# VIRGINIA

## COVID-19 Update April 8th, 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.

# Bottom Line Up Front
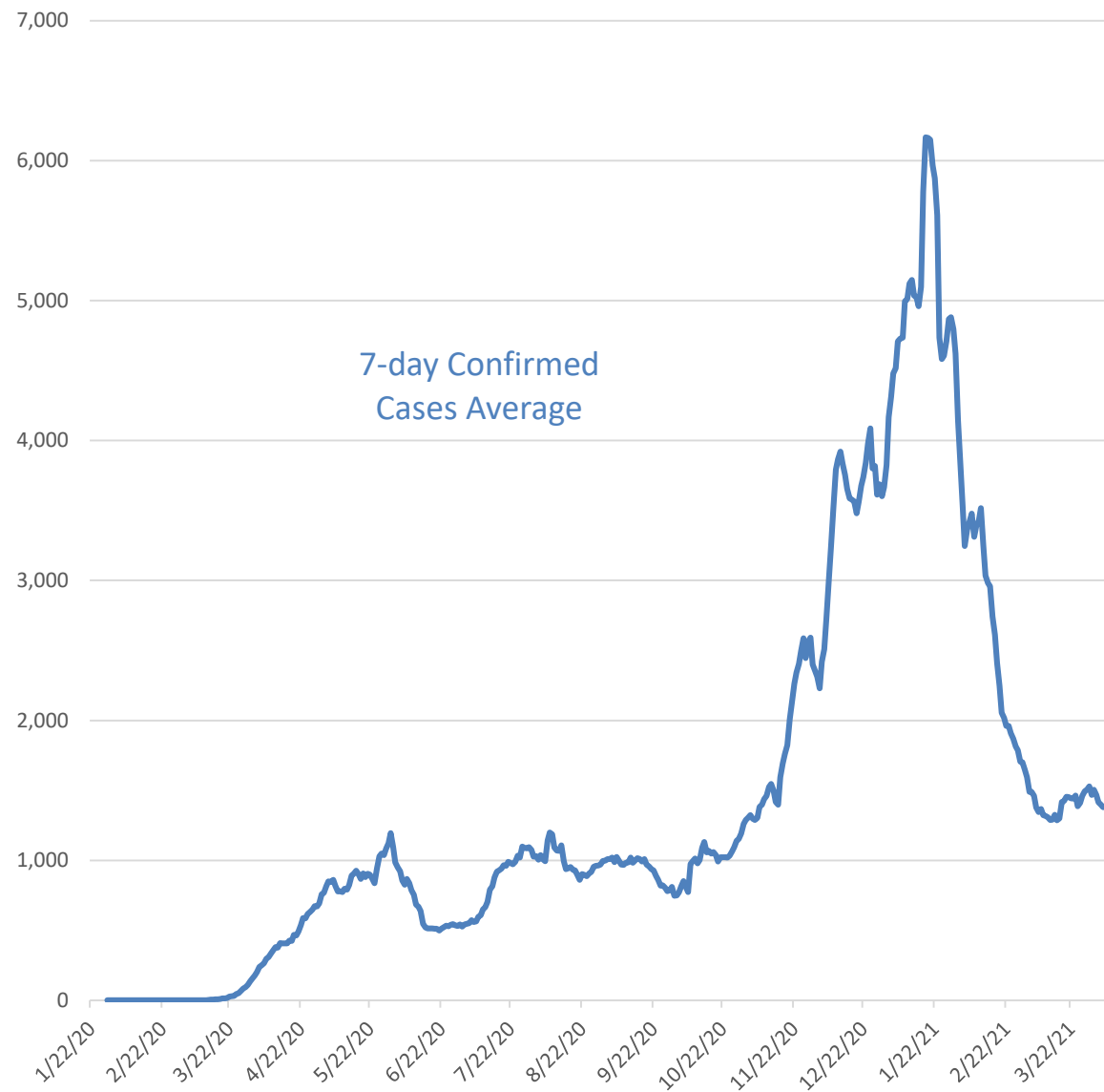
**Confirmed cases** have declined to 1,381 per day (-10%)
- This is up 7 percent from the low three weeks ago and 13 percent from the summer highs

**COVID hospitalizations** have risen slightly to 1,059 (+1%)

**COVID tests** have stabilized but at a lower level than in the winter
- The test positivity rate has dipped from 8.3 percent last week to 7.8 percent

**Vaccination** is continuing to increase rapidly (+2.9 percentage points fully vaccinated and +1.1 percentage points partially vaccinated)

**Despite growth in the share of the population vaccinated, case rates remain high**
- The variants of concern and higher movement may be increasing the case numbers among the unvaccinated
- The linkage between case rates and hospitalizations may be changing as the elderly population is increasingly vaccinated
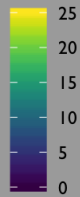
7-day Confirmed
Cases Average

# Case trends are mixed across the counties, but levels are drifting lower overall

## CASE COUNT
Source: VDH



Cases per 100,000
25
20
15
10
5
0

**Yellow** indicates at least 25 cases per 100,000

**Case levels have dipped across the Commonwealth**
- 75 percent of counties have fewer than 20 cases per 100,000 (66 percent last week)
- 29 percent of counties have fewer than 10 cases per 100,000 (17 percent last week)

These data were updated April 7<sup>th</sup> and represent a seven-day average of the previous week

# Most neighboring states' case levels were flat or down last week

Over the last 7 days, Virginia had 16.7 new confirmed cases per day per 100,000 (-10% from last week)

## Very high case loads (>20):
- Maryland (21.5 new cases per 100k, +6% from last week)
- West Virginia (21.4, -7%)
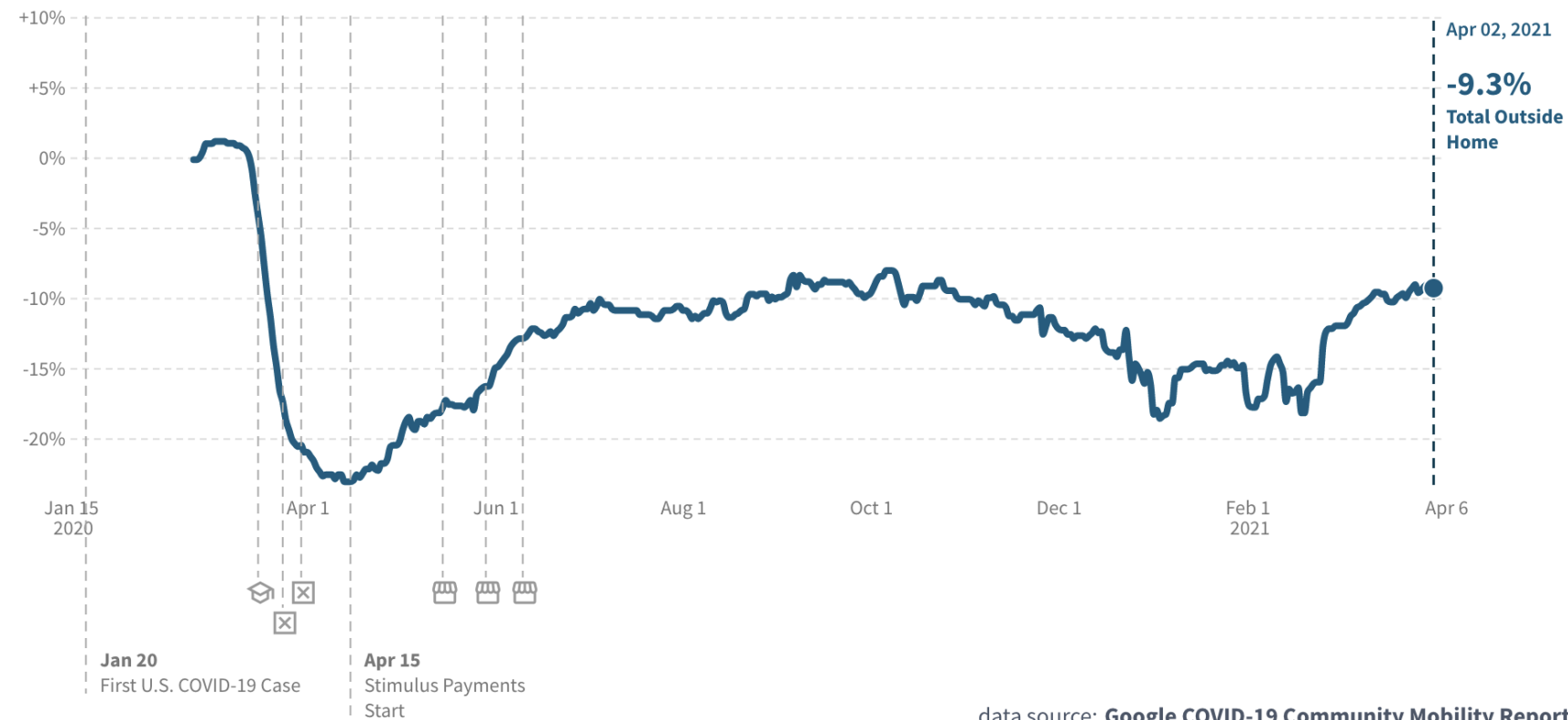
## High case loads (10-20):
- District of Columbia (16.6, -11%)
- North Carolina (15.3, -13%)
- Tennessee (15.7, +1%)
- Kentucky (12.1, -8%)

## Lower case loads (<10): None

These data were updated April 7th and represent a seven-day average of the previous week

# Mobility data estimate that time away from home is back to the levels from the summer and fall



data source: **Google COVID-19 Community Mobility Reports**

**Mobility is down 9.3 percent from pre-pandemic levels**

- This is up around five percentage points from the range in January and February of 2021
- The current level is roughly the same as July through October of 2020

**These types of data have been found useful in estimating the case growth rate in the past**

- The recent growth may have been partially driven by higher mobility

Source: Google COVID-19 Community Mobility Reports via
https://tracktherecovery.org/
Accessed April 6th

# Variants could increase the rate of spread

**The CDC has Identified five variants of concern that spread more rapidly than the baseline variant and may also bypass immune protection from vaccines or previous infection**

- B.1.1.7 is also known as the U.K. variant and has been found in Virginia and all neighboring states
- B.1.351 ("South African variant") has been found in Virginia and most neighboring states
- P.1 ("Brazilian variant") has been found in Maryland and Tennessee but not in other neighboring states
- B.1.427/B.1.429 ("California variants") have been reported in Virginia and Maryland

**Additionally, there are three variants of interest**

- B.1.525/B.1.526 ("New York variants") are estimated to spread more quickly than the baseline
- P.2 is another Brazilian variant that is estimated to be similar to P.1

**Testing will be key to tracking the variants**

- Banada et al. produced an RT-PCR screen for a set of mutations common to the B.1.1.7, B.1.351, and P.1 variants
- Spurbeck et al. describe the successful implementation of a wastewater-based epidemiology approach to monitor viral load including a PCR approach capable of detecting the mutations of the S protein characteristic of the B.1.1.7 variant
- Similarly, Graber et al. developed an approach for estimating the prevalence of B.1.1.7 using wastewater

**Contact tracing could be particularly useful in containing outbreaks of these variants when paired with better surveillance**

# Eighteen percent of Virginians are fully vaccinated, and an additional fourteen percent are partially vaccinated

| Age | 0-9 | 10-19 | 20-29 | 30-39 | 40-49 | 50-59 | 60-69 | 70-79 | 80+ | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| **Fully Vaccinated** | 0 | 11,311 | 111,195 | 160,755 | 185,095 | 230,447 | 352,345 | 342,285 | 171,551 | 1,564,984 |
| **% Full** | 0.0% | 1.0% | 9.6% | 13.7% | 17.2% | 20.5% | 36.1% | 55.7% | 55.1% | 18.3% |
| **Partially Vaccinated** | 0 | 33,090 | 139,322 | 182,590 | 203,916 | 258,491 | 239,950 | 115,779 | 55,313 | 1,228,451 |
| **% with Partial** | 0.0% | 3.0% | 12.1% | 15.6% | 18.9% | 23.0% | 24.6% | 18.9% | 17.8% | 14.4% |
| **Confirmed Cases** | 27,835 | 65,649 | 118,729 | 100,443 | 90,638 | 89,202 | 61,255 | 33,148 | 24,019 | 610,918 |
| **% Confirmed Cases** | 2.8% | 6.0% | 10.3% | 8.6% | 8.4% | 7.9% | 6.3% | 5.4% | 7.7% | 7.2% |

Source: VDH, April 6th

**Vaccinations are being rolled out in Virginia very rapidly**
- As of April 5th, 4,532,375 doses have been distributed and 4,344,970 doses have been administered
- Over the last seven days, Virginia has averaged 78,785 doses per day

**We may be seeing the effects of the vaccinations already**
- More than 73 percent of people over the age of 70 are at least partially vaccinated
- That population only had 597 confirmed cases in the last week compared to 2,624 cases two months ago when only 30 percent had received at least one dose
- At the beginning of February, ten percent of the cumulative cases had been among those over the age of 70, but only six percent of last week's cases were among the elderly

**Vaccine supply is currently the constraint, but efforts to improve demand are needed to reach needed levels of protection** 7

# We've been monitoring recent, relevant literature

**Grossmann et al. examined the shortcomings of SEIR-type models for detailed projections**
- The authors compared an SEIR model to a more sophisticated agent-based model under different social network configurations
- Because the SEIR model cannot account for the variation in social network structure, those types of models may not be suitable for informing policies that are highly sensitive to estimates of the rate of spread

**Taquet et al. used medical records to estimate the prevalence of neurological and psychiatric outcomes among 236,379 COVID survivors six months after infection**
- They found that 34 percent had at least one negative neurological or psychiatric outcome with mood, anxiety, or psychotic disorders being the most common with 24 percent
- In a similar study, Harerall et al. tracked 2,149 Swedish health care workers who had tested positive for COVID and found that, of those seropositive eight months after their infection, 15 percent had lingering symptoms, most commonly the loss of smell

**Liu et al. studied 617 school districts to determine the effects of different modes of schooling on the spread of COVID**
- In the fall of 2020, 47 percent were hybrid, 13 percent were remote, and 40 percent were in-person
- Hybrid districts were found to have case growth that was significantly higher than districts using either exclusively remote or exclusively in-person learning
- The difference in case growth between remote and in-person districts was not statistically significant

# 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 and hybrid/ensemble models are also used now
- 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?

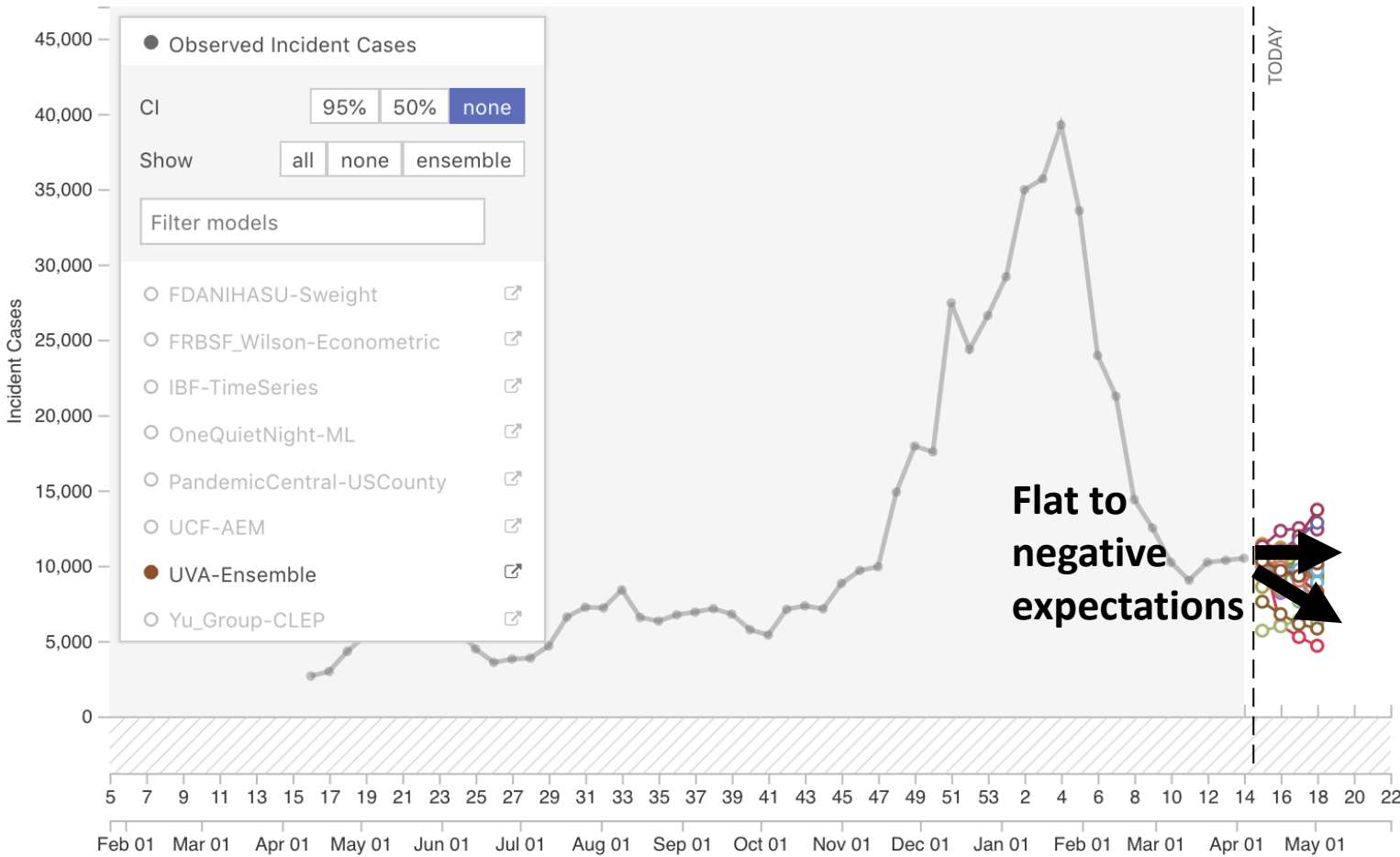**For other questions, surveillance is likely to be more useful:**
- How widespread are the variants in Virginia?
- How many cases should we expect in the next few weeks?

**Robust, integrated 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 estimating flat to lower case levels over the next few weeks



Observed Incident Cases

CI: 95% | 50% | none

Show: all | none | ensemble

Filter models

○ FDANIHASU-Sweight
○ FRBSF_Wilson-Econometric
○ IBF-TimeSeries
○ OneQuietNight-ML
○ PandemicCentral-USCounty
○ UCF-AEM
● UVA-Ensemble
○ Yu_Group-CLEP

**Flat to negative expectations**

**The models differ on whether the rates will level off or decline**
- Some models, like the SEIR-type, are structurally incapable of producing a plateau at a relatively high level of cases
- It is not clear how the trade-off between the variants and vaccines is made in each model, and this will be particularly challenging for statistical models
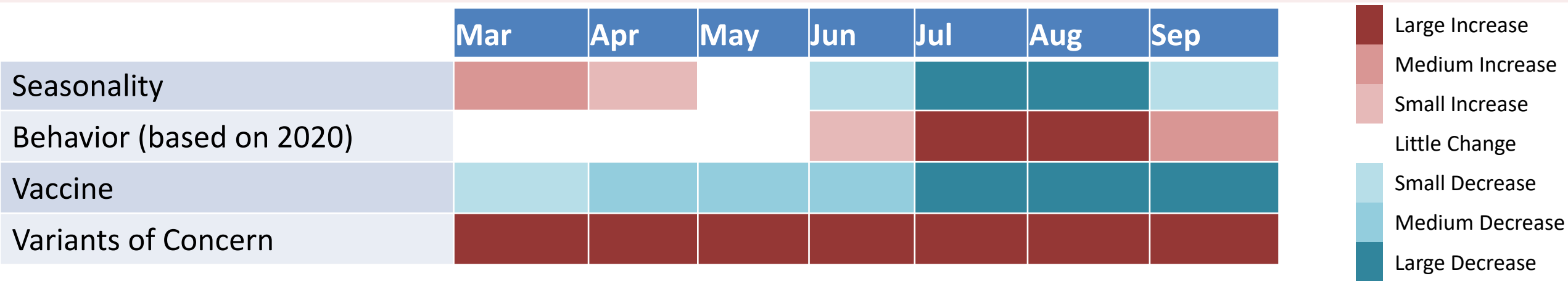
**Many of the model predictions lag the data**
- This means that they match the trends in retrospect but not as forecasts

Source: COVID-19 Forecast Hub, https://viz.covid19forecasthub.org/
Accessed April 7th

| | Mar | Apr | May | Jun | Jul | Aug | Sep |
|---|---|---|---|---|---|---|---|
| Seasonality | Medium Increase | Small Increase | | Small Decrease | Large Decrease | Large Decrease | Small Decrease |
| Behavior (based on 2020) | | | | Small Increase | Large Increase | Large Increase | Medium Increase |
| Vaccine | Small Decrease | Medium Decrease | Medium Decrease | Medium Decrease | Large Decrease | Large Decrease | Large Decrease |
| Variants of Concern | Large Increase | Large Increase | Large Increase | Large Increase | Large Increase | Large Increase | Large Increase |

Legend:
- Large Increase
- Medium Increase
- Small Increase
- Little Change
- Small Decrease
- Medium Decrease
- Large Decrease

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

- Seasonal effects for COVID-19 appear to increase/decrease spread with cooler/hotter weather
- Behavioral changes appear to have increased the rate of spread during the summer of 2020 and may have a similar effect this summer
- The vaccines have begun to meaningfully slow the spread for certain populations, but maintaining the rate of vaccine administration will require a continuation of the high acceptance rate
- The Variants of Concern may be increasing the rate of spread in Virginia, and future variants could also change the severity or the efficacy of vaccines

**There are some key unknowns about the current spread**

- How long does the immune protection from a prior infection last? From the vaccines? Against which variants?
- What portion of the population will eventually want to take a vaccine?

# What might a "new normal" look like and how might we influence it?

**Some of the factors that will influence the "new normal" can be influenced by policy, but others cannot**
- Efforts to maximize the vaccination rate will determine whether community immunity is feasible in Virginia
- Additionally, the spread of the variants and their nature will determine whether community immunity is feasible in any circumstance
- Even if community immunity is reached, outbreaks may still occur and require special interventions

**Regardless of the local case levels, some policies may be advisable until the global pandemic has abated**
- Efforts to monitor for outbreaks, track new variants of concern, and trace contacts may be useful to continue
- Similarly, low cost NPIs, such as masking, may be prudent to retain

**There will likely be substantial long-term consequences that may require additional resources**
- As of April 7th, 629,155 Virginians had been diagnosed with COVID, and 52,111 had been hospitalized for it
- Many of these people will have lingering physical and mental health consequences from their infections
- Patients with chronic conditions may suffer long term consequences due to delayed care
- Stress among health care providers has substantially lowered morale and may lead to additional attrition
- Further, distress and mental illness have risen substantially in the broader public and may require additional capacity to treat appropriately

**Efforts to ensure adequate capacity for timely care could mitigate the effects of these consequences**

Discussion and Questions