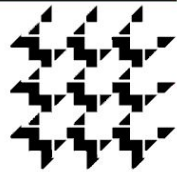


A Pandemic Model: Looking at Policies and Historic COVID Data to Promote a Resilient Future

Cole Bligh, Elisavet Gallou, James Robinson, Yuqing Zhou

DIMACS

*Center for Discrete Mathematics & Theoretical Computer Science
Founded as a National Science Foundation Science and
Technology Center*



RUTGERS

Miller Center for Community
Protection and Resilience

Introduction

Objective: Assess the response of the United States to the COVID-19 pandemic at the Federal and State level to identify evidence based policy decisions that could, if implemented, reverse the current course of the virus.

How should we prepare for the next pandemic?

Definitions:

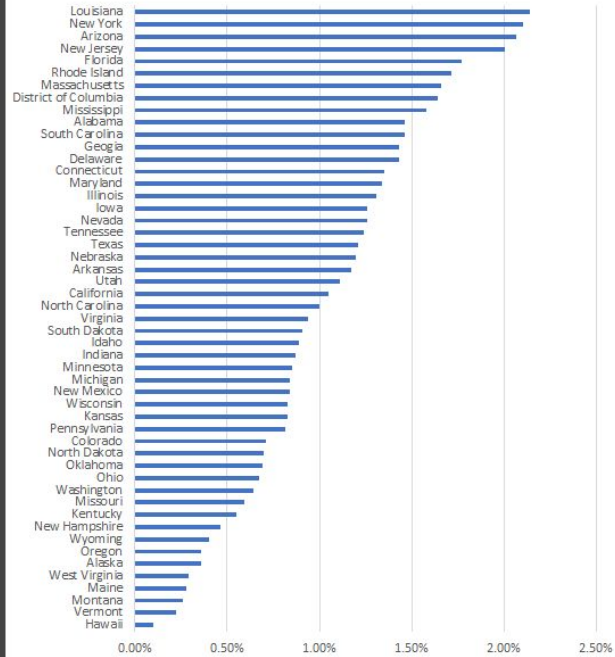
Fatality rate: measures of the SEVERITY of the condition.

Prevalence rate: determines a person's likelihood of having a disease.

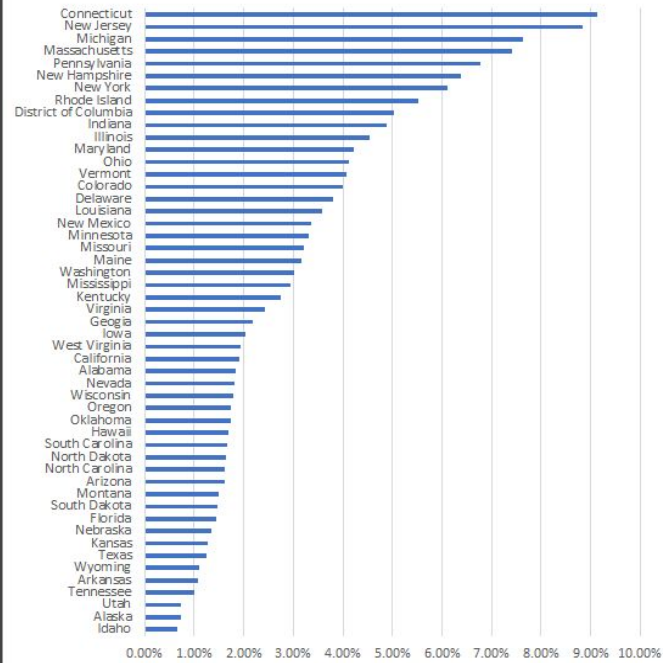


National Infographic

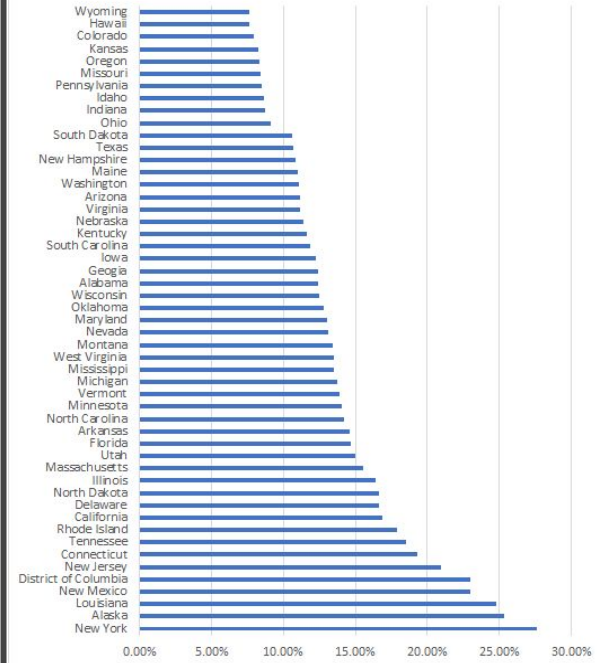
Prevalence Rate by State



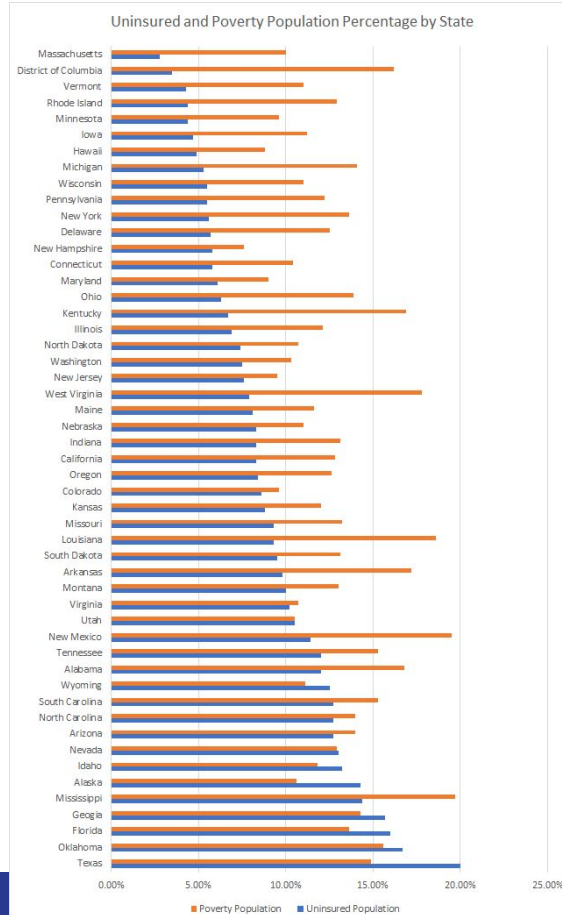
Case-Fatality Rate by State



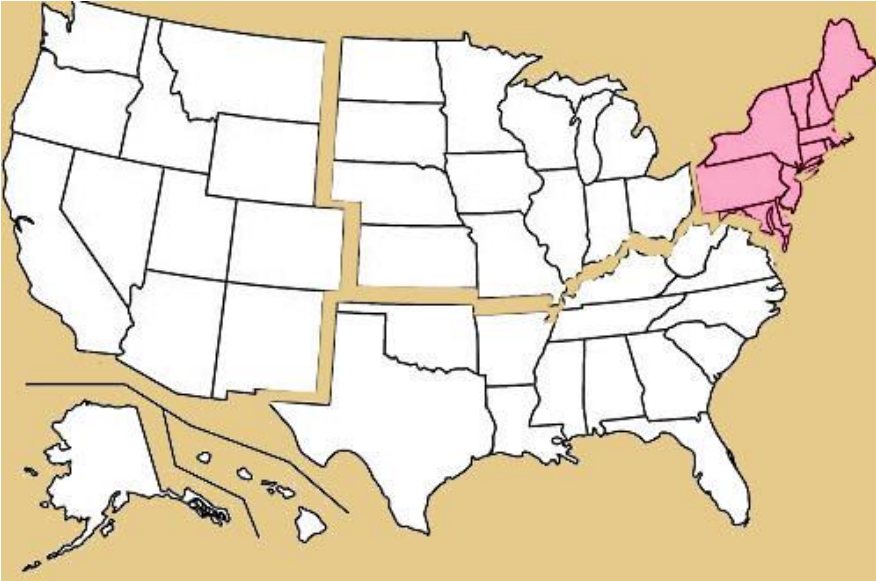
Tests with respect to State Population



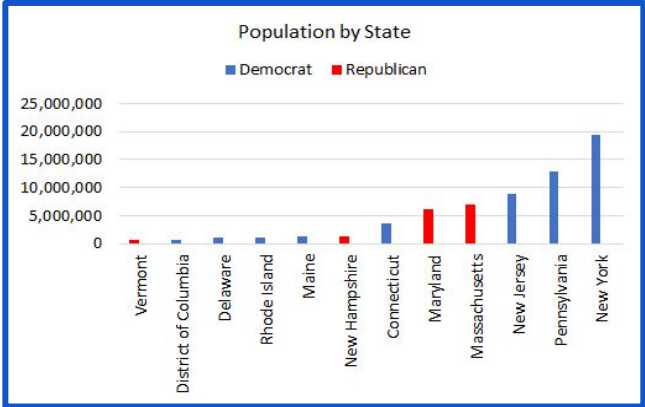
More National Analytics



Northeast Overview

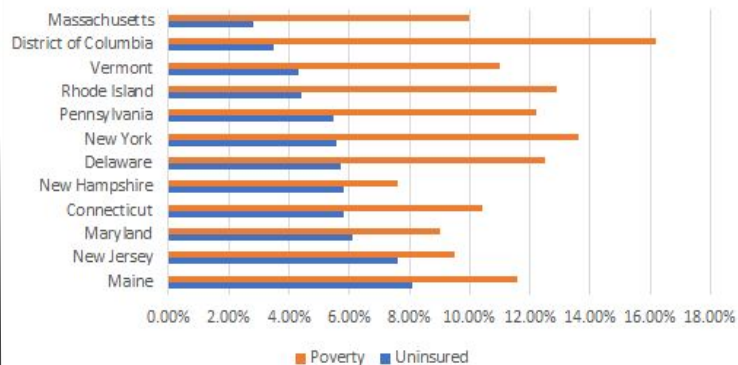


- Population: 63,707,996
- COVID-19 Cases: 923,517
- COVID-19 Deaths: 64,643
- Total Tests: 8,681,361

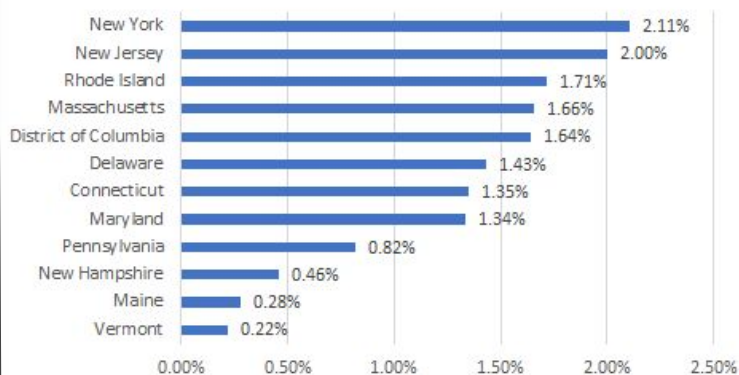


Northeast

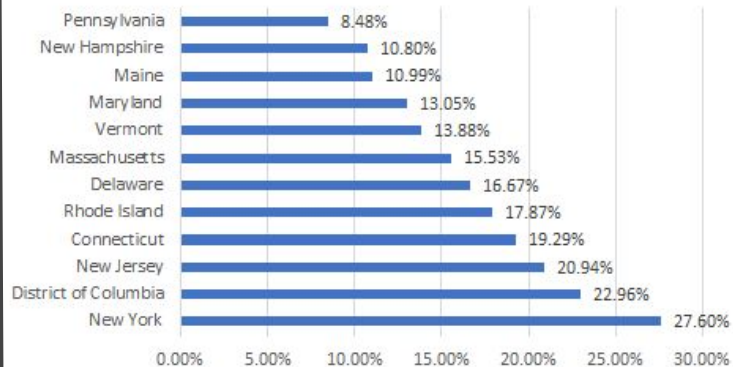
Uninsured and Poverty Population by State



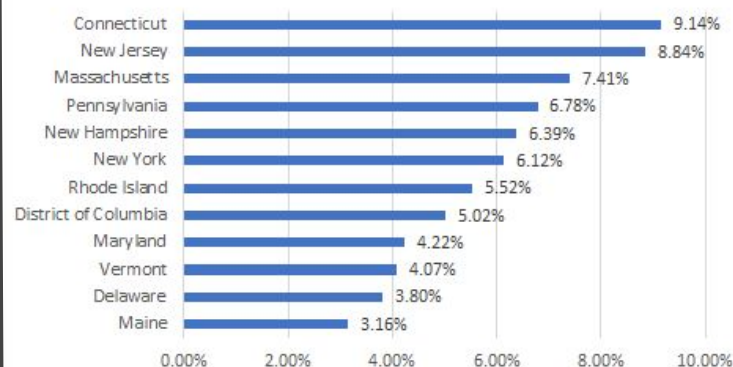
Prevalence Rate by State



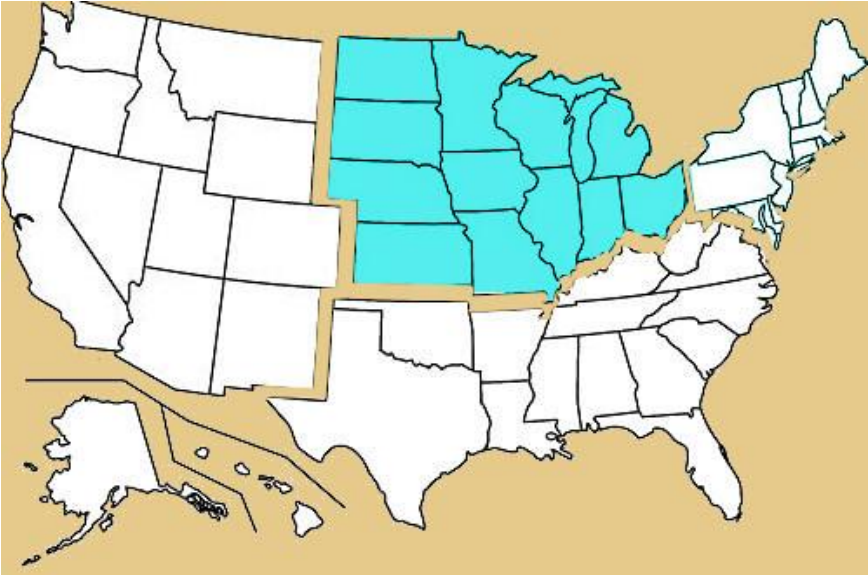
Tests with respect to State Population



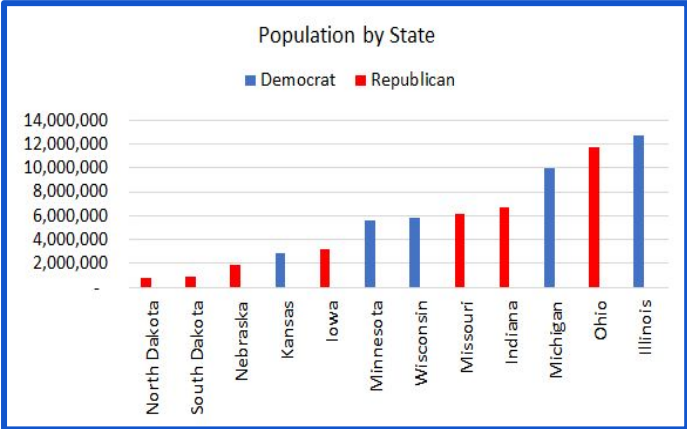
Fatality Rate by State



Midwest Overview

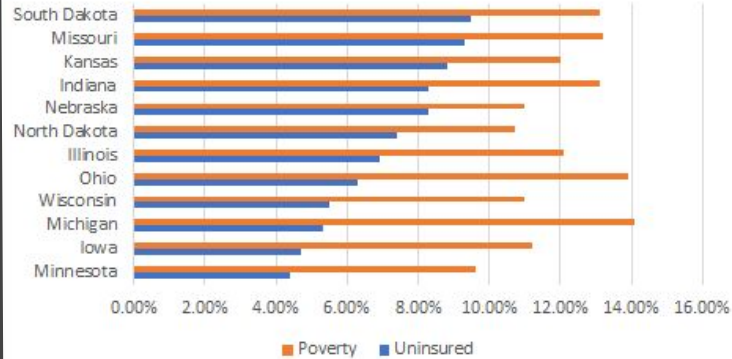


- Population: 68,329,004
- COVID-19 Cases: 620,759
- COVID-19 Deaths: 25,282
- Total Tests: 9,254,574

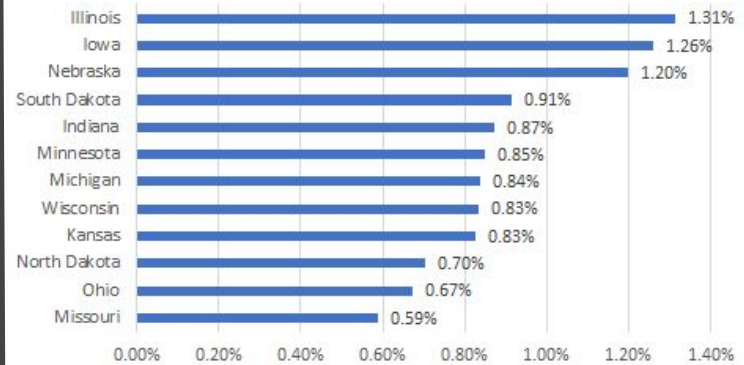


Midwest

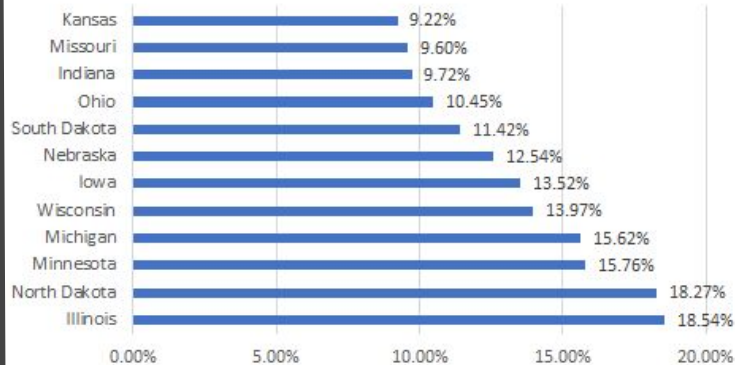
Uninsured and Poverty Population by State



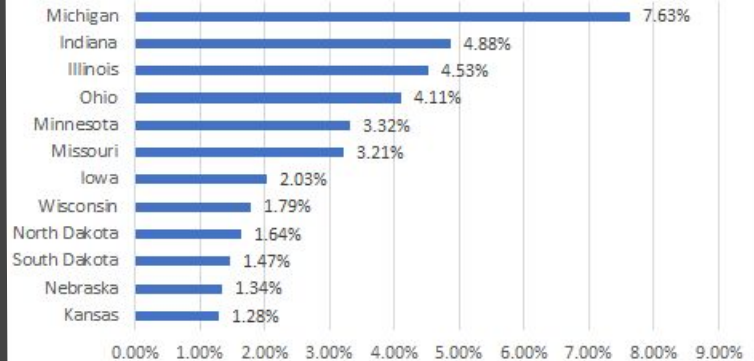
Prevalence Rate by State



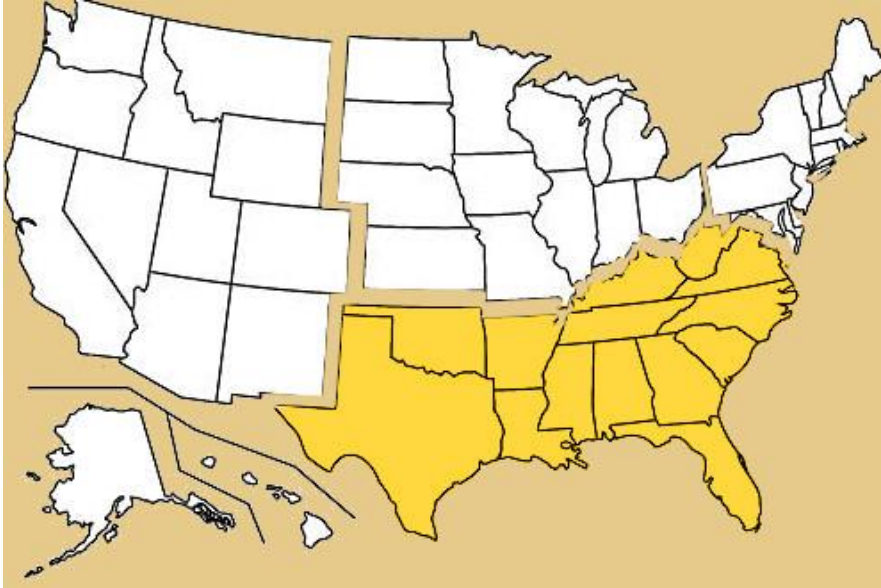
Tests with respect to State Population



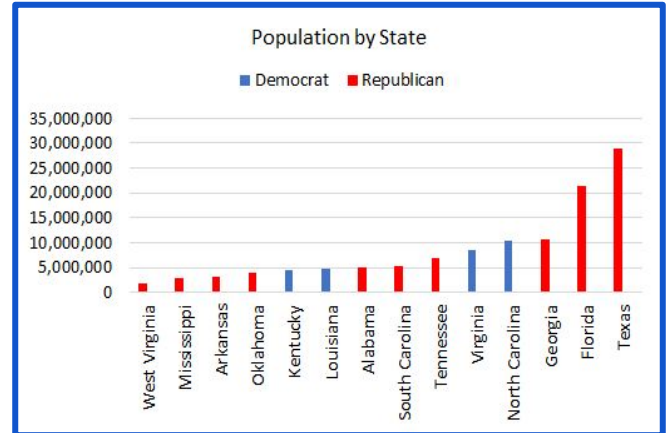
Fatality Rate



South Overview

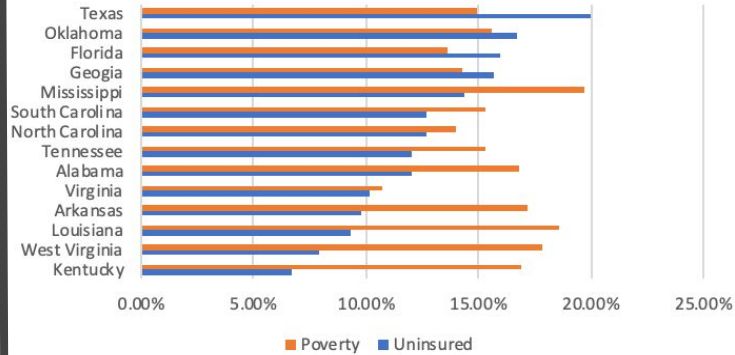


- Population: 117,855,255
- COVID-19 Cases: 1,538,923
- COVID-19 Deaths: 26,786
- Total Tests: 15,769,927

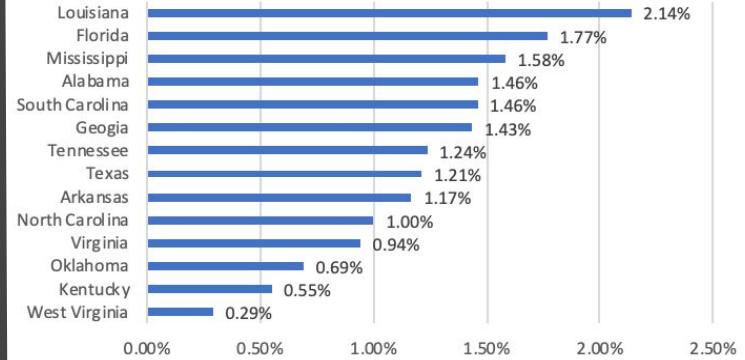


South

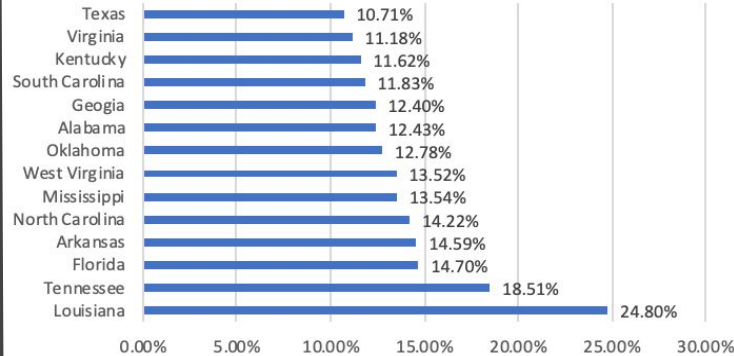
Uninsured and Poverty Population by State



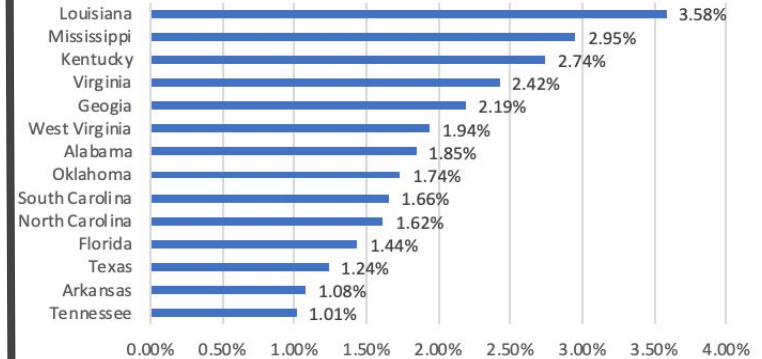
Prevalence Rate by State



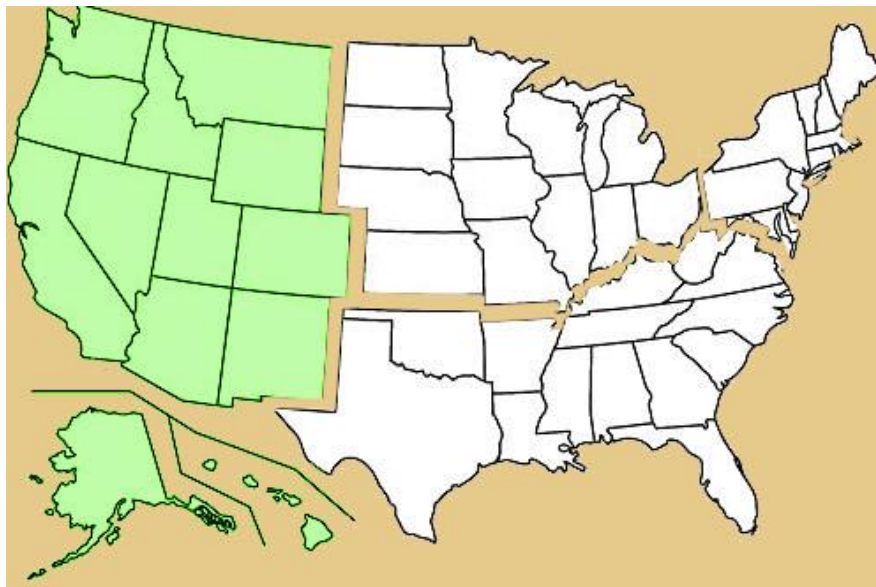
Tests with respect to State Population



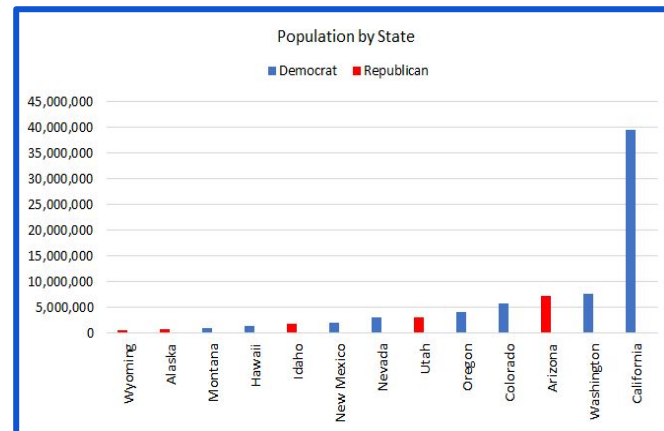
Fatality Rate by State



West Overview

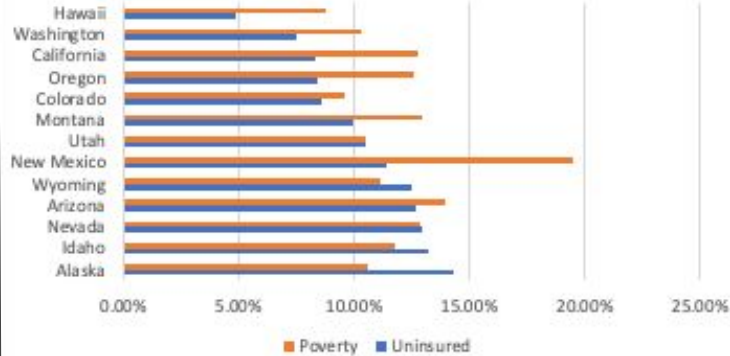


- Population: 78,347,268
- COVID-19 Cases: 785,924
- COVID-19 Deaths: 15,443
- Total Tests: 11,132,250

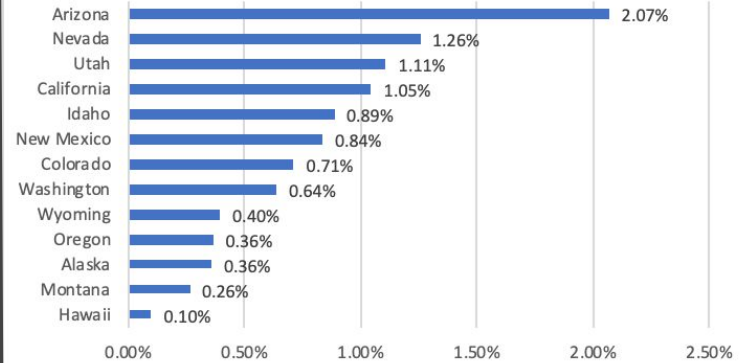


West

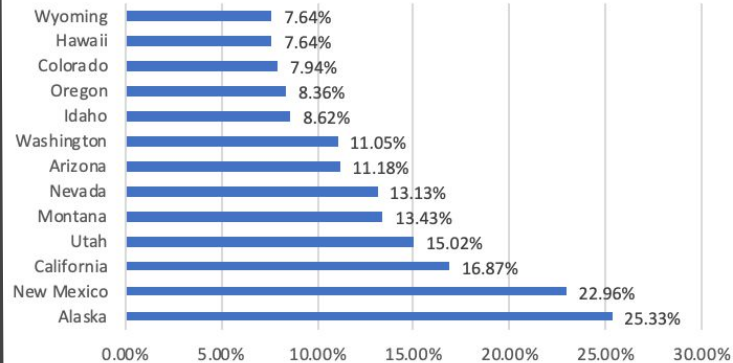
Uninsured and Poverty by State



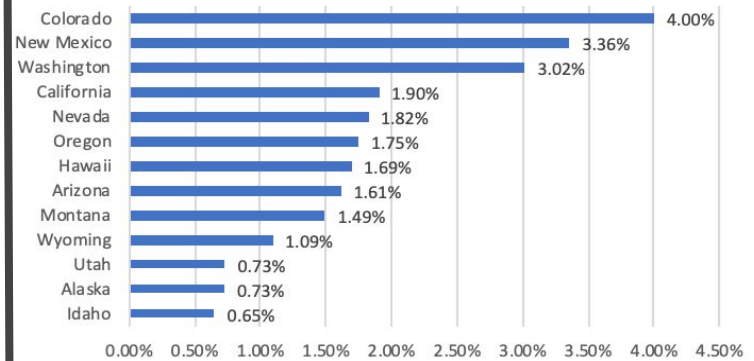
Prevalence Rate by State



Tests with Respect to State Population



Fatality Rate by State



Lowest Prevalence Rate

Hawaii

Prevalence Rate: 0.10%

Population: 1,415,872

Contact Tracing: 80 tracers; tracing 73% infections

Testing: 7.64%

Positive Test Rate: 1.31%

Shortage Areas:

Health Professional Shortage Areas: 81

Medically Underserved Areas/Pop.: 13

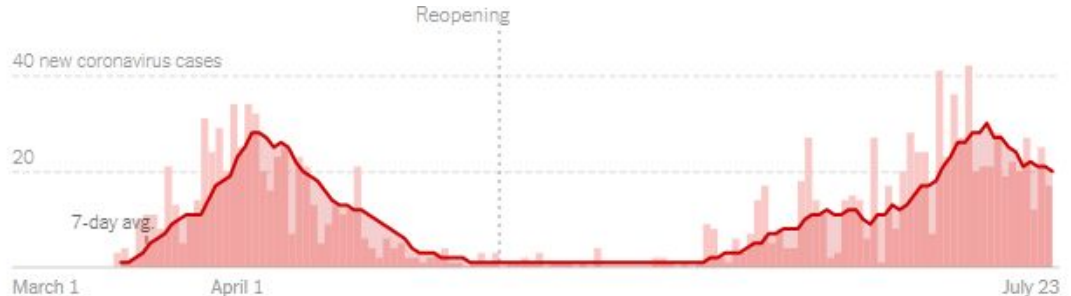
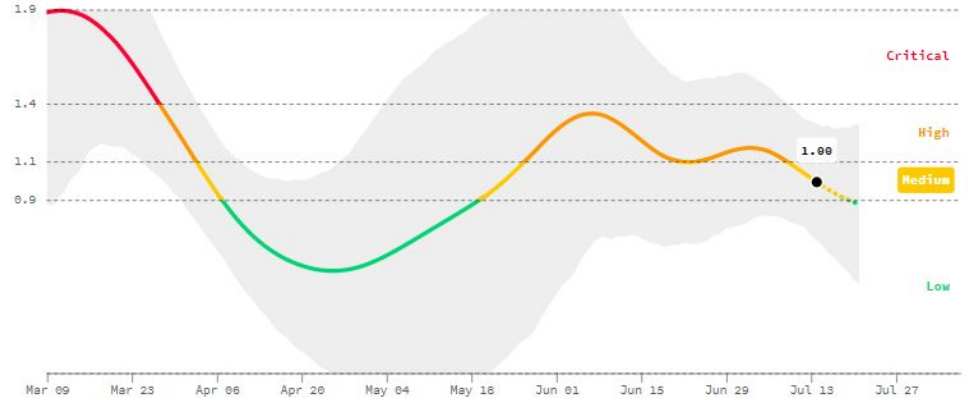
Status: Reopening (5/7)

Infection rate

HAWAII

Save Share

On average, each person in Hawaii with COVID is infecting 1.00 other people. Because this number is around 1.0, it means that COVID continues to spread, but in a slow and controlled fashion.



Highest Prevalence Rate

Louisiana

Prevalence rate: 2.14%

Population: 4,648,794

Contact tracing: 400 tracers; tracing 4% infections

Testing: 24.80%

Positive test rate: 8.62%

Shortage areas:

Health Professional Shortage Areas: 434

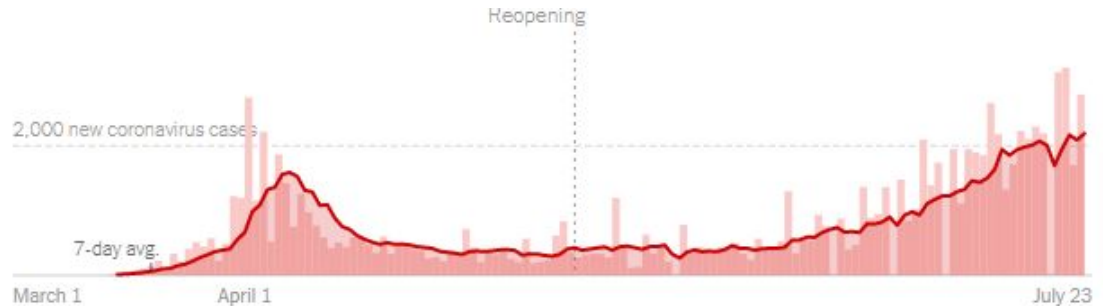
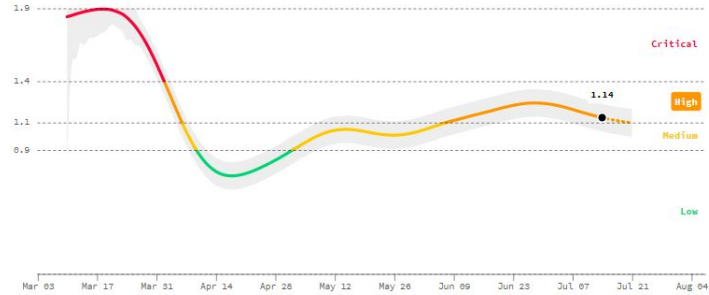
Medically Underserved Areas/Pop.: 73

Status: Reversing (Reopened 5/15)

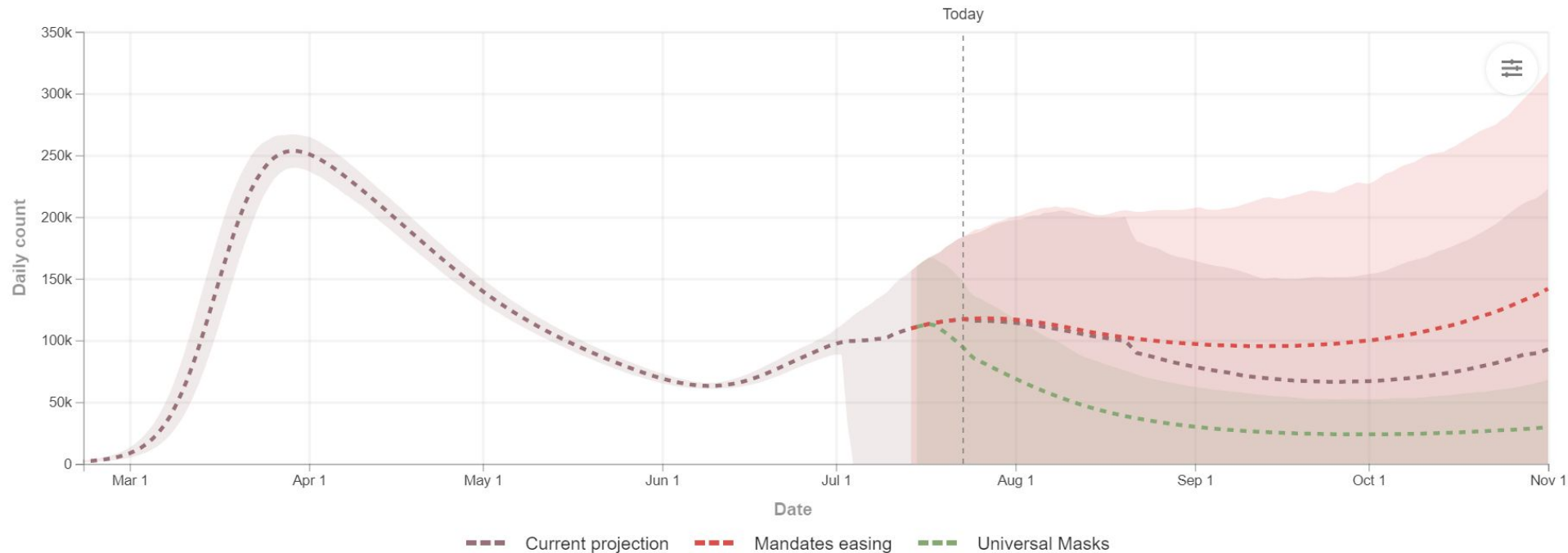
Infection rate

LOUISIANA

On average, each person in Louisiana with COVID is infecting 1.14 other people. As such, the total number of active cases in Louisiana is growing at an unsustainable rate. If this trend continues, the hospital system may become overloaded. Caution is warranted.



National Future Projection



Current projection: Mandates are re-imposed for 6 weeks whenever daily deaths reach 8 per million (0.8 per 100k).

Mandates easing: Continued easing of social distancing mandates, and mandates are not re-imposed.

Universal Masks: 95% mask usage in public in every location, reaching levels seen in Singapore. Mandates are re-imposed for 6 weeks if daily deaths reach 8 per million (0.8 per 100k).

United States Government / NSC Playbook

Phase 1: Primarily Pre-Incident

Normal Operations

No unusual Infectious Disease Outbreaks

long time ago



Departments and agencies are monitoring per usual systems

Elevated Threat

Case reports/clusters of novel pathogen: 31-Dec-20

17-Jan-20



Consider border screenings to prevent the spread into the US

29-Jan-20



Determine joint reporting structure and frequency of situation reports

7-Jan-20



Health Advisory

23-Jan-20



Travel Advisory

25-Feb-20



Determine need for higher level engagement on research and development of countermeasures

1-Mar-20



Determine the risk communication strategy

Credible Threat

Confirmation of multiple human cases of a PPP anywhere: 4-Jan-20

29-Apr-20



Evaluate Contact Tracing

6-Feb-20



Diagnostic testing



Office of Foreign Affairs Disaster Declaration

3-Jan-20



Consider funding options

17-Mar-20



PREP Act Declaration

United States Government / NSC Playbook

Phase 2: Begins Upon Notification When/After an Incident occurs

Initial Response: Activation, Situational, Assessment, and Movement

Declaration of a Public Health Emergency: 31-Jan-20

- | | | |
|-----------|-------------------------------------|--|
| 6-Mar-20 | <input checked="" type="checkbox"/> | Donation of supplies from SNS |
| 13-Mar-20 | <input checked="" type="checkbox"/> | Disaster Declaration |
| 22-Mar-20 | <input checked="" type="checkbox"/> | Military deployment in support of civilian DART response |
| 17-Mar-20 | <input checked="" type="checkbox"/> | PREP Act Declaration |

Employment of Resources and Stabilization

SLTT request for assistance: 29-Feb-20

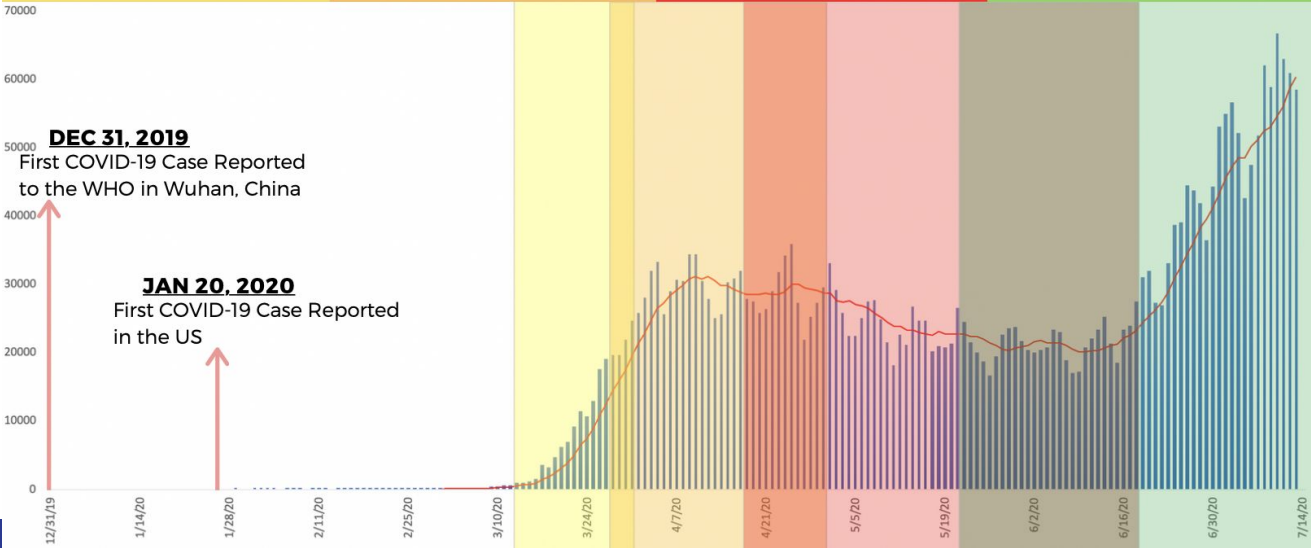
- | | | |
|-----------|-------------------------------------|--|
| 2-Apr-20 | <input checked="" type="checkbox"/> | Deploy PHS Commissioned Corps |
| 23-Mar-20 | <input checked="" type="checkbox"/> | Implement screening and monitoring in travel |
| 29-Mar-20 | <input checked="" type="checkbox"/> | Are SNS resources necessary |
| 14-Apr-30 | <input checked="" type="checkbox"/> | Use of the Defense Production Act |
| 21-Mar-20 | <input checked="" type="checkbox"/> | Use of Emergency Use Authorization |

Intermediate Operations

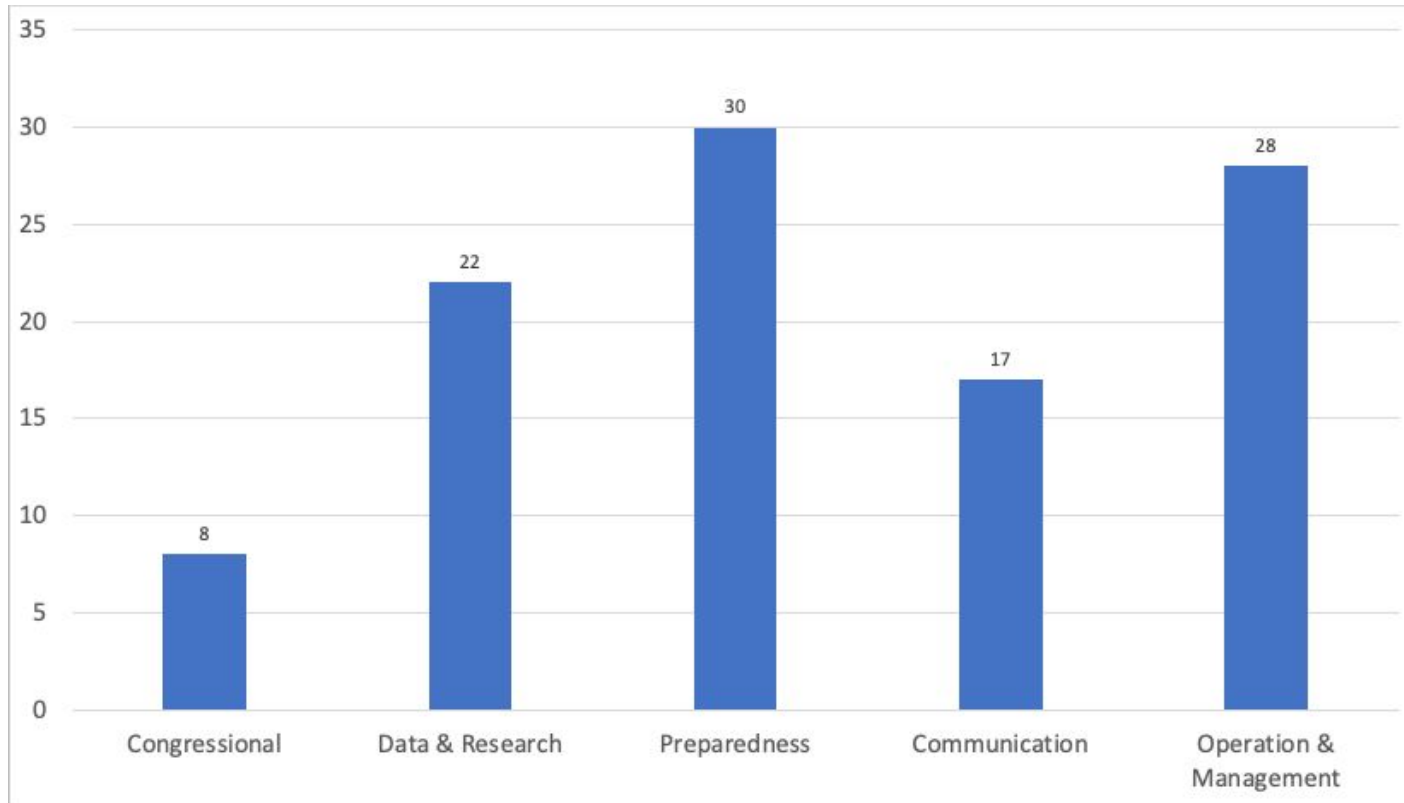
SLTT request for assistance: 29-Feb-20

- | | | |
|-----------|-------------------------------------|--------------------------------|
| 29-Feb-20 | <input checked="" type="checkbox"/> | Assistance to SLTT in response |
| 2-Apr-20 | <input checked="" type="checkbox"/> | Deploy PHS Commissioned Corps |

FEMA Response



DHS Reform



Evidence Based Policy Decisions

3 Ts (Test, Track, Treat)

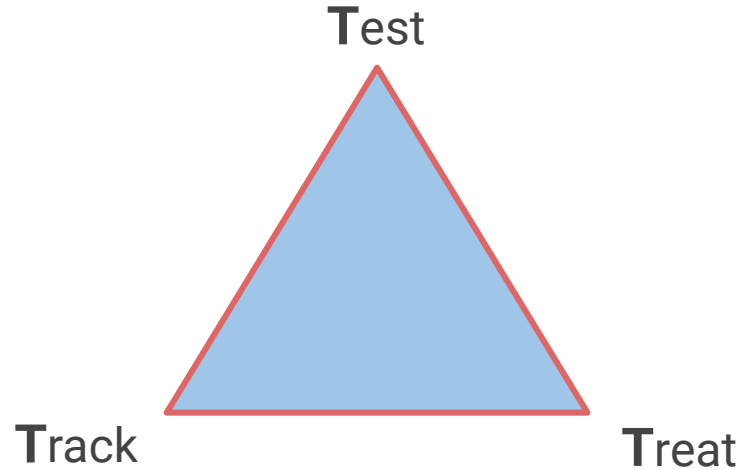
DIM (Distance, Isolate, Mask)

P.O.L.I.C.Y.(Prepare & Organize, Lead & Inform, Coordinate & Yaager Results)

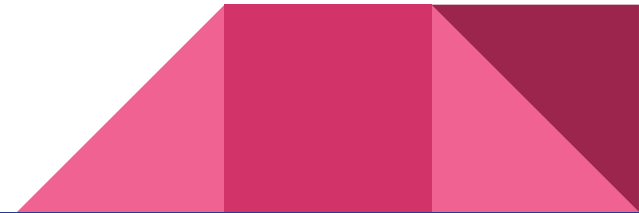
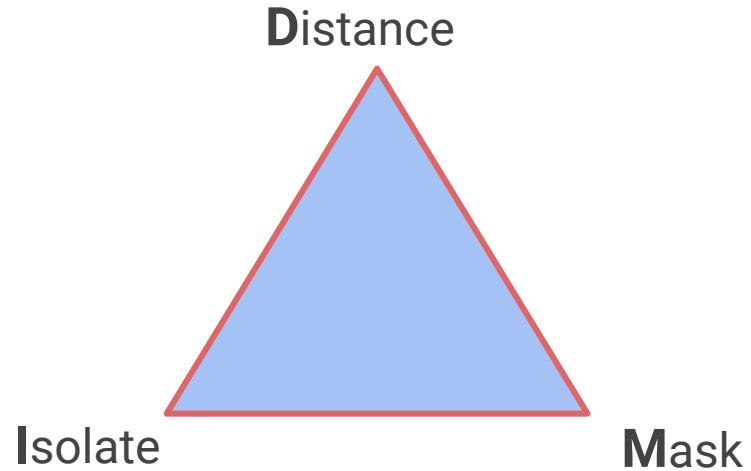


Evidence Based Policy Decisions

Test, Track, Treat

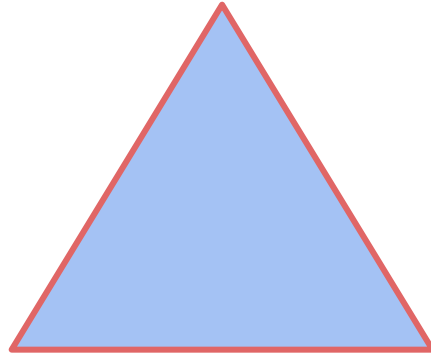


“DIM” the Virus



POLICY

Prepare & Organize



Lead & Inform

**Coordinate &
Yaager Results**



James's application

https://jnrobinsoniii.shinyapps.io/Timeline_Dashboard/



Future

All fellows will continue to work on this project through the rest of the summer and will look deeper into:

- How COVID-19 has disproportionately affected minorities and different demographics
- How specific governmental policies affected each states' trajectories
- The role of age and race distribution of a state in their cases



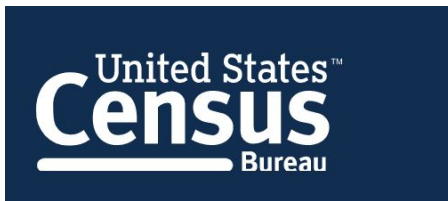
Our main data sources



U.S. BUREAU OF LABOR STATISTICS



data.HRSA.gov



**Covid
ActNow**



Acknowledgment

This work was carried out while the authors, **Cole Bligh**, **Elisavet Gallou**, **James Robinson III**, and **Yuqing Zhou**, were a Rutgers IC CAE Research Fellow participating in the 2020 DIMACS REU program, supported through the ODNI grant for Intelligence Community Centers for Academic Excellence – Critical Technology Program.

We would like to thank our mentors **Dr. Ronald J. Clark**, **Ava Majlesi**, and **Sassi Rajput**, as well as the DIMACS REU Program for making undergraduate virtual research a reality in the age of COVID-19.

