State of Missouri regional COVID-19 hospitalized cases model

March 2, 2021

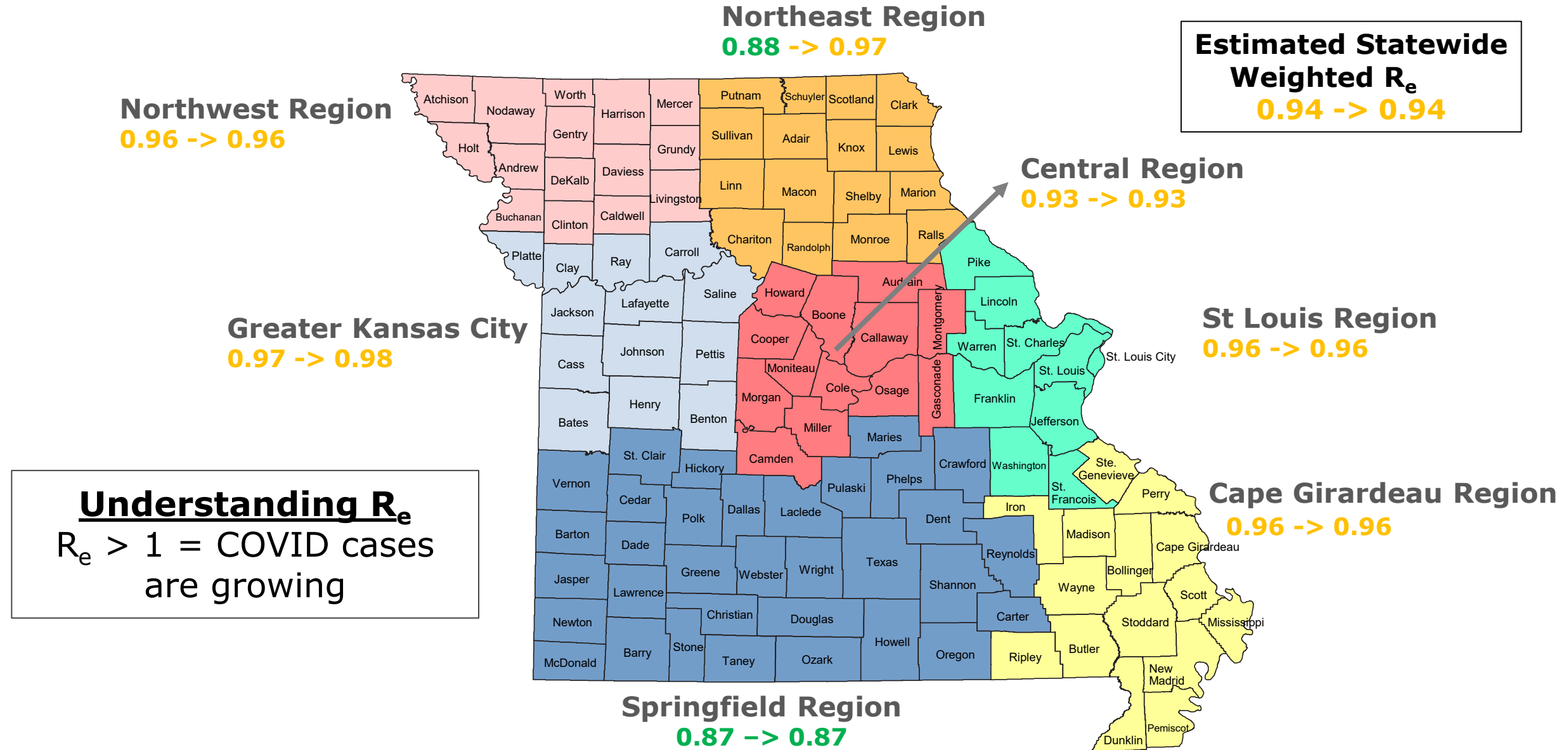# Multiple data points inform Missouri's COVID-19 response

- Syndromic surveillance

- Healthcare system capacity (bed, PPE, and staff availability)

- Testing

- COVID-19 cases and deaths

- Economic and social impact

- Insights from U.S. states, nationally, and other countries

- Evidence from scientific literature

- Mathematical disease modelling

Our model estimates possible outcomes based on currently available information

What does the model tell us	What does it not tell us
Range of plausible outcomes based on our current knowledge of COVID-19 in Missouri	What will happen in the future
Approximate date and magnitude of peak/s based on current understanding of policy interventions and human behavior and assumptions about future interventions	Date and magnitude of peak/s if there are major changes in planned policy interventions and human behavior
Approximate estimate of effective transmission rate across a region	Exact transmission rate in all parts of a region — there may be areas of higher and lower transmission within the region
Projected hospitalizations for regions in MO with sufficient data, i.e. Kansas City Area, Central, St. Louis Area, Southeast and Southwest	Projected hospitalizations in regions where daily COVID-19 hospitalizations are fewer than 15 because insufficient cases

The ability to forecast depends on the quality and availability of data. For a new disease such as COVID-19, much remains uncertain.

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Transmission rates ("R_e") remain below 1 in all Regions

Northeast Region
0.88 -> 0.97

Northwest Region
0.96 -> 0.96

Estimated Statewide Weighted R_e
0.94 -> 0.94

Central Region
0.93 -> 0.93

Greater Kansas City
0.97 -> 0.98

St Louis Region
0.96 -> 0.96

Cape Girardeau Region
0.96 -> 0.96

Understanding R_e
$R_e > 1$ = COVID cases are growing

Springfield Region
0.87 –> 0.87

Data date range: 02/23/21 – 03/01/21

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Central (Region F)

Overview	
Population	502,486
Cumulative Cases	45652
Cumulative Deaths	587
7-day New Cases	217
WoW % Case Change	0.5%

Reproductive Rate	
Pre-intervention	2.3
Last Week	0.93
Current Week	0.93
WoW % Change	0.0%

Bed / Ventilator Availability	
% ICU Beds Occupied	61%
% ICU Beds Occupied C19	4%
% ICU Beds Free	39%
% Ventilators in use	24%
% Ventilators available	76%

* % of occupied ICU beds taken by COVID-19 PUI/Confirmed patients

Base Case Central Region

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: 3/15/21 1:00 AM, + 2 more

Hospitalizations

LEMMA Projections
■ median (best fit scenario) ■ p5 ■ p25 ■ p75 ■ p95
● Peak hospitalizations (best fit scenario)
Hospitalizations
● Hospitalized COVID-19 cases (EMResource) ● Hospitalized COVID-19 cases (NHSN)
Hospital Beds

[Data updated 03/02/21]
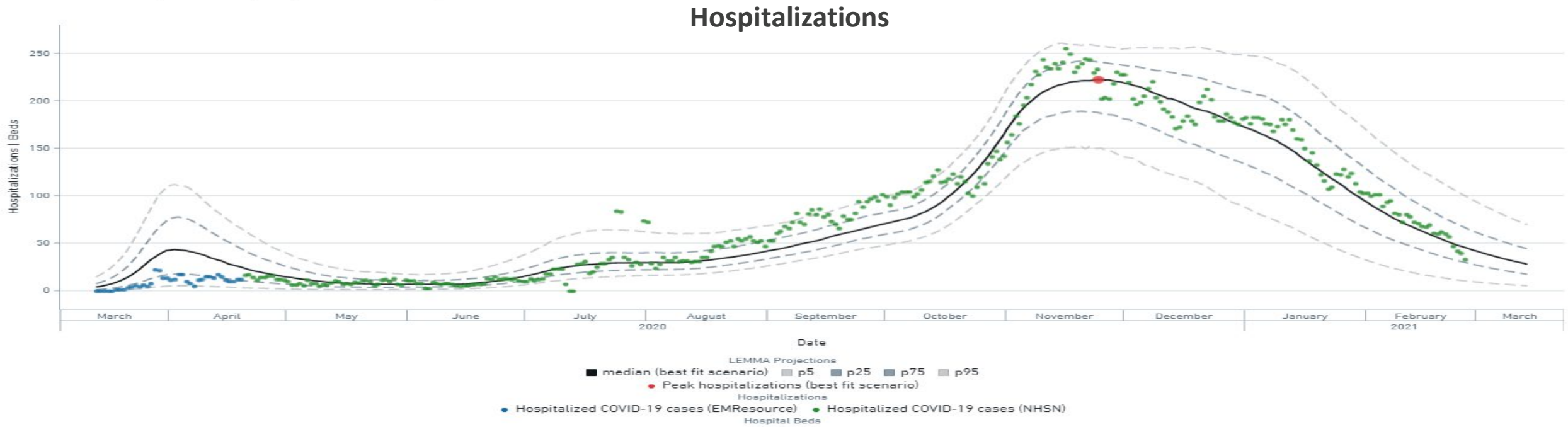
Greater Kansas City Area (Region A)

Overview	
Population	1,395,314
Cumulative Cases	105325
Cumulative Deaths	1513
7-day New Cases	729
WoW % Case Change	0.7%

Reproductive Rate	
Pre-intervention	2.8
Last Week	0.97
Current Week	0.98
WoW % Change	0.3%

Bed / Ventilator Availability	
% ICU Beds Occupied	74%
% ICU Beds Occupied C19	9%
% ICU Beds Free	26%
% Ventilators in use	23%
% Ventilators available	77%

* % of occupied ICU beds taken by COVID-19 PUI/Confirmed patients

Base Case Kansas City Region

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: 3/15/21 1:00 AM, + 2 more

Hospitalizations

LEMMA Projections
■ median (best fit scenario) □ p5 ■ p25 ■ p75 □ p95
● Peak hospitalizations (best fit scenario)
Hospitalizations
● Hospitalized COVID-19 cases (EMResource) ● Hospitalized COVID-19 cases (NHSN)
Hospital Beds

[Data updated 03/02/21]

Northeast (Region B)

Overview	
Population	179,448
Cumulative Cases	13208
Cumulative Deaths	185
7-day New Cases	92
WoW % Case Change	0.7%

Reproductive Rate	
Pre-intervention	N/A
Last Week	0.88
Current Week	0.97
WoW % Change	9.6%

Bed / Ventilator Availability	
% ICU Beds Occupied	50%
% ICU Beds Occupied C19	8%
% ICU Beds Free	50%
% Ventilators in use	3%
% Ventilators available	97%

* % of occupied ICU beds taken by COVID-19 PUI/Confirmed patients

Base Case Northeast Region

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: 3/15/21 1:00 AM, + 2 more

Hospitalizations

LEMMA Projections
median (best fit scenario) ▪ p5 ▪ p25 ▪ p75 ▪ p95
● Peak hospitalizations (best fit scenario)
Hospitalizations
● Hospitalized COVID-19 cases (EMResource) ● Hospitalized COVID-19 cases (NHSN)
Hospital Beds

[Data updated 03/02/21]
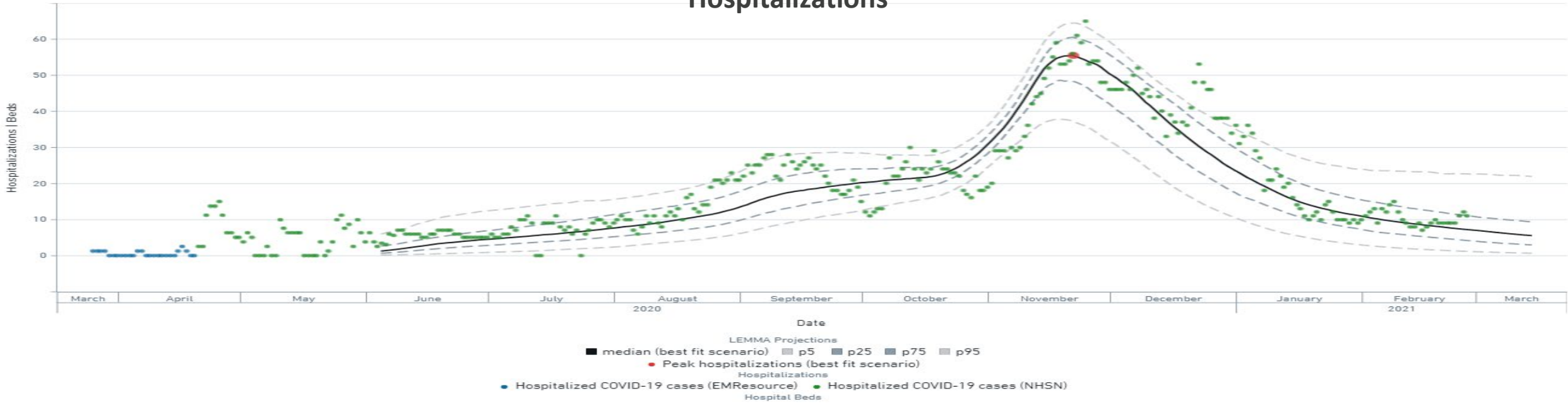
Northwest (Region H)
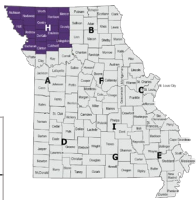
Overview	
Population	234,361
Cumulative Cases	18705
Cumulative Deaths	412
7-day New Cases	62
WoW % Case Change	0.3%

Reproductive Rate	
Pre-intervention	1.24
Last Week	0.96
Current Week	0.96
WoW % Change	0.0%

Bed / Ventilator Availability	
% ICU Beds Occupied	72%
% ICU Beds Occupied C19	3%
% ICU Beds Free	28%
% Ventilators in use	11%
% Ventilators available	89%

* % of occupied ICU beds taken by COVID-19 PUI/Confirmed patients

Base Case Northwest Region

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: 3/15/21 1:00 AM, + 2 more

Hospitalizations

LEMMA Projections
■ median (best fit scenario) ■ p5 ■ p25 ■ p75 ■ p95
● Peak hospitalizations (best fit scenario)
Hospitalizations
● Hospitalized COVID-19 cases (EMResource) ● Hospitalized COVID-19 cases (NHSN)
Hospital Beds

[Data updated 03/02/21]
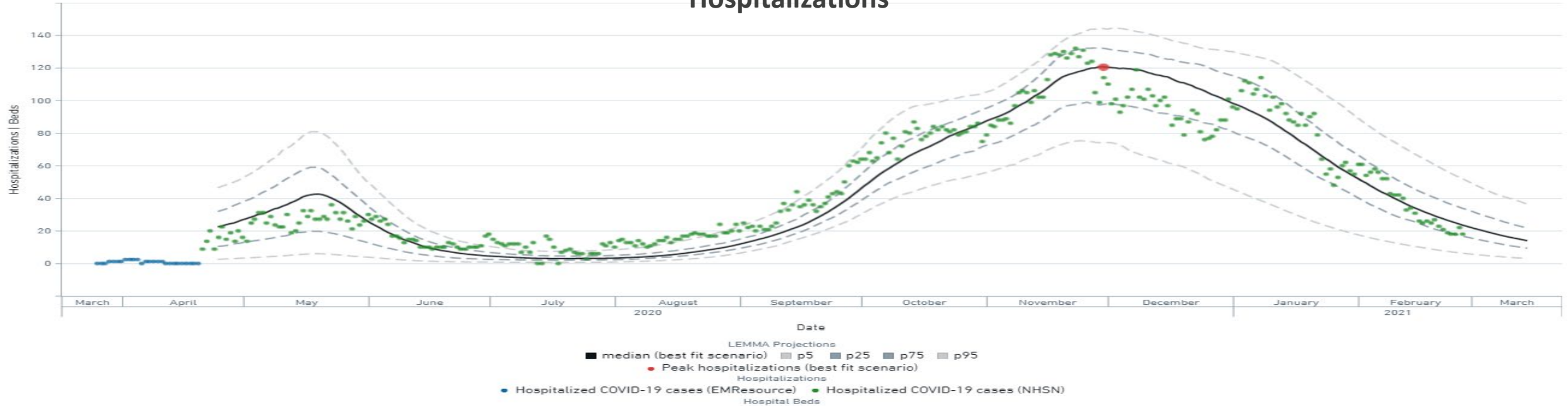
Southeast / Cape Girardeau (Region E)

Overview	
Population	363,478
Cumulative Cases	32229
Cumulative Deaths	485
7-day New Cases	222
WoW % Case Change	0.7%

Reproductive Rate	
Pre-intervention	2.61
Last Week	0.96
Current Week	0.96
WoW % Change	0.2%

Bed / Ventilator Availability	
% ICU Beds Occupied	57%
% ICU Beds Occupied C19	9%
% ICU Beds Free	43%
% Ventilators in use	28%
% Ventilators available	72%

* % of occupied ICU beds taken by COVID-19 PUI/Confirmed patients

Base Case Southeast Region

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: 3/15/21 1:00 AM, + 2 more

Hospitalizations

LEMMA Projections
■ median (best fit scenario) ■ p5 ■ p25 ■ p75 ■ p95
● Peak hospitalizations (best fit scenario)
Hospitalizations
● Hospitalized COVID-19 cases (EMResource) ● Hospitalized COVID-19 cases (NHSN)
Hospital Beds

[Data updated 03/02/21]
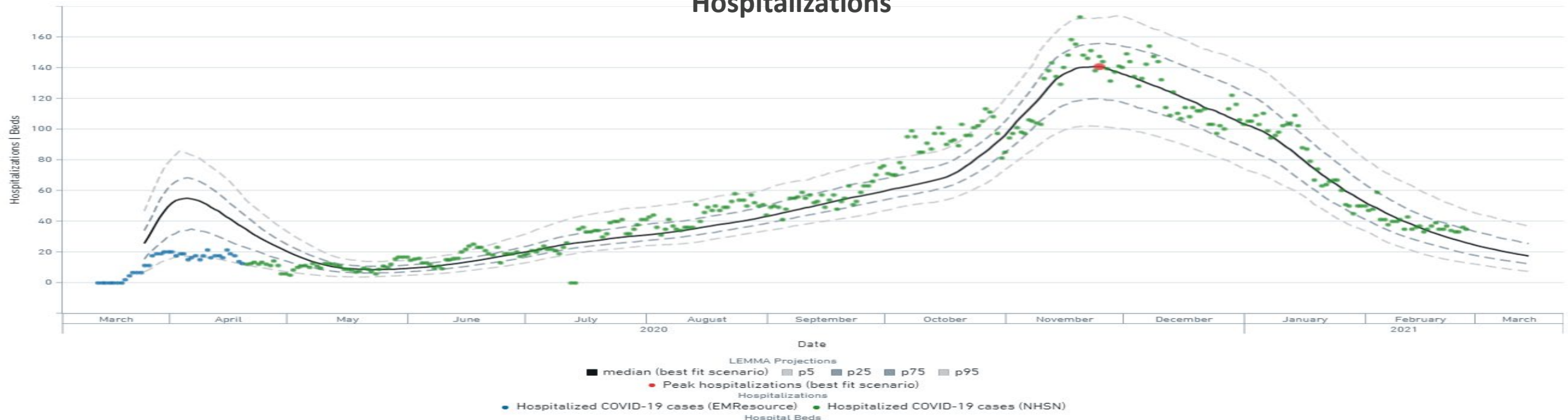
Southwest / Springfield (Regions D,G, I)

Overview	
Population	1,221,847
Cumulative Cases	91813
Cumulative Deaths	1707
7-day New Cases	686
WoW % Case Change	0.8%

Reproductive Rate	
Pre-intervention	2.36
Last Week	0.87
Current Week	0.87
WoW % Change	0.2%

Bed / Ventilator Availability	
% ICU Beds Occupied	79%
% ICU Beds Occupied C19	8%
% ICU Beds Free	21%
% Ventilators in use	20%
% Ventilators available	80%

* % of occupied ICU beds taken by COVID-19 PUI/Confirmed patients

Base Case Southwest Region

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Hospitalizations

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● Peak hospitalizations (best fit scenario)
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Hospital Beds
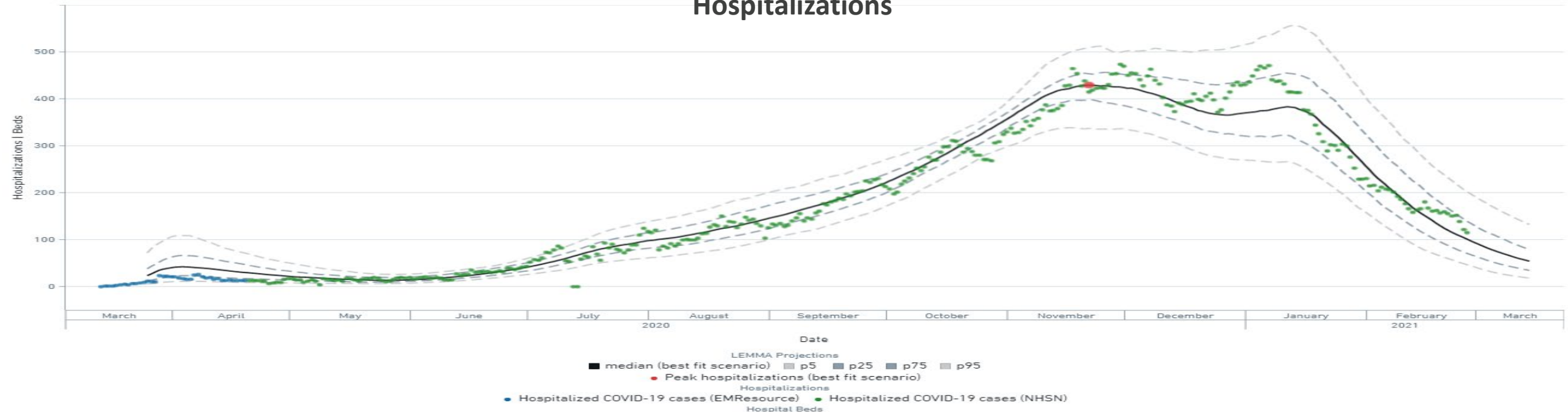
[Data updated 03/02/21]

Greater St Louis Area (Region C)

Overview	
Population	2,229,518
Cumulative Cases	171306
Cumulative Deaths	3034
7-day New Cases	1227
WoW % Case Change	0.7%

Reproductive Rate	
Pre-intervention	3.39
Last Week	0.96
Current Week	0.96
WoW % Change	0.2%

Bed / Ventilator Availability	
% ICU Beds Occupied	82%
% ICU Beds Occupied C19	9%
% ICU Beds Free	18%
% Ventilators in use	32%
% Ventilators available	68%

* % of occupied ICU beds taken by COVID-19 PUI/Confirmed patients

Base Case St. Louis Region

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Hospitalizations

LEMMA Projections
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● Peak hospitalizations (best fit scenario)
Hospitalizations
● Hospitalized COVID-19 cases (EMResource) ● Hospitalized COVID-19 cases (NHSN)
Hospital Beds

[Data updated 03/02/21]

See FAQs for additional details

Link here: https://health.mo.gov/living/healthcondiseases/communicable/novel-coronavirus/pdf/modeling-faqs06032020.pdf

Regional COVID-19 transmission models help inform local policy, public health, and business decisions

- Mathematical models are commonly used to make projections of infectious disease epidemics (e.g., tuberculosis, HIV)

- Many sophisticated models on COVID-19 make global or national projections (e.g., Imperial College, Harvard, IHME)

- However, these generally do not incorporate critical local or regional inputs, such as:
  - Variations in local population size and age structure
  - Date and nature of social distancing and other policies

- Regional projections are important because:
  - Regional epidemics may differ markedly from the national average
  - Policy response occurs at state, county, and municipal levels

State of MO, WUSTL, and MHA have developed a regional model of hospitalized COVID-19 cases

- **Standard SEIR model that combines universal characteristics of COVID-19 infection (e.g., transmission parameters) with local inputs to support regional decision making**
  - Mathematical model developed by experts from UMass Amherst, UC Berkeley, UCSF, and WUSTL
  - Uses a statistical approach that adjusts underlying parameters as new data are observed

- **Customized using the latest local data from Missouri's emergency response regions, including:**
  - COVID-19 positives and PUIs
  - Population and age structure
  - Policy interventions
  - Avg. hospital length of stay

- **Projects COVID-19 hospitalized cases** to directly address the question of hospital capacity and provide a more accurate picture on COVID-19's impact on the healthcare system

Model Structure (SEIR)