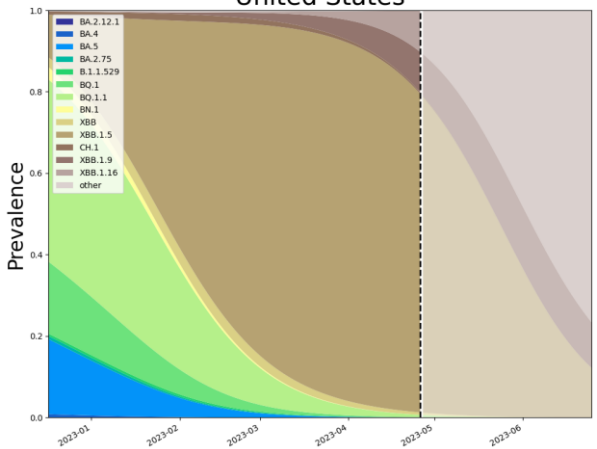
United States



United States



United States



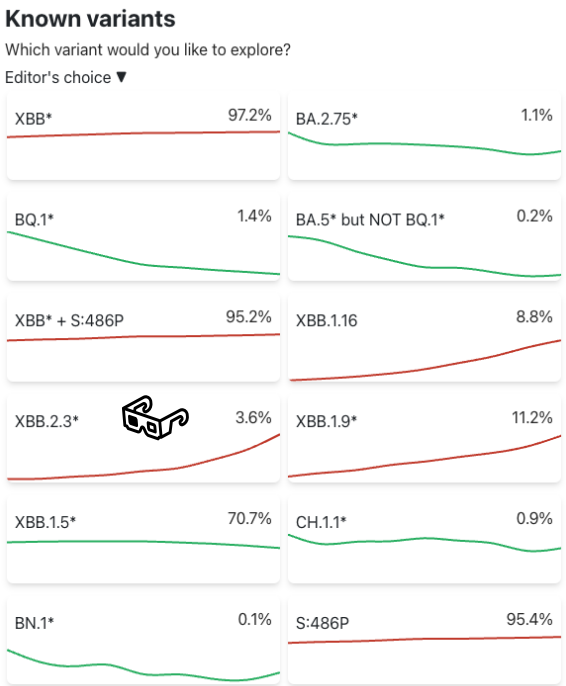
Note: Everything from dotted line forward is a projection.

SARS-CoV2 Omicron Sub-Variants

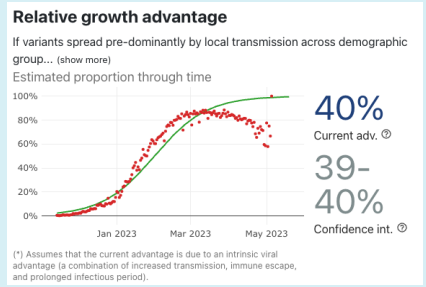
[COV-spectrum](#)

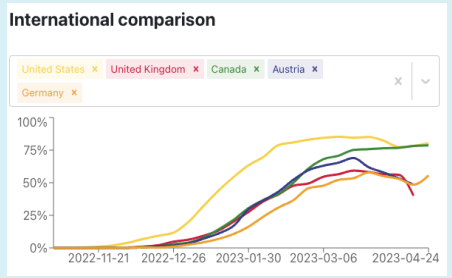
"Editor's choice"

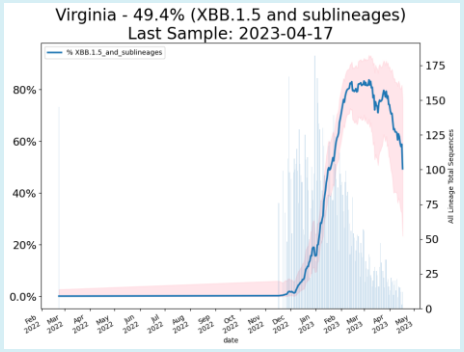
Variants to watch



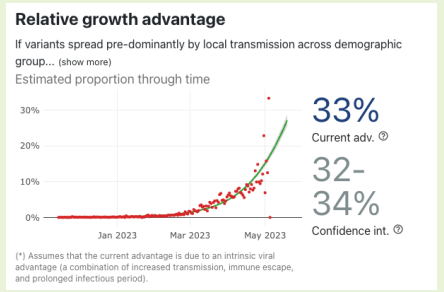
XBB.1.5*

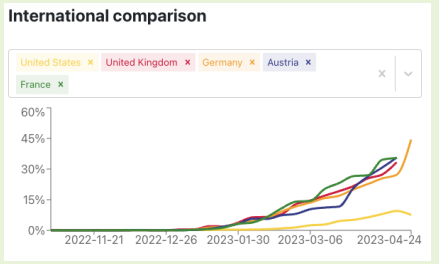


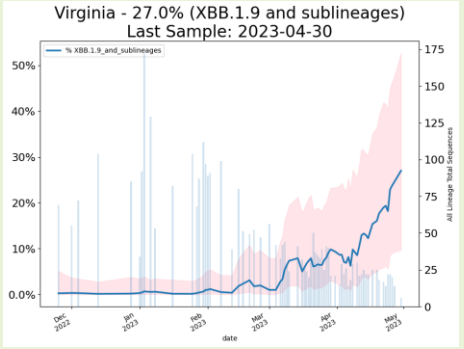




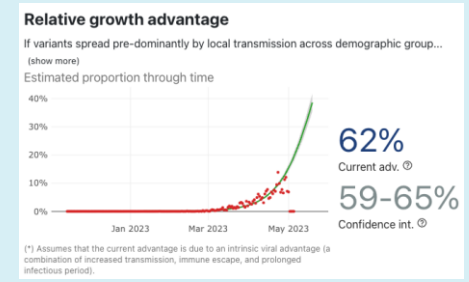
XBB.1.9*

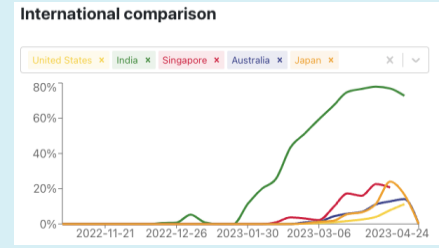


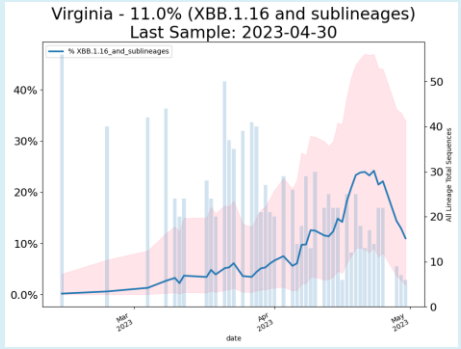




XBB.1.16*

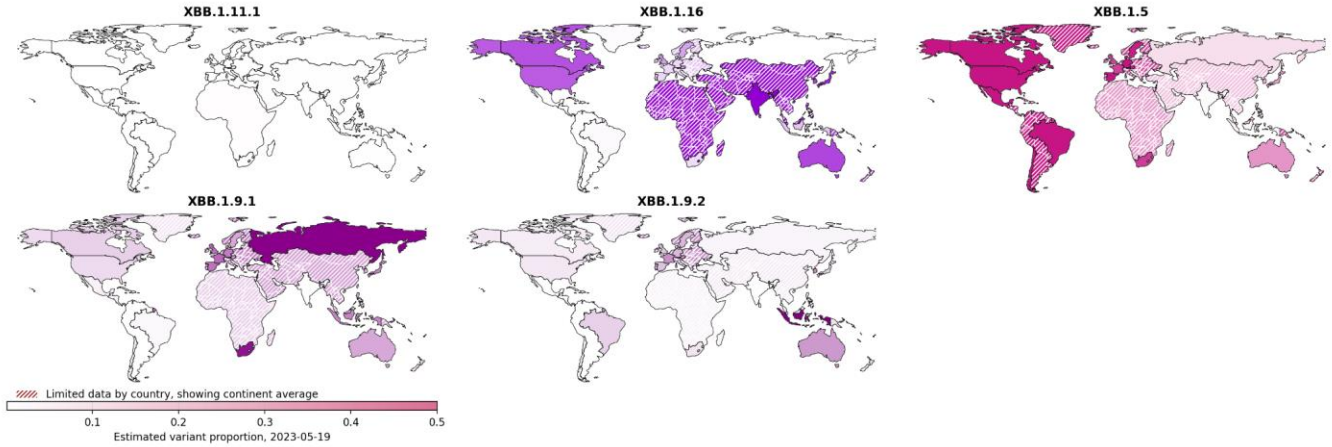


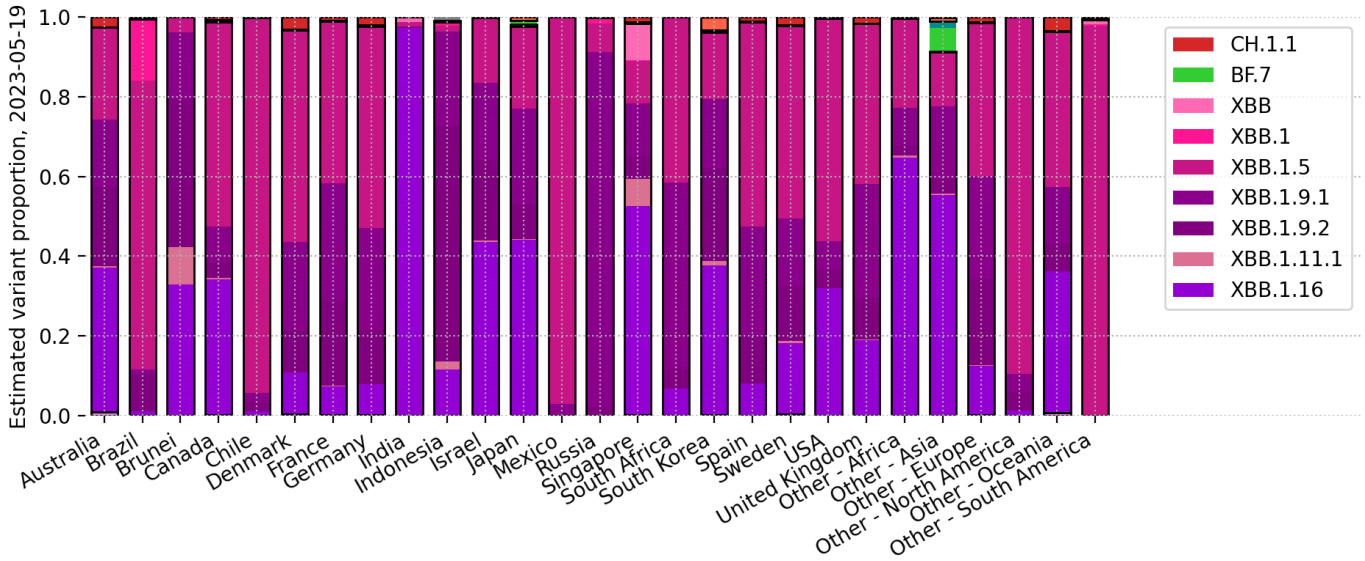


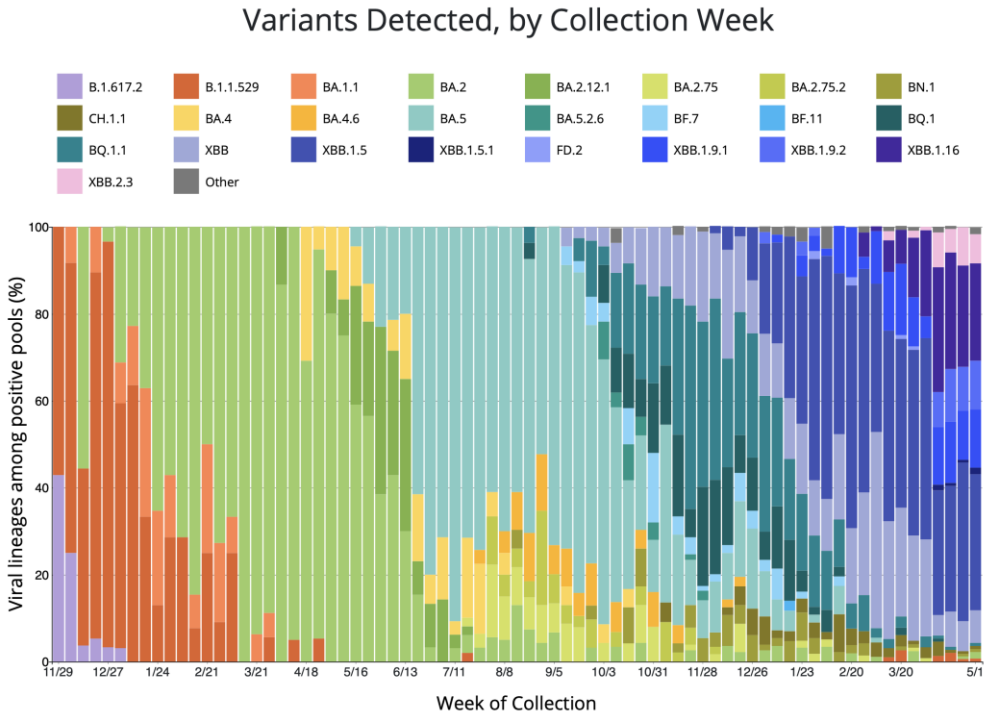


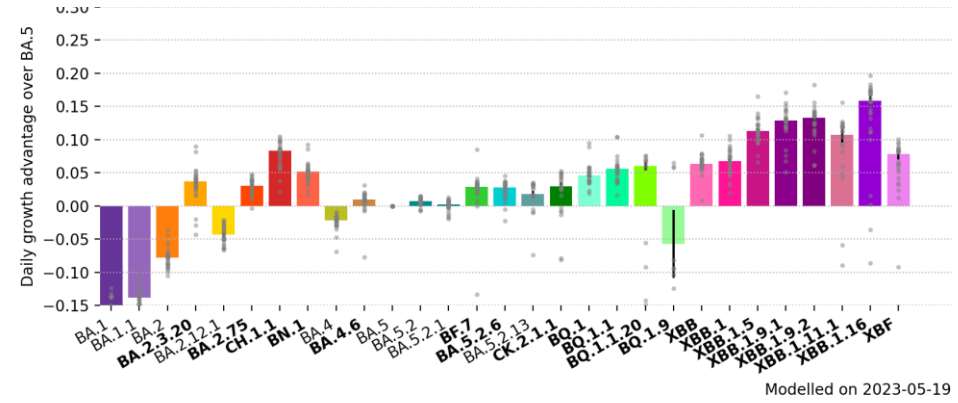
Enabled by data from GISAID

Global SARS-CoV2 Variant Status





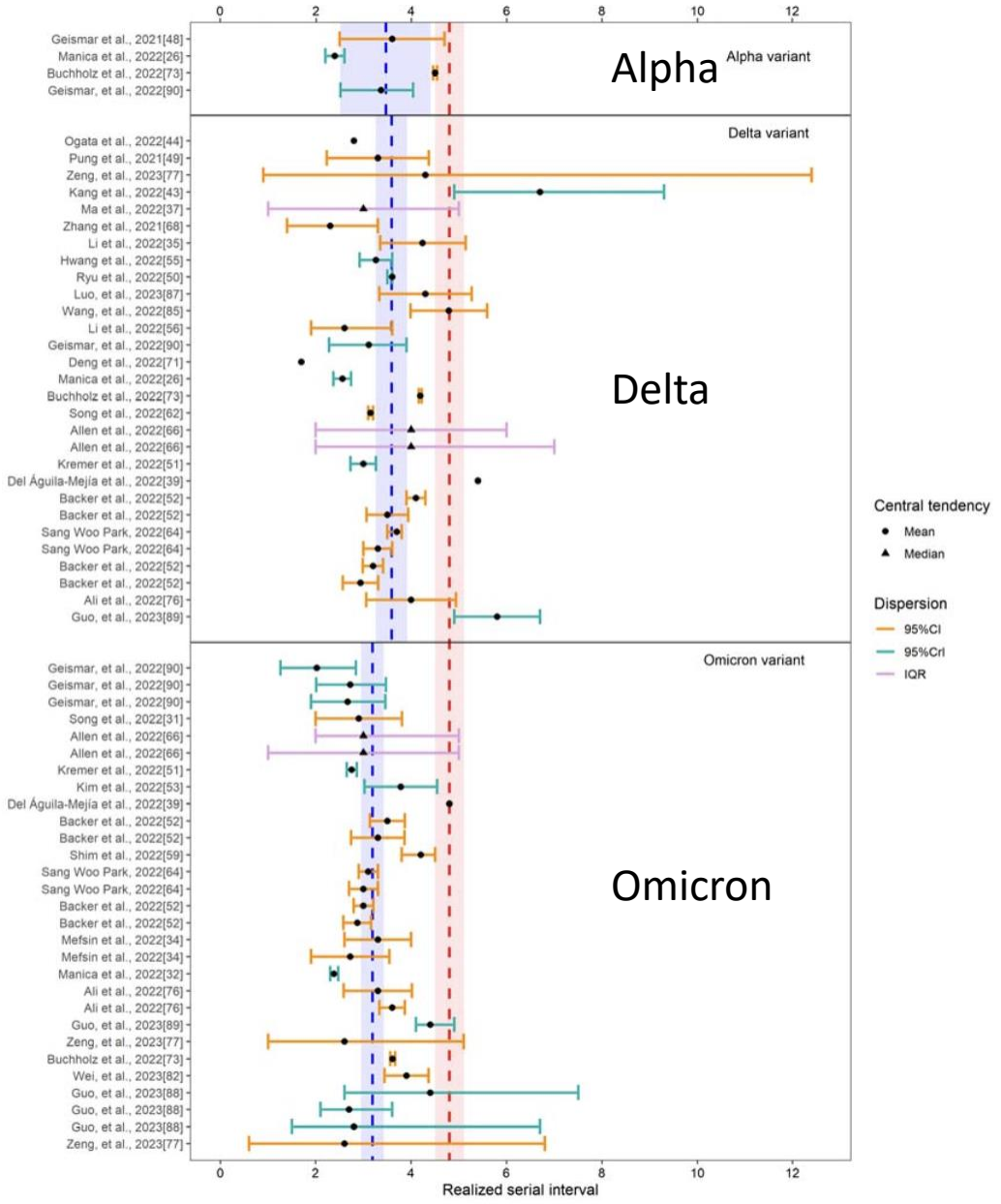




https://covid.cdc.gov/covid-data-tracker/#traveler-genomic-surveillance
https://github.com/gerstung-lab/SARS-CoV-2-International (03/29/23)

Pandemic Pubs (May 25th, 2023)

1. Meta-analysis derived pool of many household or contact tracing studies with well observed case series to further quantify the shortening of incubation and serial interval (time between infections) over time during the pandemic and across variants. Omicron's serial interval is shorter than Delta which was similar to Alpha.



Omicron had the shortest pooled estimates for the incubation period (3.63 days, 95%CI: 3.25-4.02 days), serial interval (3.19 days, 95%CI: 2.95-3.43 days), and realized generation time (2.96 days, 95%CI: 2.54-3.38 days) whereas the ancestral lineage had the highest pooled estimates for each of them . We found considerable heterogeneities (I2 > 80%) when pooling the estimates across different virus lineages, indicating potential unmeasured confounding from population factors (e.g., social behavior, deployed interventions).

MedRxiv
https://www.medrxiv.org/content/10.1101/2023.05.19.23290208v1

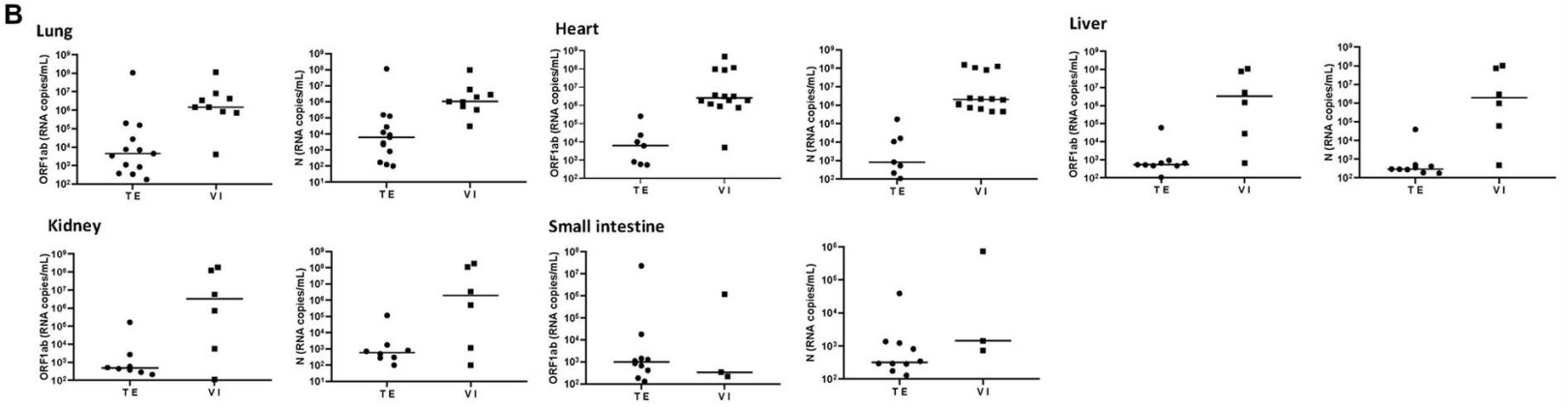
Pandemic Pubs (May 25th, 2023)

2. SARS-CoV-2 can spread to multiple tissues both after primary infection and reinfection. Further evidence of chronic infection leading to long Covid.

A

	LUNG				HEART				LIVER				KIDNEY				INTESTINE			
	homogenate		virus isolation		homogenate		virus isolation		homogenate		virus isolation		homogenate		virus isolation		homogenate		virus isolation	
CASE	ORF1ab	N	ORF1ab	N	ORF1ab	N	ORF1ab	N	ORF1ab	N	ORF1ab	N	ORF1ab	N	ORF1ab	N	ORF1ab	N	ORF1ab	N
A					12	47									111					
B	153000	129000	4020	29400	1000	827	4790	450000	464	285	28000	59200					NA	NA	NA	NA
C	7450	6160			593	531			653	482			585	498			1270	810		
D	3420	2210	3350000	1990000	96	92	1800000	1090000												
E									46	29							129	128		
F	26800	27200			89	91	759000	460000	655	95	655	461	2660	1740			17900	12900		
G	26	65	1450000	988000																
H	22	36	849000	516000	12	12	3040000	1930000	33	28							NA	NA	NA	NA
I	102	169			97	82									121000000	110000000	184	292		
J	195000	156000			23200	16100			91	175			440	795			860	733		
K	44	38	4280000	2780000	89	62	1930000	743000	52	49					5750000	3470000	23000000	423000	1170000	727000
L	34	54	1400000	1050000	86	74	3130000	2210000	44	65	1450000	988000					NA	NA	NA	NA
M	1100	827	113000000	96900000	86	83	94800000	128000000	511	272			507	305			671	294		
N	336	124	7940000	5850000	57	62	1860000	1220000	76	80					733000	498000				
O	22	54																		
P	6910	2730			6120	10600	84800000	78200000	106	187	78500000	71900000	374	707	181000000	179000000	1100	1350	214	721
Q	4370	8490			12	14	1180000	2170000					44	22						
R	105000000	114000000			254000	175000	861000	626000	59200	38900			165000	116000			NA	NA	NA	NA
S	369	101			549	210	474000000	152000000	63	66			282	282	5510	1150	414	552	341	1430
T	173	124			87	108	116000000	109000000	522	406	110000000	99000000	210	101			1420	1230		
U	53	62	698000	315000	54	42	3570000	2430000	56	42	5180000	2990000					NA	NA	NA	NA

B

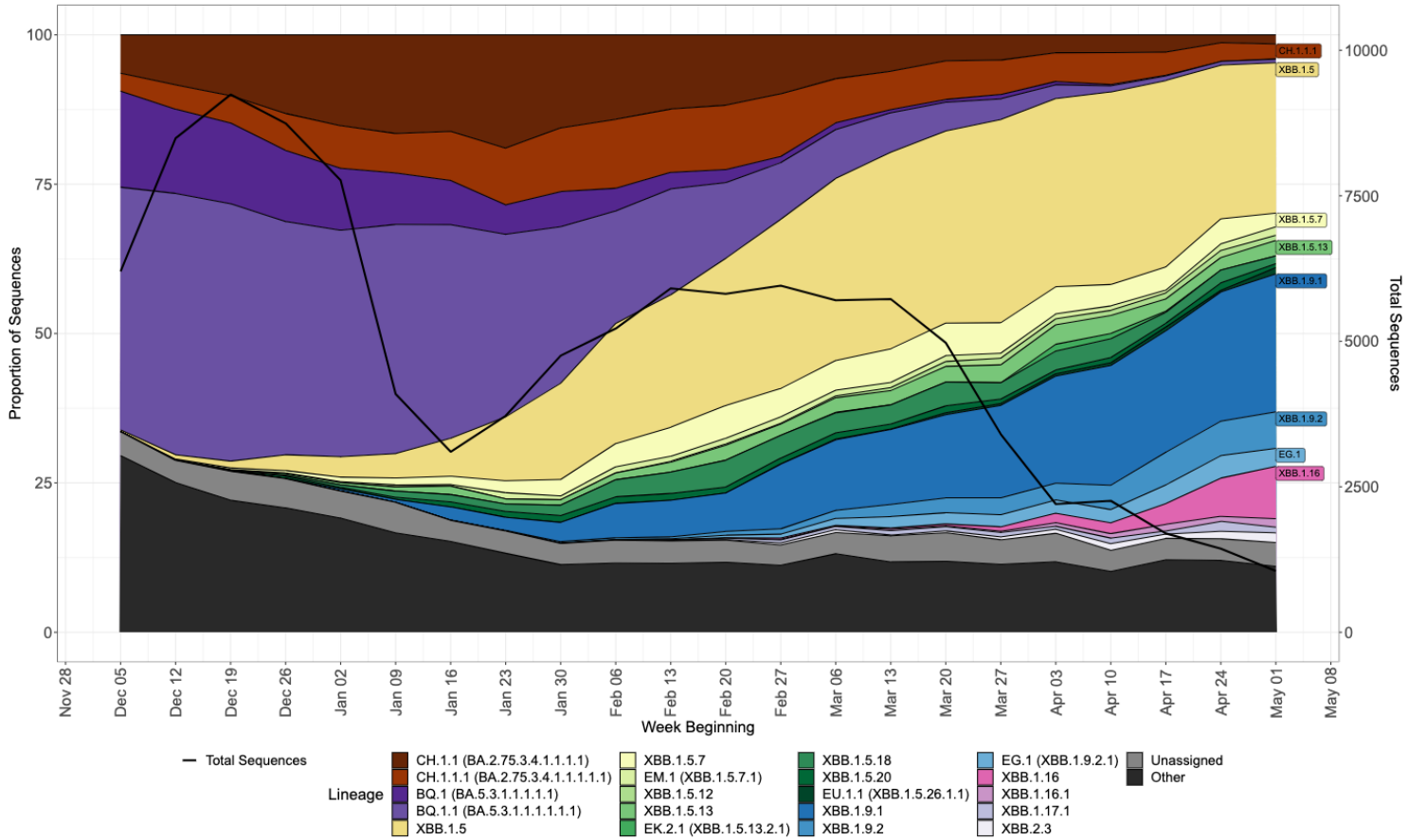


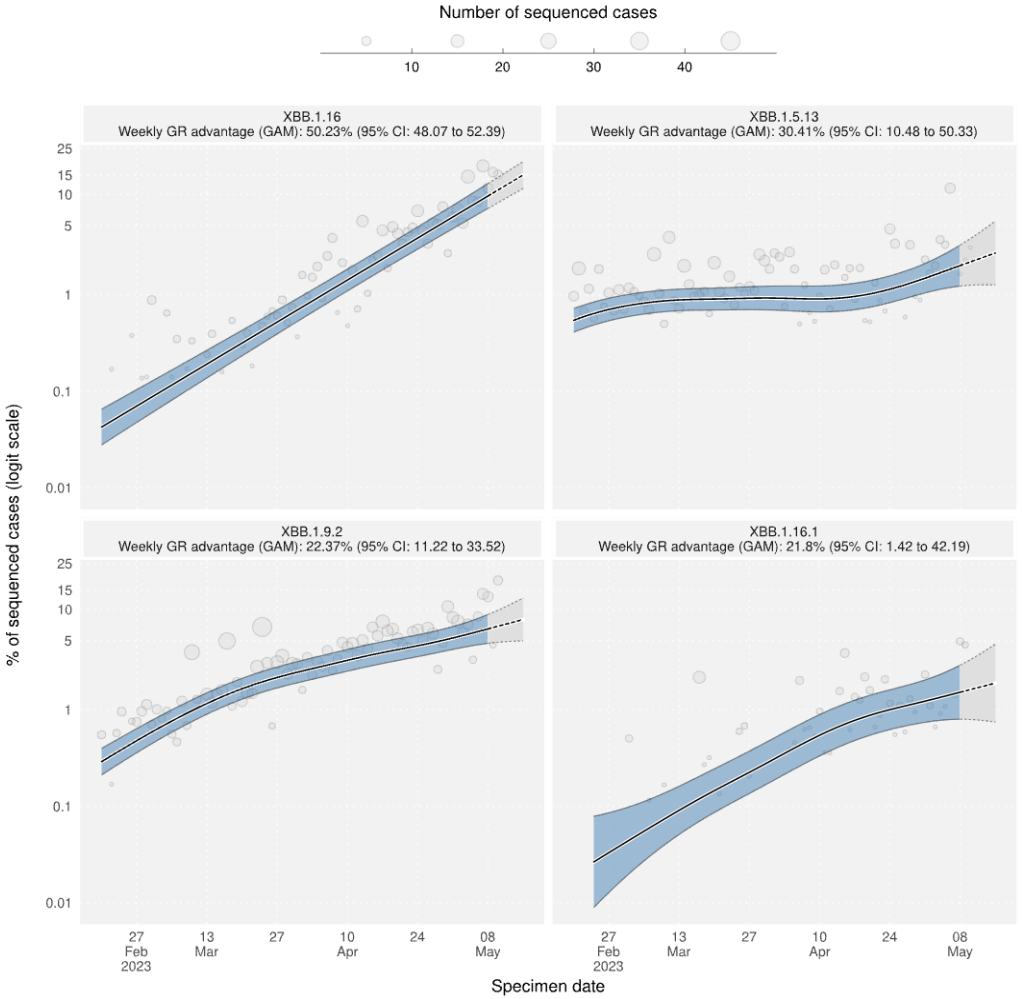
Researchers in Argentina autopsied 21 donors experience first infection or reinfection at time of death between January and August 2022. Their analysis shows persisting reservoirs of SARS-CoV-2 in multiple tissues including lungs, heart liver, kidneys and intestines with different characteristic loads after Omicron infection. Frequent causes of death included adult respiratory distress syndrome with bilateral lung compromise during COVID-19 as well as exacerbations of preexisting comorbidities and COVID-19. Genomes isolated from different tissues showed a remarkable amount of heterogeniety.

https://www.frontiersin.org/articles/10.3389/fmicb.2023.1192832/full

Pandemic Pubs (May 25th, 2023)

3. UKHSA prevalence and growth rate report shows a wide variety of variants and XBB.1.16 and XBB.1.19 having continued growth advantage





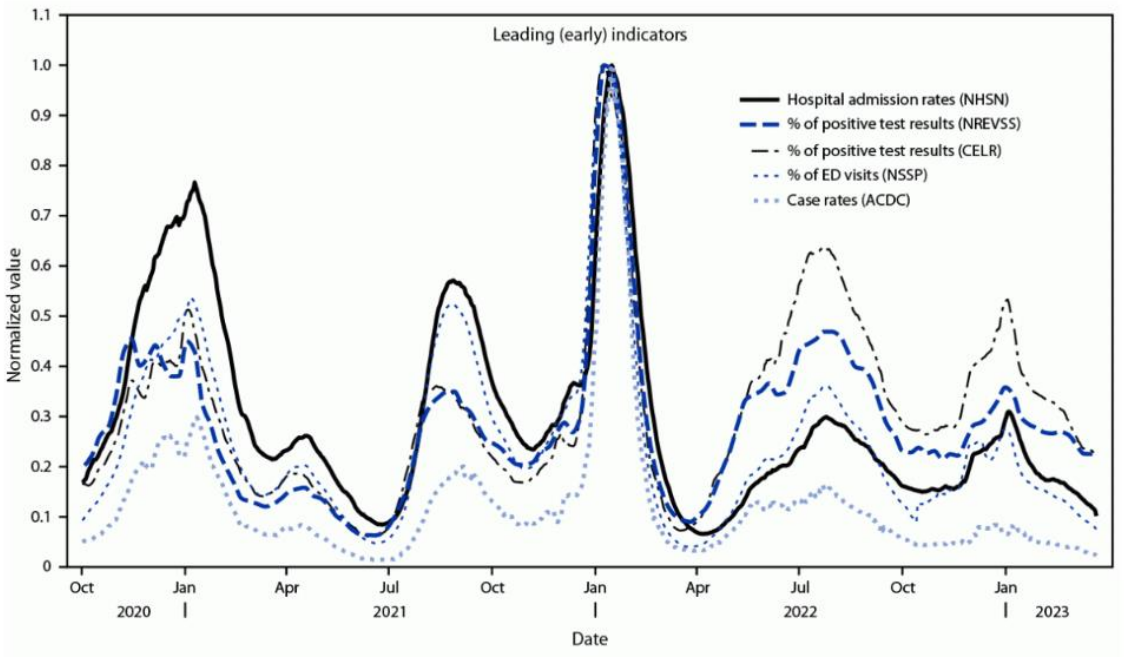
In the UK variant surveillance is now limited to individuals tested with PCR in hospitals with acute respiratory symptoms (plus a few research studies)

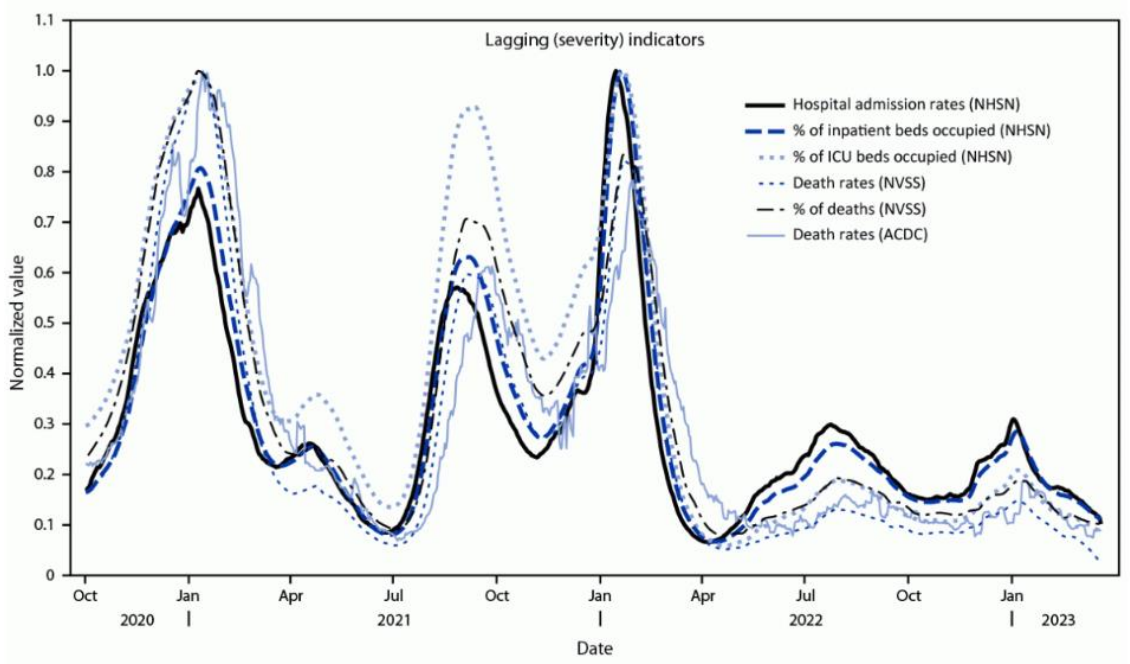
https://www.gov.uk/government/publications/sars-cov-2-genome-sequence-prevalence-and-growth-rate/sars-cov-2-genome-sequence-prevalence-and-growth-rate-update-24-may-2023

Pandemic Pubs (May 11th, 2023)

1. Positive test results, emergency department visits, and COVID-19 deaths are suitable and timely indicators of trends in COVID-19 activity and severity.

FIGURE. Trends in normalized values* of leading (A) and lagging (B)† COVID-19 surveillance indicators — United States, October 1, 2020–March 22, 2023



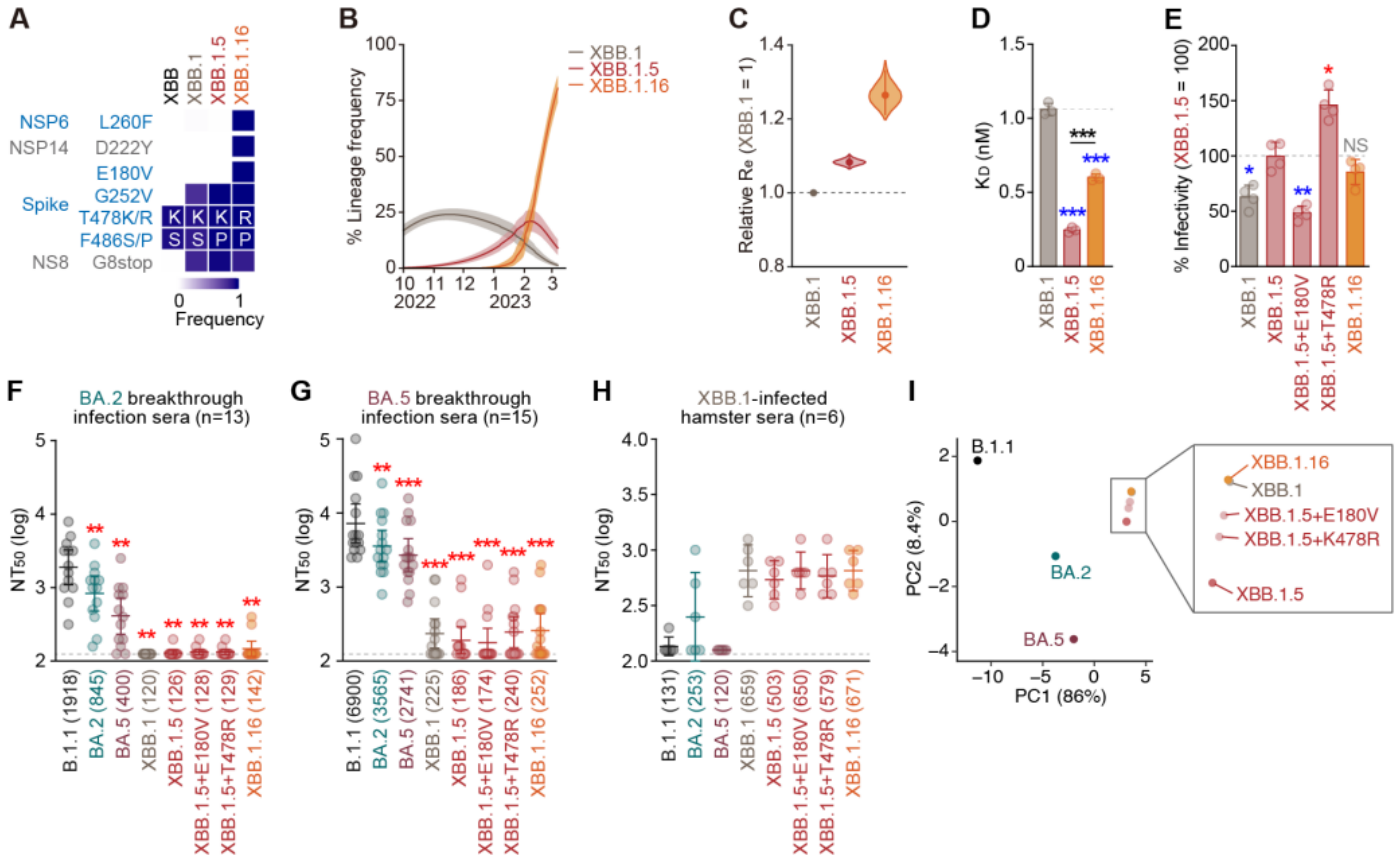


When the U.S. COVID-19 public health emergency declaration expires on May 11, 2023, national reporting of certain categories of COVID-19 public health surveillance data will be transitioned to other data sources or will be discontinued. Weekly COVID-19 Community Levels (CCLs) will be replaced with levels of COVID-19 hospital admission rates (low, medium, or high) which demonstrated >99% concordance by county during February 2022–March 2023. Authors suggest COVID-19–associated hospital admission levels are a suitable primary metric for monitoring COVID-19 trends

https://www.cdc.gov/mmwr/volumes/72/wr/mm7219e2.htm?s_cid=mm7219e2_x#contribAff

Pandemic Pubs (April 19th, 2023)

1. XBB.1.16 shows a similar resistance profile to XBB.1 and XBB.1, in that it is resistant to a variety of anti-SARS-CoV-2 antibodies from breakthrough infections. Scientists suggest this parity indicates it's growth advantage may come from some other transmission property such as a change in antigenicity or in viral growth efficiency.



Scientists in Japan characterized the antibody neutralization of XBB.1.16. Panels F, G, H indicate as similar neutralization profile to other XBB variants relative to breakthrough infections. Panels D and E show the ACE2 binding affinity and infectivity respectively. A change in antigenicity relative to XBB 1.5 is inferred from a PCA of neutralization assays F and G (neutralization cartography).

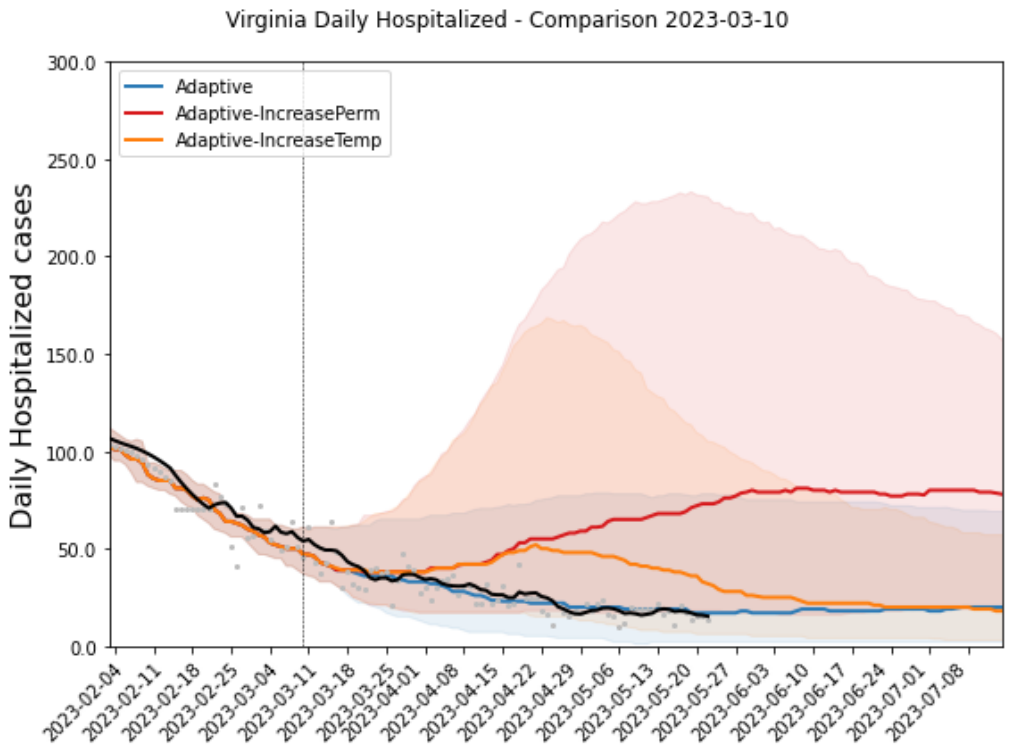
https://www.biorxiv.org/content/10.1101/2023.04.06.535883v3.article-info

Model Results

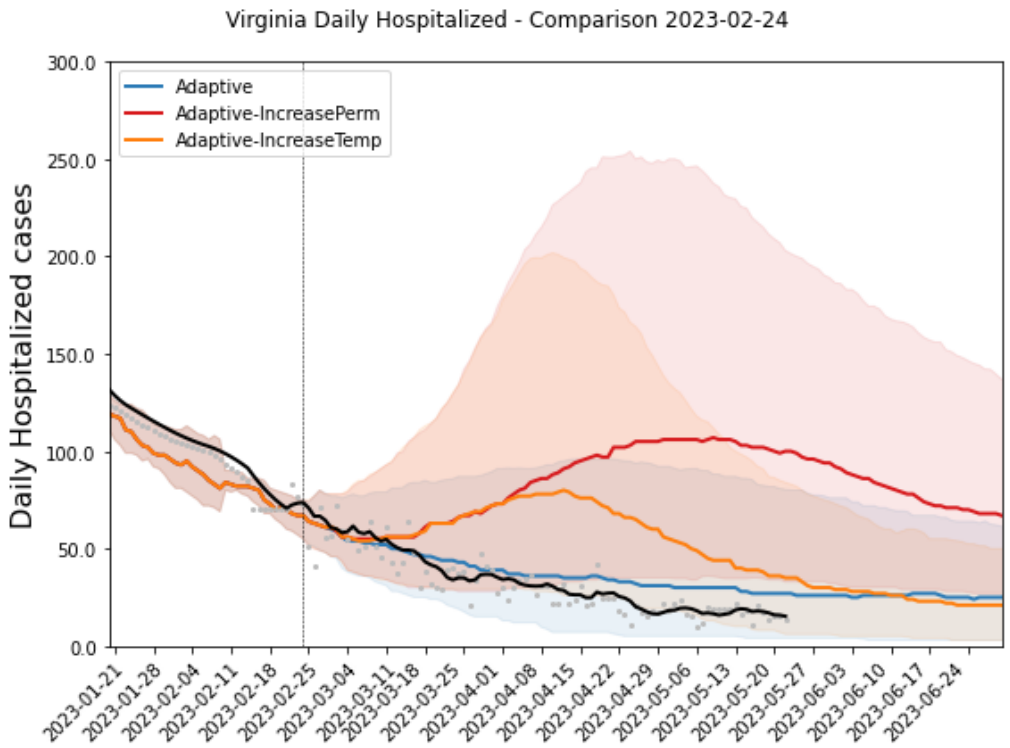
Past projections – Hospitalizations

- Previous projections remain on target with recent observations
- Past 10 weeks have stayed steady and indicate no increases in transmissions

Previous round – 10 weeks ago



Previous round – 12 weeks ago



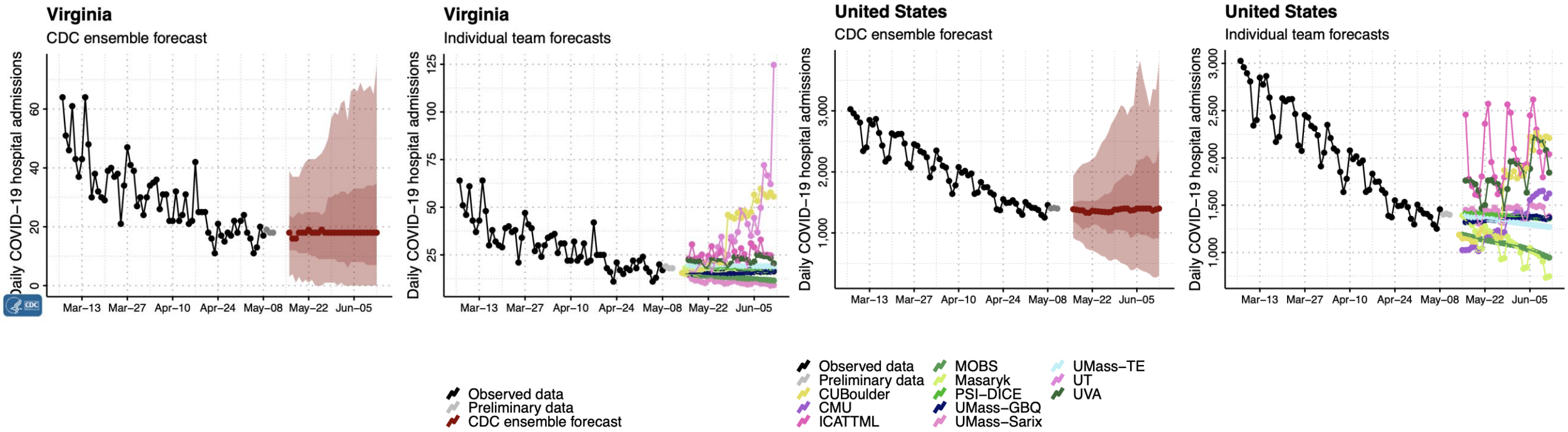
National Modeling Hub Updates

Current COVID-19 Hospitalization Forecast

Statistical models for submitting to CDC COVID Forecasting Hub

- Uses a variety of statistical and ML approaches to forecast weekly hospital admissions for the next 4 weeks for all states in the US

Hospital Admissions for COVID-19 and Forecast for next 4 weeks (CDC COVID Ensemble)



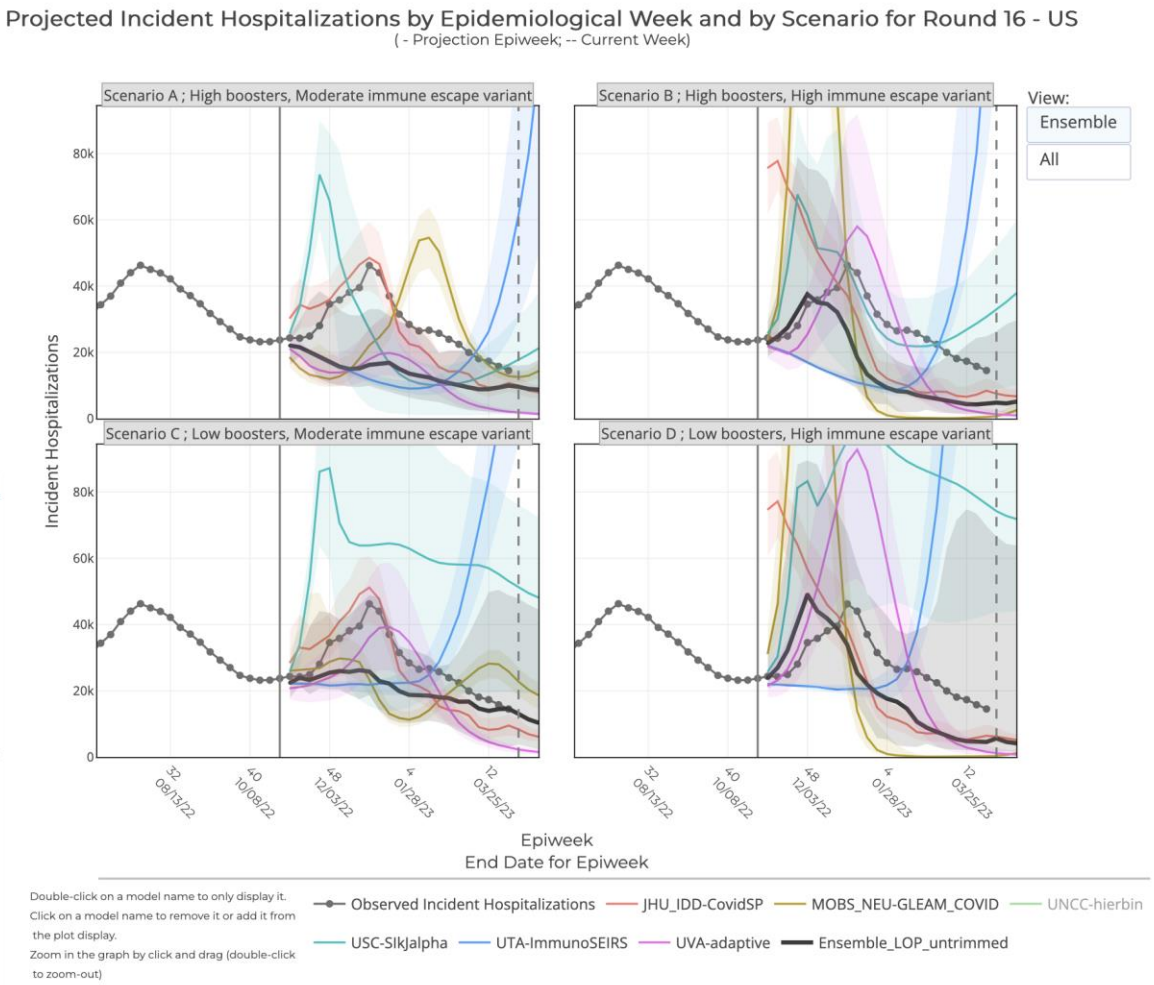
Scenario Modeling Hub – COVID-19 (Round 16)

Collaboration of multiple academic teams to provide national and state-by-state level projections for 4 aligned scenarios

- Round 16 results published
- Moderate escape scenarios tracking best
- Round 17 is underway, prelim results in coming weeks

	"Level 5" Variants	"Level 6/7" Variants
Accelerating uptake levels of reformulated boosters	Scenario A "Level 5" Variants - Variants have a 25% immune escape from BA.5.2 - Seeding based on combined observed prevalence of Level 5 variants at the start of the projection period - No change in severity given symptomatic infection Accelerating uptake levels of reformulated boosters, with coverage plateauing at 90% of flu vaccination levels by February 1st, 2023 - Teams are free to use available data and information from current and previous rollouts as tehy see fit to define rates - Teams should assume increasing uptake through October and November as necessary to reach the projected February 1st, 2022 plateau	Scenario B "Level 6/7" Variants - Variants have a 50% immune escape from BA.5.2 - Seeding based on combined observed prevalence of Level 6 and 7 variants at the start of the projection period - No change in severity given symptomatic infection Accelerating uptake levels of reformulated boosters, with coverage plateauing at 90% of flu vaccination levels by February 1st, 2023 - Teams are free to use available data and information from current and previous rollouts as tehy see fit to define rates - Teams should assume increasing uptake through October and November as necessary to reach the projected February 1st, 2022 plateau
Current uptake levels of reformulated boosters	Scenario C "Level 5" Variants - Variants have a 25% immune escape from BA.5.2 - Seeding based on combined observed prevalence of Level 5 variants at the start of the projection period - No change in severity given symptomatic infection Current uptake levels of reformulated boosters, with coverage plateauing at booster 1 levels by the end of the simulation - Teams are free to use available data and information from current and previous rollouts as tehy see fit to define rates - Based on current rates, plateau date is flexible as long as it occurs before the end of the simulation (Teams can adjust rates up if needed to achieve adequate coverage by target date)	Scenario D "Level 6/7" Variants - Variants have a 50% immune escape from BA.5.2 - Seeding based on combined observed prevalence of Level 6 and 7 variants at the start of the projection period - No change in severity given symptomatic infection Current uptake levels of reformulated boosters, with coverage plateauing at booster 1 levels by the end of the simulation - Teams are free to use available data and information from current and previous rollouts as tehy see fit to define rates - Based on current rates, plateau date is flexible as long as it occurs before the end of the simulation (Teams can adjust rates up if needed to achieve adequate coverage by target date)

https://covid19scenariomodelinghub.org/viz.html



Scenario Modeling Hub – COVID-19 (Round 17)

Collaboration of multiple academic teams to provide national and state-by-state level projections for 6 aligned scenarios

https://covid19scenariomodelinghub.org/viz.html

- Preliminary Results
- Round Designed to explore different seasonal vaccination levels and the impact of Immune Escape

Scenario Dimensions:

Immune Escape (IE):

Slower IE (20%/yr) vs.
Faster IE (50%/yr)

Vaccination levels:

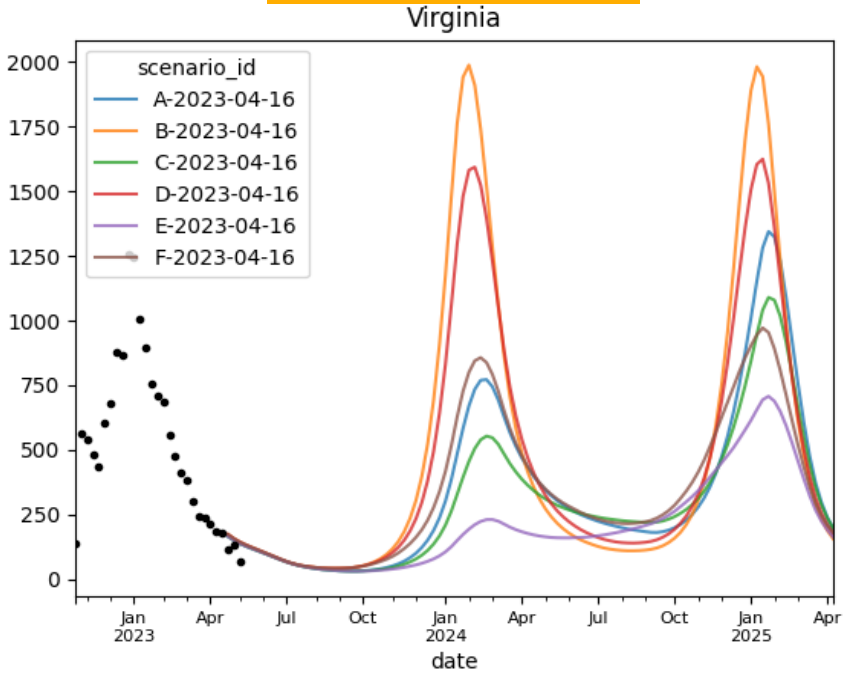
None vs.
Vulnerable and 65 + vs.
Broader population of eligible

	Low immune escape • Immune escape occurs at a constant rate of **20% per year**	**High immune escape** • Immune escape occurs at a constant rate of **50% per year**
No vaccine recommendation • Uptake negligible or continues at very slow levels based on existing 2022 booster trends	Scenario A	Scenario B
Reformulated annual vaccination recommended for 65+ and immunocompromised • Reformulated vaccine has **65% VE against variants circulating on June 15** • Vaccine becomes **available September 1** • Uptake in 65+ same as first booster dose recommended in September 2021 • Uptake in individuals under 65 negligible or continues to trickle based on 2022 booster trends	Scenario C	Scenario D
Reformulated annual vaccination recommended for all currently eligible groups • Reformulated vaccine has **65% VE against variants circulating on June 15** • Vaccine becomes **available September 1** • 65+ uptake same as first booster dose recommended in September 2021 • Coverage in individuals under 65+ saturates at levels of the 2021 booster (approximately 34% nationally)	Scenario E	Scenario F

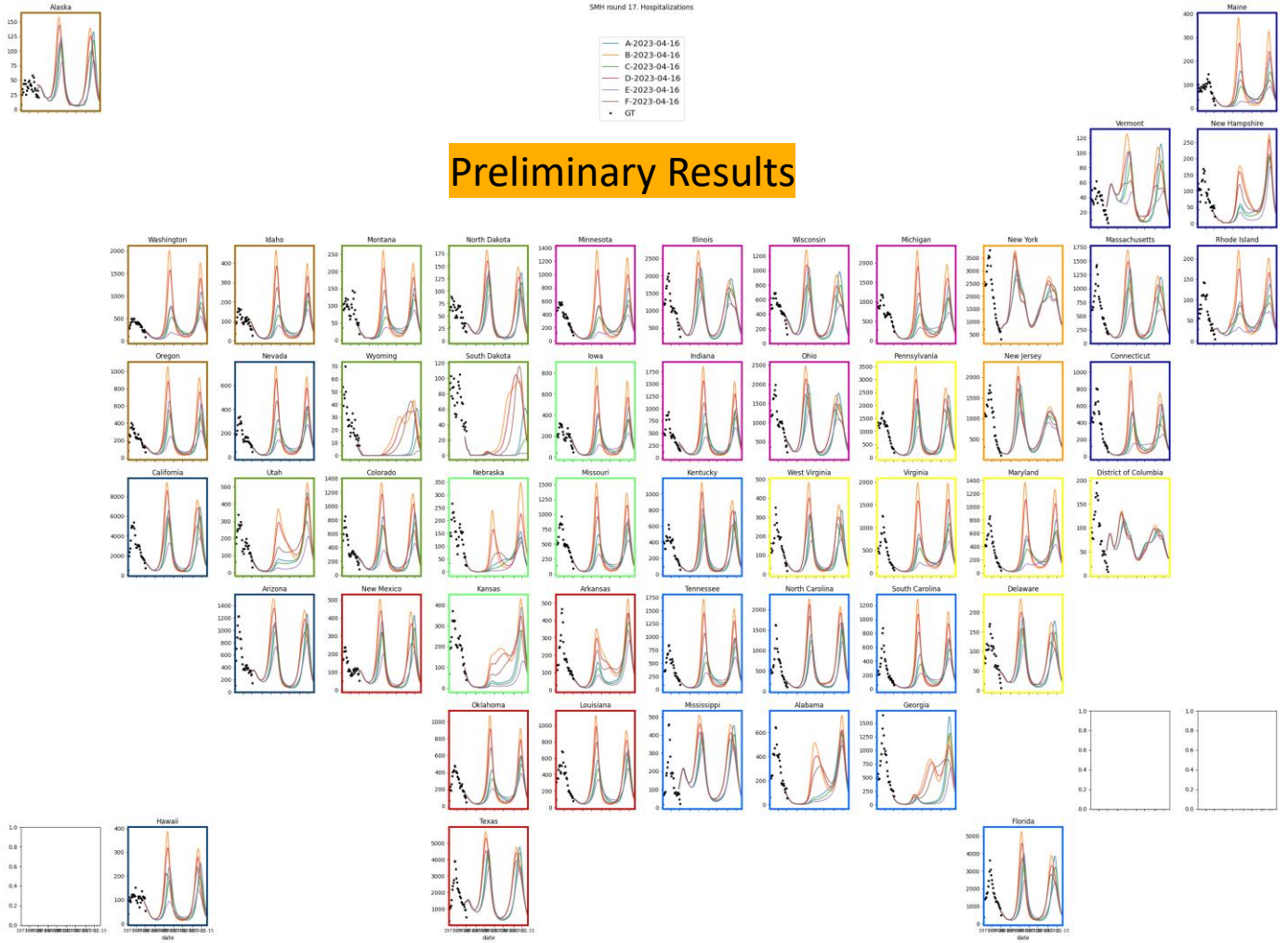
UVA model – Preliminary Results (Round 17)

- Vaccination drives down hospitalizations
- Broad population vax levels akin to bivalent booster significantly reduce hospitalizations

Preliminary Results

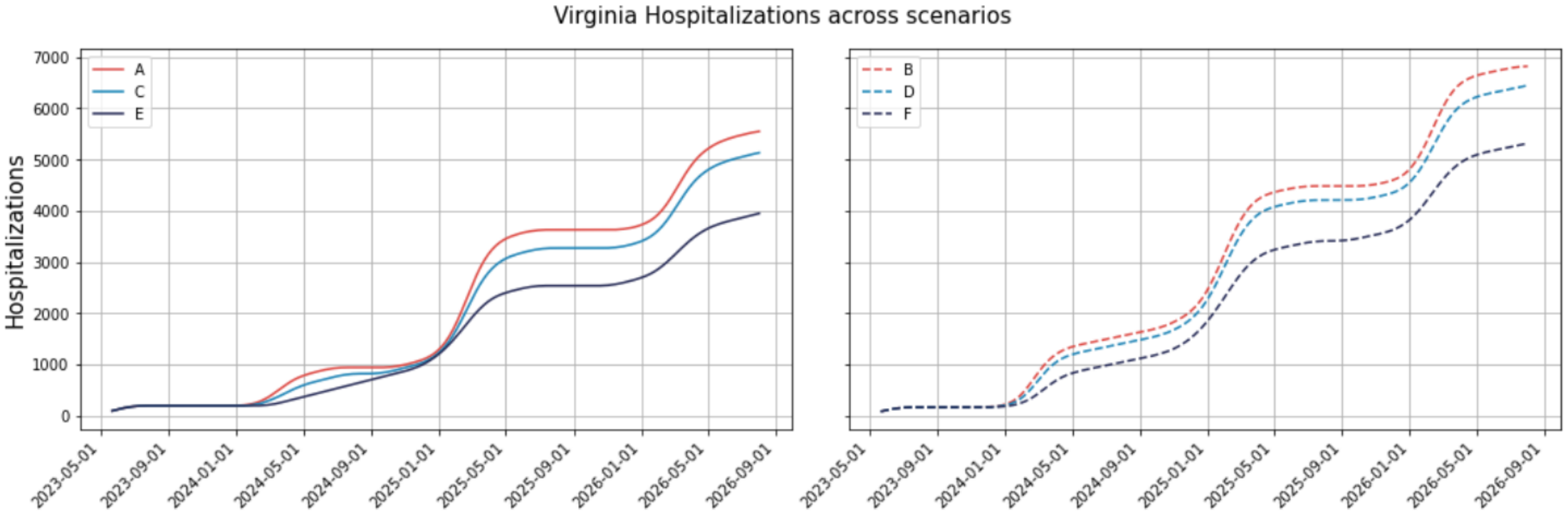


Preliminary Results



UVA model – Preliminary Results (Round 17)

- Cumulative hospitalizations over 2 years shows spread across vaccination levels
- Broad annual vaccination campaign reduces hospitalizations by 27% over 2 years



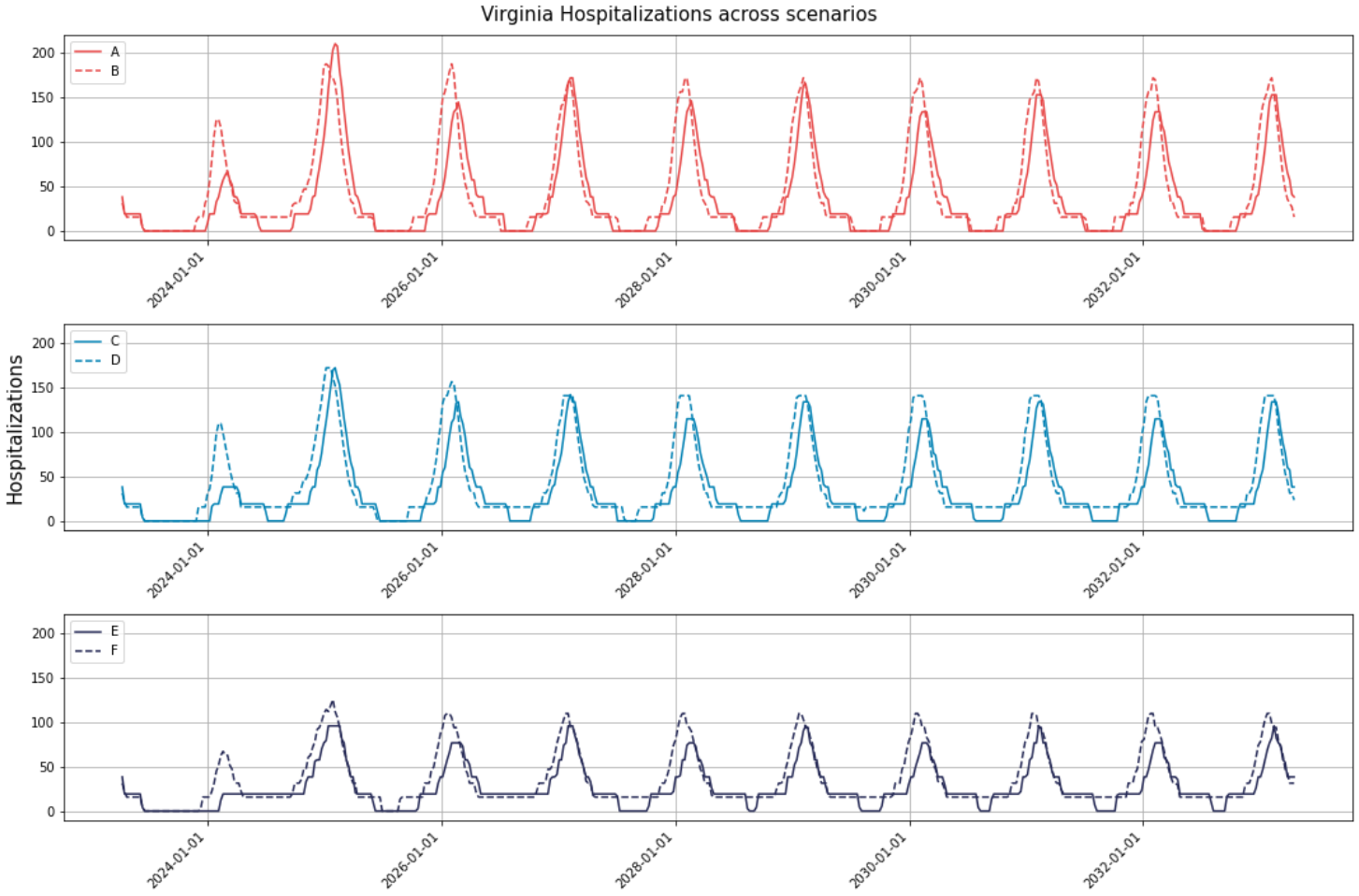
Slower Immune Escape (20%)

Faster Immune Escape (20%)

Preliminary Results

UVA model – Preliminary Results (Round 17)

- Peak timing and size can oscillate over the longer term
- These scenarios are very unlikely to remain stable over longer term, nonetheless, some of these patterns may remain
- Scenarios with faster immune escape (dashed) converge more quickly than the slower immune escape



Preliminary Results

Key Takeaways

Projecting future cases precisely is impossible and unnecessary.
Even without perfect projections, we can confidently draw conclusions:

- Case rates and hospitalizations have entered a plateau at a steady low level
- Nearly all indicators point to this trend continuing in near term
- Long term projections that assume a seasonal trend in the winter show impact of vaccine coverage and slow vs. fast evolution of immune escape
    - Broad annual vaccination campaign reduces hospitalizations by 27% over 2 years

Model Updates

- Projected Trajectories from previous rounds remain on target, no new projections made this round

Questions?

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