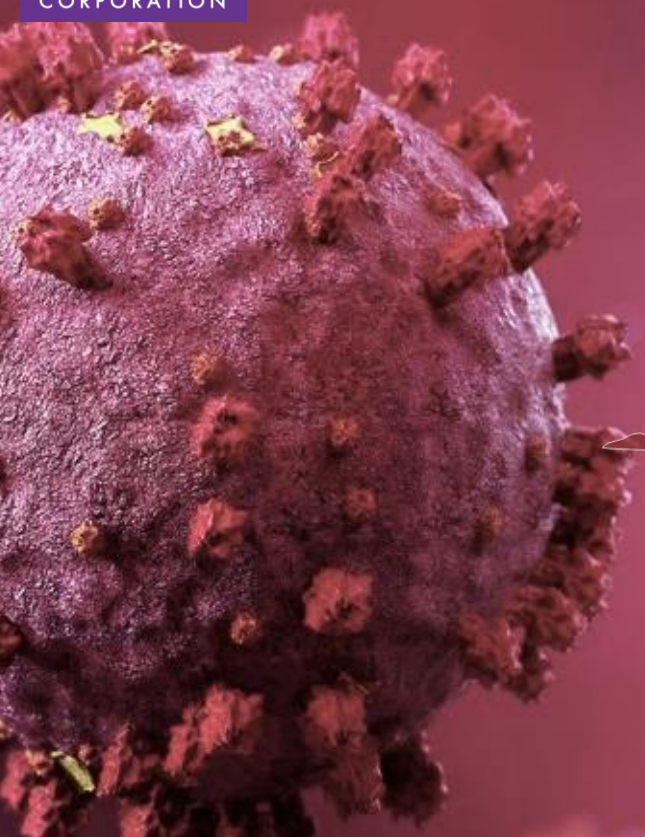

VIRGINIA

COVID-19 Update March 4th, 2021

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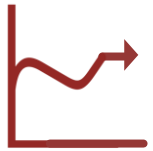
A team of RAND researchers was asked by the Commonwealth of Virginia to review available information on COVID-19 models of the Commonwealth to determine the strengths and weaknesses of each model and their relevance to decisionmaking. The information in this presentation is intended to keep policymakers abreast of the latest findings of the research team.

This research was sponsored by the Commonwealth of Virginia and conducted by the RAND Corporation. RAND is a research organization that develops solutions to public policy challenges to help make communities throughout the world safer and more secure, healthier and more prosperous. RAND is nonprofit, nonpartisan, and committed to the public interest. For more information, visit www.rand.org.

Bottom-Line Up Front



Virginia's total case levels remain high but continue to decline

- Hospitalizations are declining but remain somewhat elevated
- Testing has leveled to the pre-winter levels

Vaccine administration is accelerating

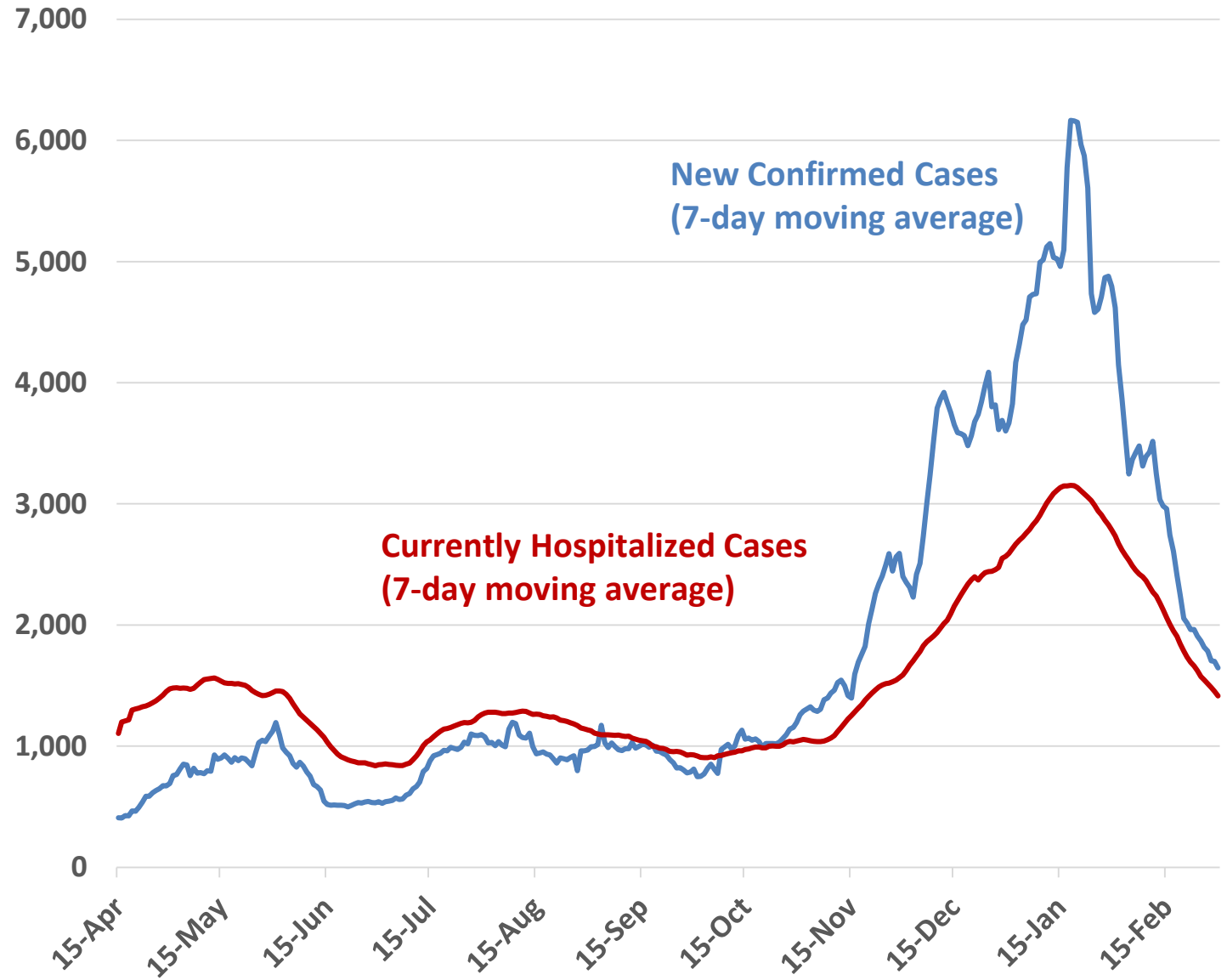
- Stockpiles have declined
- Supply will remain a constraint for another month or two
- Efforts to increase vaccine demand will be needed to reach some populations

New COVID variants have been detected in Virginia and could accelerate spread

Model forecasts may be less accurate because behavior is driving growth

- Models will continue to be useful for comparing policies and exploring scenarios

Cases and hospitalizations have declined significantly but remain high relative to previous waves



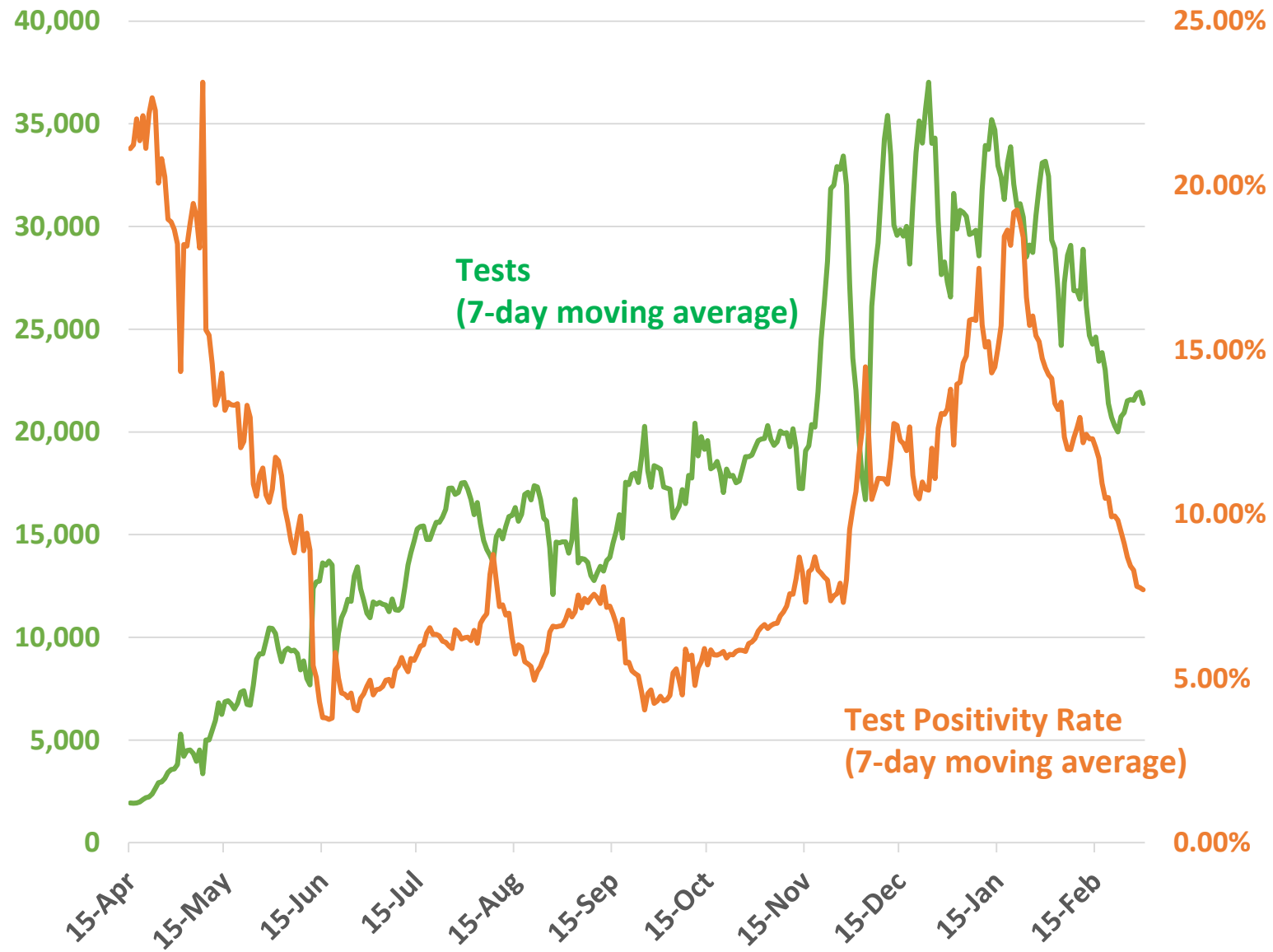
New confirmed cases have dipped to 1,600/day on average

- This is the level from mid-November
- The rate of decline has slowed, but it is not clear whether this is a plateauing or pause before a continued drop

Currently hospitalized cases peaked in mid-January

- Hospitalizations are likely to continue to fall for the next few weeks
- The decline in hospitalizations will typically be slower than that of cases

Testing has drifted to the levels before the third wave



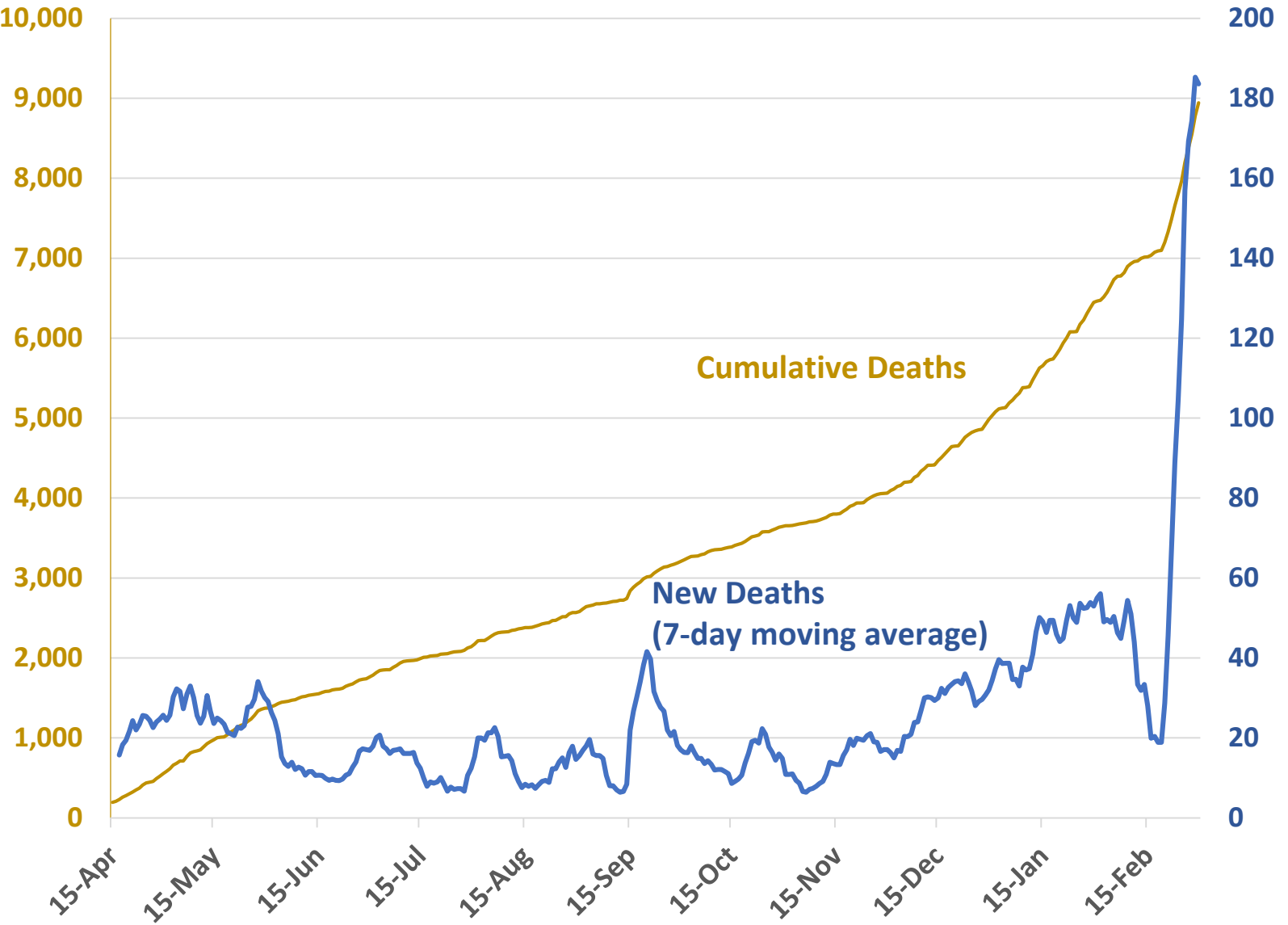
Tests per day have averaged around 20,000

- This is roughly equivalent to the highest level before November

The test positivity rate is roughly 8 percent

- Five percent is a suggested target
- At this rate, the case count levels are likely to be slightly less reliable

New deaths from COVID remain elevated



Cumulative Deaths have approached 9,000

- At 105 per 100,000, Virginia's death rate from COVID remains well below the national rate of 157 per 100,000

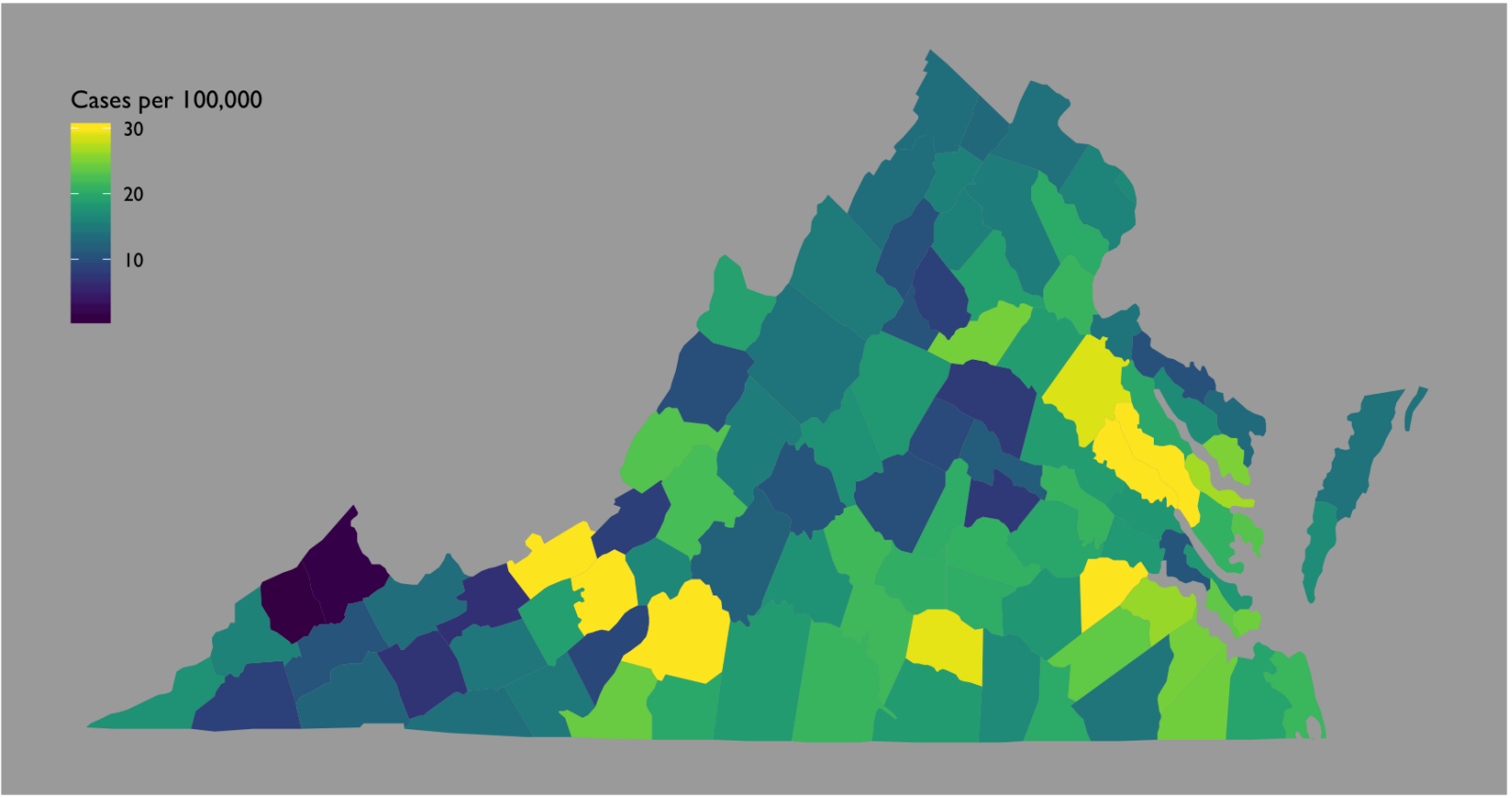
New deaths spiked in the last two weeks

- This spike has been largely driven by a lag in reporting and data entry
- Death rates typically lag case rates by several weeks

Case levels have continued to decline but remain very high in pockets

CASE COUNT

Source: VDH



Yellow indicates at least 30 cases per 100,000

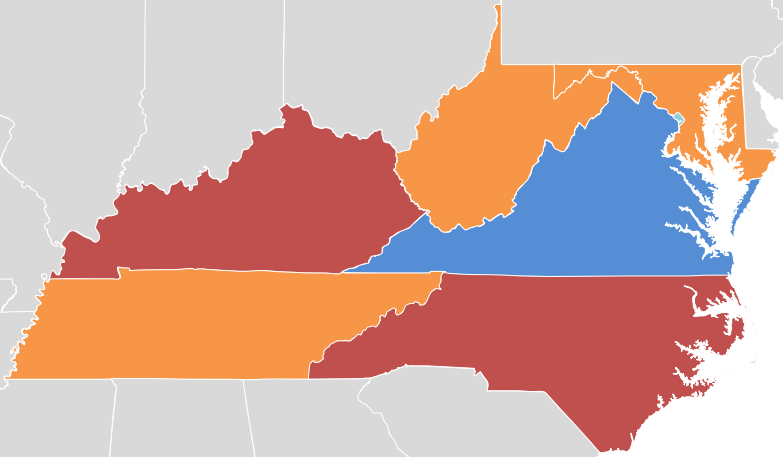
Case levels have declined across the Commonwealth

- 65 percent of counties have fewer than 20 cases per 100,000
- 14 percent of counties have fewer than 10 cases per 100,000

These data were updated March 3rd and represent a seven-day average of the previous week

Declines have stalled in many neighboring states

Over the last 7 days, Virginia had 19.3 (-16% from last week) new confirmed cases per day per 100,000



Very high case loads (>20):

- North Carolina (23.3 new cases per 100k, -14% from last week)
- Kentucky (23.0, -13%)

High case loads (10-20):

- Tennessee (18.9, +16%)
- District of Columbia (18.7, +29%)
- West Virginia (16.3, +1%)
- Maryland (13.1, +19%)

Lower case loads (<10): None

These data were updated March 3rd and represent a seven-day average of the previous week

Nearly eight percent of Virginians are fully vaccinated and seven percent have received the first shot

Age	0-9	10--19	20-29	30-39	40-49	50-59	60-69	70-79	80+	Total
Fully Vaccinated	0	3,369	55,868	80,873	88,745	98,325	102,878	122,962	87,713	640,733
% Full	0.0%	0.3%	4.8%	6.9%	8.2%	8.7%	10.5%	20.0%	28.2%	7.5%
Partially Vaccinated	0	4,400	36,335	50,796	58,654	74,747	139,589	141,776	67,671	573,968
% with Partial	0.0%	0.4%	3.1%	4.3%	5.4%	6.6%	14.3%	23.1%	21.7%	6.7%
Confirmed Cases	24,460	58,434	108,221	92,200	83,505	82,326	56,748	31,161	22,767	559,822
% Confirmed Cases	2.4%	5.3%	9.4%	7.9%	7.8%	7.3%	5.8%	5.1%	7.3%	6.6%

Source: VDH, March 3rd

Vaccinations are being rolled out in Virginia

- 2,481,525 doses have been distributed as of March 3rd
- Virginia's program has administered 90 percent (1,194,905 out of 1,332,930) of its first doses
- It has also administered 69 percent (639,683 out of 925,125) of its second doses

At some point in the next month or two, vaccine supply will likely be less of a constraint, and growing the vaccination rates will rely on improving demand

We've been monitoring recent, relevant literature

Vardavas et al. simulated economic and health outcomes associated with the use of periodic NPI strategies (i.e., "pulsing") to combat COVID

- They found several strategies that oscillate between a period of strict adherence and a relaxation that dominate strategies with a continuous strict adherence to NPIs
- They also note that the marginal effectiveness of NPIs will decrease as the vaccine rollout continues

Bogart et al. surveyed attitudes towards the COVID vaccines of 207 Black Americans

- Vaccine hesitancy was high among this population and particularly high among Black health care workers
- The primary concerns were related to side-effects and safety
- The authors recommend a communication strategy that includes an acknowledgement that systemic racism is a justifiable reason for mistrust and that community engagement from trusted sources is one approach to overcome this mistrust

Menges et al. estimated the long-term burden of COVID for the purpose of planning health care services

- The authors used data from 431 residents of Zurich who had been diagnosed with COVID to estimate the proportion with continued effects at least six months after their diagnosis
- After at least six months, 55 percent had lingering fatigue, 26 percent had not fully recovered, and 26 percent had symptoms of depression
- They note the need for additional health care services to address the lingering conditions among survivors

We've been monitoring recent, relevant literature (2/2)

Choi et al. examined the role variability in transmission rates had in the spread of COVID in Massachusetts with a particular focus on the rapid decline in January and the implications for herd immunity

- The authors used town-level data from April 15th, 2020 to February 9th, 2021 to identify variations in spread
- Towns with high (low) rates of spread in 2020 saw a rapid (slow) decline in cases in January of 2021
- They note that this variation implies standard estimates for herd immunity may overestimate the level of infections and vaccinations required for herd immunity
- However, if behavior and NPIs are relaxed, communities with low levels of COVID would be the most vulnerable

Gold et al. investigated COVID clusters among Georgia educators in December and January

- The authors examined nine clusters with 13 educators, 32 students, and 18 household members
- Educator-to-educator and educator-to-student transmission appeared to be the primary modes for the clusters
- While the sample was small, this study highlights the importance of vaccinating teachers

Gordon et al. studied the effect COVID lockdowns had on the exposure to spoken language for children with cochlear implants

- The authors collected data on 45 children with cochlear implants in Ontario, Canada
- They found a large decline in the exposure to spoken communication among these children
- This could lead to delays in social, language, and cognitive development
- This work builds on the literature indicating that the indirect effects of COVID include negative consequences for childhood development and skill acquisition that may require intervention

What is next for modeling and analysis?

Pandemic modeling has greatly evolved over the last year

- Initially, there was a dearth of high-quality data and the models were typically either SEIR-based or statistical
- As behaviors and policies changed, the models grew in complexity to respond
- Growing immunity, behavioral changes, and other factors will make modeling for the purpose of producing accurate forecasts particularly challenging in the coming months

At this stage of the pandemic, modeling and data analysis will be useful for addressing specific types of questions:

- How might the spread change as new variants enter Virginia?
- Which segments of the population remain the most vulnerable?
- As vaccinations increase and case levels decline, which NPIs can be relaxed and when?
- Are there early warnings or triggers that should be monitored to help inform policy?

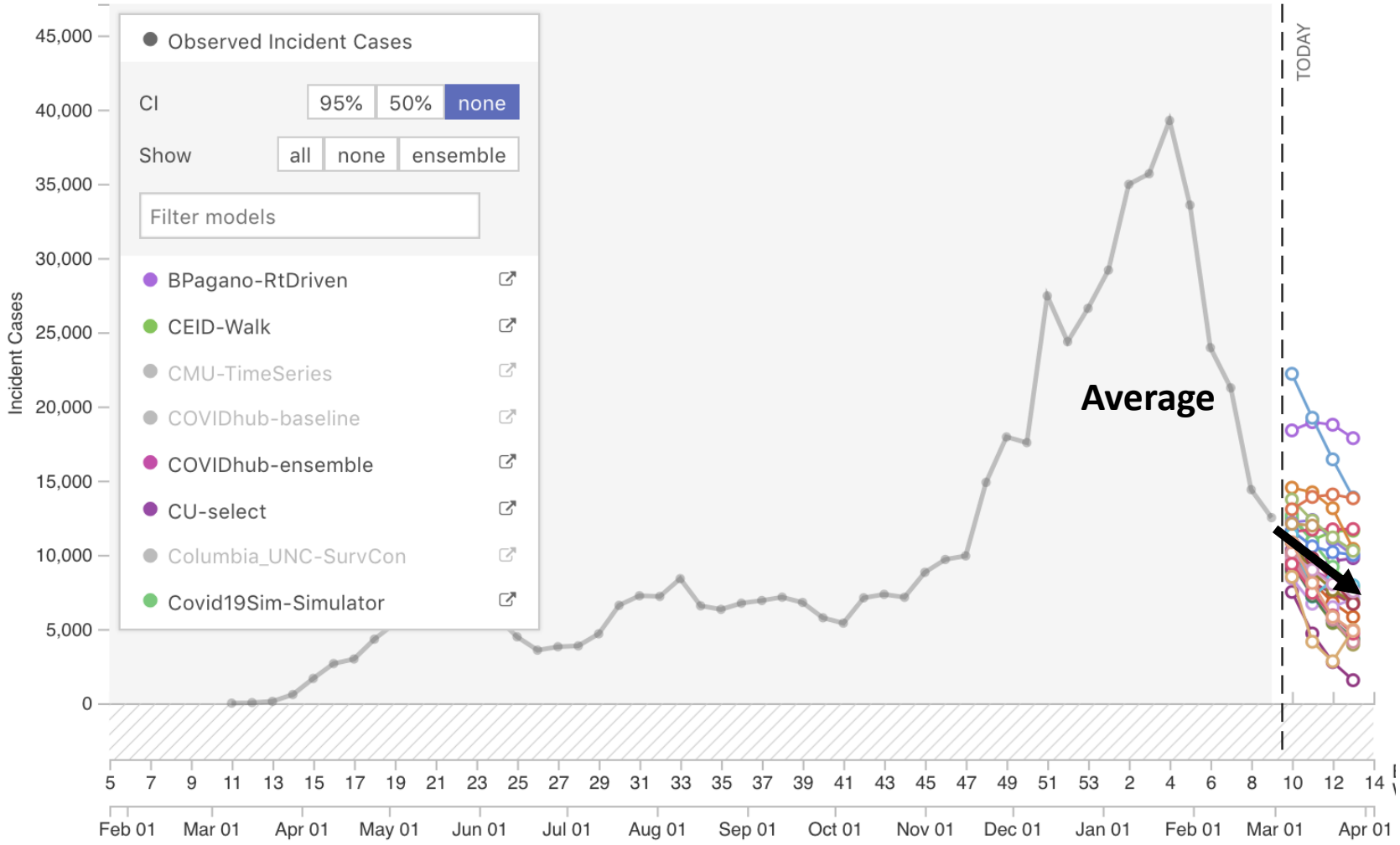
For other questions, surveillance is likely to be more useful:

- How widespread are the variants in Virginia?
- How many cases should we expect in the next few weeks?

Robust testing programs are necessary to conduct effective surveillance

- Data on the sampling approaches are useful to understand which areas and populations are well covered versus under-covered
- Improving external access to data sources like wastewater testing or genomic sequencing could improve analysis

The models are generally forecasting a continued decline in cases but many are projecting a plateau



There is broad agreement among the forecasts that cases will decline

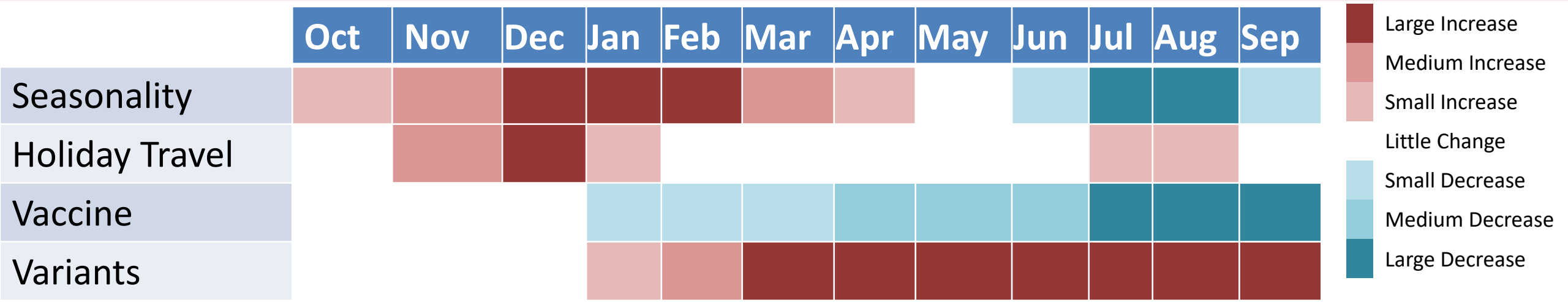
- Roughly one third of models are estimating a plateauing of cases in the next few weeks
- The models differ on specific levels more than change
- The variation between models typically arises from different definitions (e.g., cases versus infections)

Many of the model predictions lag the data

- This means that they match the trends in retrospect but not as forecasts

Source: COVID-19 Forecast Hub, https://viz.covid19forecasthub.org/
Accessed March 3rd

There are several factors driving the spread



There are several factors that will continue to drive the spread for the next few months

- Seasonal effects for COVID-19 appear to have increased spread during colder weather
- Holiday activities appear to have increased spread but are largely over for now
- The vaccines may begin to meaningfully slow the spread in the next month or two, but maintaining the rate of vaccine administration will require outreach to skeptical subpopulations
- The B.1.1.7, B.1.351, and P.1 Variants of Concern may increase the rate of spread as they enter Virginia, and future variants could also change the severity or the efficacy of vaccines

There are some key unknowns about the current spread

- How many people have been infected with COVID-19 and have lingering protection?
- To what degree are people complying with best practices for prevention?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