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# COVID-19: How states can forecast the impacts on state budgets

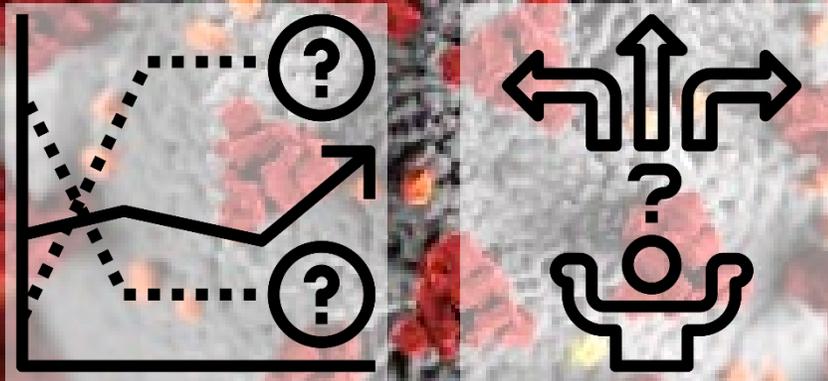
May 13, 2020

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# Today's webinar

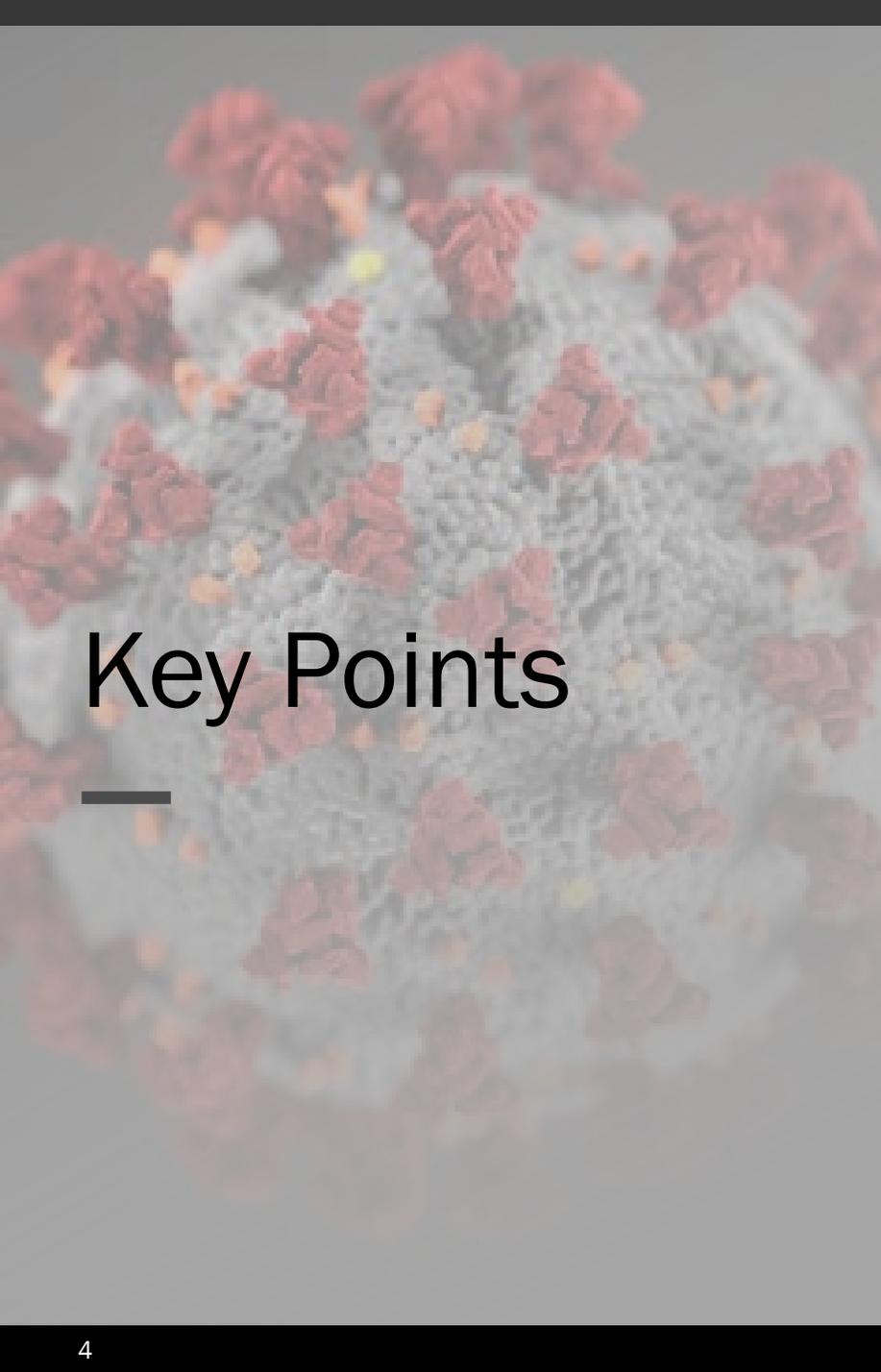
- **Dr. Dylan George**, vice president of In-Q-Tel and former senior policy advisor in the White House Office of Science and Technology Policy
- **Dan White**, director of public sector research with Moody's Analytics and former economist with the New Mexico State Legislature
- **Don Boyd**, co-director of the State and Local Government Finance Project, Rockefeller College, State University of New York at Albany and principal of Boyd Research

# COVID-19: epidemiological modeling overview



Dylan George, PhD

May 13, 2020



# Key Points

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- Data, analytics help understand the pandemic, consider potential scenarios, and respond

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- COVID-19 likely will be disruptive for months

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- Key metrics for understanding the pandemic

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- Need a coordinated effort on analytics for outbreak response – like weather forecasting

# Math modeling basics for outbreaks – SIR model

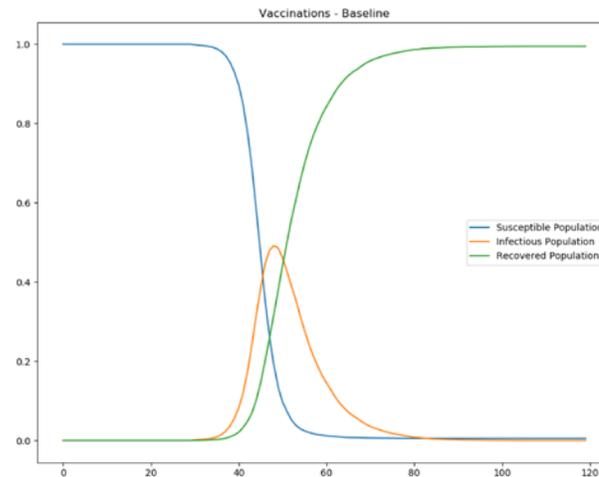
S – susceptible, I – Infectious, R- Recovered, removed



$$\frac{dS}{dt} = -\frac{\beta IS}{N},$$

$$\frac{dI}{dt} = \frac{\beta IS}{N} - \gamma I,$$

$$\frac{dR}{dt} = \gamma I,$$



1.  $R_0$  – estimate of pathogen spread
2. Herd immunity – threshold of population protection

[https://en.wikipedia.org/wiki/Compartmental\\_models\\_in\\_epidemiology](https://en.wikipedia.org/wiki/Compartmental_models_in_epidemiology)  
<https://idmod.org/docs/general/model-vaccination.html>

# How to measure spread of the virus?

$R_0$  average number of secondary cases

$R_0 > 1$  spread increases,  $R_0 < 1$  spread decreases

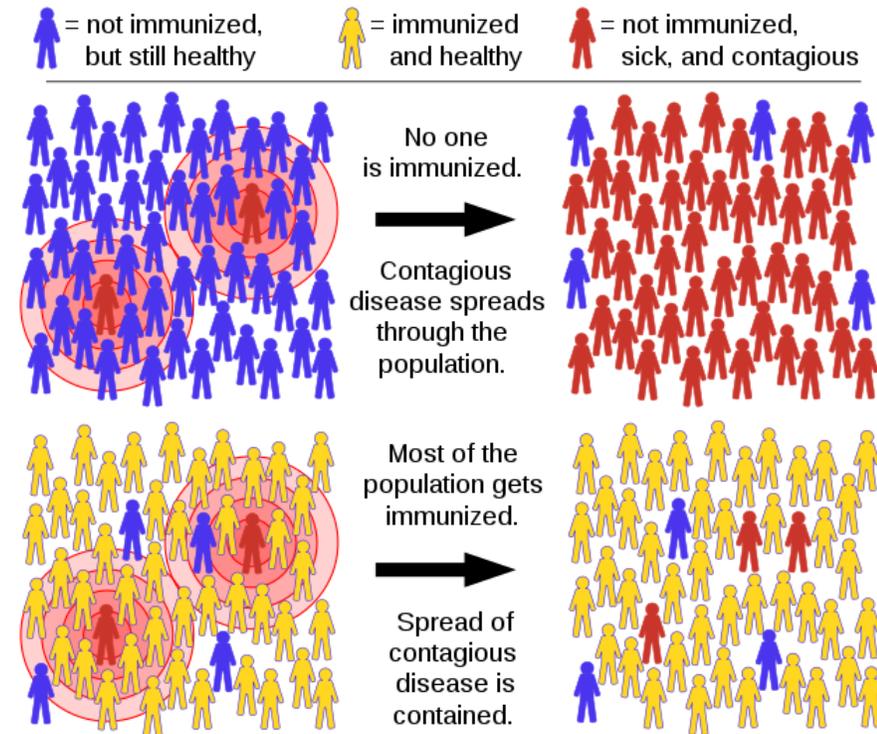
Three components –

- Probability of contact between susceptible and infectious individuals
- Probability of transmission given a contact
- Duration of infectiousness

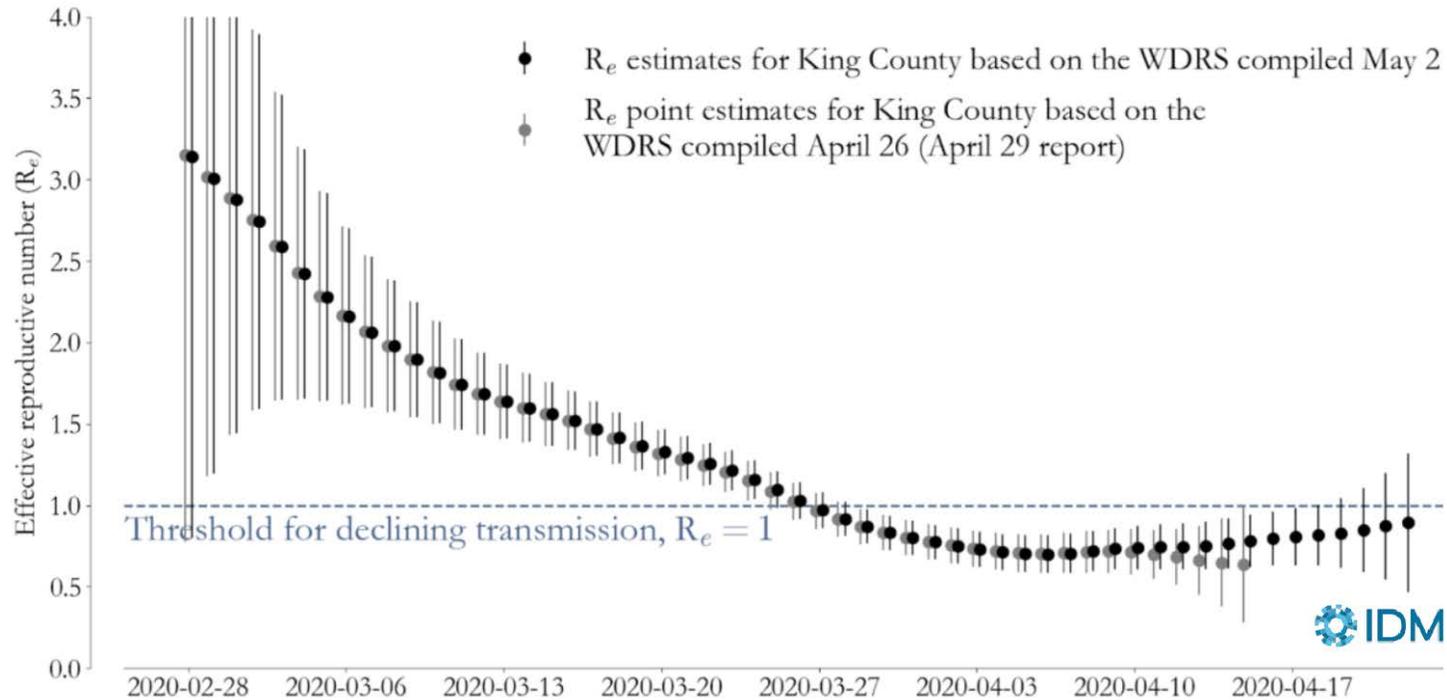
Contact is a critical component for spread.

# Herd immunity - immunity shield for a population

- Probability of contact between infectious and susceptible very low.
- Critical for vulnerable populations like immunocompromised
- Safest way to achieve herd immunity is through vaccination
- Can be estimated based on  $R_0$



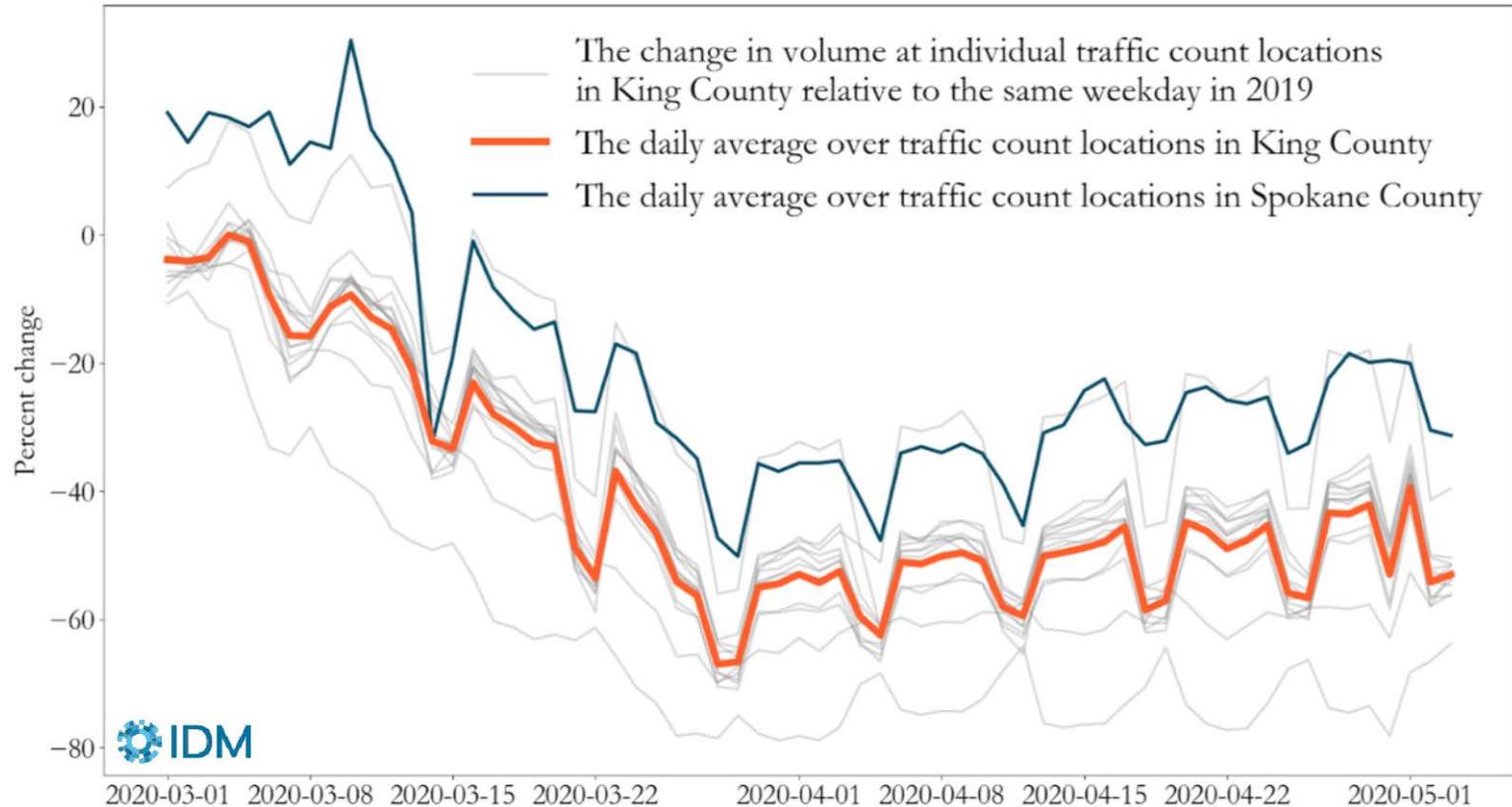
# Estimated spread changing through time



Estimates for King County, Washington State from IDM

1. Physical distancing is working to slow spread
2. More effort needed to control spread
3. Case identification and contact tracing as solutions

# Change in spread correlated with mobility data



- Washington State Department of Transportation mobility data.
- Traffic volume relative to same weekday last year.

Figure: "Recent data are consistent with increasing COVID-19 transmission through April 22 in King County and across Washington State." Available soon on [covid.idmod.org](https://covid.idmod.org).

# Unclear what scenario will happen

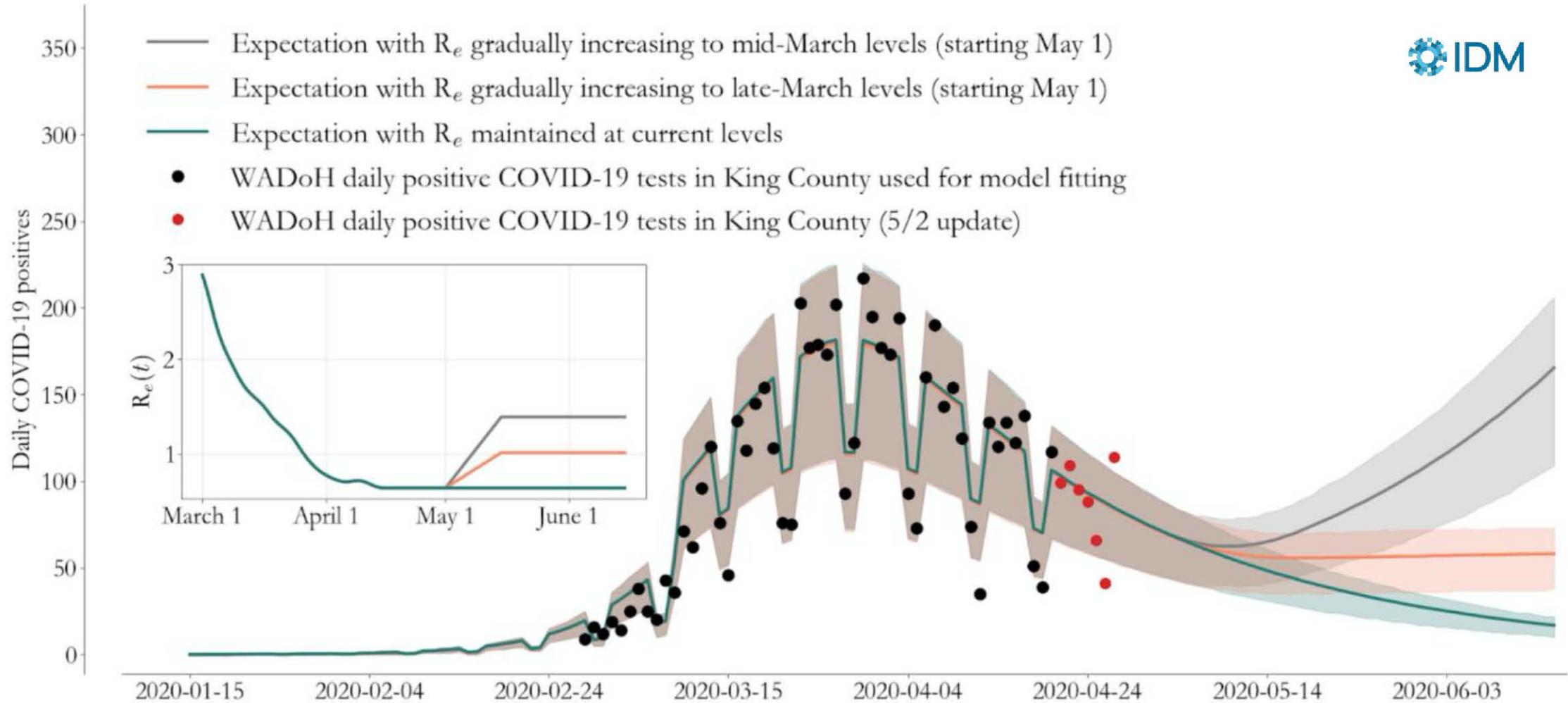


Figure: "Recent data are consistent with increasing COVID-19 transmission through April 22 in King County and across Washington State." Available soon on [covid.idmod.org](https://covid.idmod.org).



# Key metrics to watch

## Epidemiology – decreasing cases with sufficient testing, declining spread

- Deaths, case counts, trends; vulnerable populations – long-term care facilities
- $R_t$
- Testing capacity

## Hospital capacity – surge capacity to avoid being overwhelmed

- Hospitalization rates
- ICU bed availability
- PPE, ventilator, staff availability

## Public Health capacity – able to chase down the virus; “box it in”

- Contact tracing capacity; cases found from tracing
- Isolation, quarantine services

# Pandemics are not like natural disasters



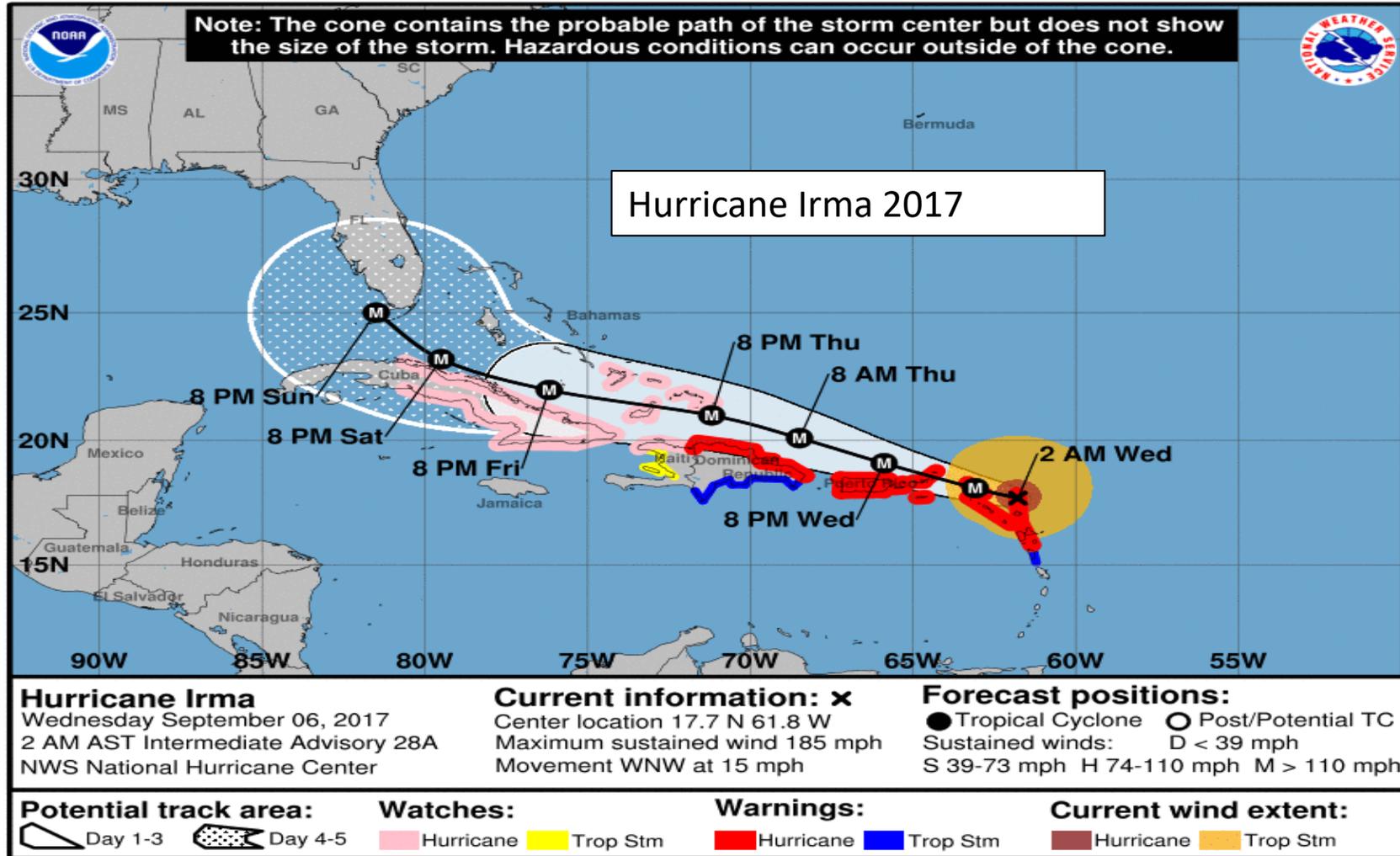
## Natural disasters

- Acute, discrete, rapid events – “lights and sirens”
- Bring people together uniquely
- Quickly transition efforts to recovery

## Pandemics

- Slowly unfold over months
- Social, economic, and political disruption
- Consequential decisions are being made under conditions of uncertainty

# Need a National Center for Epidemic Forecasting & Analytics



[https://www.nhc.noaa.gov/archive/2017/IRMA\\_graphics.php?product=5day\\_cone\\_with\\_line\\_and\\_wind](https://www.nhc.noaa.gov/archive/2017/IRMA_graphics.php?product=5day_cone_with_line_and_wind)



Thank you...

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# Acknowledgements

Marc Lipsitch, Harvard

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Caitlin Rivers, Johns Hopkins University

# Resources

CDC - <https://www.cdc.gov/coronavirus/2019-ncov/index.html>

JHU CSSE - <https://www.arcgis.com/apps/opsdashboard/index.html>

Resolve to save lives – <https://preventepidemics.org>

COVID Tracking Project - <https://covidtracking.com>

COVID act now - <https://covidactnow.org>

Institute for Disease Modeling - <https://www.idmod.org>

# References

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- How will country-based mitigation measures influence the course of the COVID-19 epidemic? <https://www.thelancet.com/action/showPdf?pii=S0140-6736%2820%2930567-5>
- This Is the Future of the Pandemic - <https://www.nytimes.com/2020/05/08/health/coronavirus-pandemic-curve-scenarios.html>

# State Stress Tests – COVID 19

# Managing Stress

## Baseline Scenario Moderate Stress

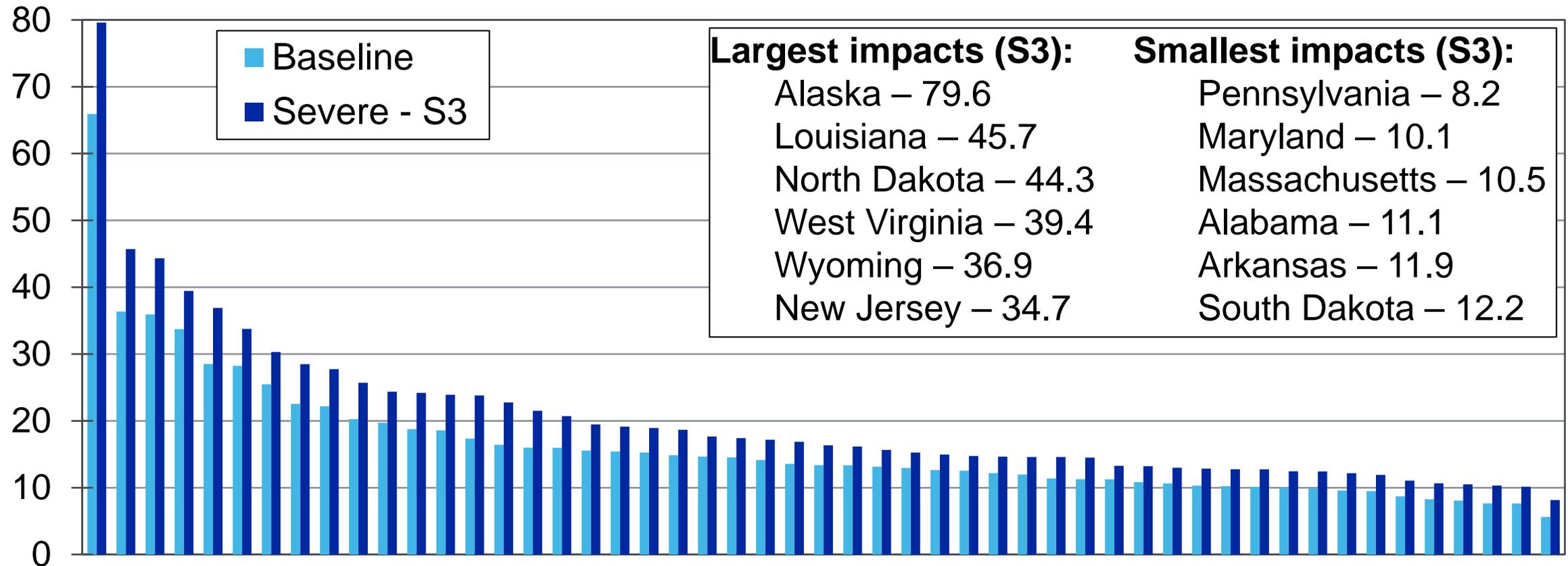
- » Deep recession in first half of 2020 followed by modest rebound. Travel and business restrictions in effect through late second quarter.
- » Peak jobless rate of 13% in 2020Q2. Peak-to-trough real GDP decline of 10%.

## S3 Scenario Severe Stress

- » Travel and business restrictions last into the third quarter, delaying recovery and causing more long-term disruptions.
- » Peak jobless rate of 17%. Peak-to-trough real GDP decline of 14%.

# Wide Range of Revenue Outcomes

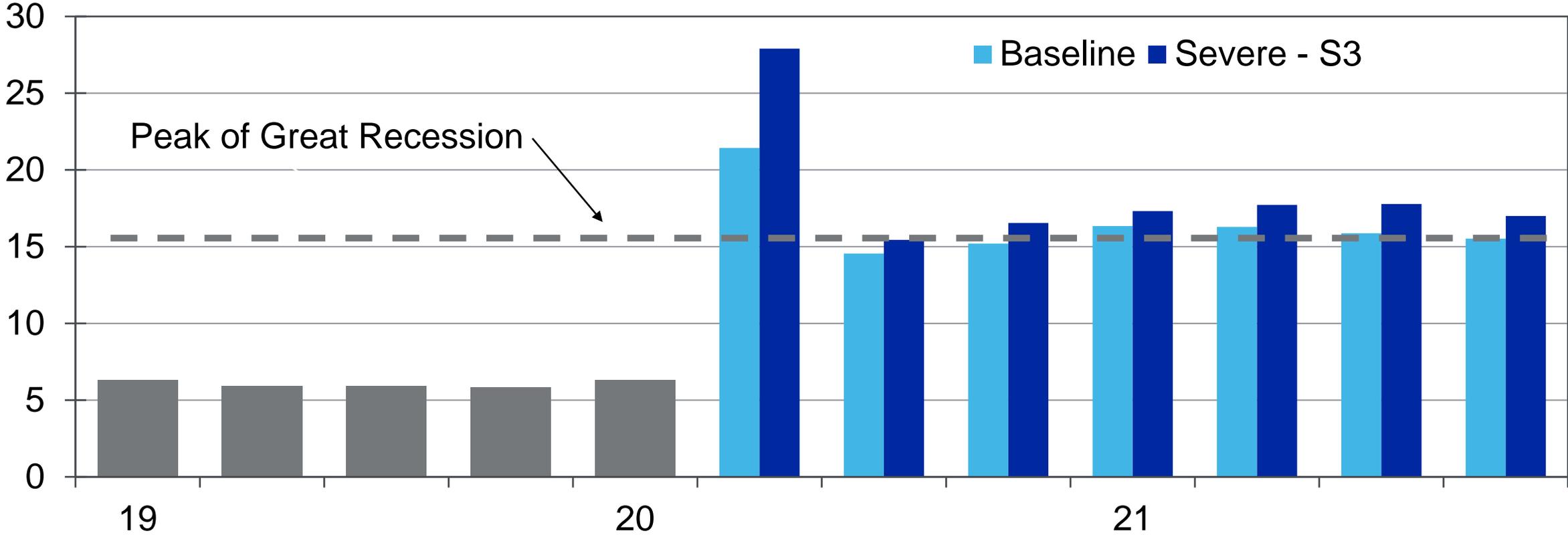
Estimated revenue losses, % of 2019 general fund revenues



Source: Moody's Analytics

# Unemployment Drives Medicaid Higher

Number of unemployed people in the U.S., mil



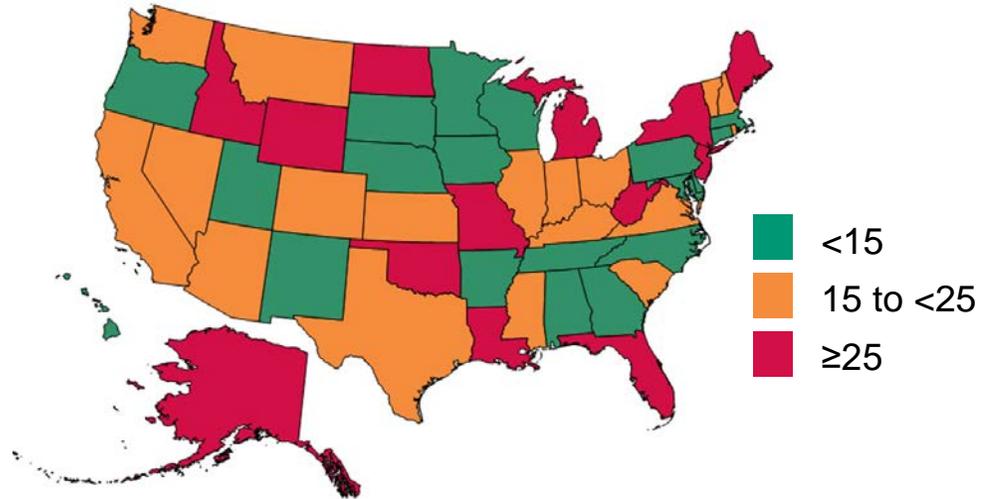
Sources: BLS, Moody's Analytics

# Economic Stress Is Unprecedented

	Baseline		Severe - S3	
	\$ bil	% of GF	\$ bil	% of GF
Revenues	130.4	14.8%	172.1	19.5%
Medicaid	27.4	3.1%	31.2	3.5%
Fiscal shock	157.8	17.9%	203.3	23.0%

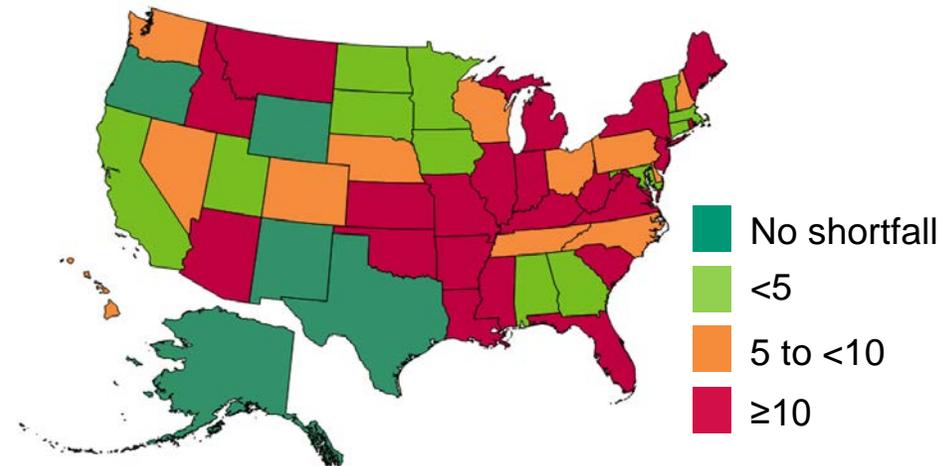
- » **5** states have the reserves they need to absorb baseline levels of projected economic stress
- » **12** states have most of the reserves they need to absorb the baseline scenario
- » An unprecedented **21** states would see budget gaps of 10% or more even after using reserves

Baseline Fiscal Shock, % of general fund



Sources: NASBO, Moody's Analytics

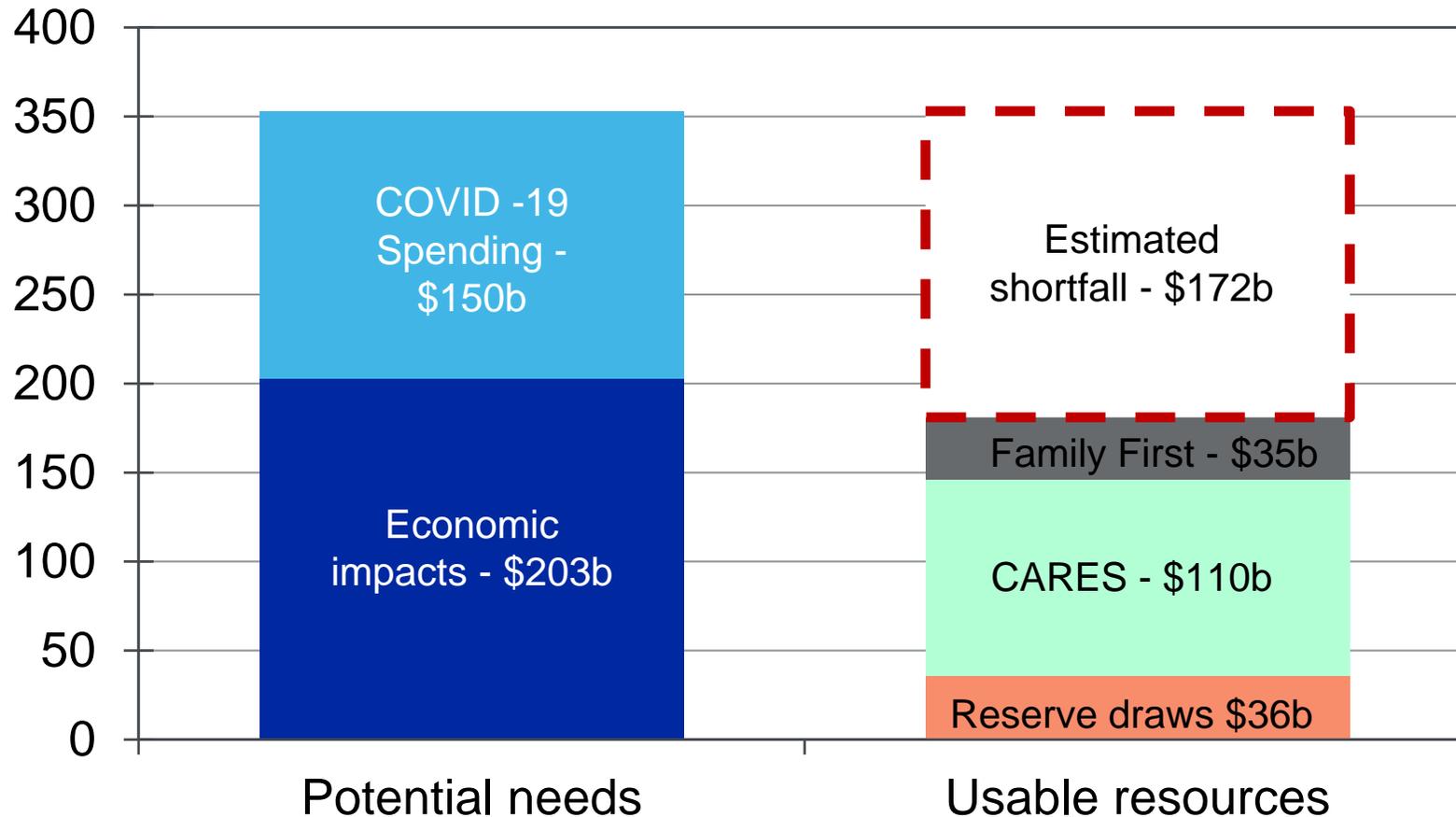
Baseline Shock Net of Reserves, % of general fund



Sources: NASBO, Moody's Analytics

# Even Best Prepared States Could Eventually Struggle

State governments, \$ bil



- » Assumes states will initially draw on roughly half of their overall reserves
- » Total need for additional federal aid comes to nearly **\$200 billion** through FY21
- » Impacts through FY22 could be at least another **\$100 billion+**
- » **Shortfalls of this magnitude will lead to massive layoffs and substantially increase the likelihood of local government defaults**

Source: Moody's Analytics

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