UVA COVID-19 Model Explorer

The stay at home order and other community mitigation strategies undertaken in Virginia successfully flattened the curve and kept hospitals from being overwhelmed. The model estimates that by taking a cautious approach to reopening, and improving testing and tracing, Virginia has avoided 911,291 cases since May 15*.

However, the COVID-19 pandemic remains a public health emergency. The future course of COVID-19 depends on all of us. In Virginia, cases are growing. The model forecasts new confirmed cases will peak at 9,980 per week during the week ending September 27, 2020. If residents and businesses adhere to good social distancing and infection control practices, new case growth rates may decrease. Otherwise, cases may peak later in the fall or winter.

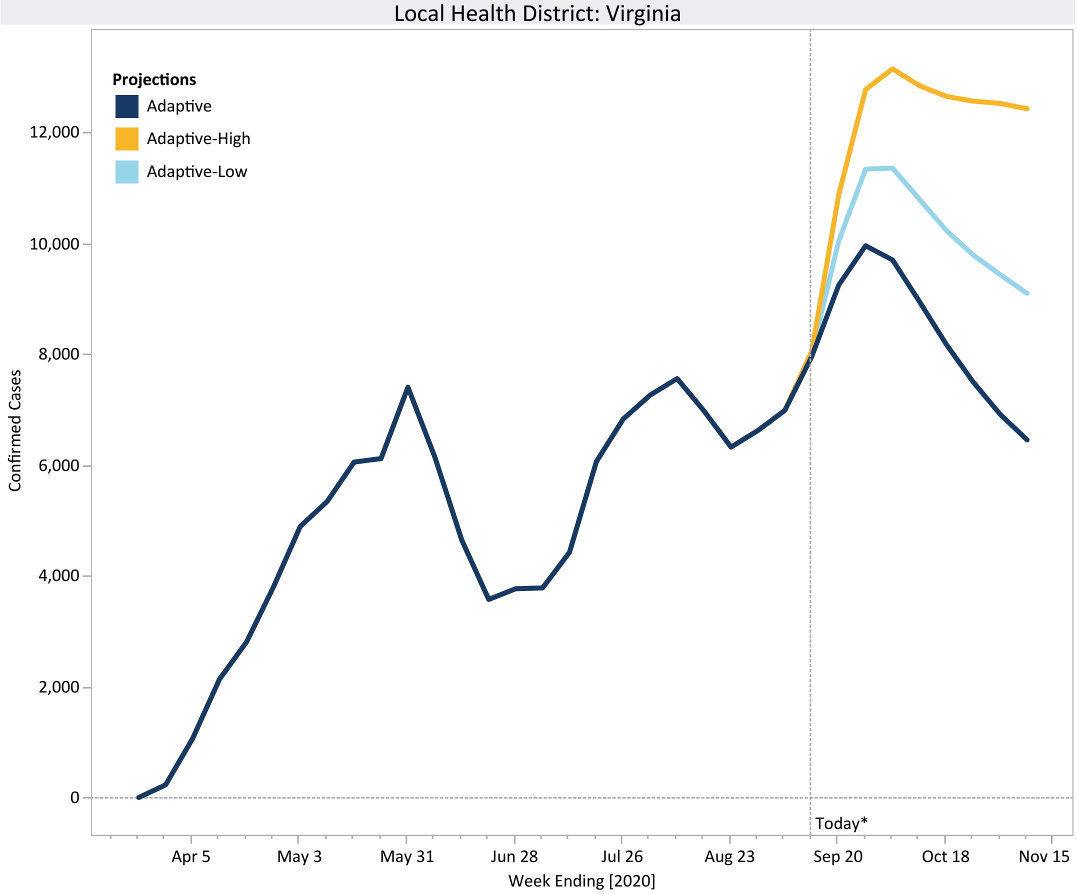
Estimated Impact of Phased Reopening and Vigilance

Scenario	Confirmed Cases† by Today*	Expected by Thanks giving*
Adaptive	121,430	208,237
Adaptive-Low	121,430	228,922
Adaptive-High	121,430	253,591

† Model estimates only. For case counts visit: https://www.vdh.virginia.gov/c..

Colleges, universities and K-12 schools are also reopening, pursuing a variety of online, in-person and hybrid models. The return to school, including student travel, and the onset of fall weather are likely to cause some increase in new cases but the extent is unknown. If the surge in low (10%) in Virginia then new cases may peak at 11,380 per week during the week ending October 4, 2020. If the surge is high (20%) then new cases may peak at 13,170 per week during the week ending October 04, 2020.

Local Health District: Virginia



Geography Type
Local Health District

Geography
- Virginia
- Alexandria
- Alleghany
- Arlington
- Central Shenandoah
- Central Virginia
- Chesapeake
- Chesterfield
- Chickahominy
- Crater
- Cumberland Plateau
- Eastern Shore
- Fairfax
- Hampton
- Henrico
- Lenowisco
- Lord Fairfax
- Loudoun
- Mount Rogers
- New River
- Norfolk
- Peninsula
- Piedmont
- Pittsylvania-Danville
- Portsmouth
- Prince William
- Rappahannock
- Rappahannock Rapidan
- Richmond

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UVA COVID-19 Model

What is a Model? | Understanding Models | Overview of the UVA PatchSim Model | UVA COVID-19 Model Explorer Overview | Model Explorer | Surge Map

VIRGINIA'S HEALTH IS IN OUR HANDS. Do your part, stop the spread.

What is a Model?

VIRGINIA DEPARTMENT OF HEALTH

Since the COVID-19 pandemic began, researchers, academics, and others, have built models to try to understand and forecast how COVID-19 is impacting, and will impact, Virginia and the nation. While it is tempting to dive into the data, it is important to understand what models are, what they can do, what they cannot do, and why we use them.

What is a model?

A simplification of reality.

A tool for understanding.

A technology that improves over time.

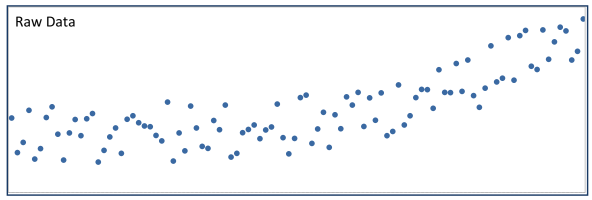
What can't models do?

Make precise predictions about future events - models are tools, not crystal balls.

Make choices among competing priorities.

Make up for a lack of knowledge, data, or subject matter expertise.

Advance the slider below to see how models can make complex data understandable



What can models do?

Help us understand complex systems.

Make clear what we do, and what we don't, know about these systems.

Make approximate forecasts of future outcomes.

Make approximate estimates about the effect of policy choices

Why use models?

To make reality comprehensible.

To see signals in the noise.

To guide and test policy options.

To forecast events.

> ***"All models are wrong, but some are useful."***
>
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Understanding Models

VIRGINIA DEPARTMENT OF HEALTH

Models come in a dizzying array of forms, from the simple to the unfathomably complex, each fine-tuned to a specific field and purpose. However, they share many common components. Like the parts of an engine, a model is only as good as its components. As these compenents improve, the model improves as well.

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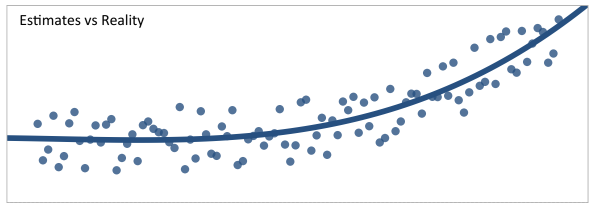


Basic Model Components:

Data is the fuel for models. More data, and higher quality data, means better results. Data itself usually consists of two parts: independent variables and dependent variables. It is best to think of dependent variables as the factor being estimated, while independent variables do the work of estimating. Regardless, models love data. More and higher quality data leads to more accurate and useful models.

Mathematical Equations: If data is the fuel for models, mathematical equations are the engine. And just like engines, they can range in complexity from simple electric turbines to hypersonic jet engines. Researchers have applied two basic types of mathematical equations to the COVID-19 pandemic: Statistical Models and Systems Dynamic Models. More on types of models on the next slide.

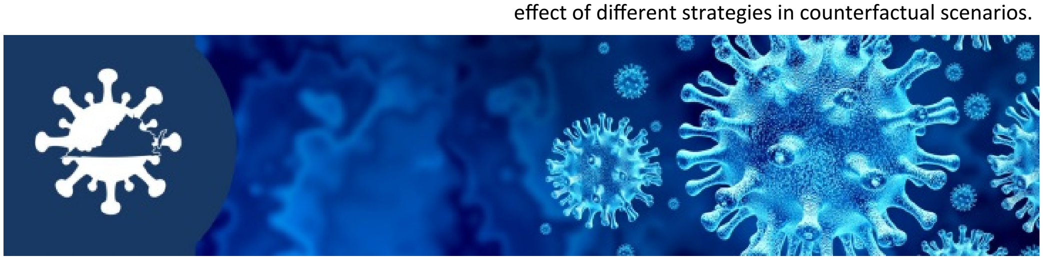
Assumptions and Parameters are the steering wheel, gas pedal, brake and shifter of a model. These are the factors in the model that change based on theory or knowledge (assumptions), or that can be changed based on purpose or preference (parameters). Sometimes these overlap. Examples of assumptions and parameters in COVID-19 models include the rate of spread, the length of asymptomatic periods, community mitigation strategies and level of compliance. Many assumptions and parameters are themselves estimated by models.

Basic Model Outputs:

Estimates are the reason we make models, and the output that most of us are interested in. An estimate is basically our best guess at the dependent variable, given what we know or want to test (assumptions or parameters), how those things interact (equation), and the situation being examined (data).

Confidence Intervals: Since models are simplifications of reality, any given estimate is likely to vary from reality, even if the model is perfect. Confidence intervals account for this variation. Confidence intervals are usually expressed in 95 percentile ranges. That is, we expect 95 percent of the real results to fall within the confidence intervals. It is important to note that wide confidence intervals do not indicate a poor quality model, just something that varies widely. For instance, bowling balls move in pretty straightforward ways. Rubber bouncey balls do not. A model that has narrow confidence intervals for the path of a rubber bouncey ball is likely a bad model.

Forecasts are similar to estimates, but it is important to note that estimates are based on past data while forecasts extrapolate that data into the future. Forecasts are far less certain than estimates, since underlying factors or conditions may change in ways we cannot predict, affecting assumptions and parameters. For instance, community mitigation strategies may change, or compliance levels decrease. Similar to forecasts are **counterfactuals**--better known as alternate histories. The "unmitigated" scenario in COVID-19 models is a good example of a counterfactual, since all states and countries have taken some action to mitigate the spread of COVID-19. Models are often used to estimate and forecast the effect of different strategies in counterfactual scenarios.



UVA COVID-19 Model

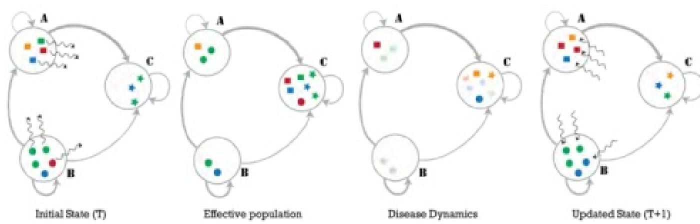
VIRGINIA'S HEALTH IS IN OUR HANDS. Do your part, stop the spread.

The UVA PatchSim Model

VDH VIRGINIA DEPARTMENT OF HEALTH

The University of Virginia's COVID-19 model uses the UVA Biocomplexity Institute's "PatchSim" simulation engine. It is a simulation model using the (S)usceptible, (E)xposed, (I)nfected, (R)ecovered epidemiologic method for modeling flu and other infectious diseases. The UVA Biocomplexity Institute has over 20 years of experience crafting and analyzing infectious disease models, and has provided response and support for Influenza, Zika, Ebola, and other epidemics.

More Information on the UVA COVID-19 Model is included in Briefing on Virginia COVID-19 Models and Slideshow, above



Limitations:

Projecting future cases precisely is impossible.

COVID-19 and the response to it are **unprecedented**, making parameter estimates difficult.

Evidence regarding seasonality is lacking. Seasonality is not currently included in the model.

Early parameters come from China studies that may not reflect reality in Virginia.

Assumptions about **counterfactual scenarios and human-behavior** once public health restrictions are lifted are especially difficult.

Early estimates are based on **limited, county-level case counts**, and may be less accurate in smaller, rural counties with fewer cases.

A **lack of testing** may bias all COVID-19 models.

Advantages of the UVA COVID-19 Model include:

It incorporates **Virginia-specific data**, including data provided by the Virginia Department of Health, the Virginia Hospital & Healthcare Association and other partners.

It uses county-level data to produce c**ounty-specific projections**, better tuned to different regions.

Spread between counties is explicitly modeled **using travel data**.

The PatchSim engine allows for **a lag between exposure and infection onset**, matching COVID-19's asymptomatic period.

Parameters can be adjusted to **model different policies**, helping officials improve policy choices and the public to understand decisions.

It is sensitive to new data, and **will get more accurate in time** as more relevant data becomes available and Virginia-specific parameters are developed.

UVA COVID-19 Model Explorer Overview

Virginia Department of Health staff created the UVA COVID-19 model explorer to assist the public in understanding the implications of the model in their community, and what the model tells us about the effectiveness in community mitigation strategies in their community. It includes weekly estimates and forecasts of **confirmed cases** only, for different scenarios, without confidence intervals, for communities at the locality level, the local health district (LHD) level, and by metropolitan area (areas in Virginia only).

What do the models tell us about Virginia's community mitigation efforts?

First, Virginia's public health restrictions and social distancing efforts worked. They paused the spread of COVID-19.

However, the assumption that the public will maintain social distancing and other mitigating efforts, and that these will work without public health restrictions, is untested. There are already signs that social distancing is waning.

Even with these assumptions, the model shows that case growth may increase quickly once public health restrictions are eased--possibly overwhelming hospital capacity. For this reason, Virginia's residents should follow the guidelines in the Forward Virginia plan closely. The Virginia Department of Health is also working to increase testing, and is hiring over 1,300 contact tracers, investigators and other personnel to stop the spread of COVID-19 as we move through the phases of the Forward Virginia plan.

The Projections

The UVA team continues to improve the model weekly. This week the model underwent a major overhaul. Now that more historical data are available, UVA switched to an "adaptive fitting" methodology, where the model precisely traces past and current trends and uses that information to predict future cases. These new projections are based on recent trends the model learns through its precise fitting of each individual county's cases. This model replaces the 8 scenarios reported in prior weeks. Each health district now has its own unique scenario.

The new model also includes two "what-if" scenarios to predict what we might see if cases increase in response to seasonal effects in the Fall, such as schools re-opening and changing weather patterns. It is still too early to know the impact that these seasonal effects will have. For now, the model assumes a 10-20% increase in transmissibility beginning on Labor Day. The model will be updated regularly to incorporate new information.

Low impact of seasonal effects: 10% increase in transmission starting September 8, 2020.

High impact of seasonal effects: 20% increase in transmission starting September 8, 2020.

The model also uses the Full Rebound scenario to estimate the impact of prevention efforts by residents, business, and public health authorities.

Full Rebound: Instead of taking a phased approach, public health restricitions were lifted entirely on May 15, and interactions returned to 100% of pre-pandemic levels, with transmission returning to its pre-March 15 rate.

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UVA COVID-19 Model Explorer

VDH VIRGINIA DEPARTMENT OF HEALTH

The stay at home order and other community mitigation strategies undertaken in Virginia successfully flattened the curve and kept hospitals from being overwhelmed. The model estimates that by taking a cautious approach to reopening, and improving testing and tracing, Richmond, VA has avoided 143,115 cases since May 15*.

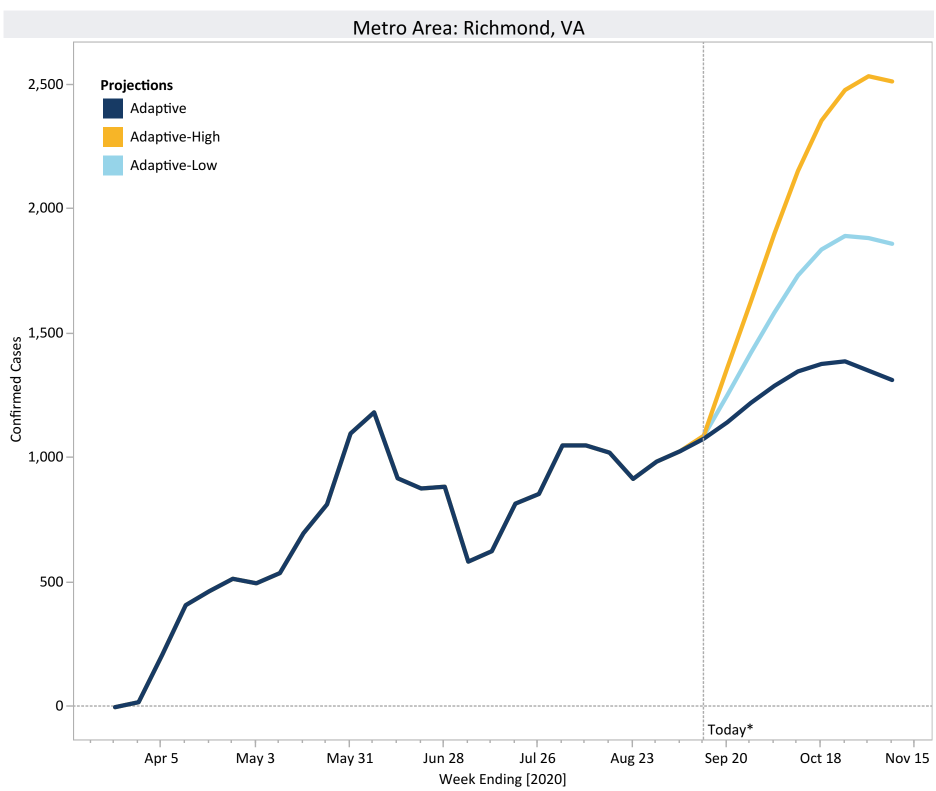
However, the COVID-19 pandemic remains a public health emergency. The future course of COVID-19 depends on all of us. In Richmond, VA, cases are growing. The model forecasts new confirmed cases will peak at 1,390 or higher per week during the week ending November 29, 2020 or later. If residents and businesses adhere to good social distancing and infection control practices, new case growth rates may decrease. Otherwise, cases may peak later in the fall or winter.

Estimated Impact of Phased Reopening and Vigilance

Scenario	Confirmed Cases† by Today*	Expected by Thanksgiving*
Adaptive	18,091	32,062
Adaptive-Low	18,091	36,182
Adaptive-High	18,091	40,940

† Model estimates only. For case counts visit: https://www.vdh.virginia.gov/c..

Colleges, universities and K-12 schools are also reopening, pursuing a variety of online, in-person and hybrid models. The return to school, including student travel, and the onset of fall weather are likely to cause some increase in new cases but the extent is unknown. If the surge in low (10%) in Richmond, VA then new cases may peak at 569.5 per week during the week ending November 15, 2020. If the surge is high (20%) then new cases may peak at 2,536 per week during the week ending November 15, 2020.



Geography Type
Metro Area

Geography
- Virginia
- Big Stone Gap, VA
- Blacksburg-Christiansburg..
- Bluefield, WV-VA
- Charlottesville, VA
- Danville, VA
- Harrisonburg, VA
- Kingsport-Bristol-Bristol, ..
- Lynchburg, VA
- Martinsville, VA
- Non-metro
- Richmond, VA
- Roanoke, VA
- Staunton-Waynesboro, VA
- Virginia Beach-Norfolk-Ne..
- Washington-Arlington-Ale..
- Winchester, VA-WV

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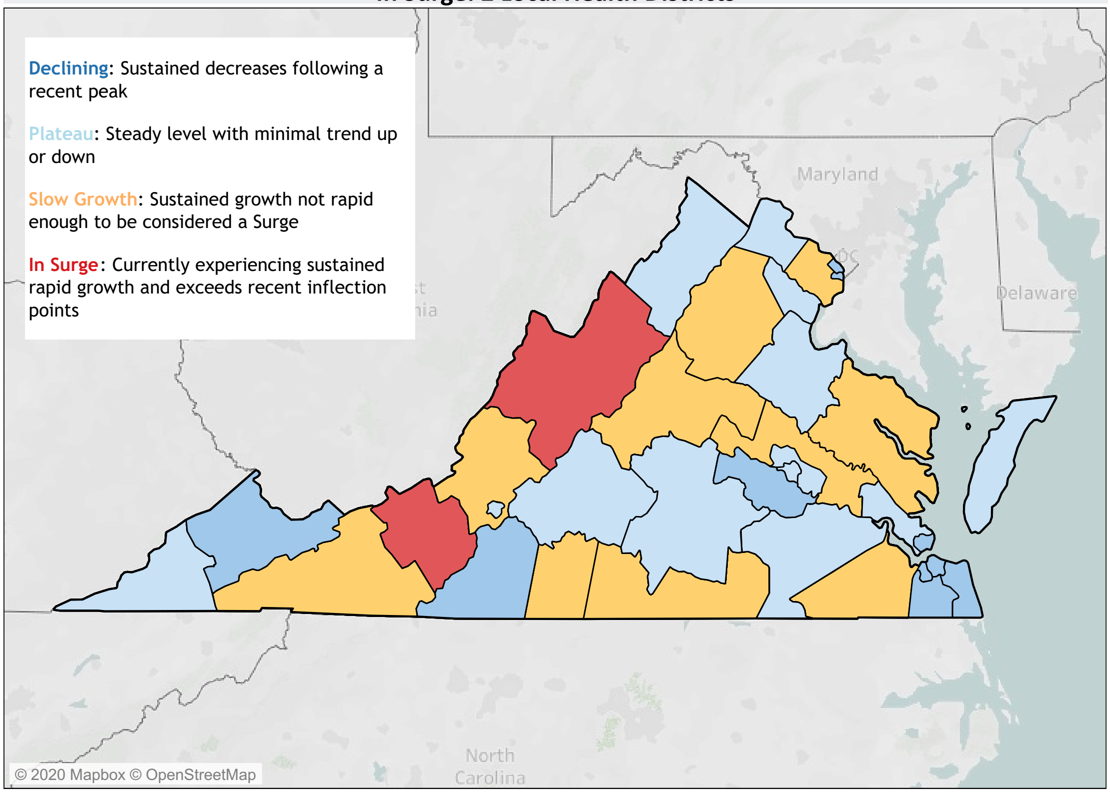
In Surge: 2 Local Health Districts



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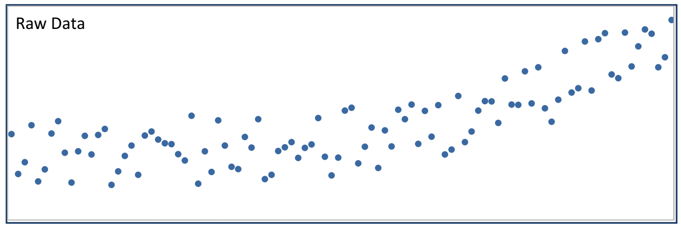

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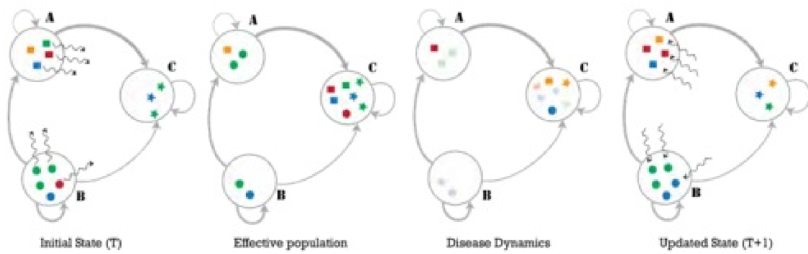

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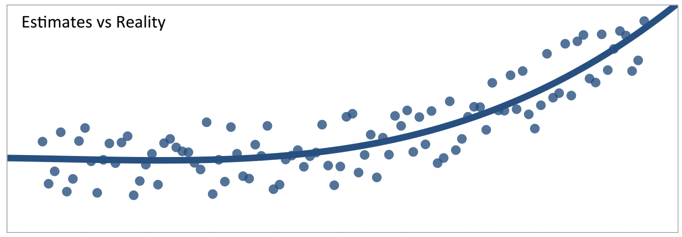

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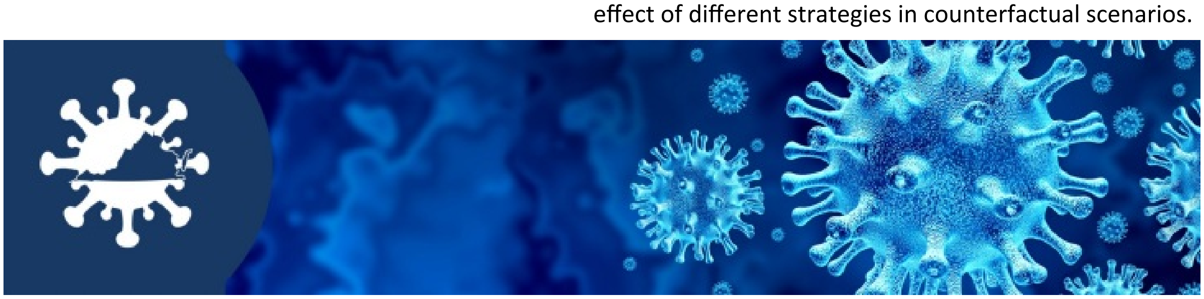
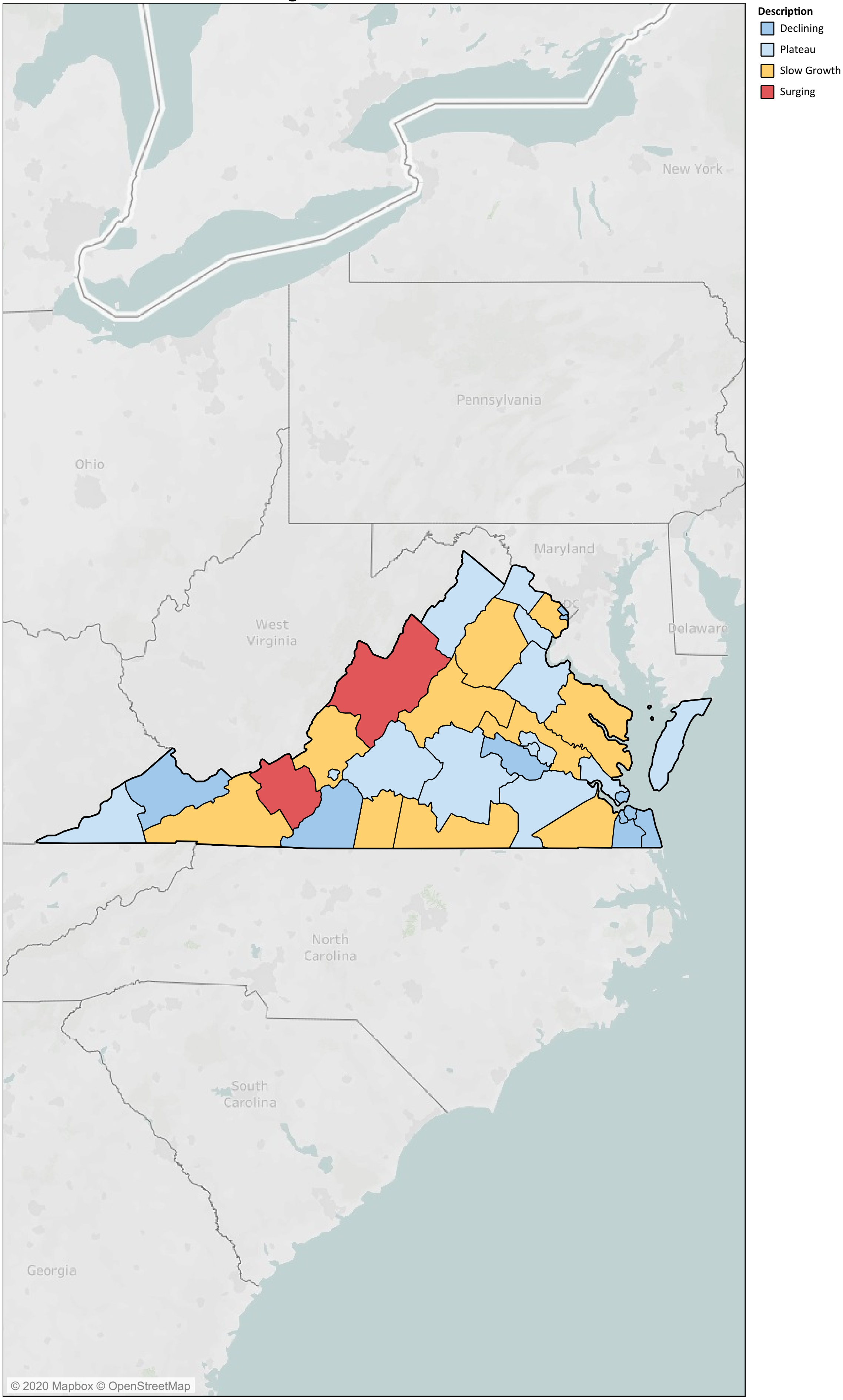


In Surge: 2 Local Health Districts



In Surge: 2 Local Health Districts