Network Systems Science & Advanced Computing

Biocomplexity Institute & Initiative

University of Virginia

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

December 14th, 2023

(data current to Dec 1st – Dec 13th)

Biocomplexity Institute Technical report: TR BI-2023-286

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biocomplexity.virginia.edu

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

Most COVID-19 indicators show continued growth

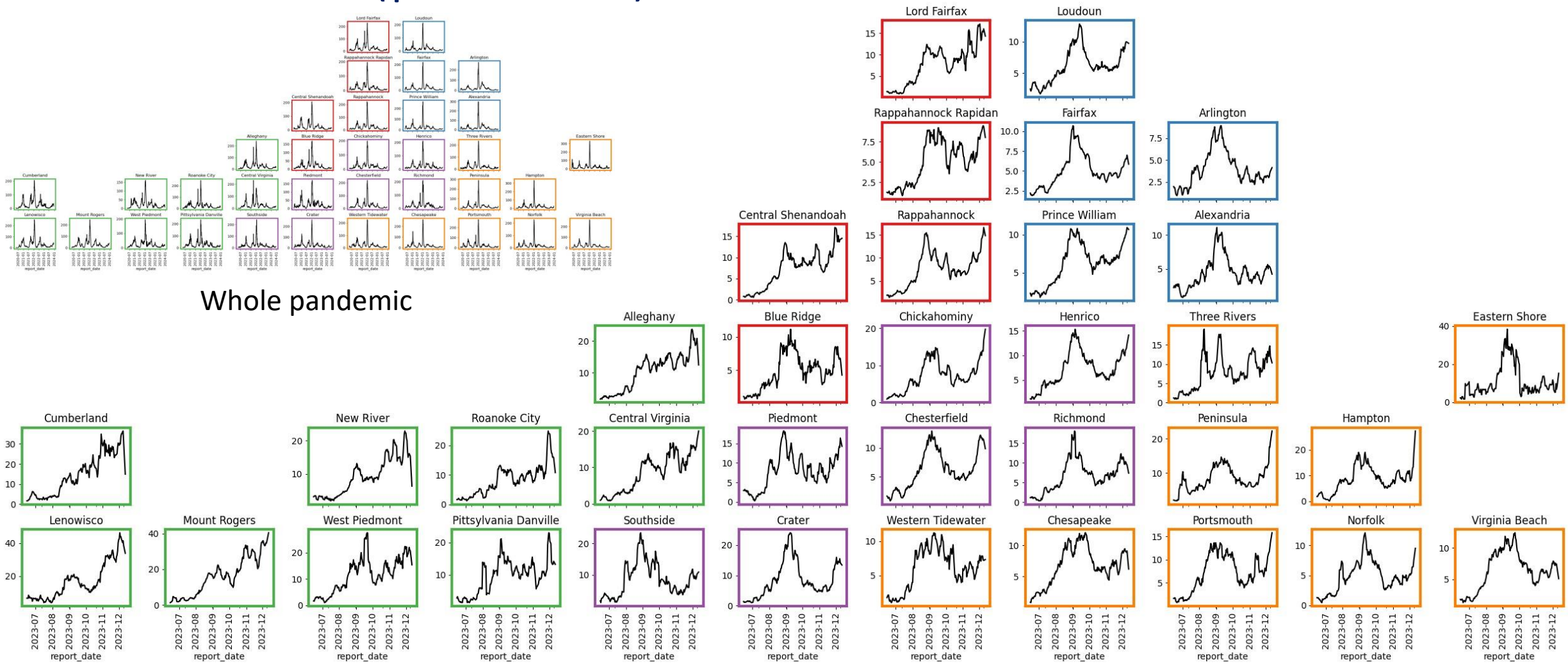
- Case and Hospitalization growth may be slowing but remain elevated
- Other indicators are mixed with some plateaus and some growth
- Wastewater indicators have receded from growth of past weeks; some sites remain high
- Together this suggest continued slow growth which may accelerate going forward.

Other Respiratory diseases (Flu, RSV) are active

COVID-19 Surveillance

Case Rates (per 100k)

Whole pandemic

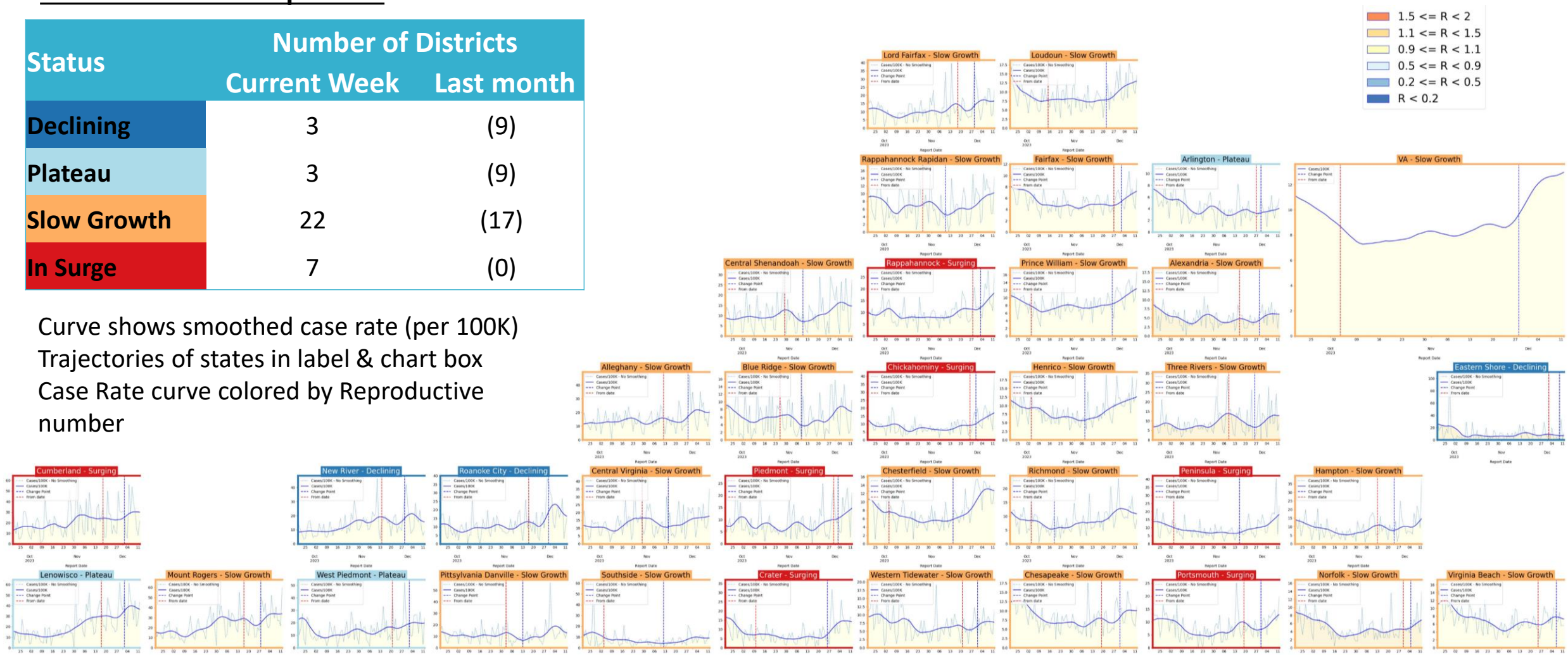


District Case Trajectories – last 10 weeks

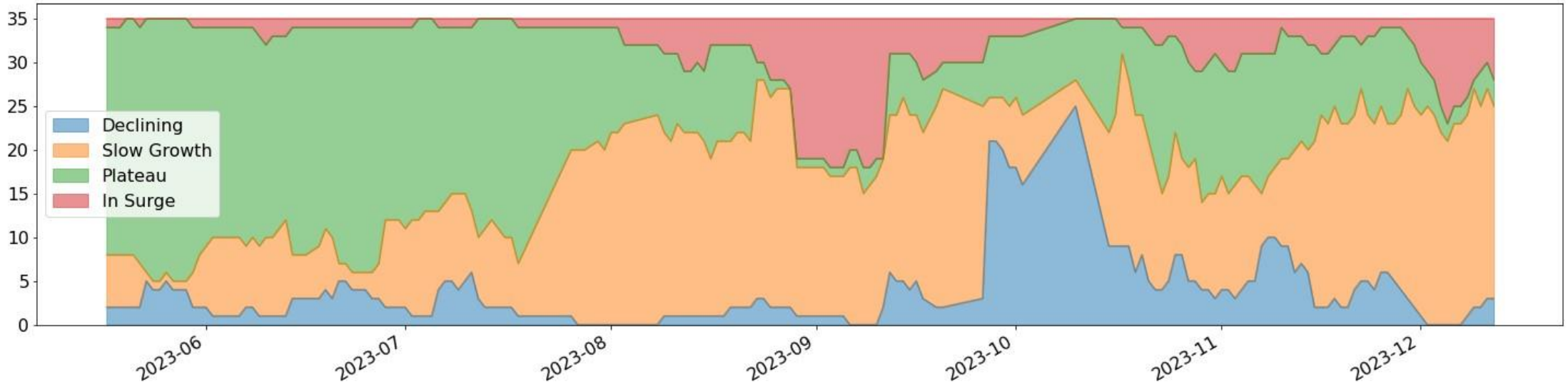
Rt estimates from EpiNow2

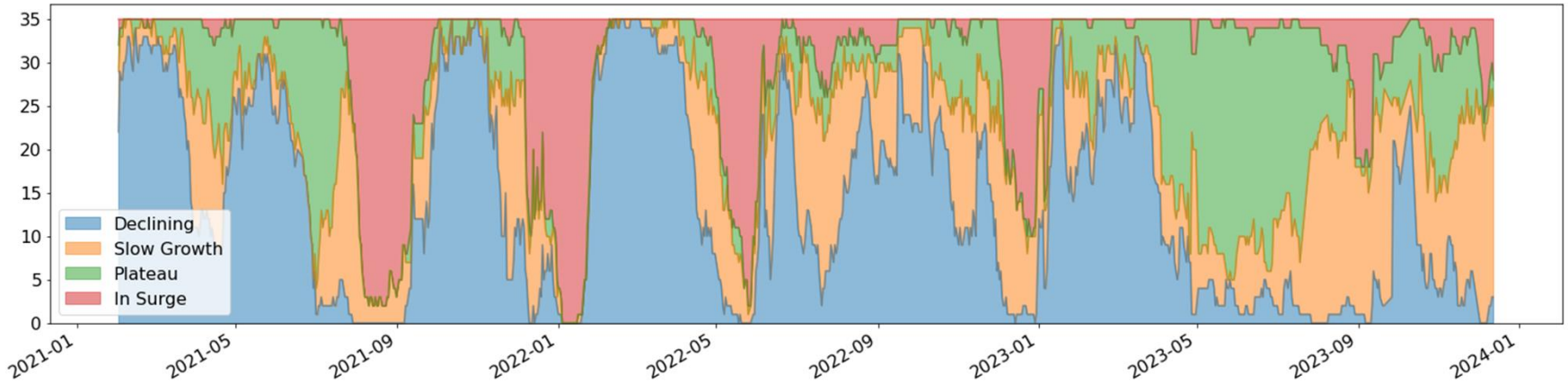
Status	Number of Districts	
	Current Week	Last month
Declining	3	(9)
Plateau	3	(9)
Slow Growth	22	(17)
In Surge	7	(0)

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



District Case Trajectories – Recent 6 months





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District Hospital Trajectories – last 10 weeks

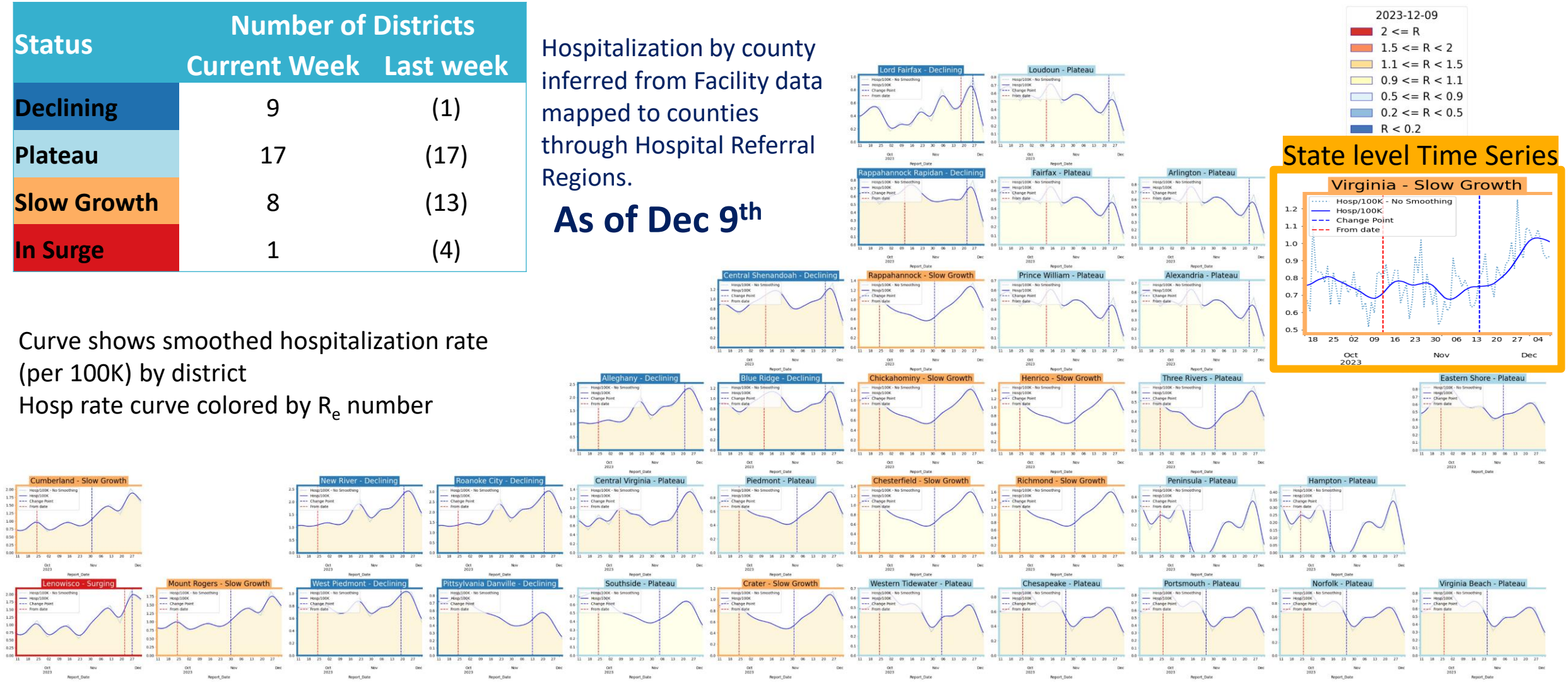
Rt estimates from EpiNow2

Status	Number of Districts	
	Current Week	Last week
Declining	9	(1)
Plateau	17	(17)
Slow Growth	8	(13)
In Surge	1	(4)

Hospitalization by county inferred from Facility data mapped to counties through Hospital Referral Regions.

As of Dec 9th

Curve shows smoothed hospitalization rate (per 100K) by district
Hosp rate curve colored by R_e number



COVID-19 Spatial Epidemiology

ZIP Code level case rate since last meeting

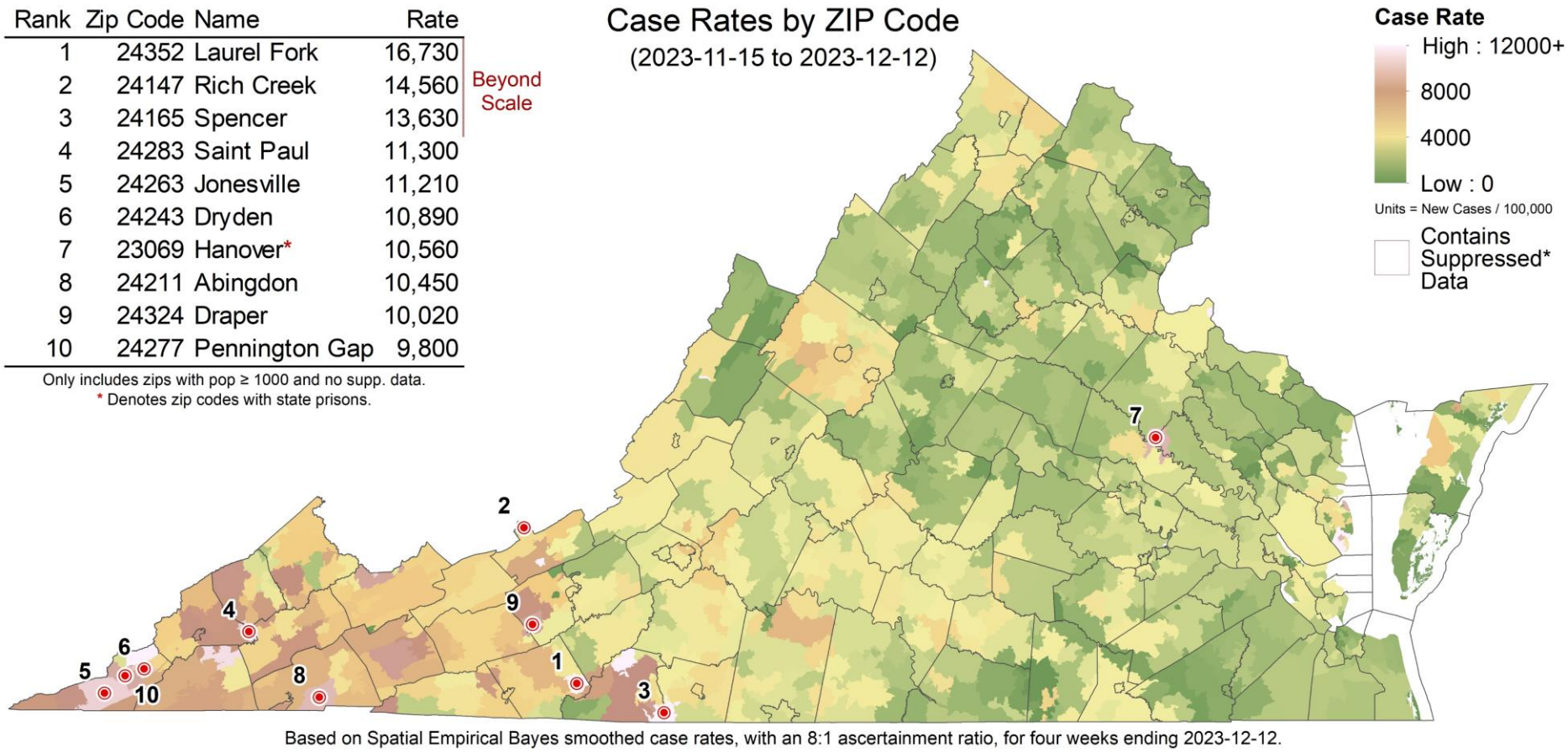
New cases per 100k in the last four weeks

- Rates are for the weeks since last meeting. Divide rates by four to calculate average weekly incidence.
- Case rates remain highly elevated in the Southwest, particularly west of Martinsville.
- Other areas of higher burden include Hanover, as well as Augusta and Pittsylvania Counties.
- Hanover is the only prison containing ZIP code in the top 10.

Rank	Zip Code	Name	Rate
1	24352	Laurel Fork	16,730
2	24147	Rich Creek	14,560
3	24165	Spencer	13,630
4	24283	Saint Paul	11,300
5	24263	Jonesville	11,210
6	24243	Dryden	10,890
7	23069	Hanover*	10,560
8	24211	Abingdon	10,450
9	24324	Draper	10,020
10	24277	Pennington Gap	9,800

Beyond Scale

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



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Risk of Exposure and Hot Spots

Case rates since last meeting by zip code used to calculate risk of encountering someone infected in a gathering of randomly selected people and find spatial hot spots

- **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 15 in Laurel Fork, there is a 50% chance someone will be infected).
- **Spatial Clustering**: Getis-Ord Gi* based hot spots compare clusters of zip codes with four-week case rates higher than nearby zip codes to identify larger areas with statistically significant deviations.

Rank	Zip Code	Name	Size
1	24352	Laurel Fork	15
2	24147	Rich Creek	18
3	24165	Spencer	19
4	24283	Saint Paul	23
5	24263	Jonesville	23
6	24243	Dryden	24
7	23069	Hanover*	25
8	24211	Abingdon	25
9	24324	Draper	26
10	24277	Pennington Gap	27

Beyond Scale

Only includes zips with pop ≥ 1000 and no supp. data.
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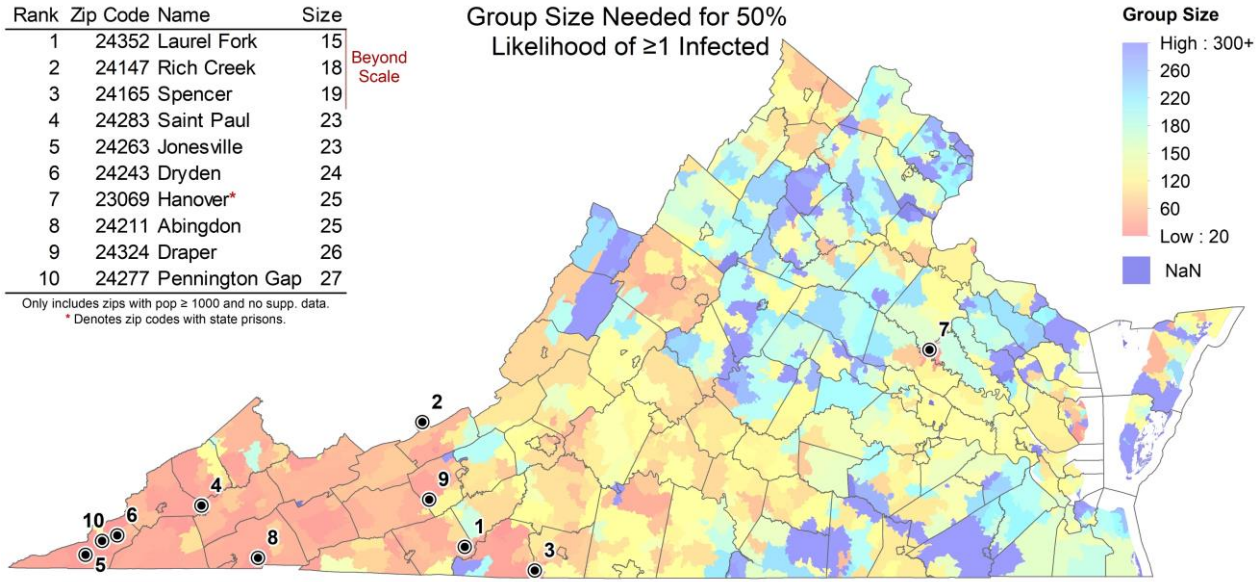
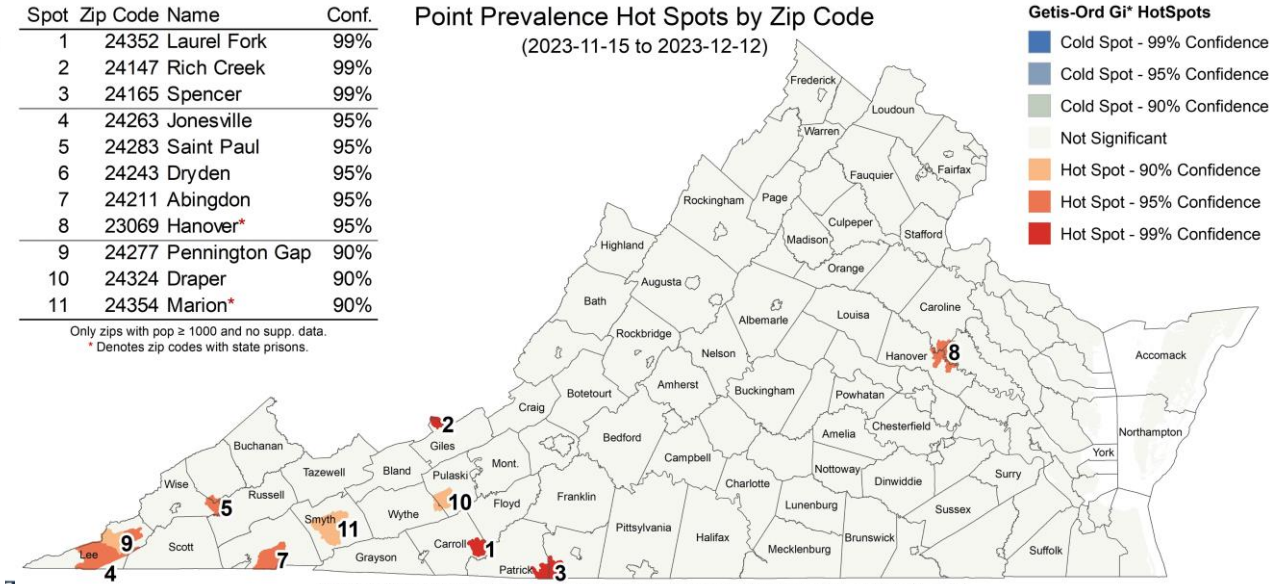


Based on Spatial Empirical Bayes smoothed point prevalence, with an 8:1 ascertainment ratio, for four weeks ending 2023-12-12.

Spot	Zip Code	Name	Conf.
1	24352	Laurel Fork	99%
2	24147	Rich Creek	99%
3	24165	Spencer	99%
4	24263	Jonesville	95%
5	24283	Saint Paul	95%
6	24243	Dryden	95%
7	24211	Abingdon	95%
8	23069	Hanover*	95%
9	24277	Pennington Gap	90%
10	24324	Draper	90%
11	24354	Marion*	90%

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



Based on Global Empirical Bayes smoothed point prevalence for the four weeks ending 2023-12-12.

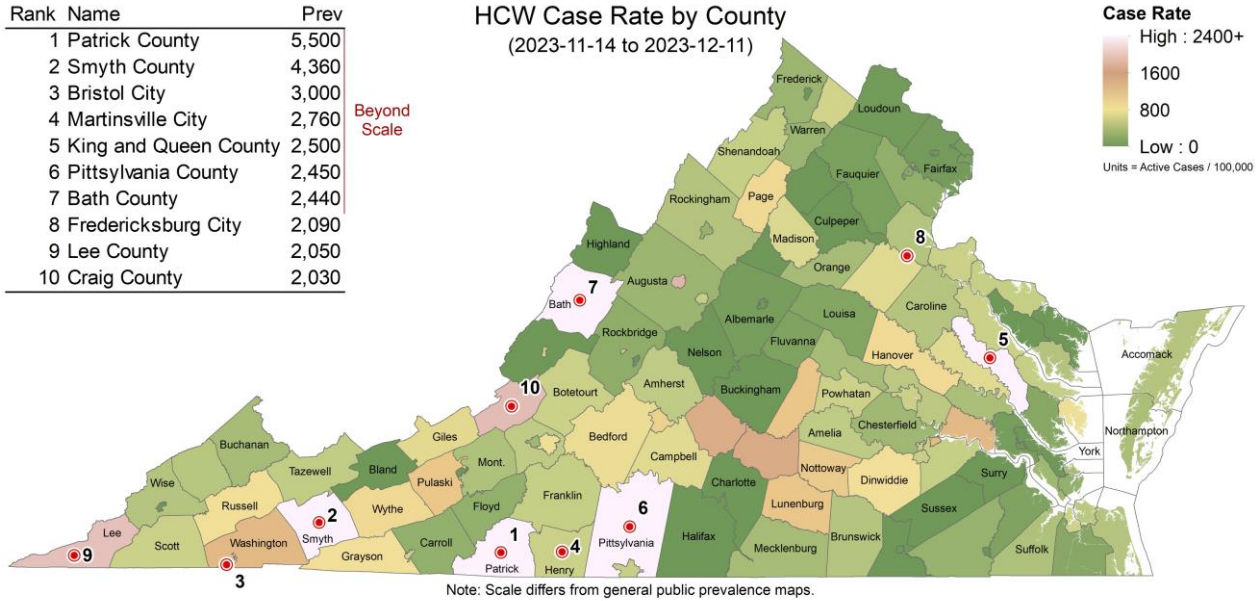
COVID-19 among Healthcare Workers

COVID-19 case rates for the public and for healthcare workers (HCW) were compared to find regions where HCW suffered unusually high burdens of disease

- **HCW Rate:** Case rate among health care workers (HCW) over a four-week period ending December 11.
- **HCW Ratio**: Case rate among health care workers (HCW) over the same period using patient facing health care workers as the numerator, and the population's case rate as the denominator.
- High HCW regions are sporadically spread across Virginia. But Patrick County, King and Queen County, and Martinsville appear on both top 10 lists. They have high HCW rates, despite comparably low case rates.

Rank	Name	Prev
1	Patrick County	5,500
2	Smyth County	4,360
3	Bristol City	3,000
4	Martinsville City	2,760
5	King and Queen County	2,500
6	Pittsylvania County	2,450
7	Bath County	2,440
8	Fredericksburg City	2,090
9	Lee County	2,050
10	Craig County	2,030

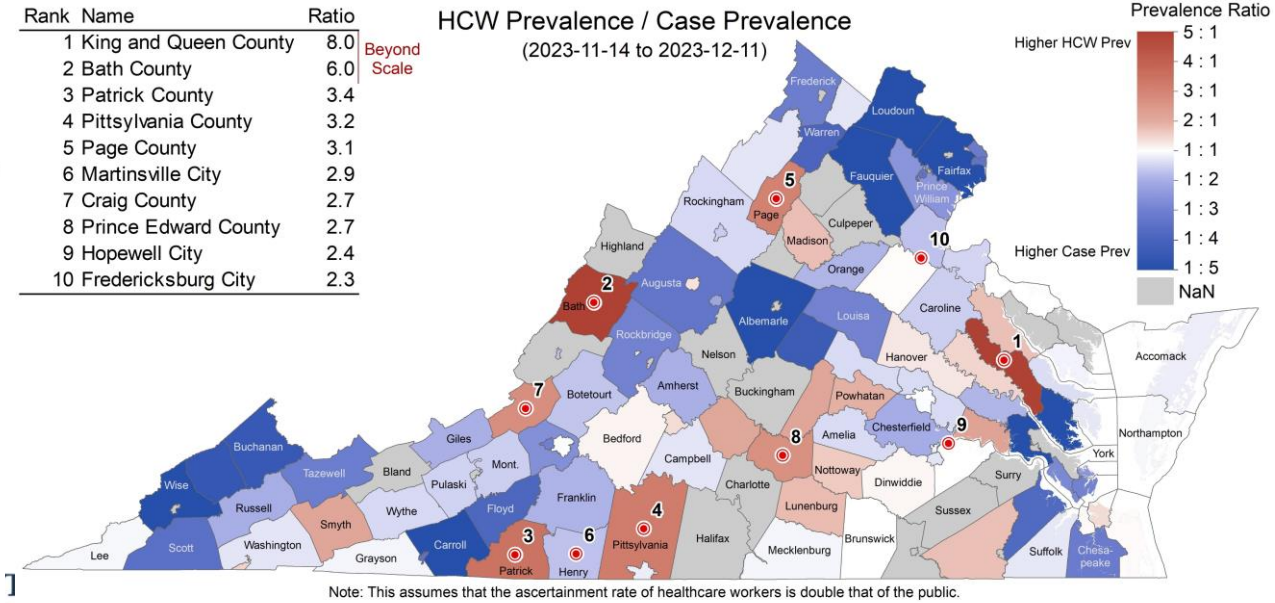
Beyond Scale



Note: Scale differs from general public prevalence maps.

Rank	Name	Ratio
1	King and Queen County	8.0
2	Bath County	6.0
3	Patrick County	3.4
4	Pittsylvania County	3.2
5	Page County	3.1
6	Martinsville City	2.9
7	Craig County	2.7
8	Prince Edward County	2.7
9	Hopewell City	2.4
10	Fredericksburg City	2.3

Beyond Scale

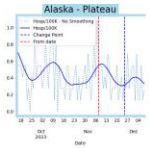


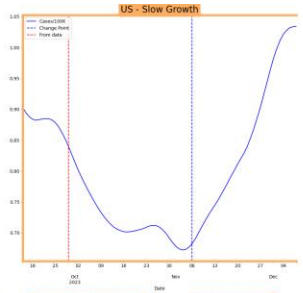
Note: This assumes that the ascertainment rate of healthcare workers is double that of the public.

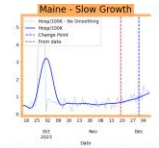
COVID-19 Broader Context

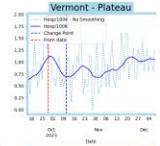
United States Hospitalizations

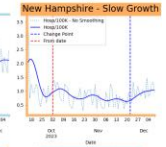
Status	Number of States	
	Current Week	Last Fortnight
Declining	2	(2)
Plateau	20	(29)
Slow Growth	26	(18)
In Surge	5	(4)

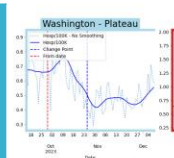


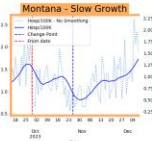


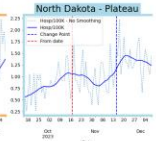


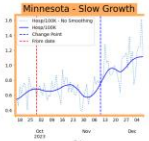


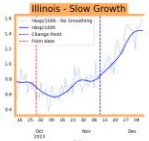


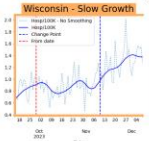


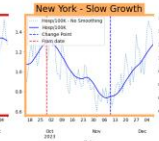


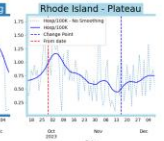


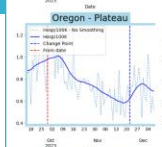


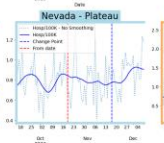


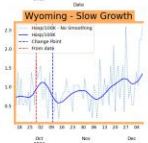


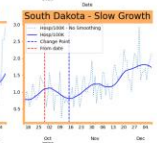


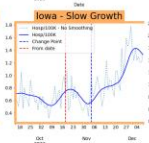


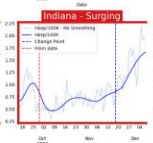


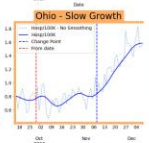


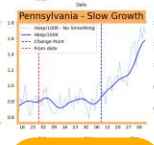


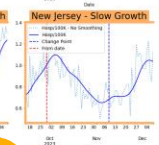


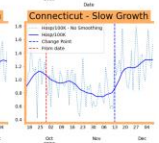


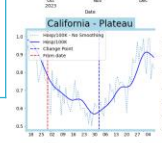


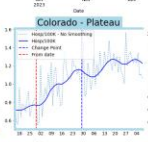


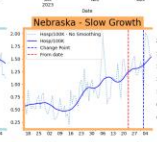


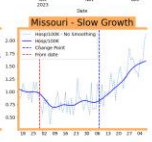


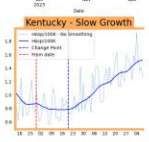


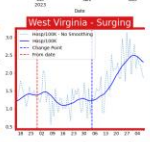


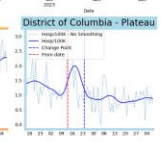


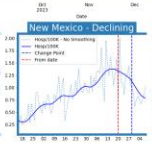


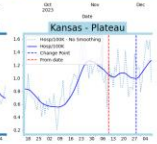


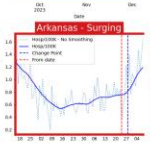


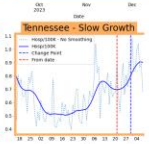


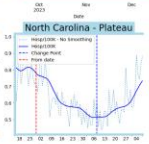


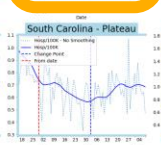


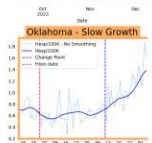


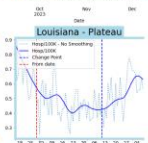


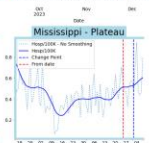


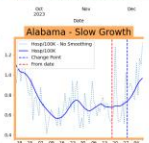


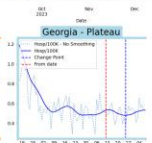


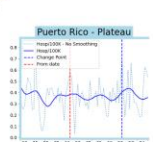


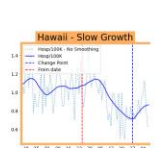


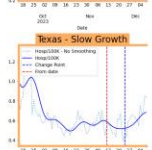


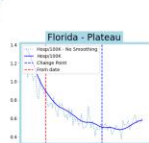




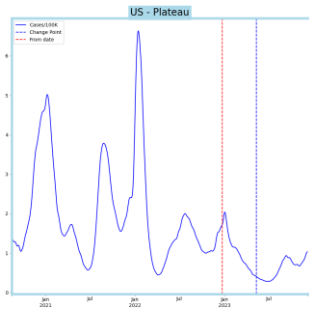


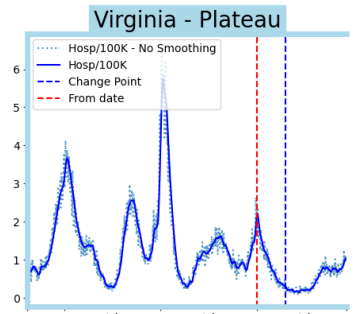




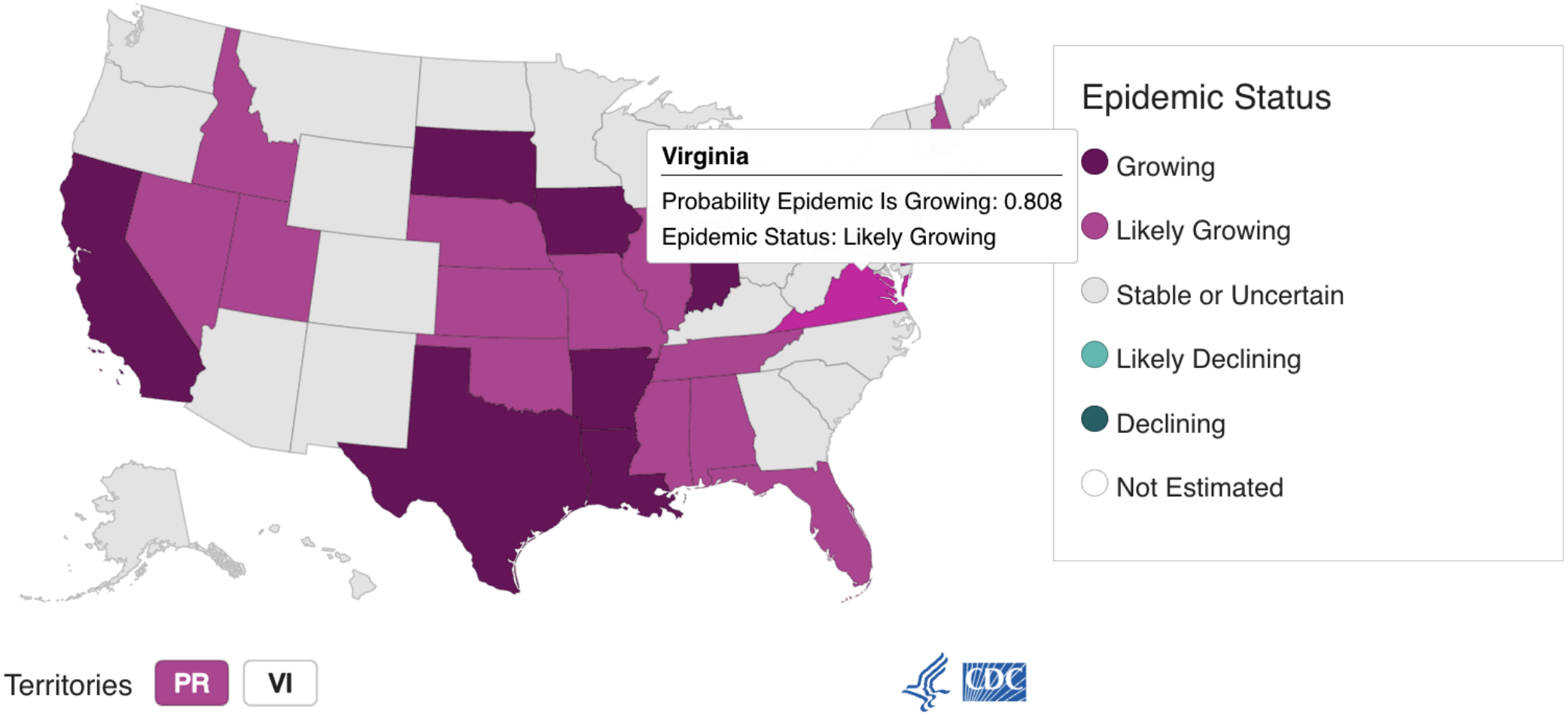


Whole Pandemic



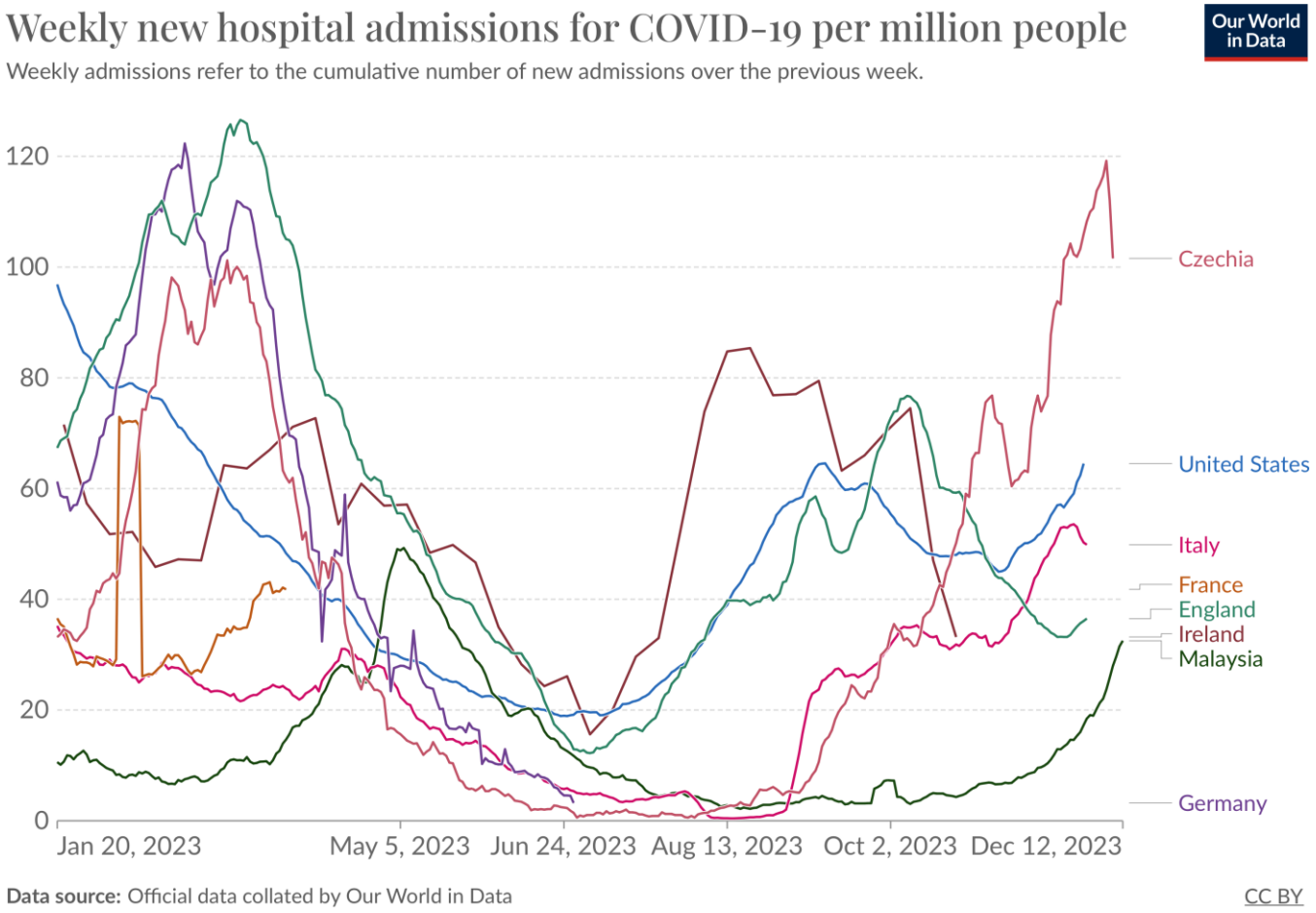


United States Hospitalizations – Epidemic Growth



CDC – CFA Epidemic Growth

Around the World – Hospital Admissions



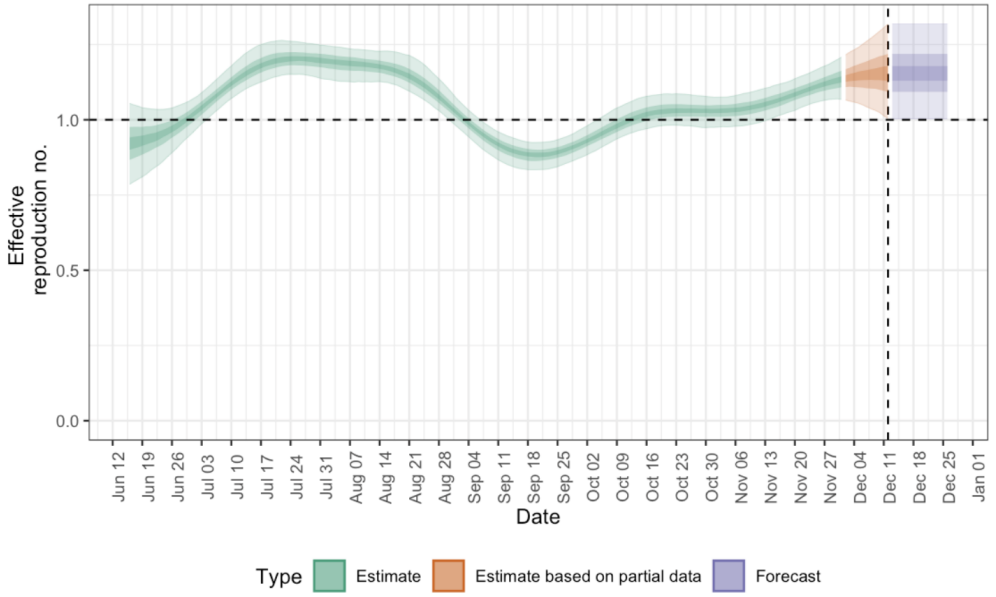
COVID-19 Growth Metrics

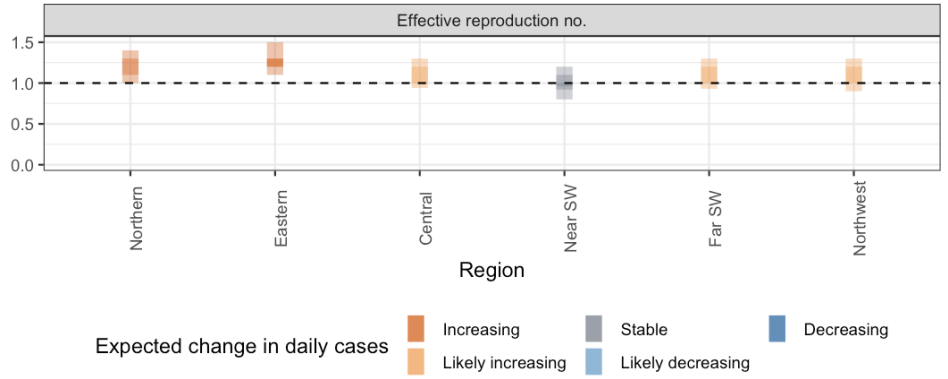
Estimating Daily Reproductive Number –
VDH report dates – EpiNow2 estimation

Reproductive Estimate Summary as of December 12, 2023

Region	Reproductive number estimate	Credible Interval	Trend forecast
State-wide cases	1.2	1.0 - 1.3	Increasing
State-wide hosp	1.0	0.88 - 1.1	Stable
Central	1.1	0.95 - 1.3	Likely increasing
Eastern	1.2	1.1 - 1.5	Increasing
Far SW	1.1	0.93 - 1.4	Likely increasing
Near SW	1.0	0.79 - 1.2	Stable
Northern	1.2	1.0 - 1.4	Increasing
Northwest	1.1	0.90 - 1.3	Likely increasing

Re from VDH Cases (last 6 months)





Methodology

- Sam Abbott, Joel Hellewell, Katharine Sherratt, Katelyn Gostic, Joe Hickson, Hamada S. Badr, Michael DeWitt, Robin Thompson, EpiForecasts, Sebastian Funk (2020). **EpiNow2**: Estimate Real-Time Case Counts and Time-Varying Epidemiological Parameters. doi:10.5281/zenodo.3957489.
- Serial interval, generation time, and incubation period per CDC CFA: https://www.cdc.gov/forecast-outbreak-analytics/about/technical-blog-rt.html.
- Uses confirmation date but report date biases are better accounted for; estimated date of infection is inferred using Bayesian smoothing techniques and used to produce Rt estimates.
- Note: most recent data point for hospitalizations is 3 days prior to that of cases (HHS hospitalization through 12/09/23 vs. VDH case data through 12/12/23).

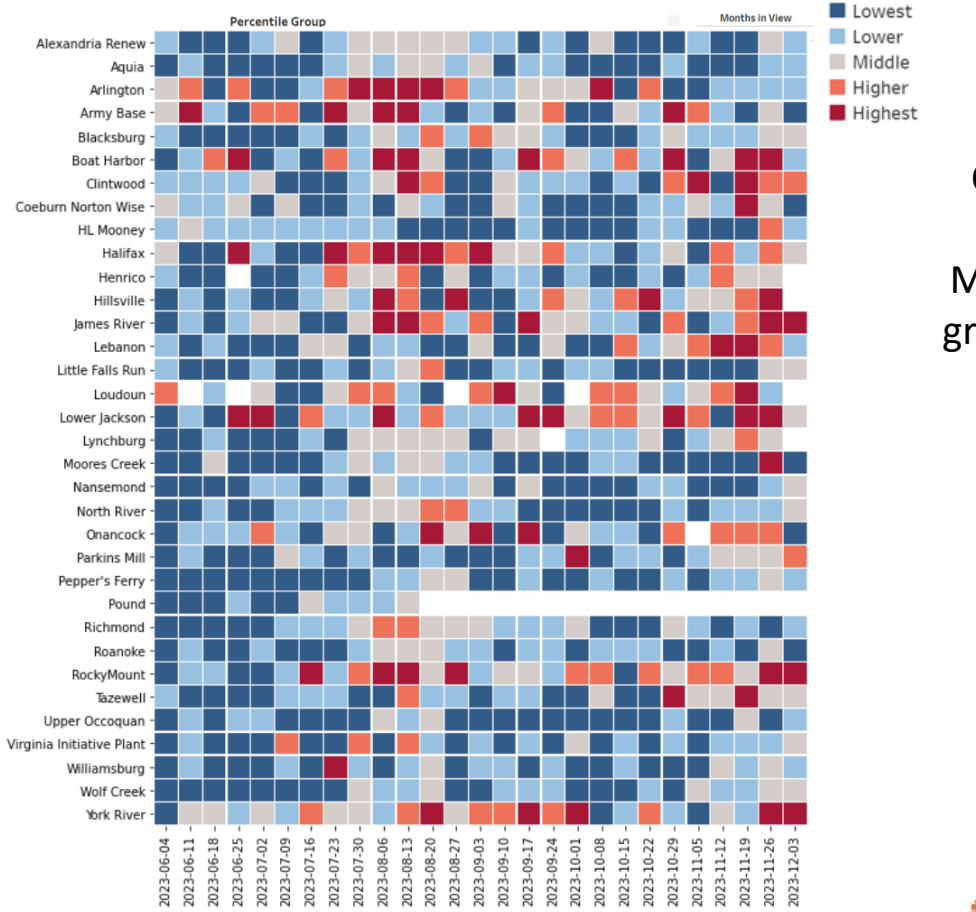
EpiNow2 home: https://epiforecasts.io/EpiNow2/

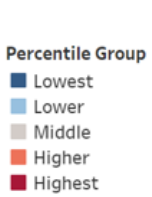
Wastewater Monitoring – VA Sites

Wastewater provides a coarse early warning of COVID-19 levels in communities

- Some VA sites (esp. Eastern) are starting to shift to higher quintiles in wastewater percentile groups

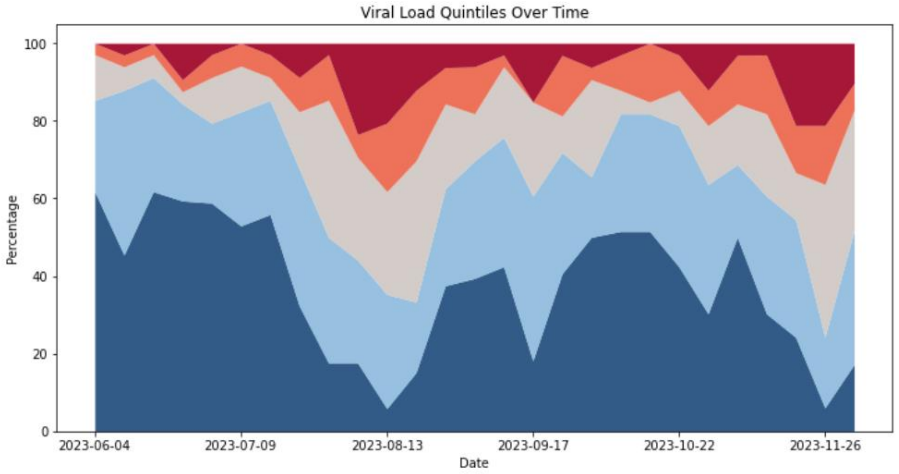
Viral Load Percentiles by Sampling Week

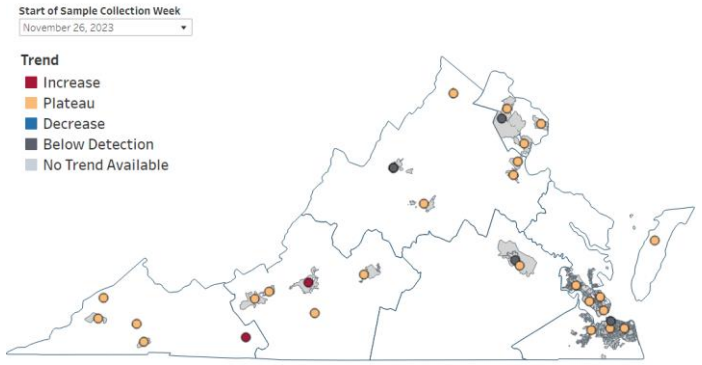




Quintile proportions over time

Middle and higher are growing in past couple weeks





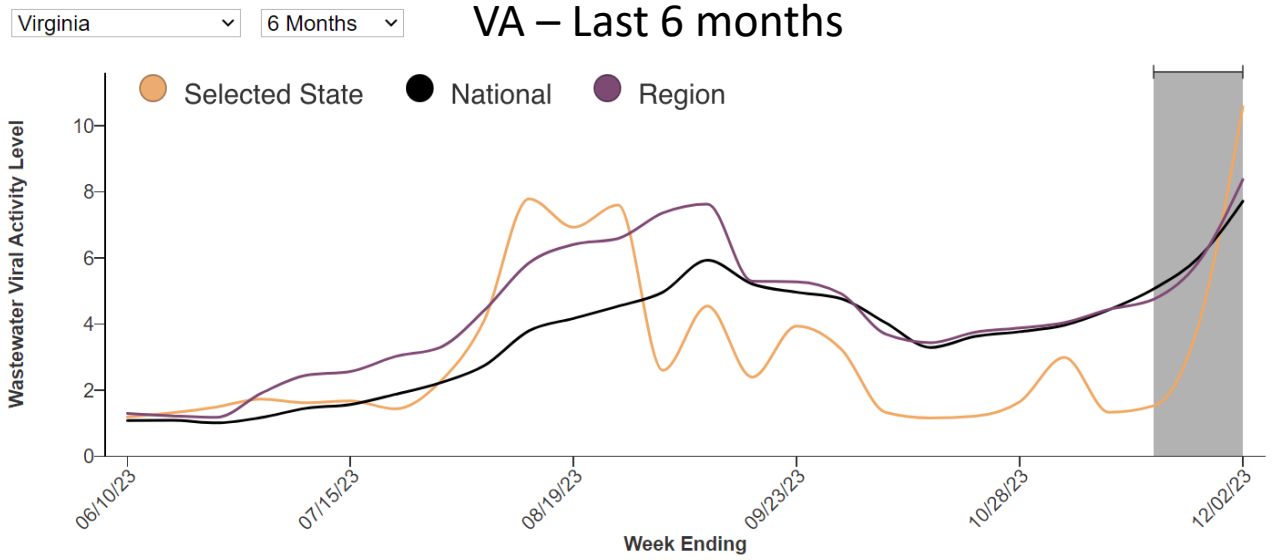
From: https://www.vdh.virginia.gov/coronavirus/see-the-numbers/covid-19-data-insights/sars-cov-2-in-wastewater/#surveillance-trend

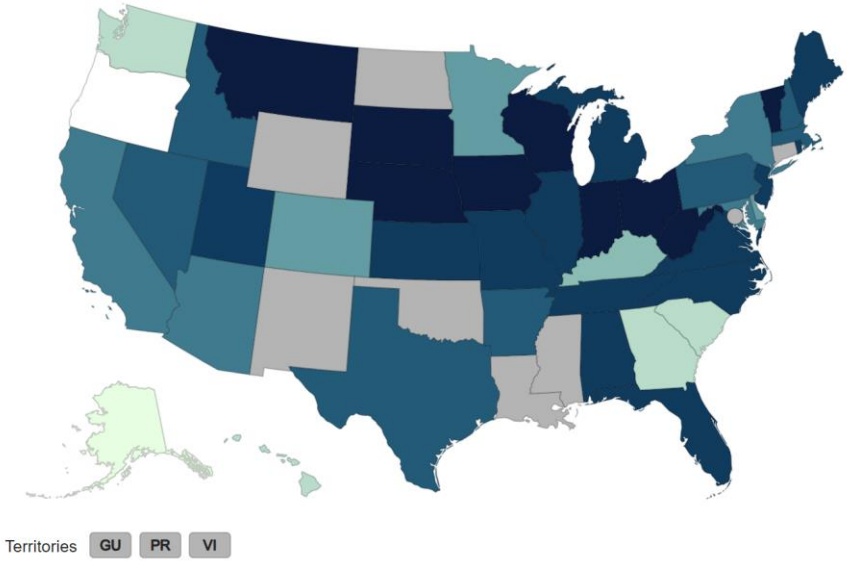
Wastewater Monitoring – NWSS

Wastewater provides a coarse estimate of COVID-19 levels in communities

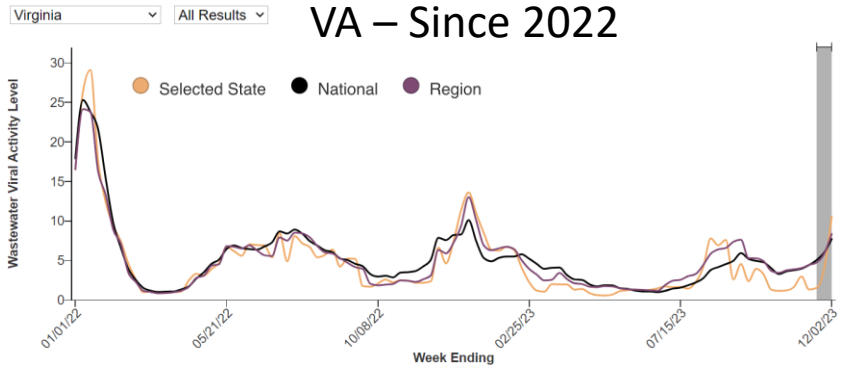
- VA currently “Very High” (may be due to limited reporting in recent weeks)
- Pervious, well observed, levels below region and national levels

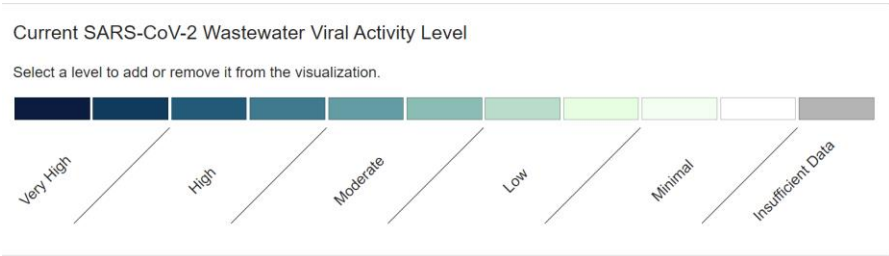
VA – Last 6 months





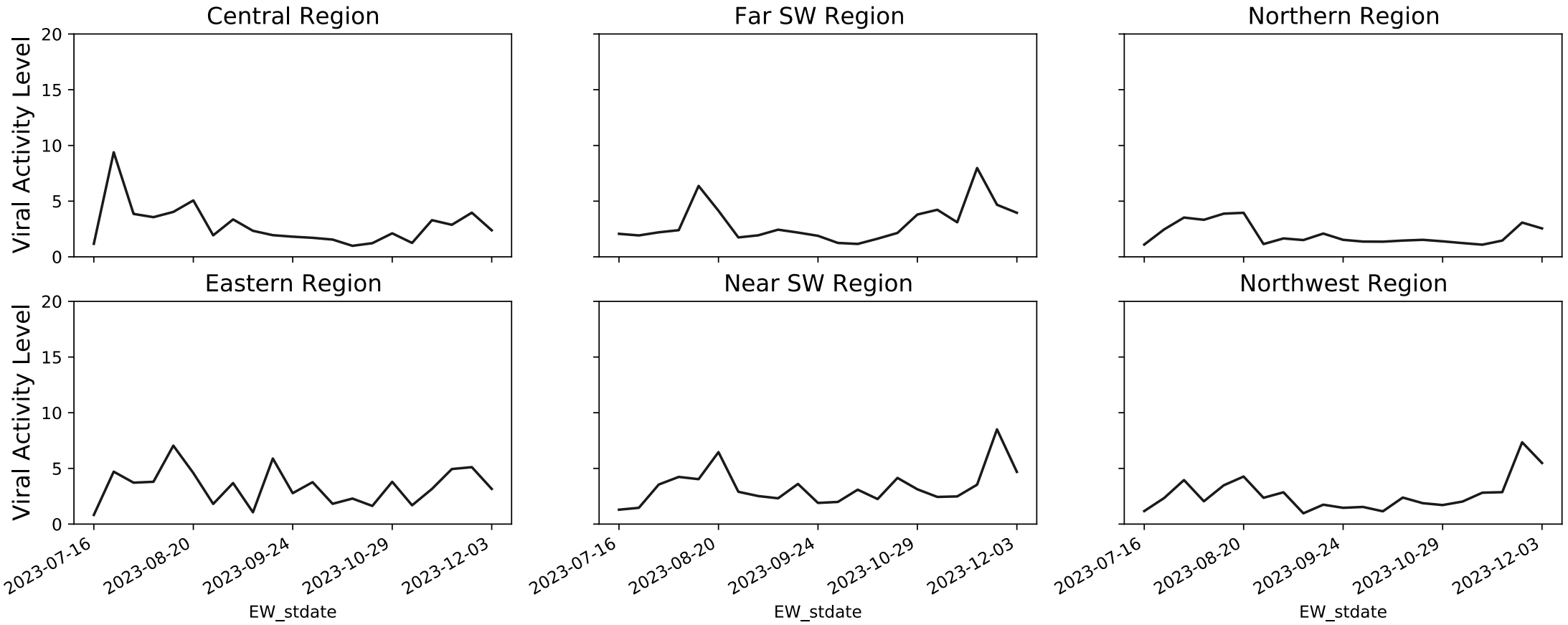
VA – Since 2022





Data Source: [CDC Data Tracker]

Region Level Viral Activity Level



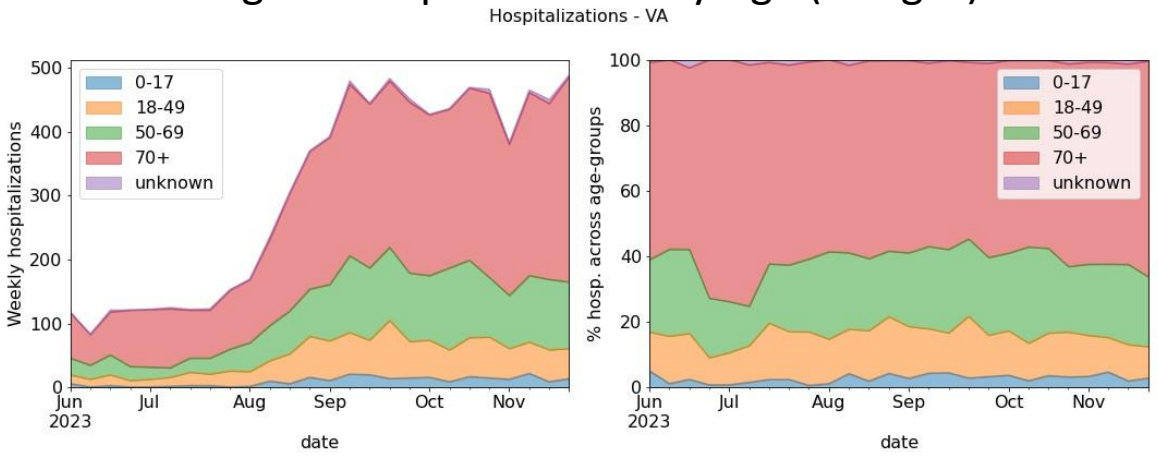
Hospitalizations in VA by Age

Age distribution in hospitals showing slight shift towards younger age groups

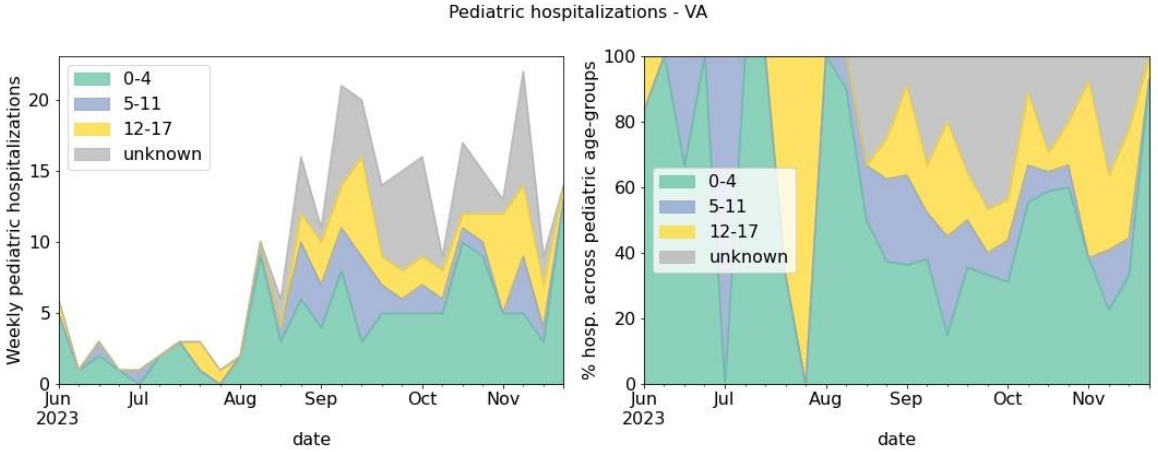
- Overall hospitalizations stable across all age groups
- Pediatric hospitalizations remain high compared to summer

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

Virginia Hospitalizations by Age (all ages)



Pediatric Hospitalizations by Age (0-17yo)

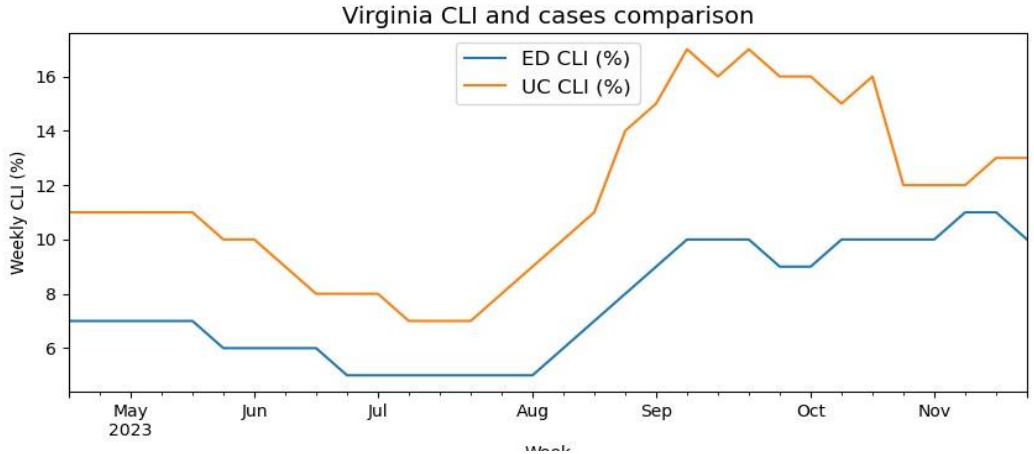


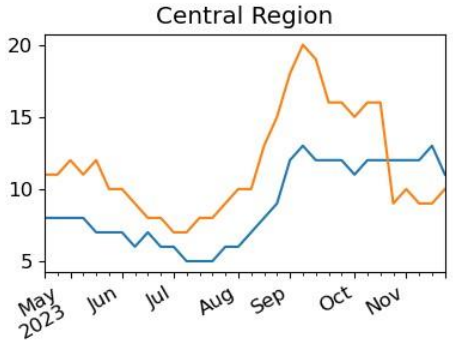
Data Source: Delphi and HHS

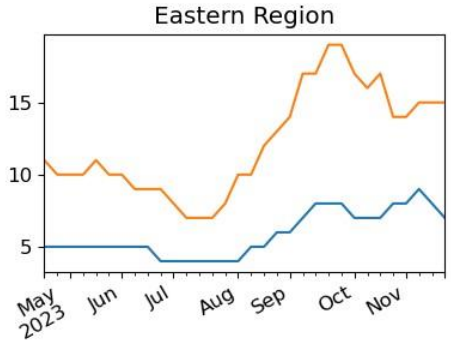
COVID-like Illness Activity

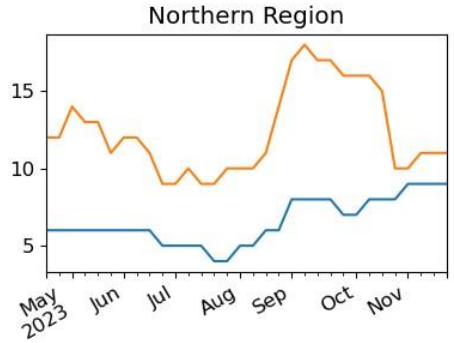
COVID-like Illness (CLI) gives a measure of COVID transmission in the community

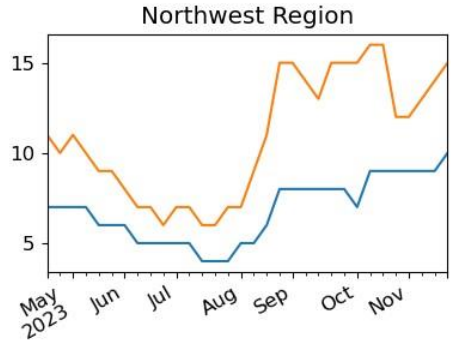
- Emergency Dept (ED) based CLI is more correlated with case reporting
- Urgent Care (UC) is a leading indicator but may be influenced by testing for other URIs
- **CLI remains reduced and plateaued in most regions, with Southwest showing slow continued growth**
- **Levels returning to spring-time levels in most regions**

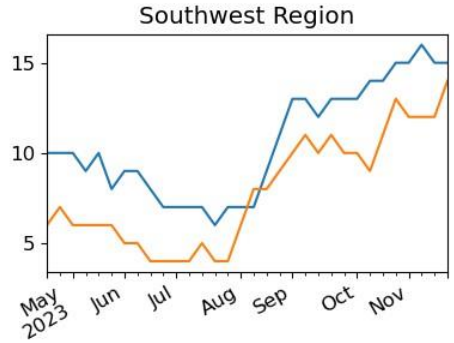




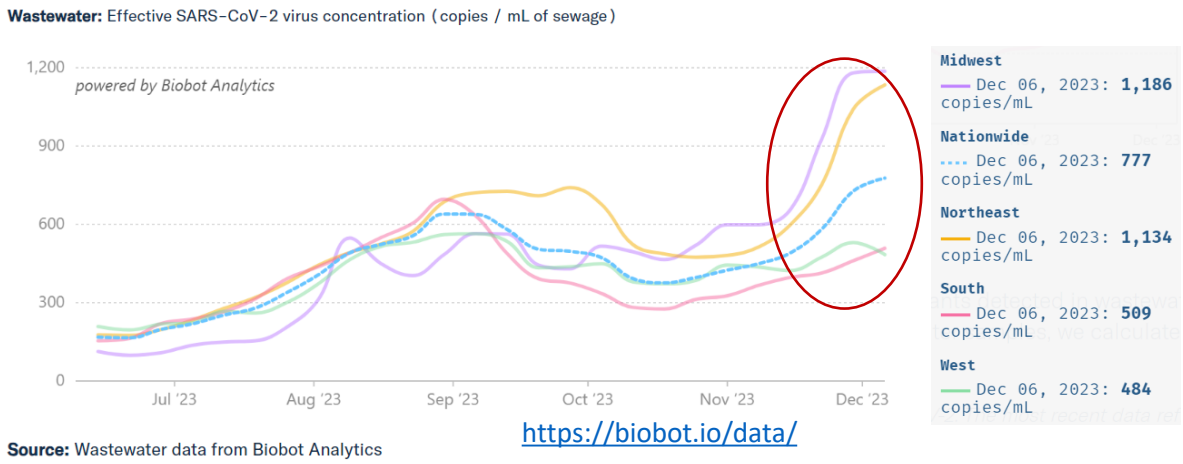




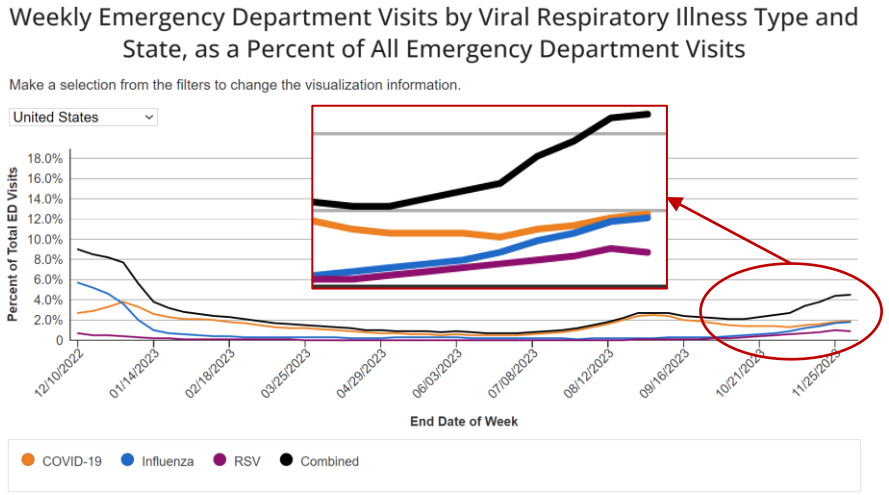




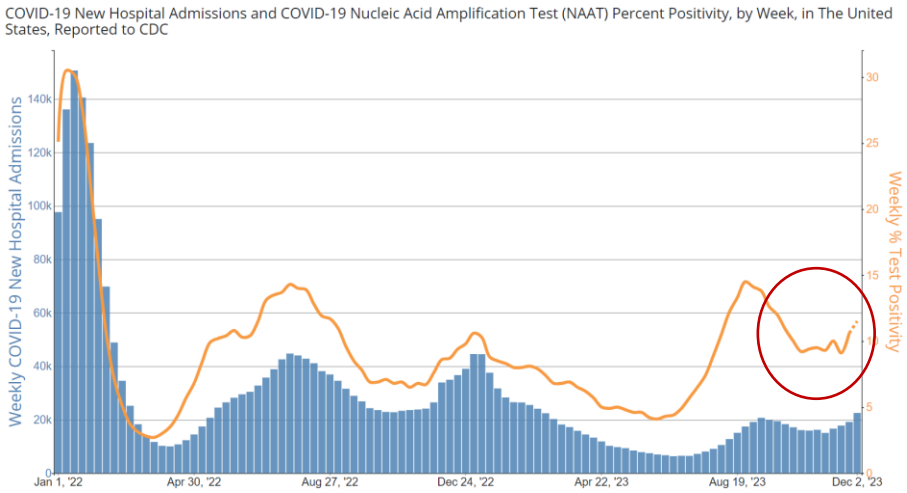
Wastewater, ED visits, and Test positivity



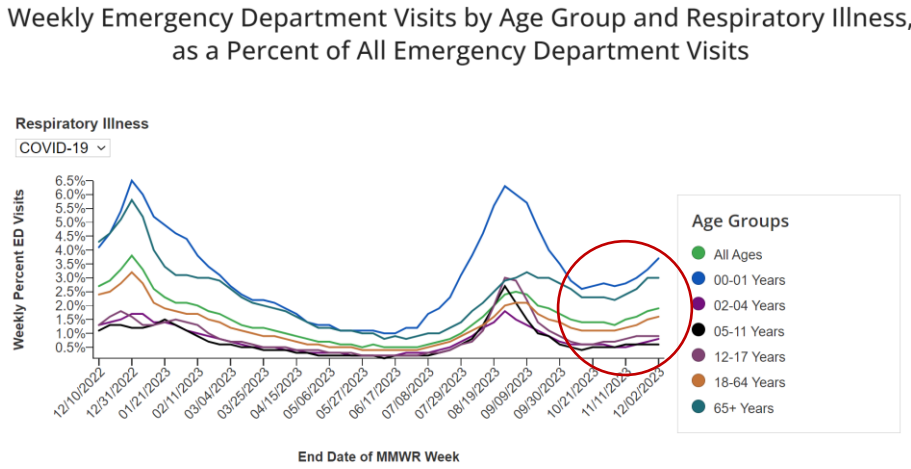
https://biobot.io/data/



- National WW signals have increased over the past two weeks
- ED visits for COVID are beginning to increase



https://covid.cdc.gov/covid-data-tracker/#trends_weeklyhospitaladmissions_testpositivity_00



https://www.cdc.gov/ncird/surveillance/respiratory-illnesses/index.html

UNIVERSITY of VIRGINIA

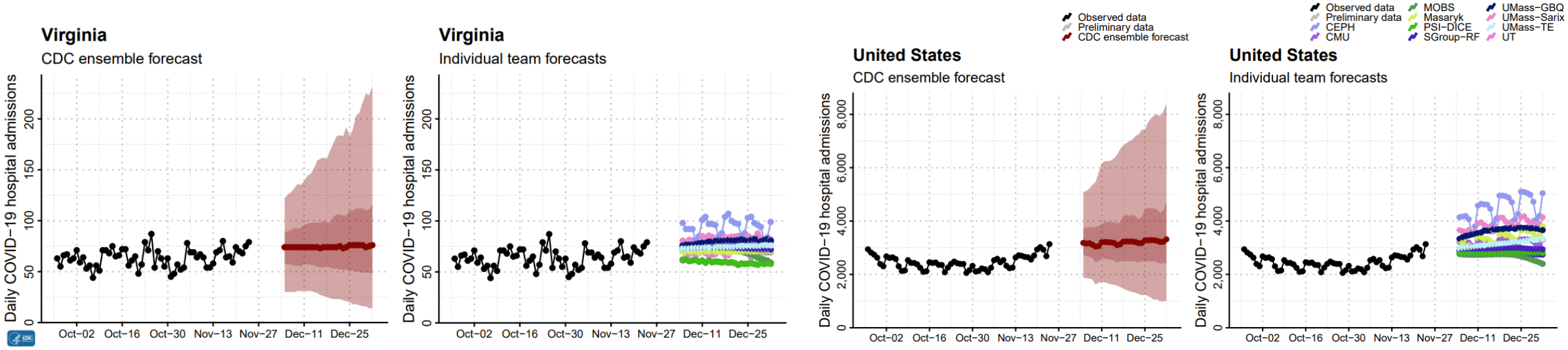
BIOCOMPLEXITY INSTITUTE

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)

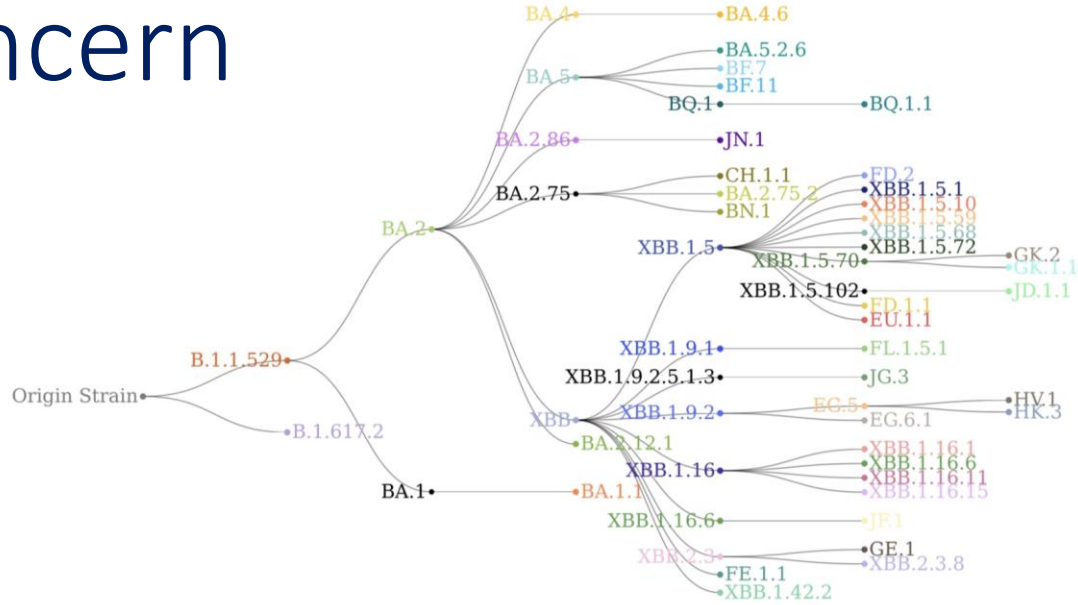


COVID-19 Genomic Update

SARS-CoV2 Variants of Concern

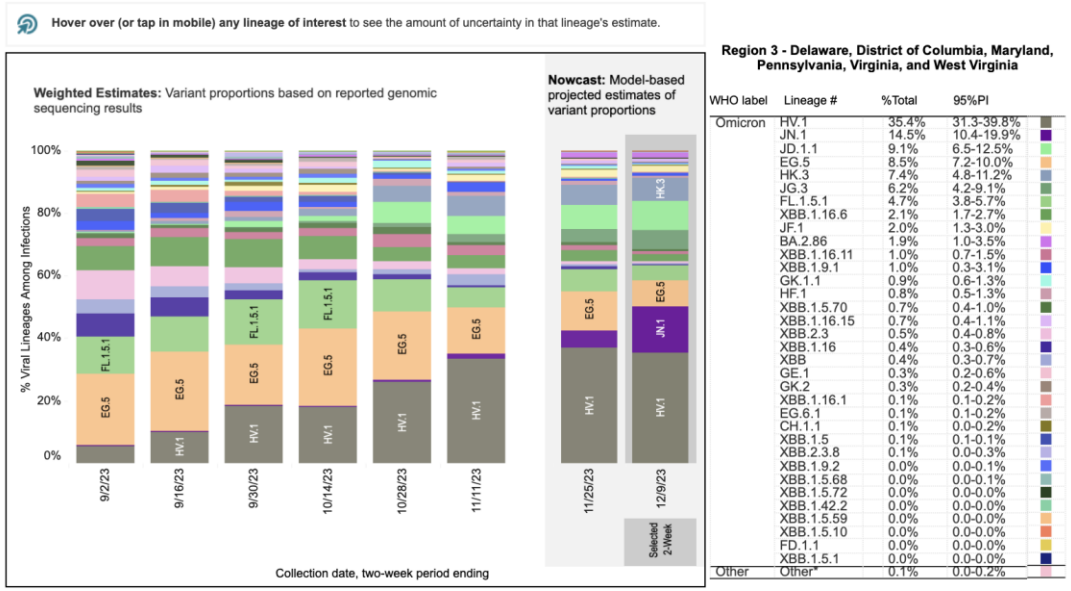
Emerging variants have potential to continue to alter the future trajectories of pandemic and have implications for future control

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



Weighted Estimates in HHS Region 3 for 2-Week Periods in 8/20/2023 – 12/9/2023

Nowcast Estimates in HHS Region 3 for 11/26/2023 – 12/9/2023



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

WHO label	Lineage #	%Total	95%PI
Omicron	HV.1	35.4%	31.3-39.8%
	JN.1	14.5%	10.4-19.9%
	JD.1.1	9.1%	6.5-12.5%
	EG.5	8.5%	7.2-10.0%
	HK.3	7.4%	4.8-11.2%
	JG.3	6.2%	4.2-9.1%
	FL.1.5.1	4.7%	3.8-5.7%
	XBB.1.16.6	2.1%	1.7-2.7%
	JF.1	2.0%	1.3-3.0%
	BA.2.86	1.9%	1.0-3.5%
	XBB.1.16.11	1.0%	0.7-1.5%
	XBB.1.9.1	1.0%	0.3-3.1%
	GK.1.1	0.9%	0.6-1.3%
	HF.1	0.8%	0.5-1.3%
	XBB.1.5.70	0.7%	0.4-1.0%
	XBB.1.16.15	0.7%	0.4-1.1%
	XBB.2.3	0.5%	0.4-0.8%
	XBB.1.16	0.4%	0.3-0.6%
	XBB	0.4%	0.3-0.7%
	GE.1	0.3%	0.2-0.6%
	GK.2	0.3%	0.2-0.4%
	XBB.1.16.1	0.1%	0.1-0.2%
	EG.6.1	0.1%	0.1-0.2%
	CH.1.1	0.1%	0.0-0.2%
	XBB.1.5	0.1%	0.1-0.1%
	XBB.2.3.8	0.1%	0.0-0.3%
	XBB.1.9.2	0.0%	0.0-0.1%
	XBB.1.5.68	0.0%	0.0-0.1%
	XBB.1.5.72	0.0%	0.0-0.0%
	XBB.1.42.2	0.0%	0.0-0.0%
	XBB.1.5.59	0.0%	0.0-0.0%
	XBB.1.5.10	0.0%	0.0-0.0%
	FD.1.1	0.0%	0.0-0.0%
	XBB.1.5.1	0.0%	0.0-0.0%
Other	Other*	0.1%	0.0-0.2%

* Enumerated lineages are US VOC and lineages circulating above 1% nationally in at least one 2-week period. "Other" represents the aggregation of lineages which are circulating <1% nationally during all 2-week periods displayed.
\# While all lineages are tracked by CDC, those named lineages not enumerated in this graphic are aggregated with their parent lineages, based on Pango lineage definitions, described in more detail here: https://www.pango.network/the-pango-nomenclature-system/statement-of-nomenclature-rules/.

Omicron Updates*

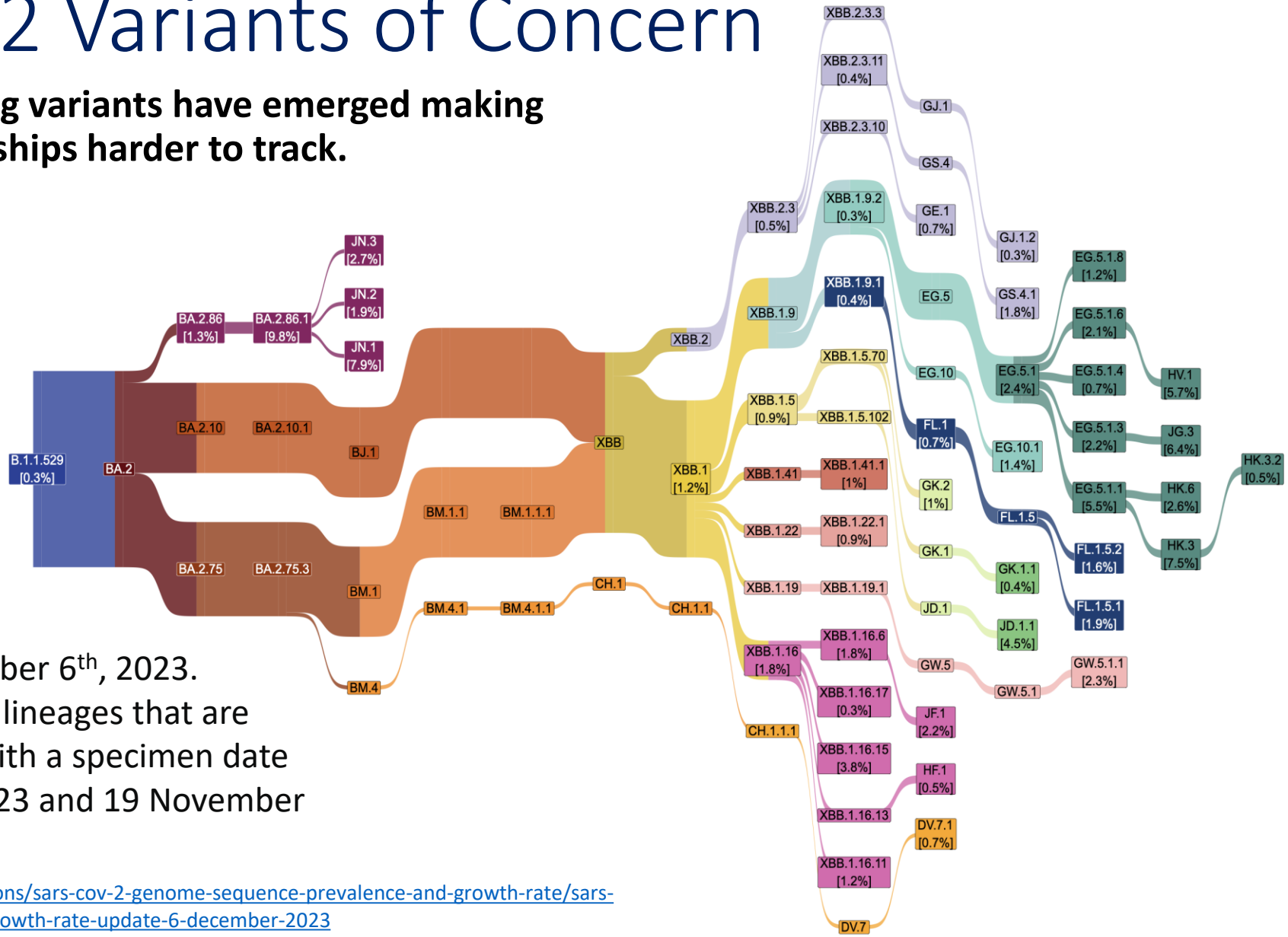
- New lineage HV.1 (XBB.1.9*) up to 35% from 34%
- BA.2.86* lineages (including JN.1) are up to 16.4% from 9%
- JD.1.1 (XBB.1.5) remains at 9%
- EG.5 (XBB.1.9) down to 9% from 12%
- HK.3 holding at 7% for several weeks
- JG.3 (XBB.1.9) now tracked at 6%
- FL.1.5.1 (XBB.1.9) down to 5% from 7%

*percentages are CDC NowCast Estimates

CDC Variant Tracking

SARS-CoV2 Variants of Concern

A variety of co-circulating variants have emerged making differences and relationships harder to track.



Data shown as of December 6th, 2023. Proportions are given for lineages that are observed in sequences with a specimen date between 3 November 2023 and 19 November 2023.

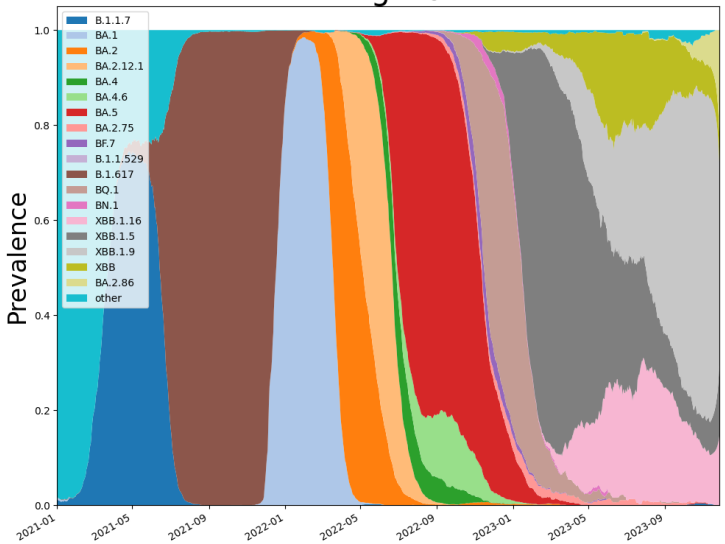
https://www.gov.uk/government/publications/sars-cov-2-genome-sequence-prevalence-and-growth-rate/sars-cov-2-genome-sequence-prevalence-and-growth-rate-update-6-december-2023

SARS-CoV2 Omicron Sub-Variants

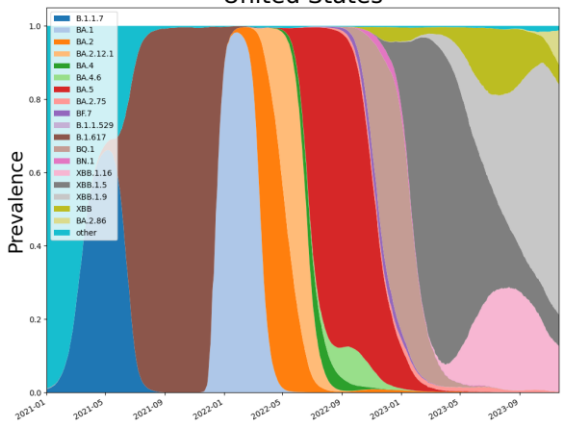
covSPECTRUM
Enabled by data from GISAID

As detected in whole Genomes in public repositories

Virginia

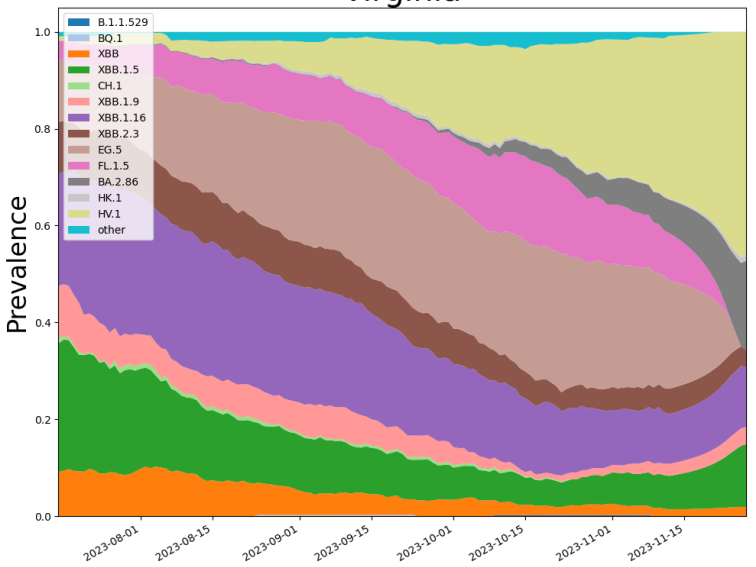


United States

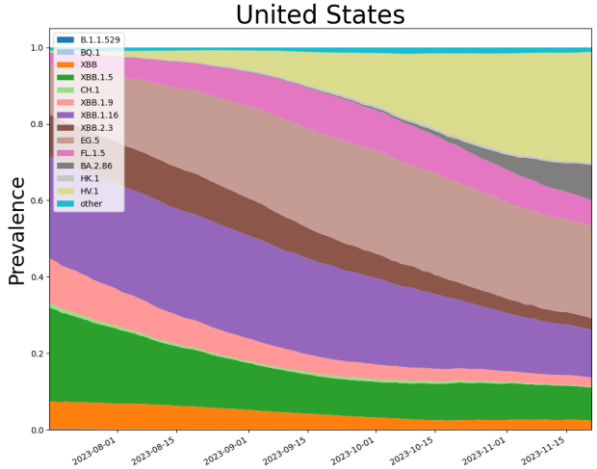


VoC Polynomial Fit Projections

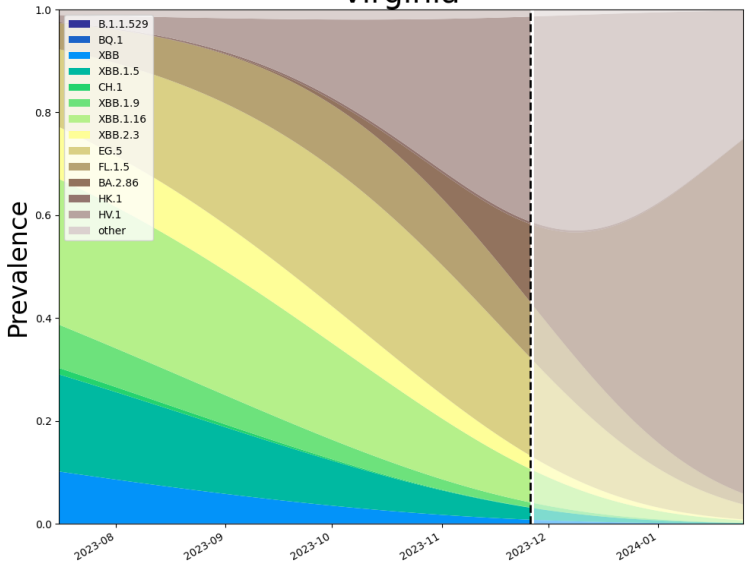
Virginia



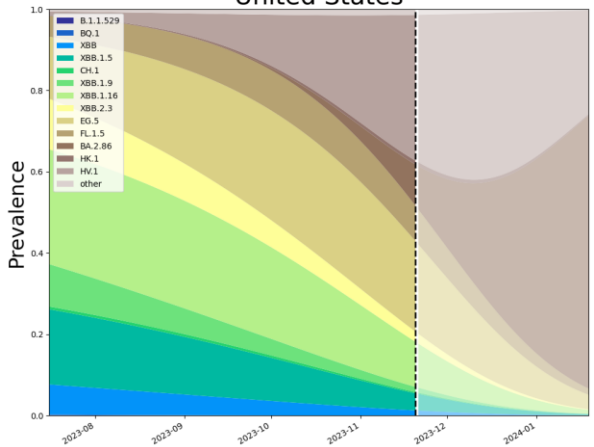
United States



Virginia



United States

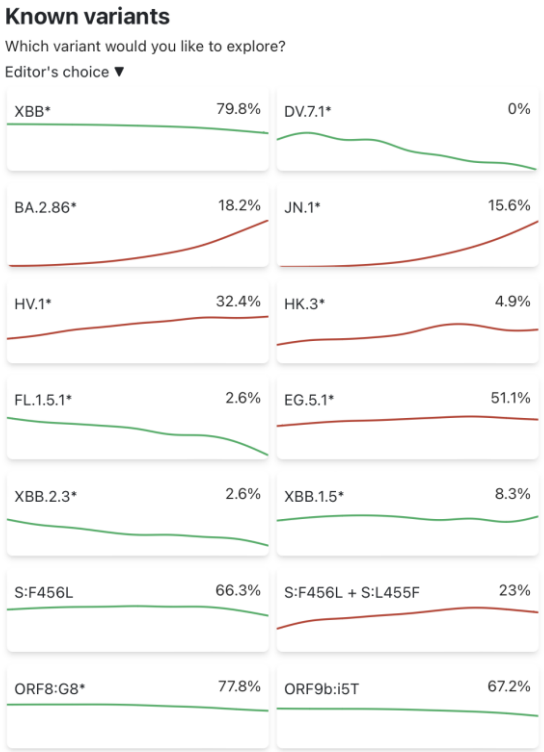


Note: Everything from dotted line forward is a projection.

SARS-CoV2 Omicron Sub-Variants

[COV-spectrum](#)

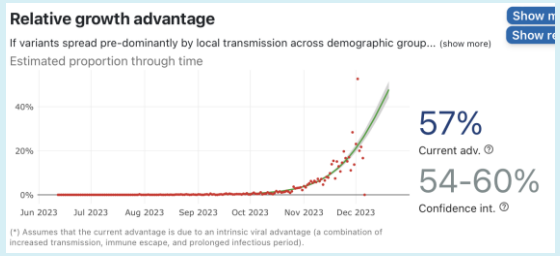
"Editor's choice"
Variants to watch

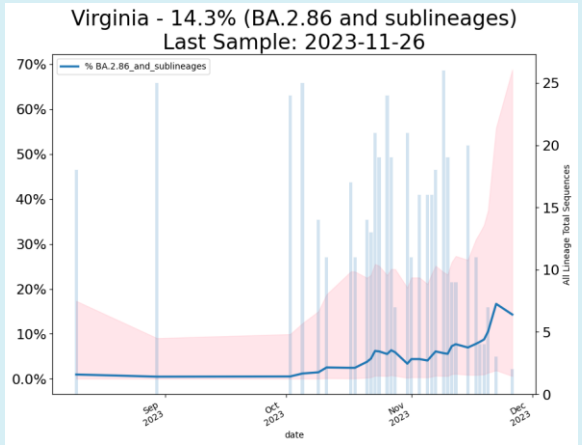


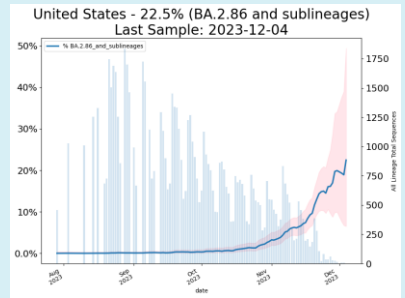
covSPECTRUM

Enabled by data from GISAID

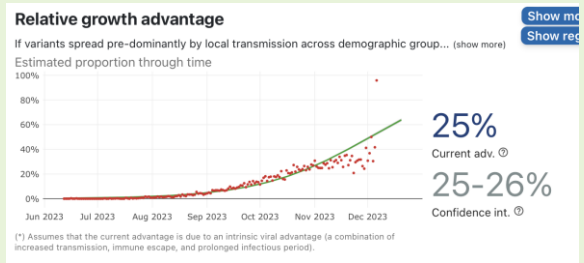
BA.2.86* (JN.1*)

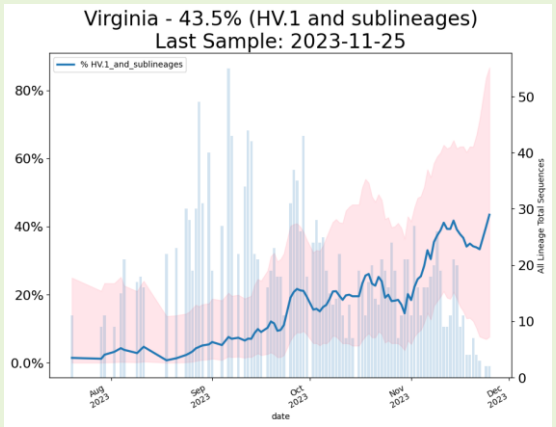


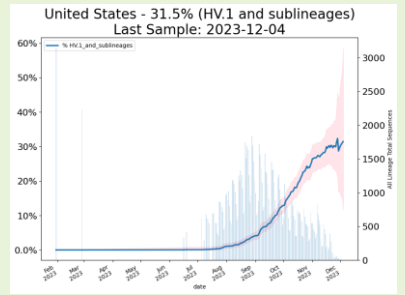




HV.1*

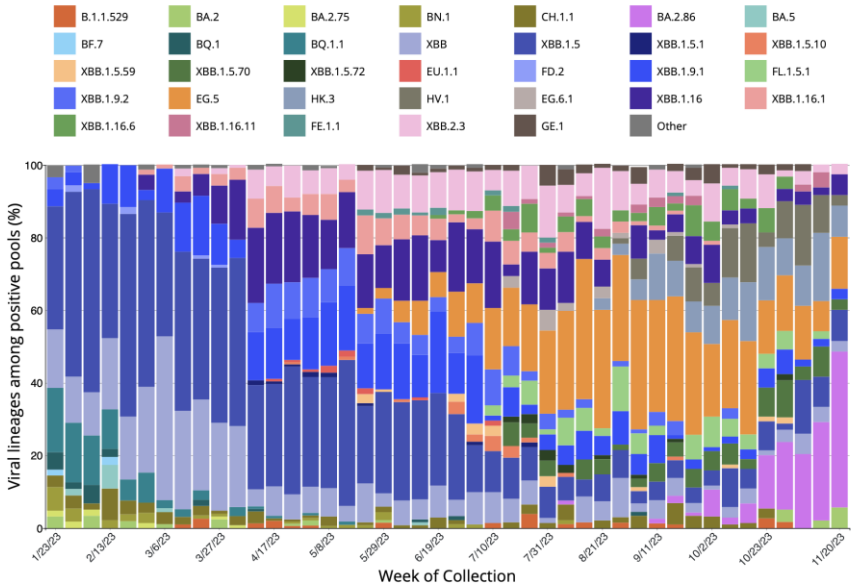


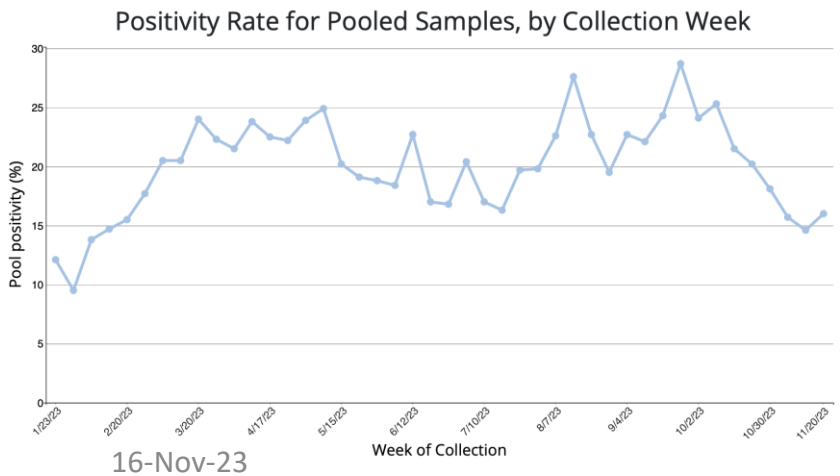


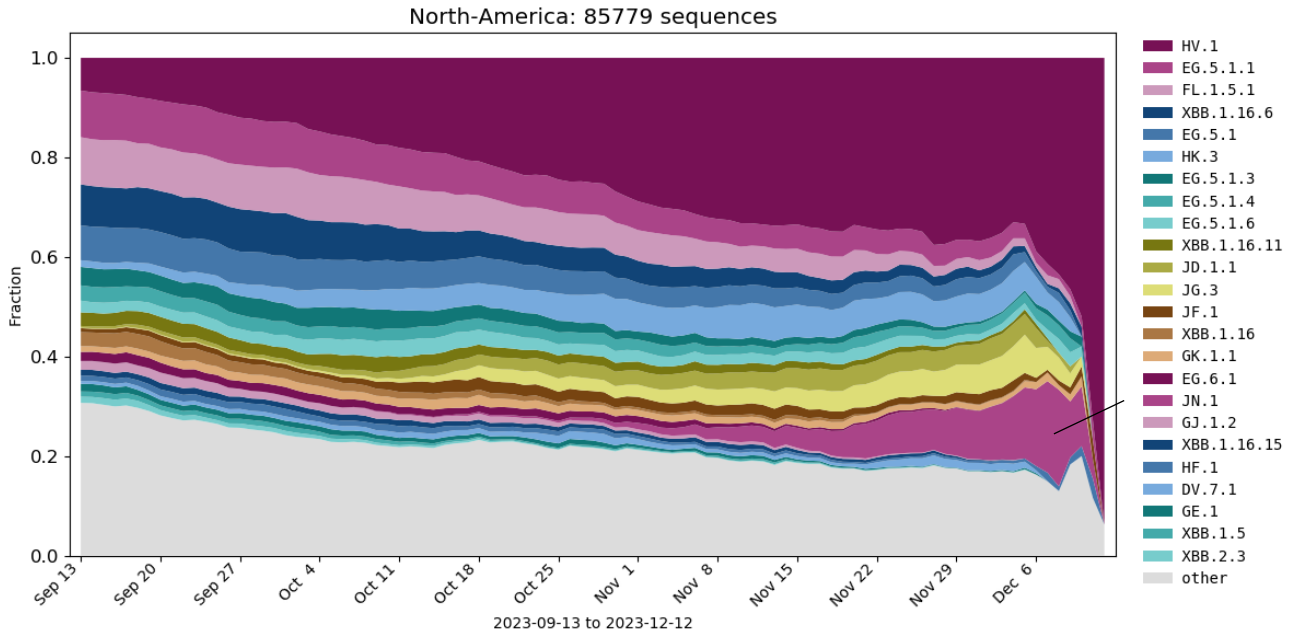


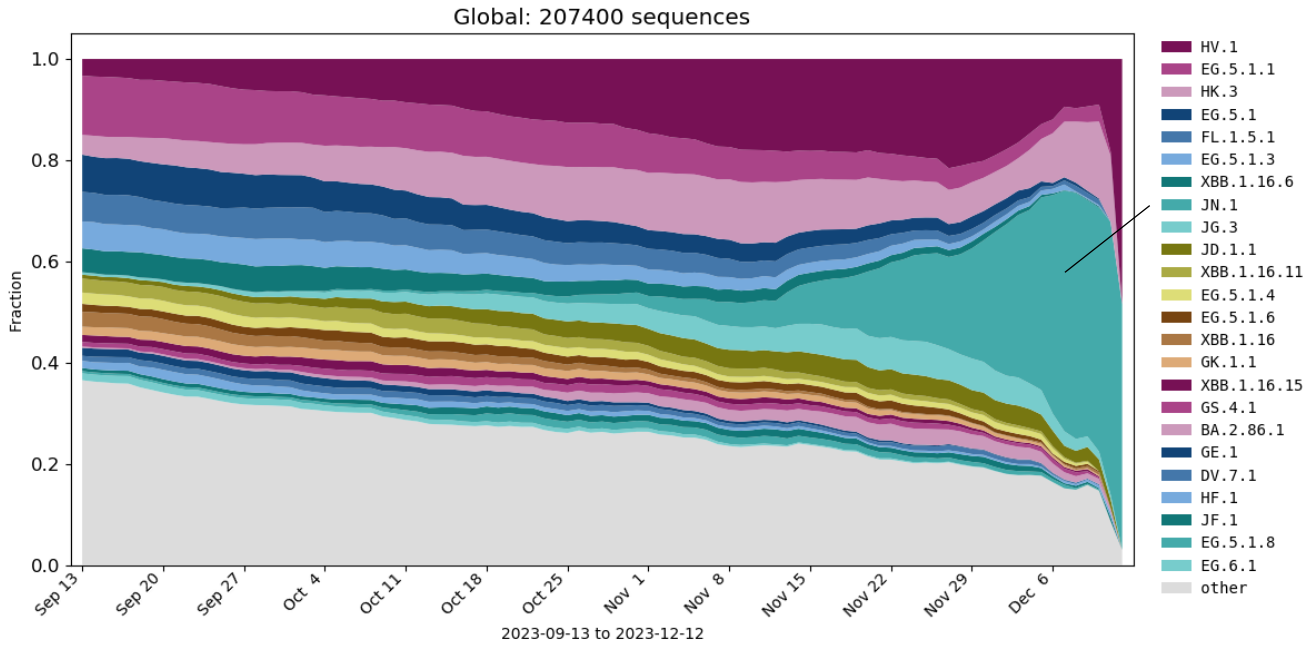
Global SARS-CoV2 Variant Status

Traveller Surveillance





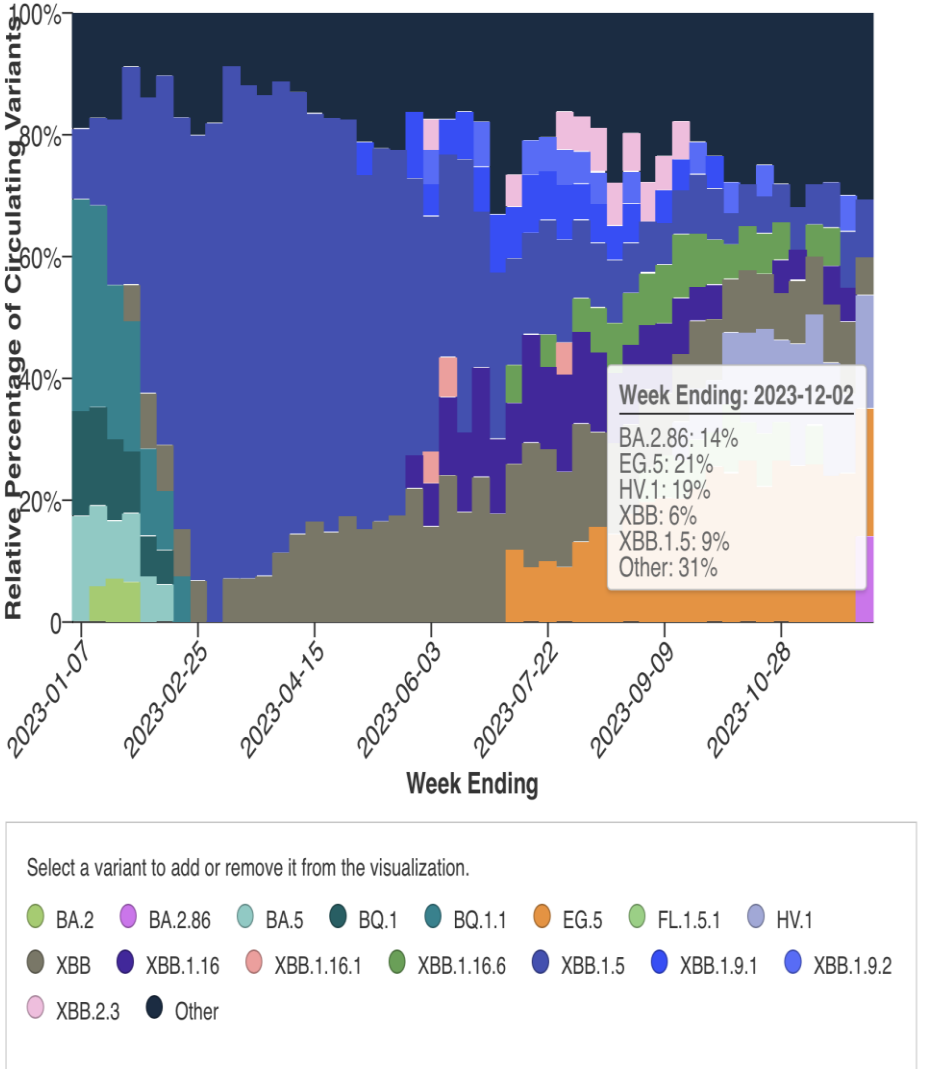




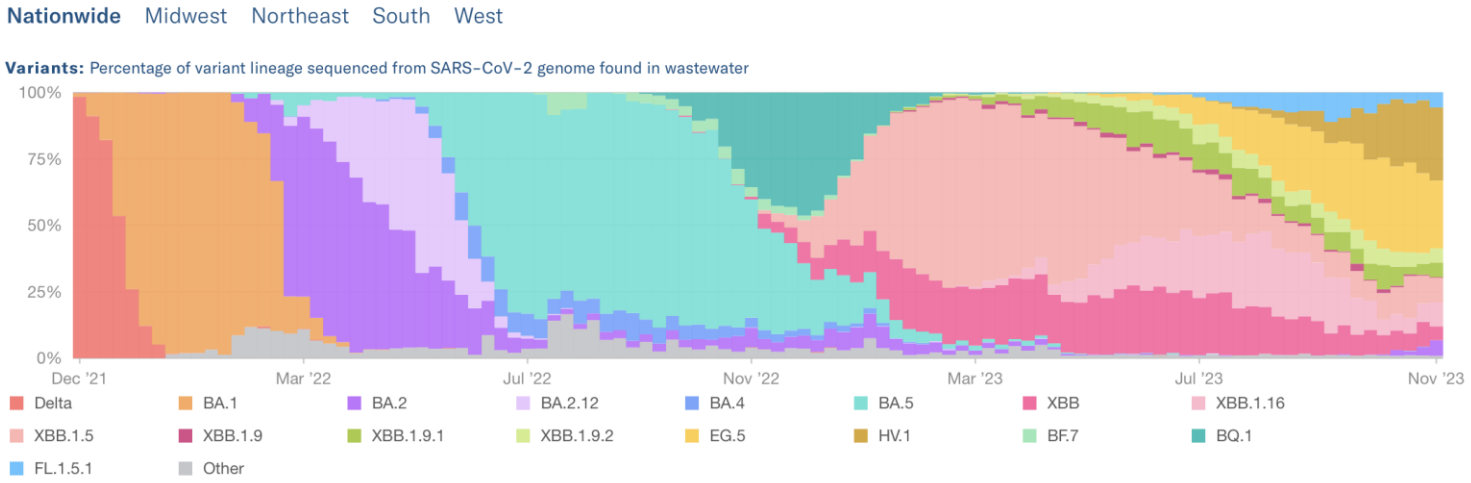
https://cov.lanl.gov/components/sequence/COV/sparks.comp
https://covid.cdc.gov/covid-data-tracker/#traveler-genomic-surveillance

National Wastewater Variant Status

CDC Wastewater

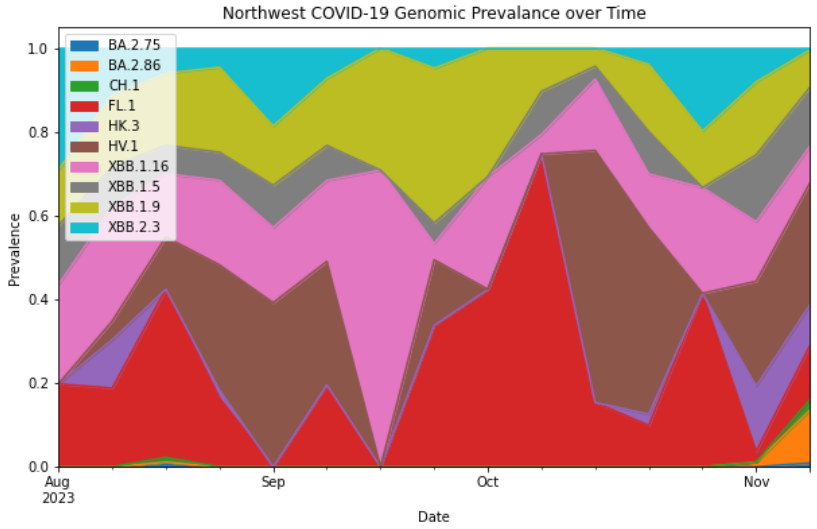


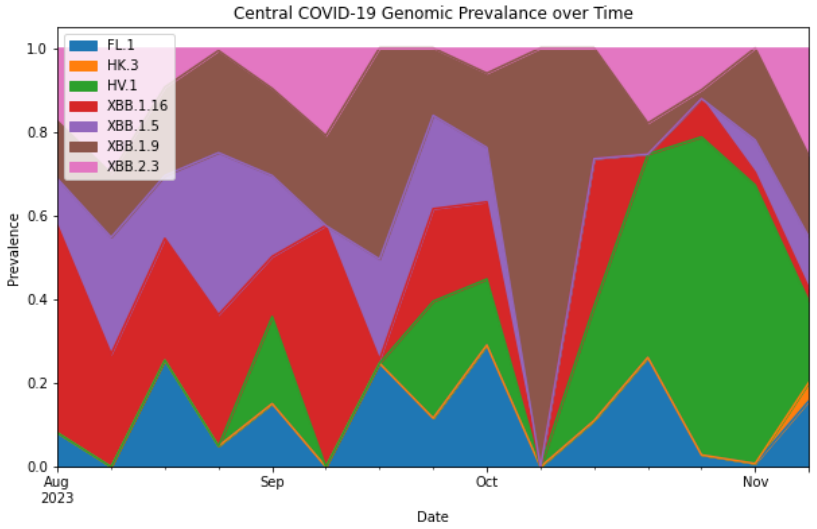
Biobot Wastewater

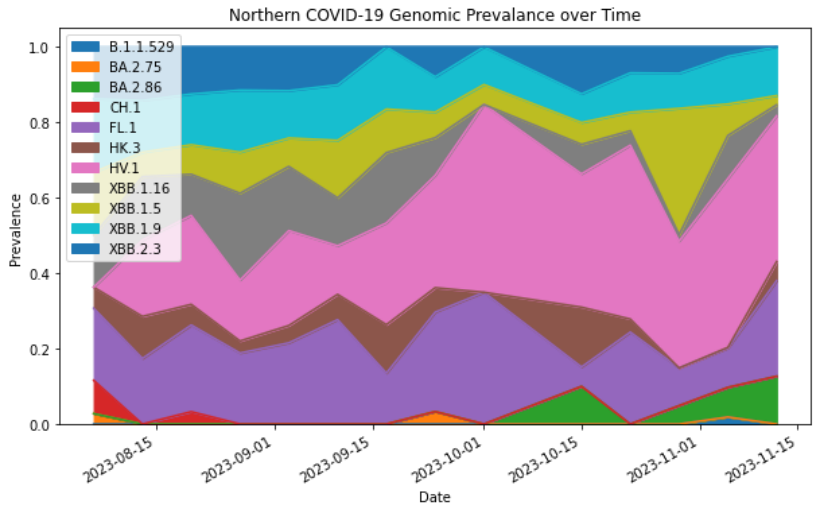


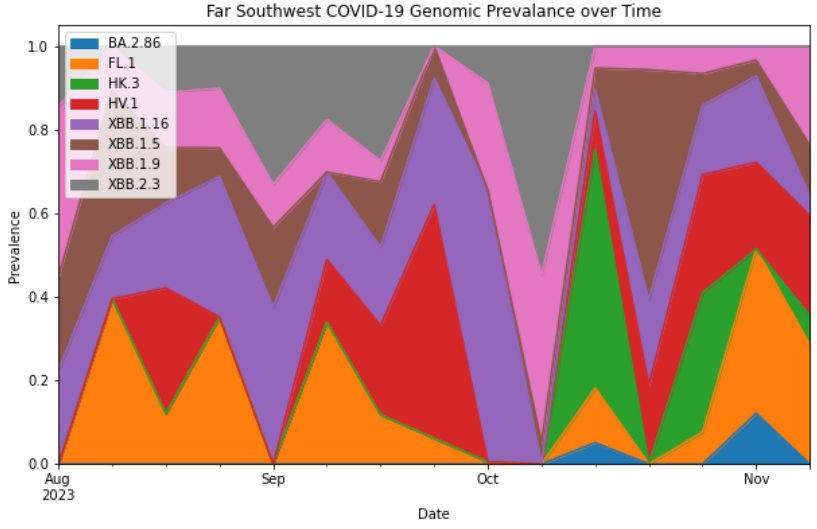
https://www.cdc.gov/nwss/rv/COVID19-variants.html
https://biobot.io/data/

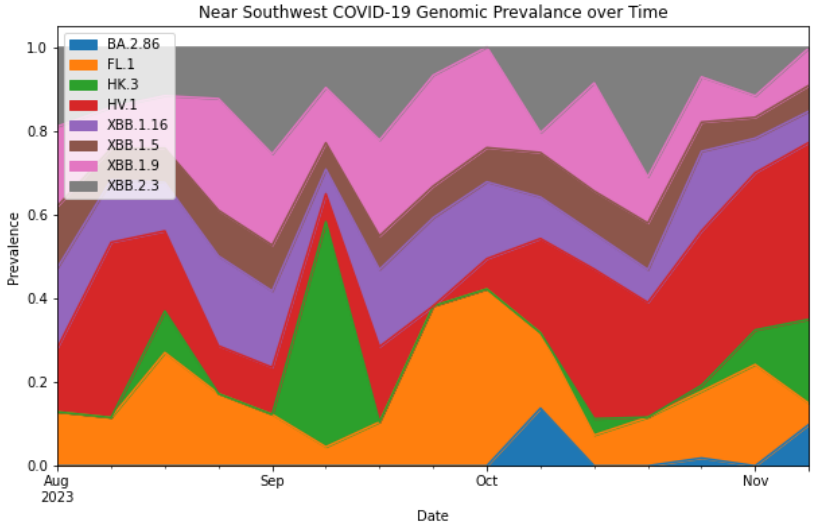
Virginia Wastewater Variant Status

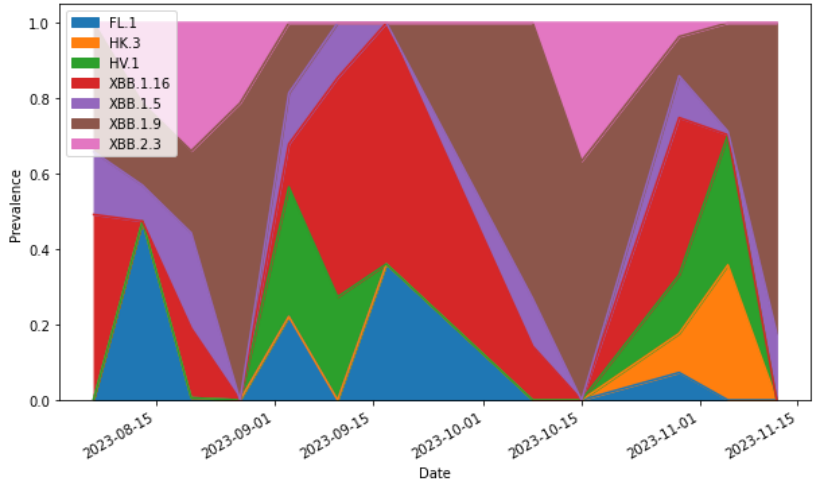






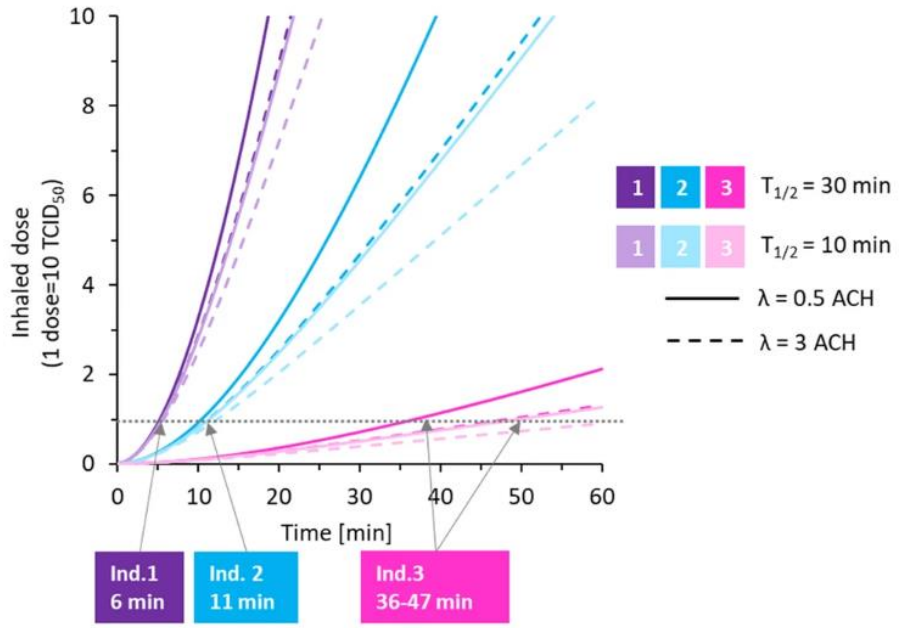




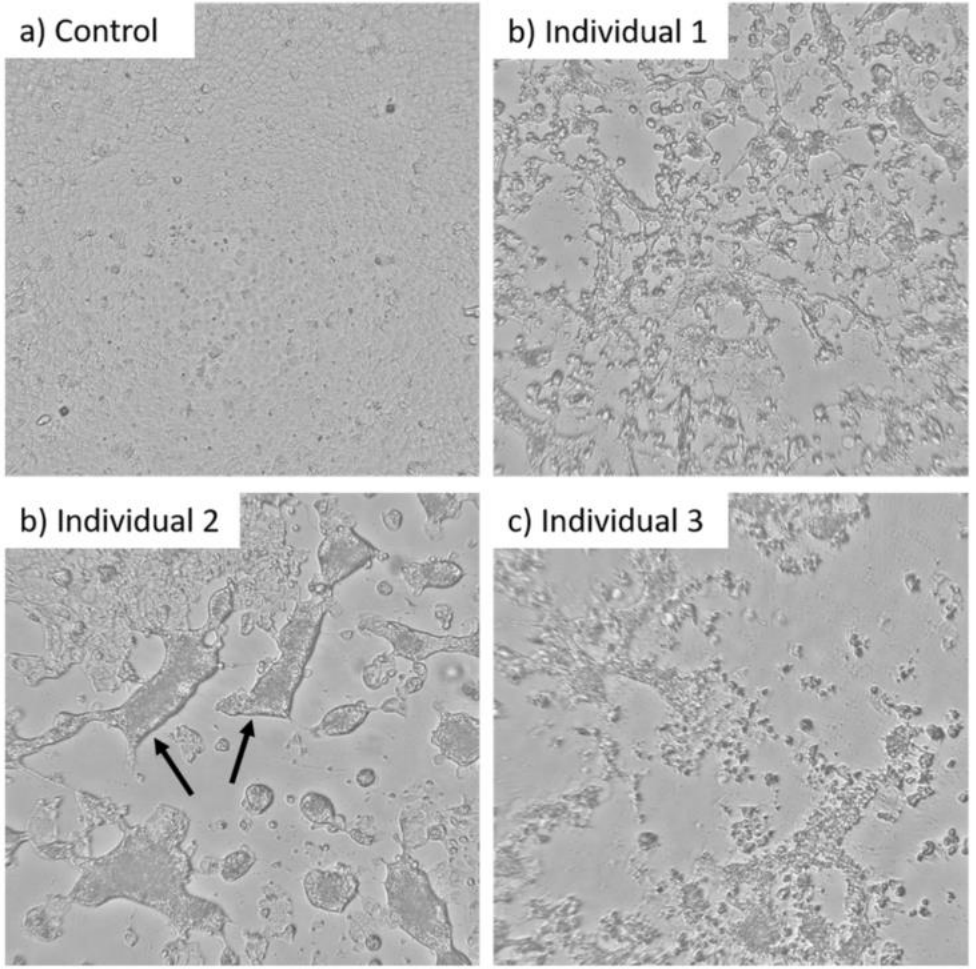


COVID-19 Literature Updates

Pandemic pubs



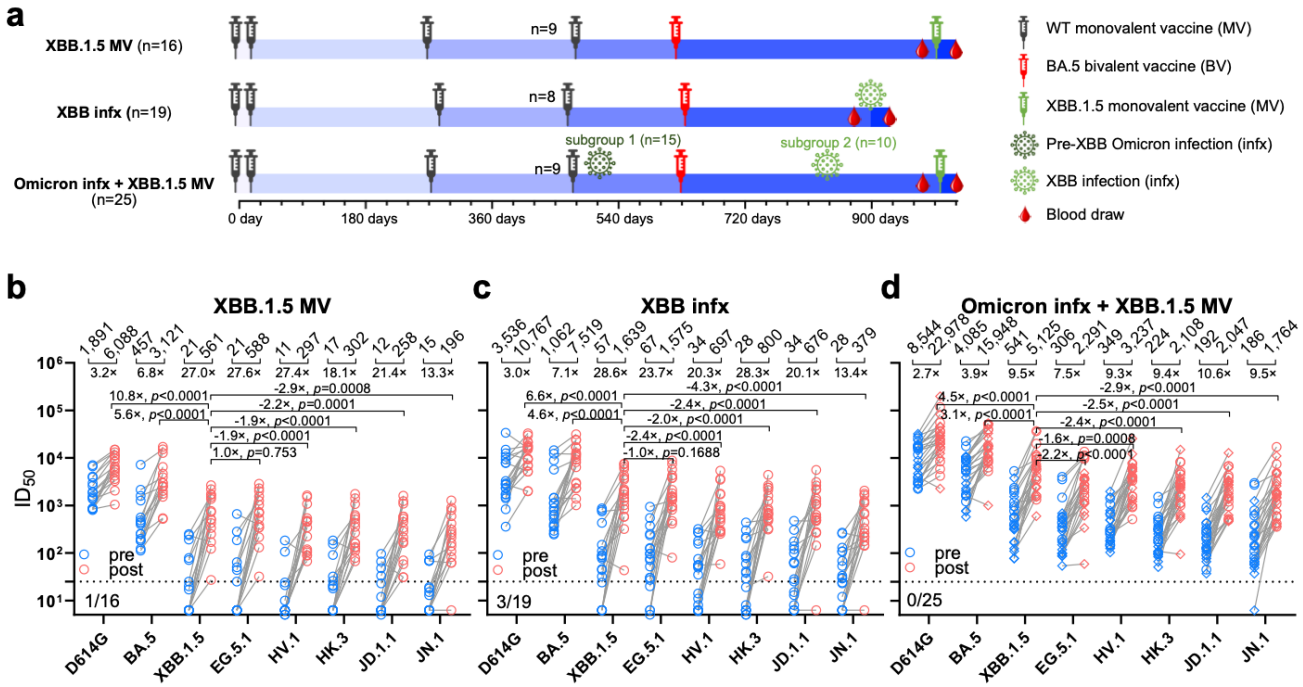
Calculations with an indoor air transmission model showed that given a range of viral load following symptom onset, a susceptible person would inhale an infectious dose within 6 to 37 min after an infected person entered a room with normal ventilation.

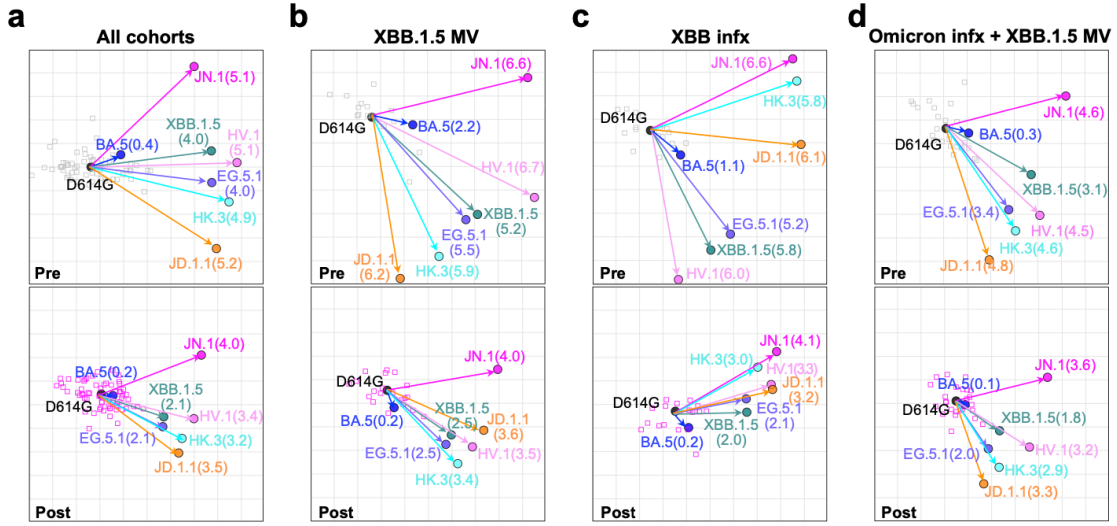


Properties of viral load were calculated from cultured aerosol samples.

https://www.nature.com/articles/s41598-023-47829-8

Pandemic pubs





Administration of an updated monovalent mRNA vaccine (XBB.1.5 MV) to uninfected individuals boosted serum virus-neutralization antibodies significantly against not only XBB.1.5 (27.0-fold) and the currently dominant EG.5.1 (27.6-fold) but also key emergent viruses like HV.1, HK.3, JD.1.1, and JN.1 (13.3-to-27.4-fold)

Anitgenic cartography shows discernible shortening of antigenic distances between D614G and other SARS-CoV-2 variants after a shot of XBB.1.5 monovalent vaccine (Figures 3b and 3d) was indicative of the significant boost in antibody potency and breadth.

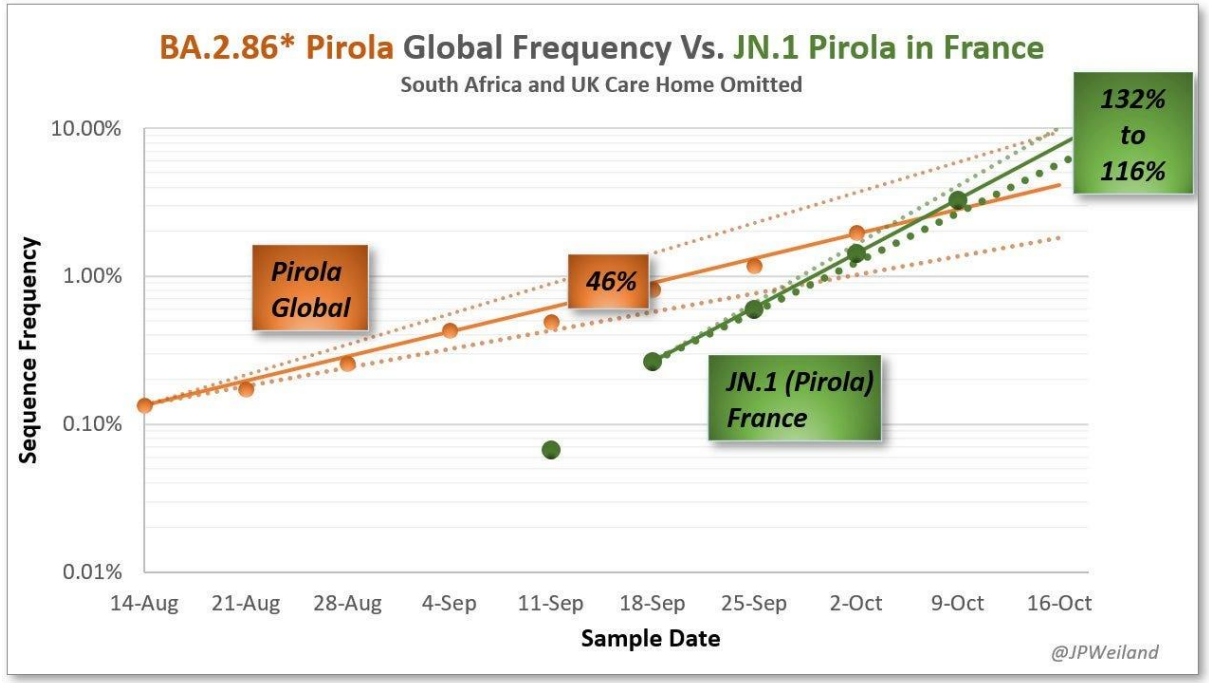
Shortening of these antigenic distances after XBB.1.5 infection was also similar (Figure 3c) to that of XBB.1.5 vaccine booster (Figure 3b), suggesting that infection and vaccination resulted in comparable enhancement of antibody responses.

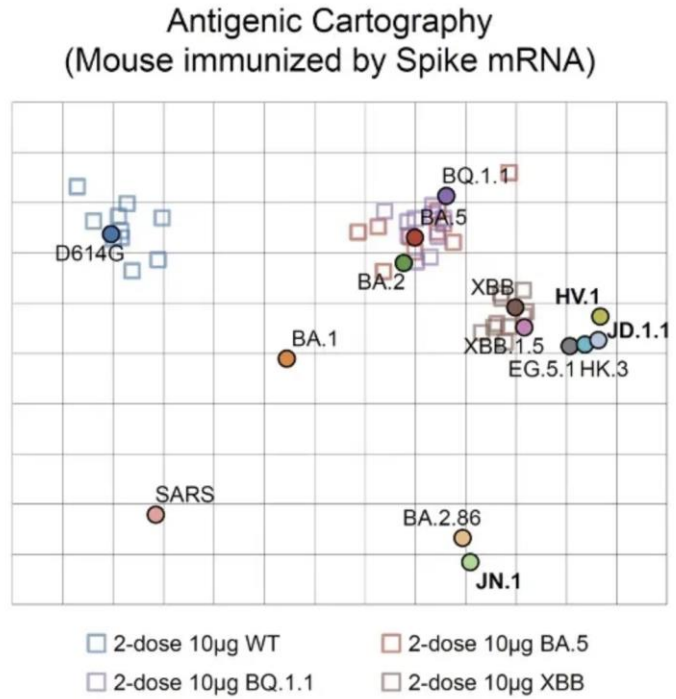
Third, the emergent subvariants HV.1, HK.3, and JD.1.1 clustered together but were more distant than XBB.1.5 and EG.5.1 (Figure 3), demonstrating not only their antigenic similarity but also their greater antibody resistance compared to their predecessors.

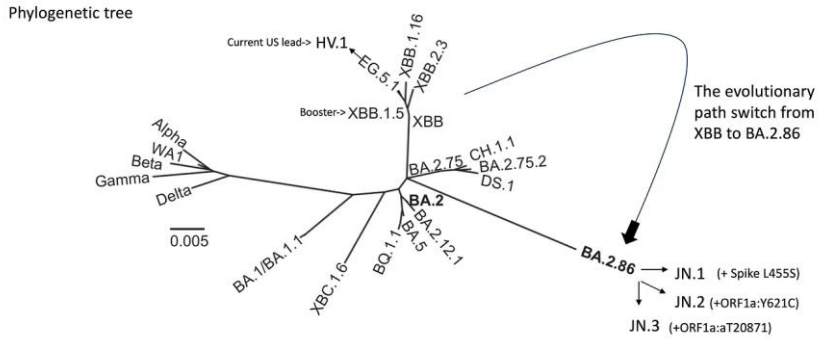
Lastly, JN.1 was antigenically distinct and more distant.

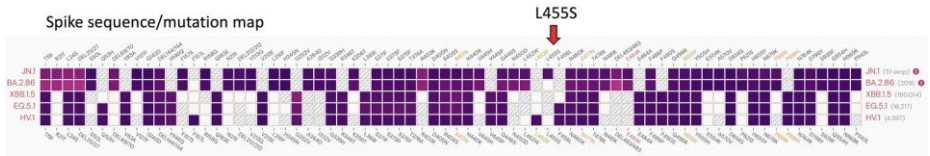
https://www.biorxiv.org/content/10.1101/2023.11.26.568730v1.full.pdf

Pandemic pubs







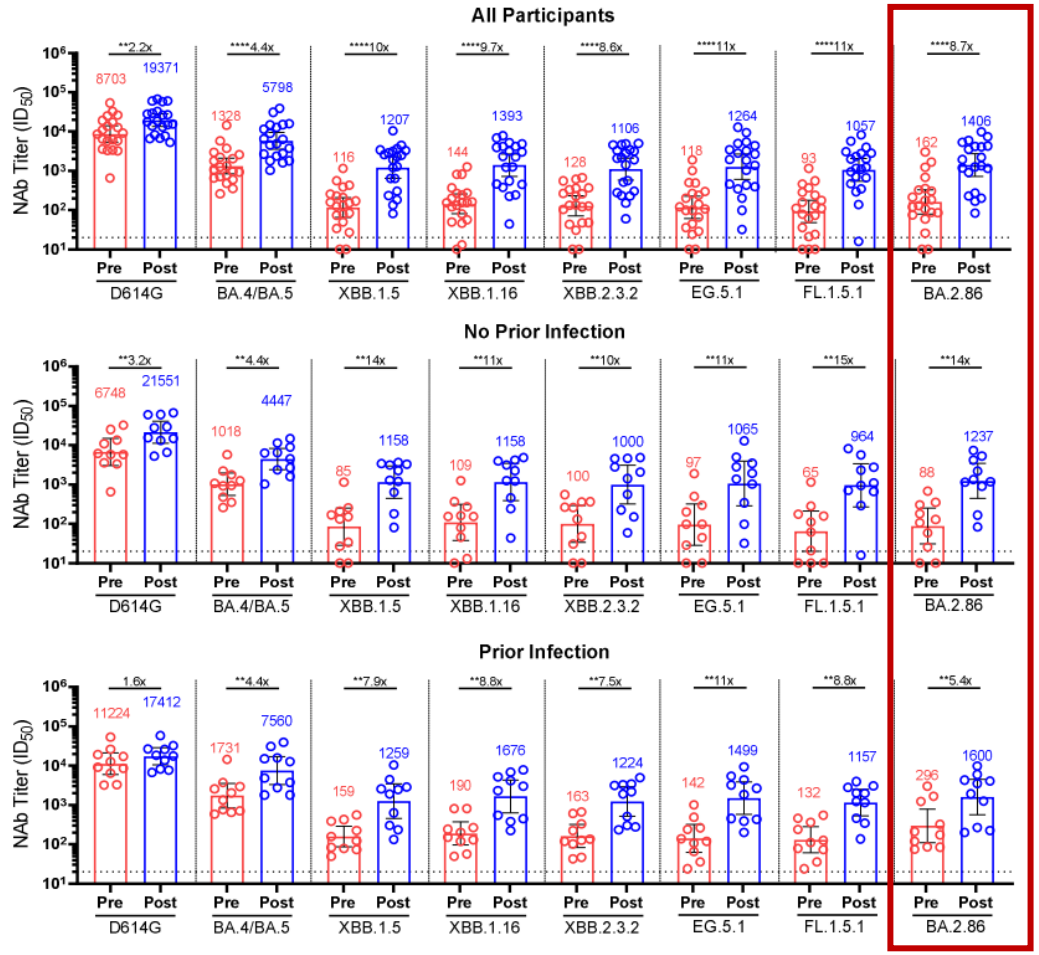


JN.1 sublineage of BA.2.86 bears watching due to immune escape, displayed growth, and mutation profile

https://erictopol.substack.com/p/the-virus-takes-a-detour-in-its-evolutionary

Updated Booster & Variants of Concern

Figure 2. Analysis of Neutralizing Antibody Titers Against Ancestral SARS-CoV-2 (D614G) and BA.4/BA.5, XBB.1.5, XBB.1.16, XBB.2.3.2, EG.5.1, FL.1.5.1 and BA.2.86 Variants in a Randomly-selected Subset of Participants Who Received Monovalent mRNA-1273.815



Phase 2/3 participants in updated booster trial show significantly increased neutralization levels for XBB.2.3.2, EG.5.1, FL.1.5.1 and BA.2.86.

The occurrence of solicited adverse reactions and unsolicited adverse events were overall similar to those previously reported for the original mRNA-1273 50-µg and omicron BA.4/BA.5-containing bivalent mRNA-1273 vaccines.

https://www.medrxiv.org/content/10.1101/2023.08.22.23293434v2

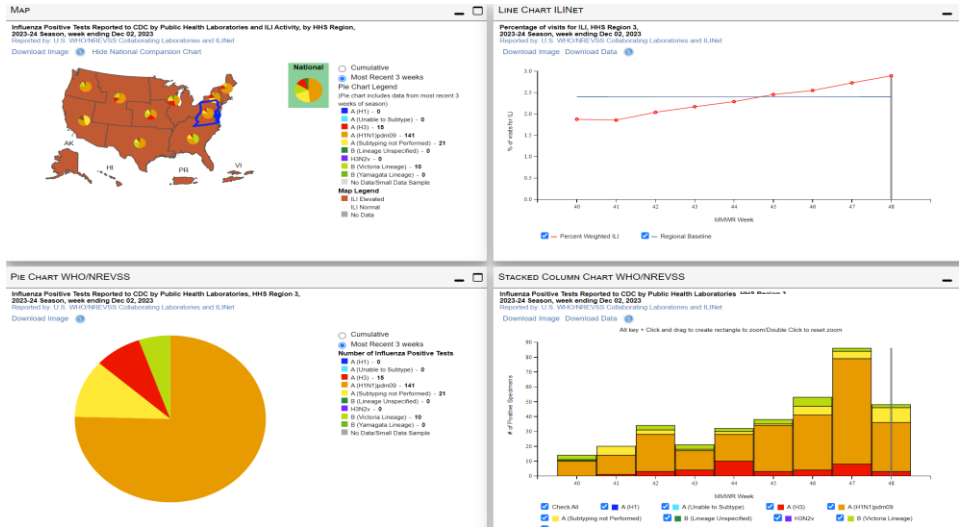
Influenza Update

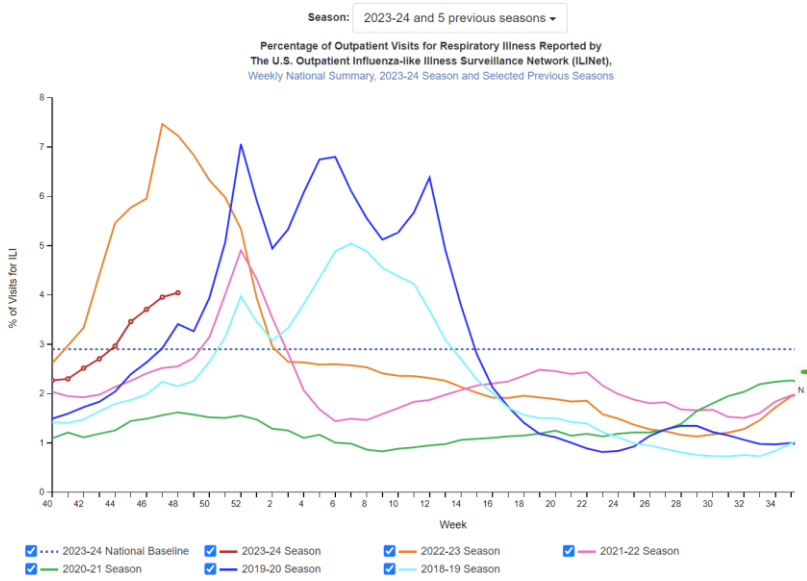
Current Influenza Situation – ILI Activity

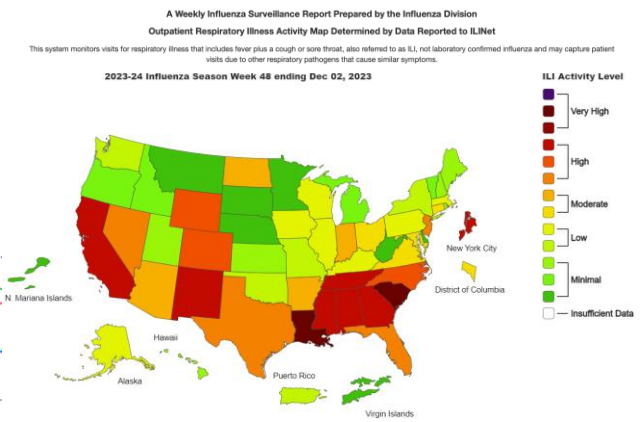
Region 3 Influenza Activity is above threshold

- Virginia is now in ”Moderate” level of Influenza activity
- National ILI activity remains above threshold after and continues to grow
- Most regions are over threshold, with the most activity in the southern states

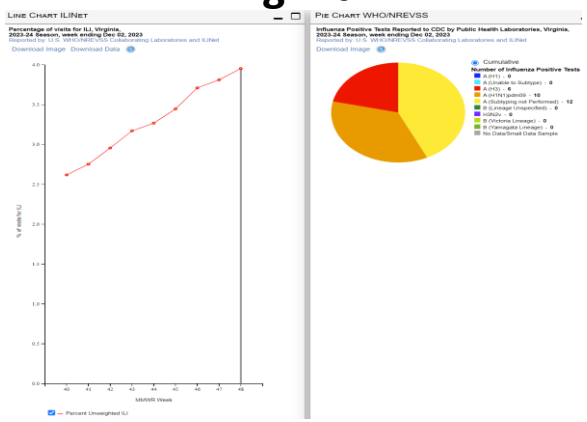
Region 3







Virginia

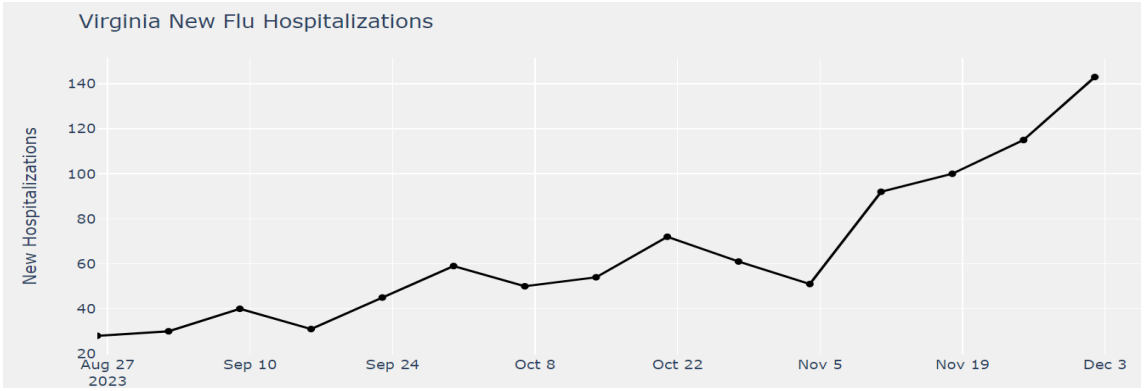


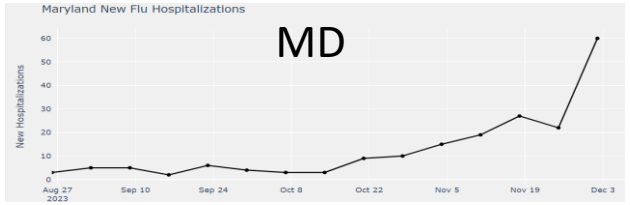
UNIVERSITY of VIRGINIA
BIOCOMPLEXITY INSTITUTE

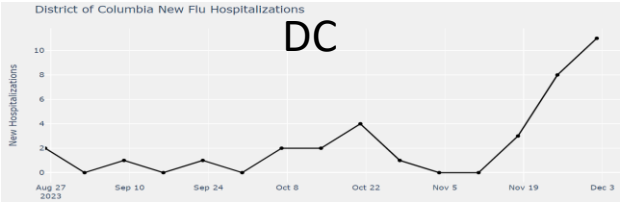
FLUVIEW
A Weekly Influenza Surveillance Report Prepared by the Influenza Division

Current Influenza Situation – Hospitalization Admissions

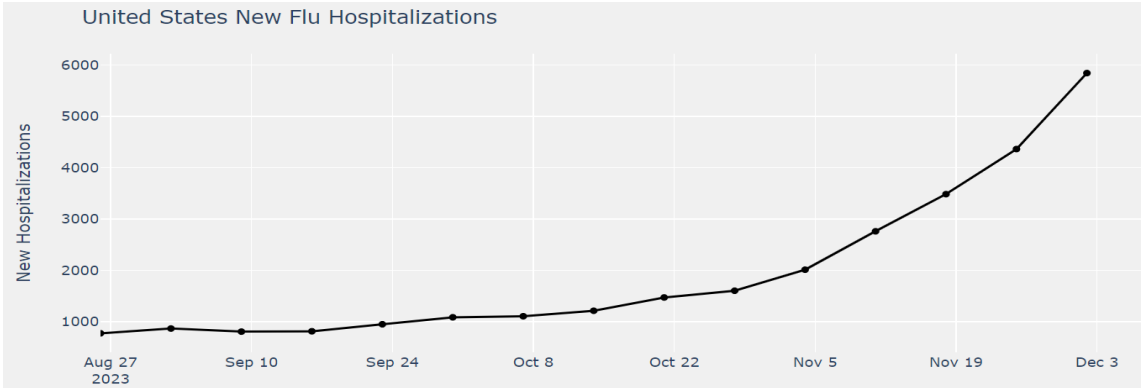
Virginia





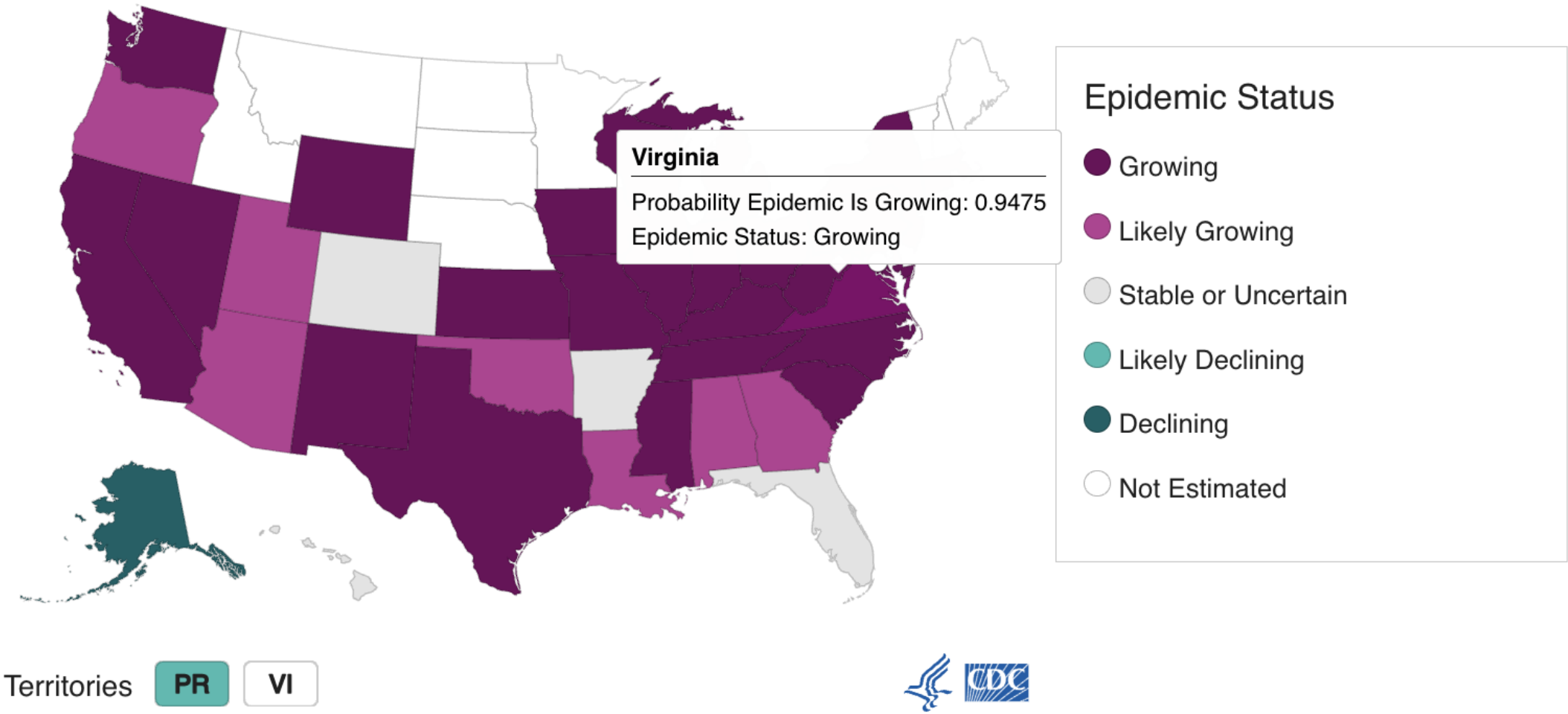


United States



- Influenza Hospitalizations continue to rise
- US and Virginia are in steady growth
- Some of Virginia's neighbors have entered exponential growth phase
- Others remain in steady state this week

United States Hospitalizations – Epidemic Growth

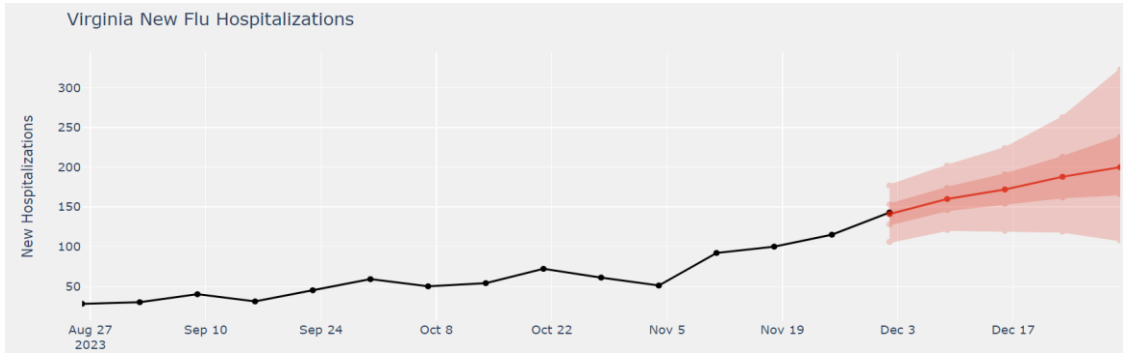


CDC – CFA Epidemic Growth

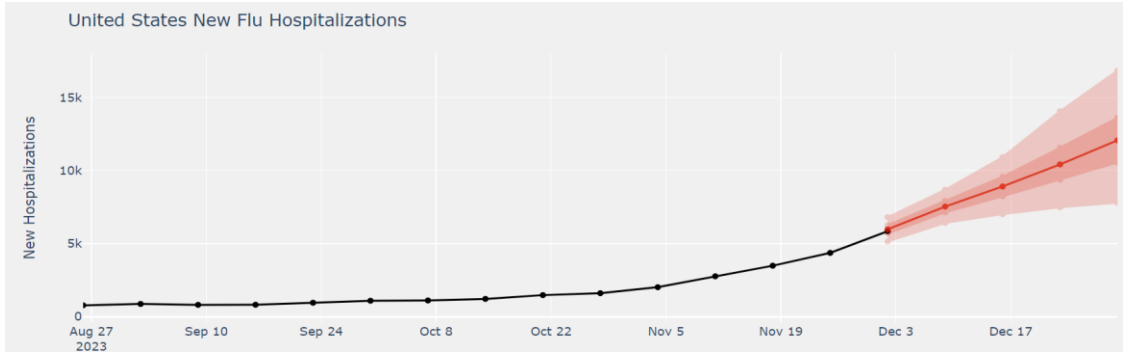
Influenza Forecasts – Hospitalization Admissions

Forecast from Dec 9th

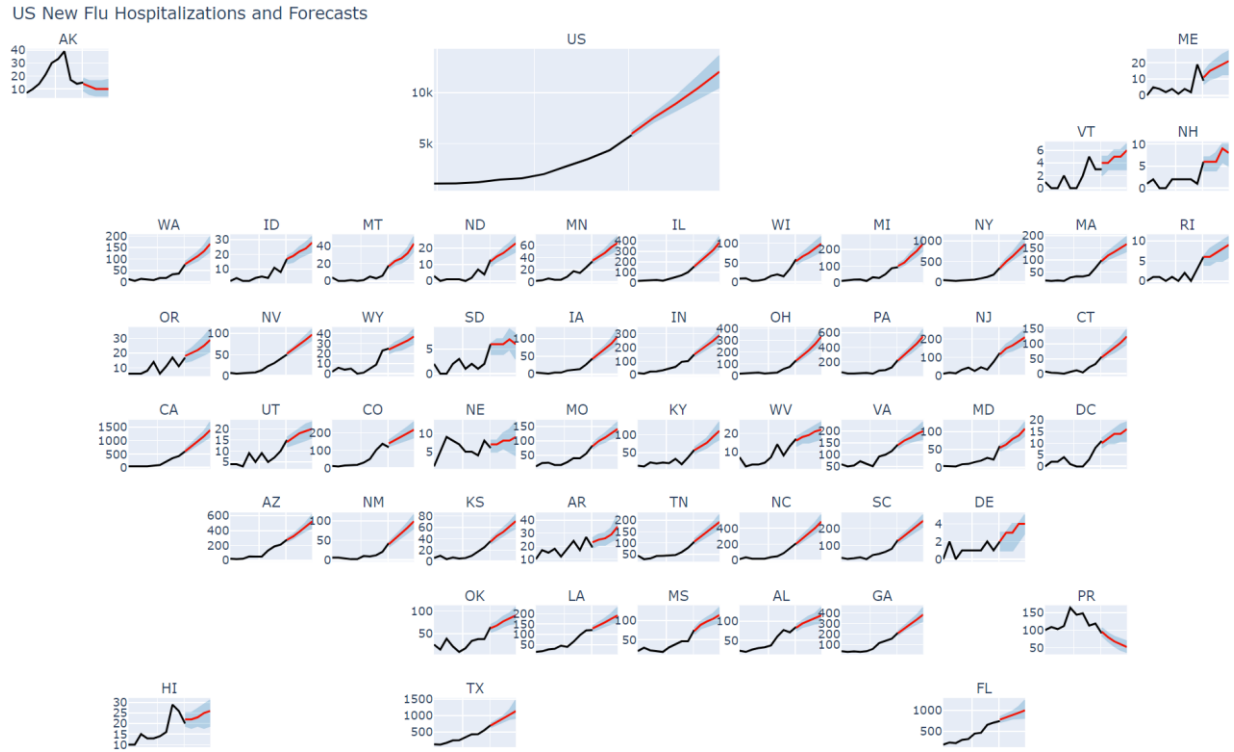
Virginia



United States



UVA forecast model only
Hospital Admissions for Influenza and Forecast for next 4 weeks
http://flux-forecasting.pods.uvarc.io



Current Influenza Hospitalization Forecast

Statistical models for submitting to CDC Influenza Forecasting Hub

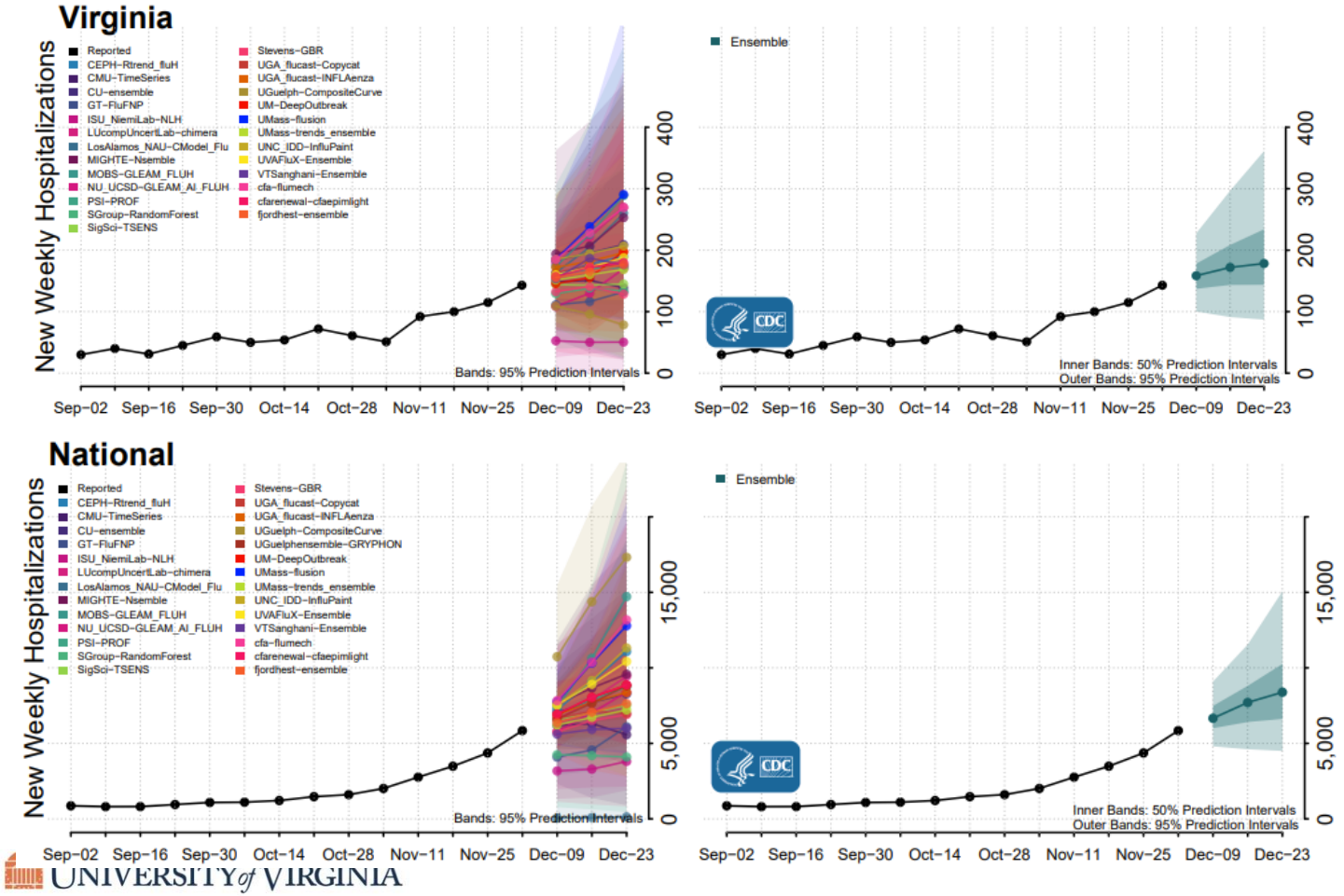
- Uses a variety of statistical and ML approaches to forecast weekly hospital admissions for the next 4 weeks for all states in the US

Hospital Admissions for Influenza and Forecast for next 4 weeks (CDC Influenza Ensemble)

From December 8th

CDC Flu Activity Surveillance

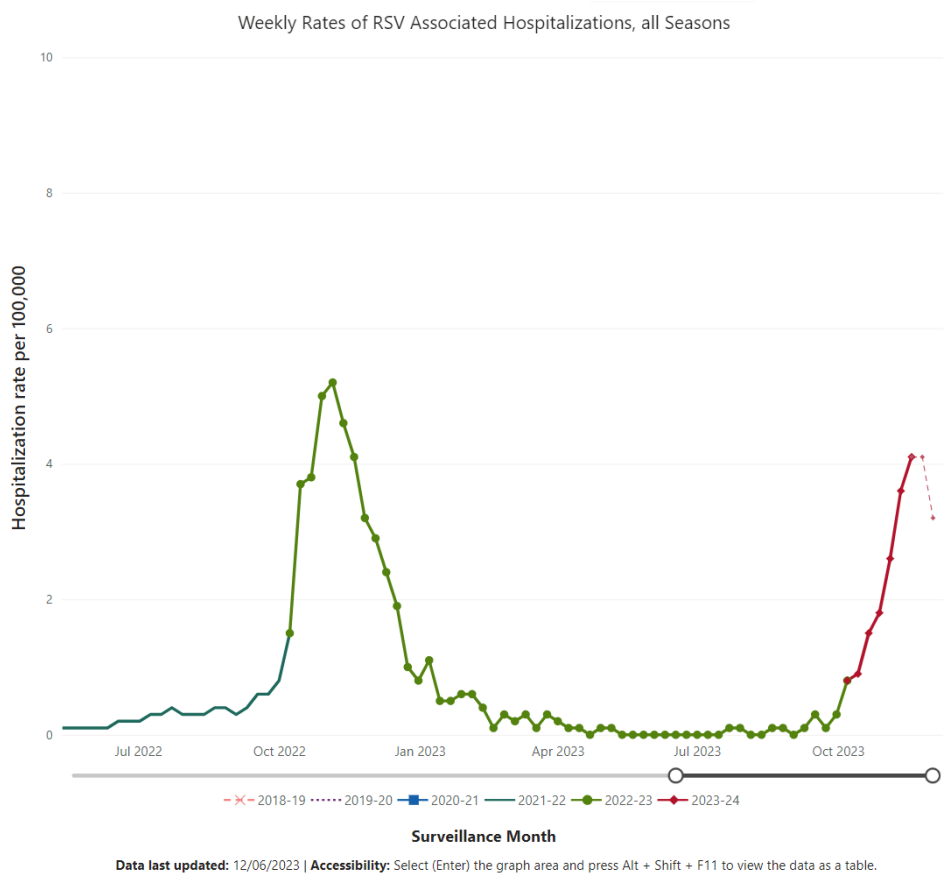
https://www.cdc.gov/flu/weekly/fluactivitysurv.htm



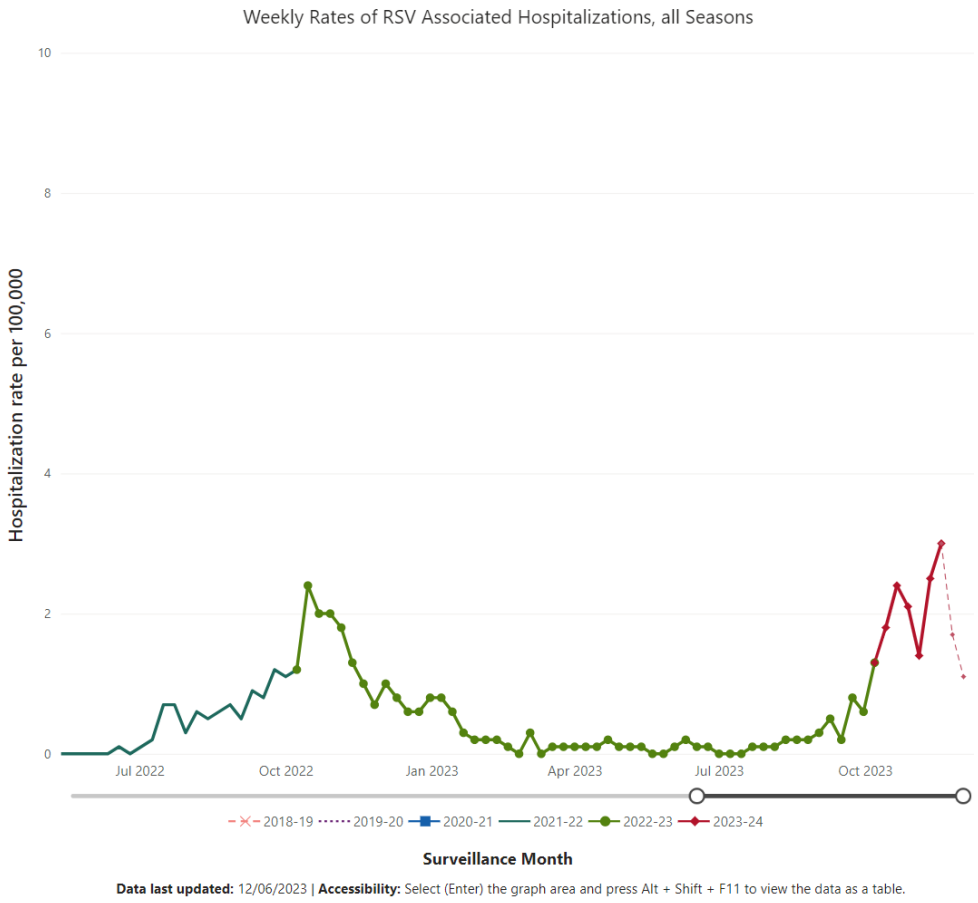
RSV Update

Current RSV Situation – Hospitalization Rates (RSV-Net)

Maryland (RSV-Net)



Tennessee (RSV-Net)



Surveillance data as of:

11/18 (last solid data)

12/2 (last recent but likely to be updated)

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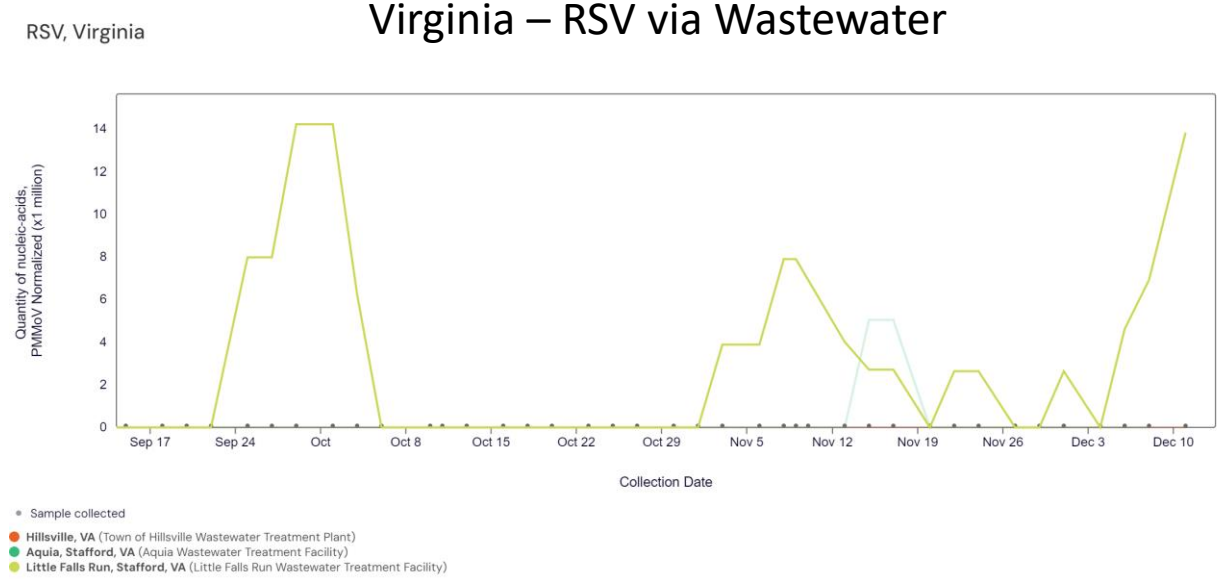
CDC

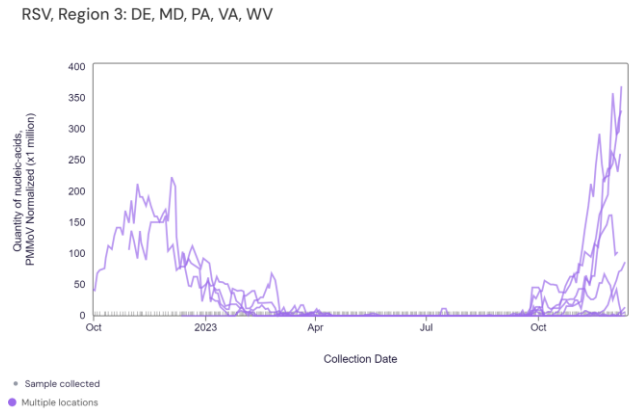
[RSV-Net Dashboard]

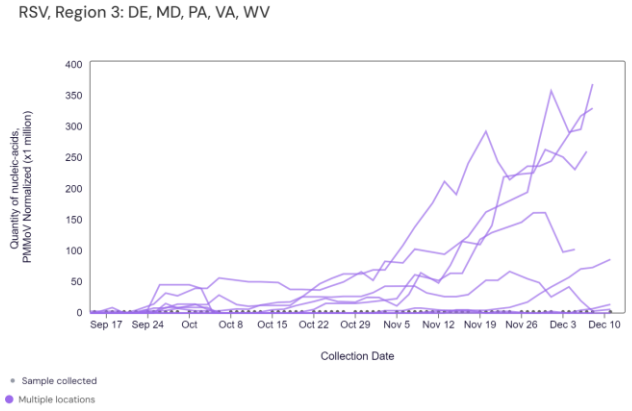
Current RSV Situation – Wastewater in VA

Virginia – RSV via Wastewater



HHS Region 3 – RSV via Wastewater





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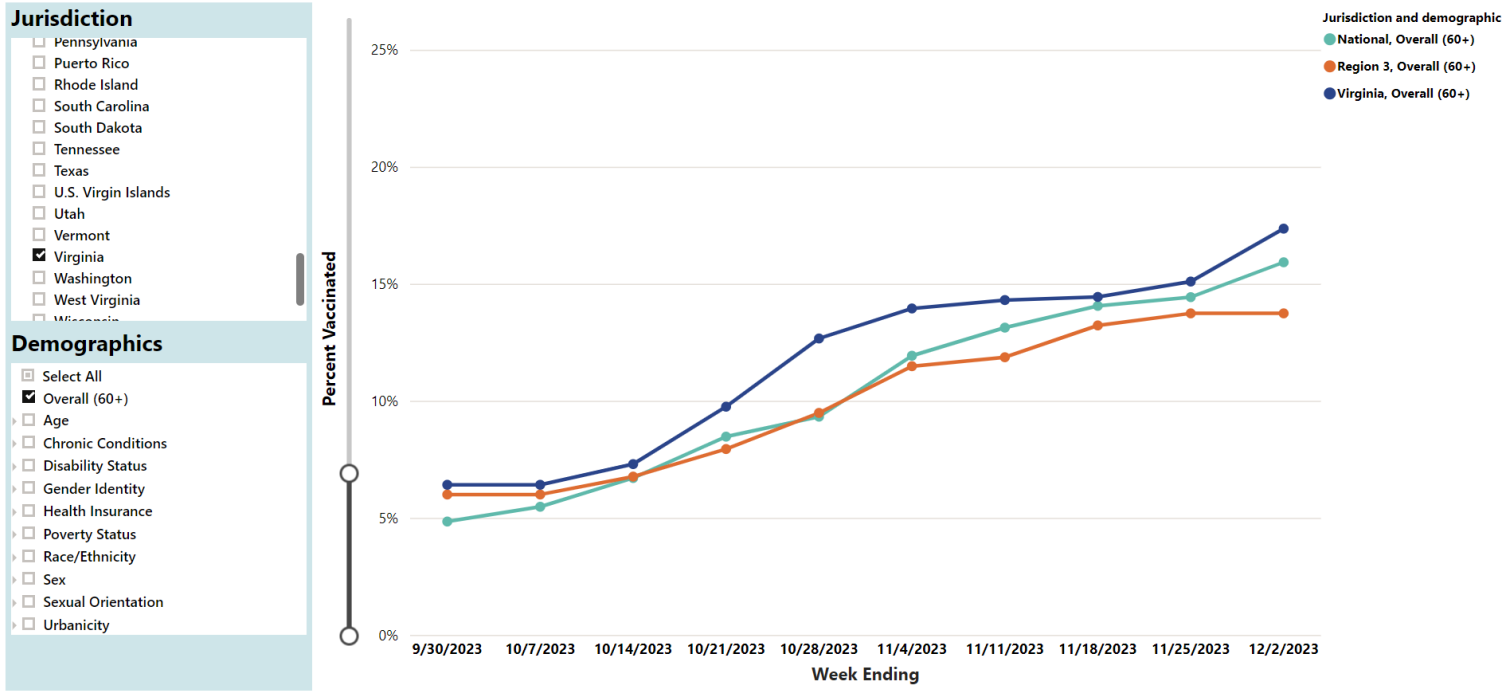
WASTEWATER SCAN [Wasterwaterscan]

Current RSV Situation – Vaccinations

Figure 1A. Cumulative Percentage of Adults 60 Years and Older Vaccinated with RSV Vaccine, 2023-2024*,†,‡,±
Data Source: National Immunization Survey–Adult COVID Module



Demographics
Level: **Overall (60+)**
Name:

Jurisdiction	Vaccination & Intent	Estimate (%)	95% CI (%)
National	Vaccinated	15.9%	14.6 - 17.2
National	Definitely will get a vaccine	15.6%	13.3 - 18.0
National	Probably will get a vaccine or are unsure	40.3%	37.1 - 43.5
National	Definitely or probably will not get a vaccine	28.1%	25.3 - 30.9

- RSV Vaccination of 60+ nears 17% and exceeds National and Regional levels
- Another 16% still ”definitely” intending to get vaccine
- Now 28% not planning on vaccinating

Scenario Modeling Hub – RSV (Round 1) in prep

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

- Round Designed to explore impacts of newly available treatments (monoclonal antibodies and vaccines)
- Based on data till **November 12th, 2023**

Scenario Dimensions:

No interventions vs. levels of treatments for infants vs. seniors:

Infants: Optimistic vs. Pessimistic - coverage (80% vs. 20%) and VE (80% vs, 60%)

Seniors: Optimistic vs. Pessimistic - coverage (40% vs. 20%) and VE (90% vs. 70%)

https://github.com/midas-network/rsv-scenario-modeling-hub

	Optimistic senior protection Vaccine is administered from Sep-June to seniors **60+ yrs** - coverage saturates at **40%** of the 2021-22 state- and age-specific flu vaccine coverage - VE against hospitalization is **90%**	**Pessimistic senior protection** Vaccine is administered from Sep-June to seniors **60+ yrs** - coverage saturates at **20%** of the 2021-22 state-and age-specific flu vaccine coverage - VE against hospitalization is **70%**	**No senior intervention**
Optimistic infant protection Long-acting monoclonals target infants **< 6 months** during RSV season (Oct-Mar) - coverage saturates at **60%** of the 2021-22 state- and age-specific flu vaccine coverage - VE against hospitalization is **80%**	**Scenario A**	**Scenario** B	
Pessimistic infant protection Long-acting monoclonals target infants **< 6 months** during RSV season (Oct-Mar) -coverage saturates at **20%** of the 2021-22 state- and age-specific flu vaccine coverage - VE against hospitalization is **60%**	**Scenario C**	**Scenario D**	
No infant intervention beyond what was used in prior years (limited supply of palivizumab, targeting ~2% of birth cohort at high risk)			**Scenario E (counterfactual)**

Scenario Modeling Hub – RSV (Round 1)

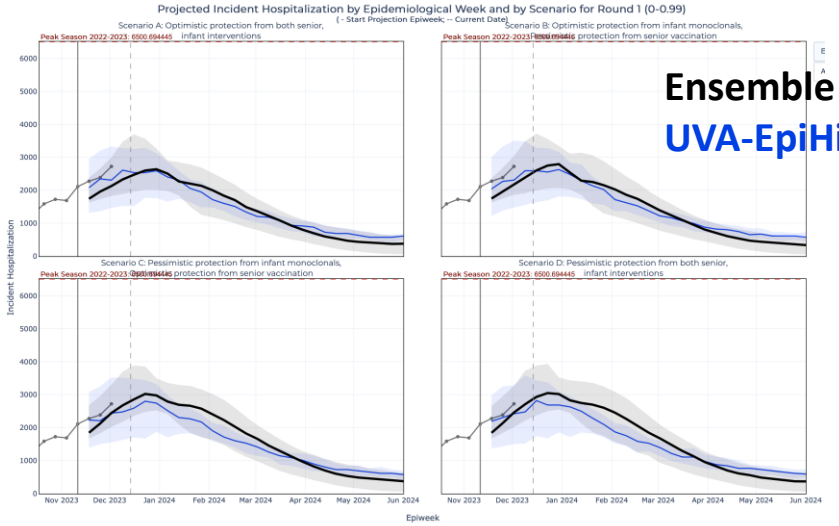
Preliminary Results based UVA-EpiHiper Model

- Hospitalizations of 0-1 year olds can be reduced 5-10% through high levels of treatments
- Hospitalization of 65+ year olds can be reduced 7-22%

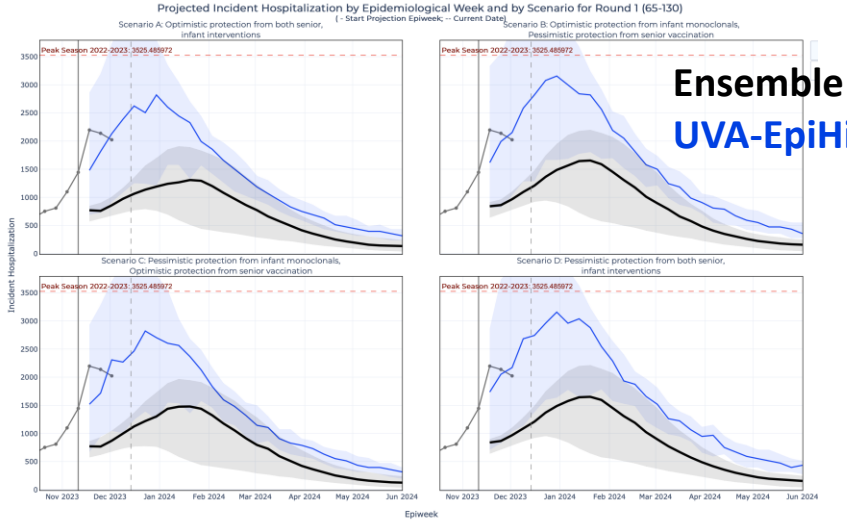
Conservative assumptions

- Treatments and vaccinations don't interrupt transmission (unlikely, but no evidence yet to prove it)
- Vaccination coverage a fraction of seasonal influenza vaccines

US RSV Hospitalizations 0-1 year olds



US RSV Hospitalizations 65+ year olds



Scenario Modeling Hub – Influenza (Round 4)

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

- Round Designed to explore a season dominated by H3 vs. H1 with different levels of seasonal flu vaccination coverage
- Based on data till **September 2nd, 2023**

Scenario Dimensions:

Influenza type A/H3 vs. A/H1:

- H3 higher hospitalization rates with vax efficacy weaker in older groups

- H1 lower hospitalization rates and efficacy even across age groups

Vaccination levels (compared to 2021-22 season):

Low (20% less) vs.
Business as Usual (same) vs.
Higher (20% more)

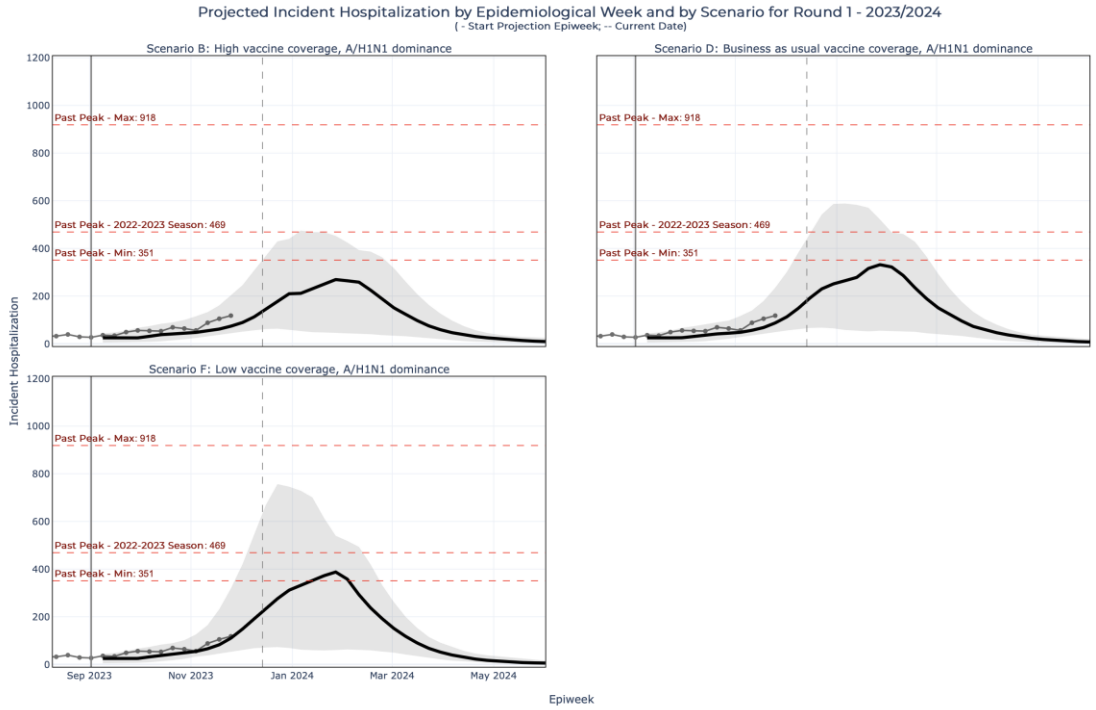
https://fluscenariomodelinghub.org/viz.html

	Season dominated by influenza A/H3N2, indexed on age distribution of 2017-18 season. **VE = 40% against medically attended illnesses and hospitalizations, VE drops in older age groups**	**Season dominated by influenza A/H1N1, indexed on age distribution of 2019-20 season.** **VE = 40% against medically attended illnesses and hospitalizations, similar VE across all age groups**
Higher than Usual Vaccine Coverage • Vaccine coverage is **20% higher than in the 2021-22** flu season in all age groups and jurisdictions. (20% is a relative change, ie a 50% coverage for age group *a* and jurisdiction *j* in 2021-22 translates to a 50%*1.20=60% coverage for 2023-24). Overall, the US coverage is about 60% in this scenario.	**Scenario A**	**Scenario B**
Business as Usual Vaccine Coverage • Vaccine coverage is **the same as in the 2021-22** flu season in all age groups and jurisdictions. Overall, the US coverage is about 50% in this scenario.	**Scenario C**	**Scenario D**
Low Vaccine Coverage • Vaccine coverage is **20% lower than in the 2021-22** flu season in all age groups and jurisdictions. Overall, the US coverage is about 40% in this scenario.	**Scenario E**	**Scenario F**

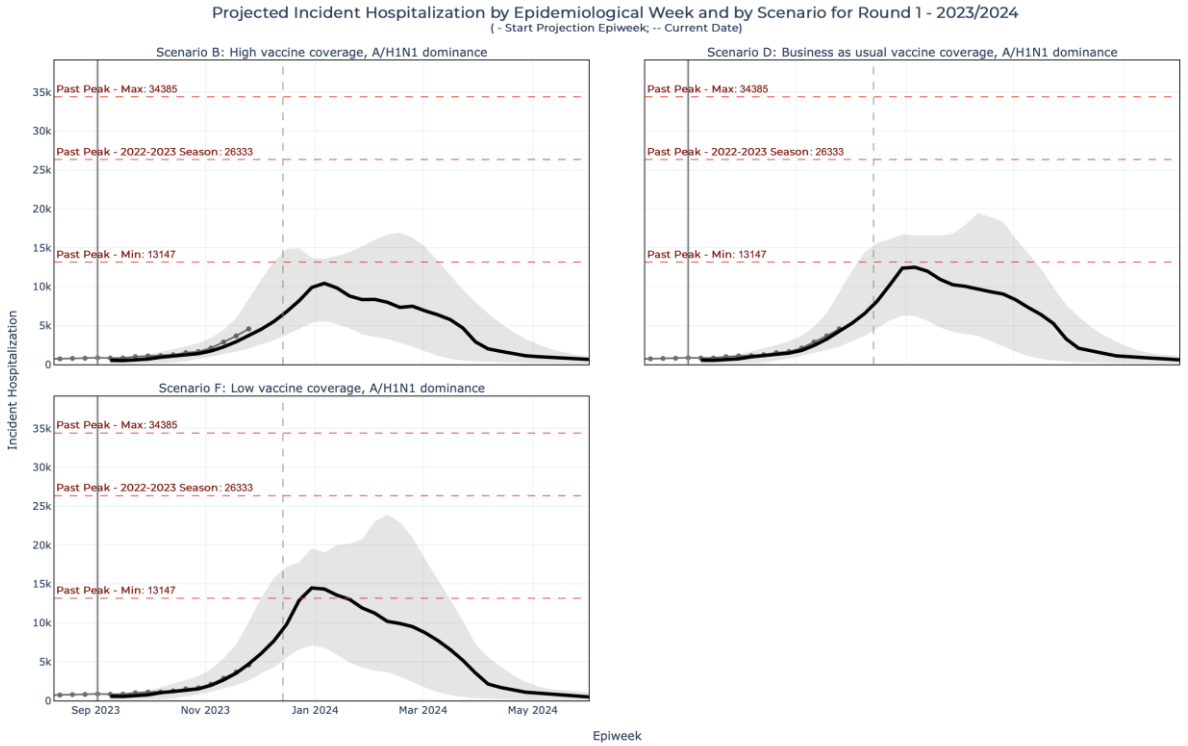
Scenario Modeling Hub – Influenza (Round 4)

- H1N1 season seems to have emerged
- Projections remain relatively on track

Virginia Hospitalizations



United States Hospitalizations



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)

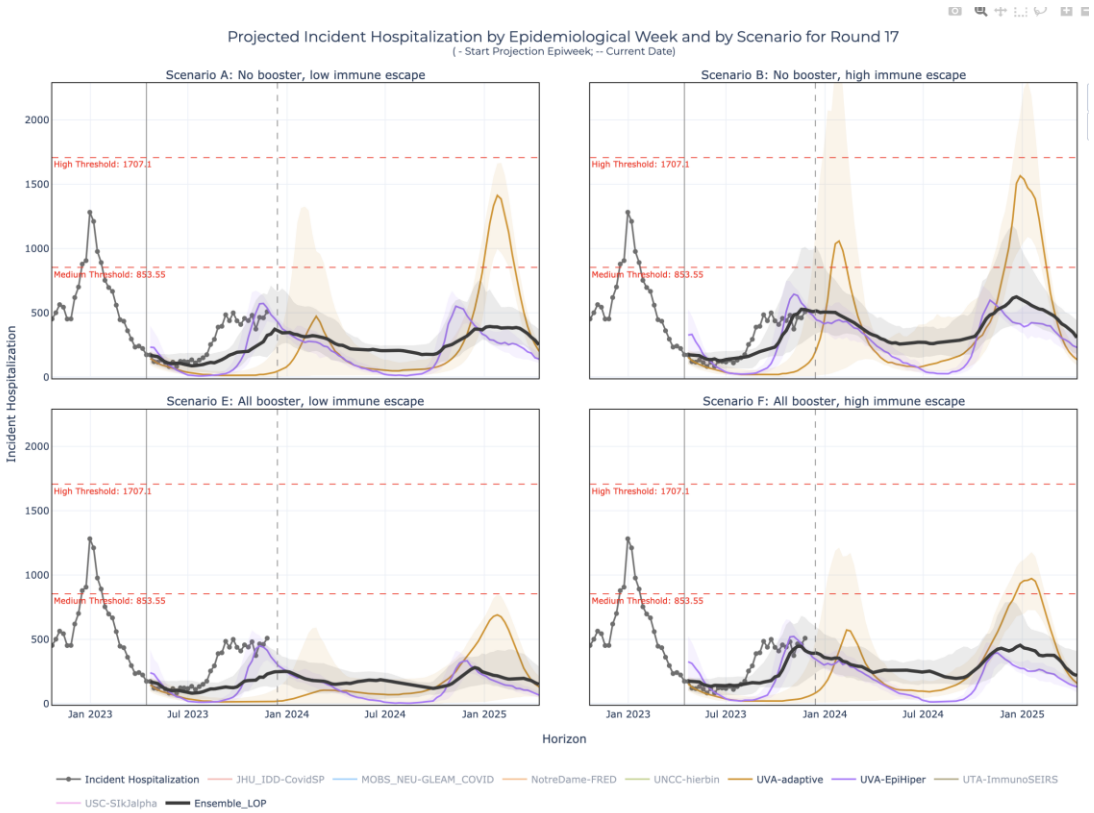
Vaccination levels:

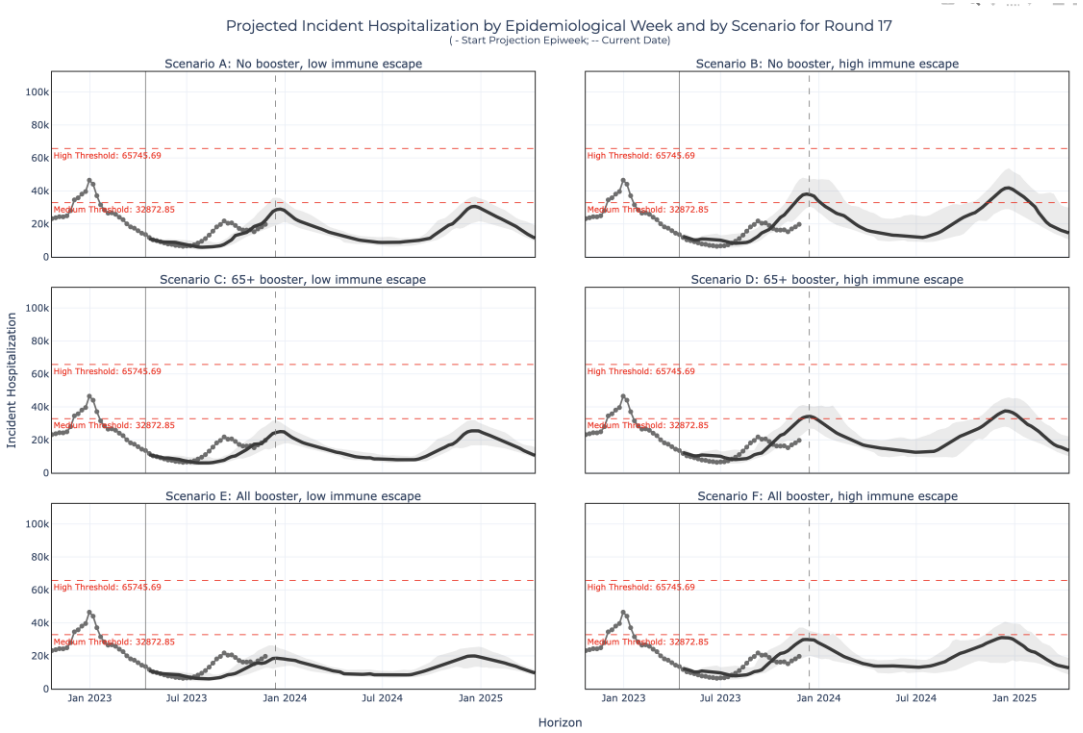
None vs.
Vulnerable and 65 + vs.
Broader population of eligible

	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

SMH – COVID-19 (Round 17) – Virginia Results

- To date, immune escape evolution has been slow. Booster campaign size remains unknown.
- Significant variation in Fall-Winter 2023 outlook across models





Slower Immune Escape (20%) **Faster Immune Escape (50%)**

Key Takeaways

COVID-19 Activity levels remain in an undulating plateau

- Cases and hospitalizations have remained flat for a month
- Other indicators continue to point towards this continuing but with some increased activity in Southwest
- Wastewater based indicators similar mix of viral loads as in previous weeks

Genomic Surveillance maintains high diversity with no dominating variant

Influenza Activity is picking up Nationally, still low in Virginia

- Recent hospitalization surveillance from the 15th shows growth

Together this suggests continued COVID-19 plateaus in near term

Questions?

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