State of Missouri regional COVID-19 hospitalized cases model

September 30, 2020

Multiple data points inform Missouri's COVID-19 response
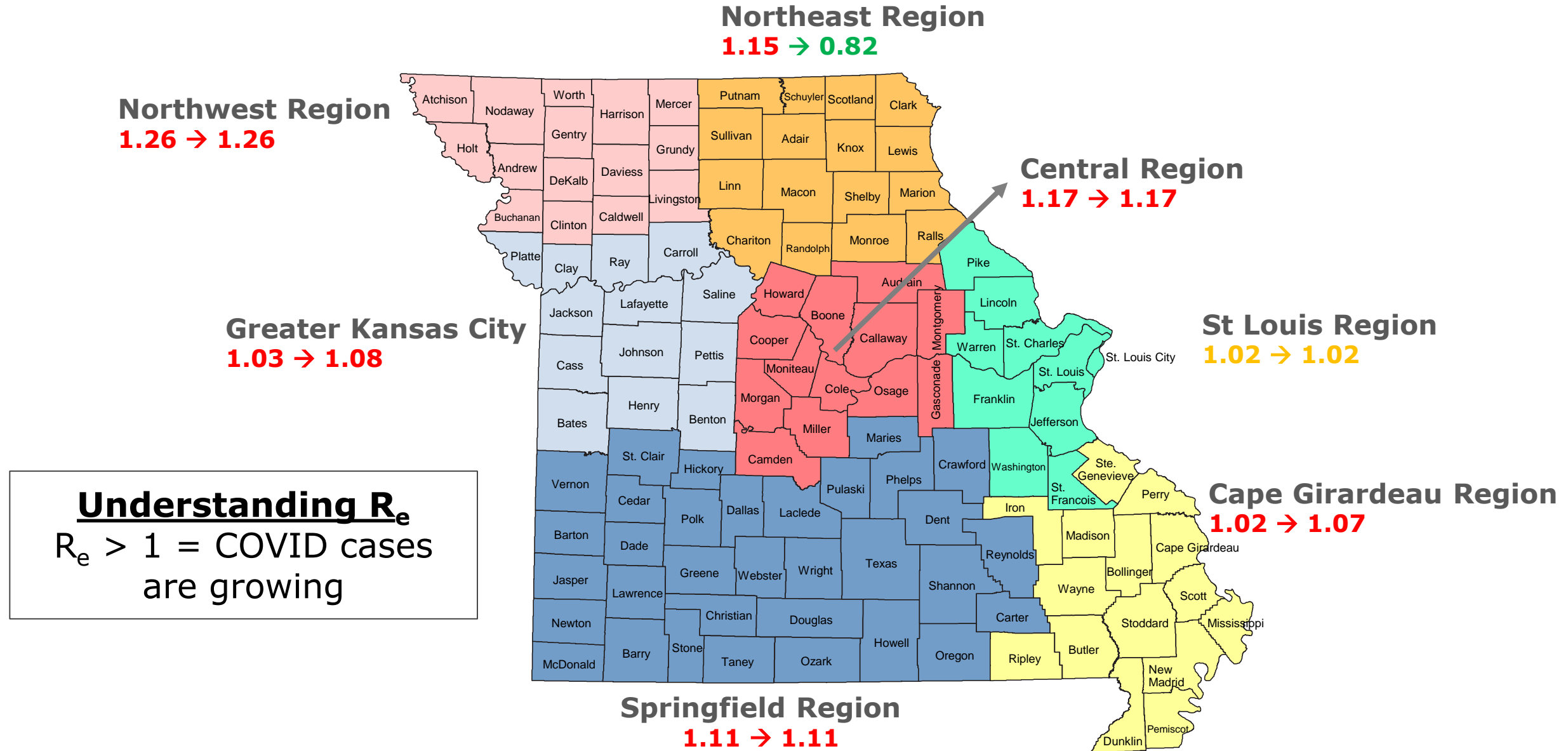
- Syndromic surveillance

- 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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▶ "R_e" rates near or above 1 in nearly every region means the disease is spreading statewide

Northeast Region
1.15 → 0.82

Northwest Region
1.26 → 1.26

Central Region
1.17 → 1.17

Greater Kansas City
1.03 → 1.08

St Louis Region
1.02 → 1.02

Cape Girardeau Region
1.02 → 1.07

Springfield Region
1.11 → 1.11

Understanding R_e
R_e > 1 = COVID cases are growing

*Data date range: 9/22/20 – 9/29/20

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Central (Region F)

Overview		
Population	502,486	
Cumulative Cases	10680	
Cumulative Deaths	76	
7-day New Cases	1076	🟥
WoW % Case Change	11.2%	🟥

Reproductive Rate		
Pre-intervention	2.3	
Last Week	1.172	
Current Week	1.169	+/- 0.07
WoW % Change	-0.3%	🟧

Bed / Ventilator Availability		
% ICU Beds Occupied	54%	
% ICU Beds Occupied C19	7%	
% ICU Beds Free	46%	🟩
% Ventilators in use	38%	
% Ventilators available	62%	

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

Base Case Central Region

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: Oct 14, 2020, + 2 more

Hospitalizations

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

[Data updated 9/29/20]

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Greater Kansas City Area (Region A)

Overview		
Population	1,395,314	
Cumulative Cases	27425	
Cumulative Deaths	334	
7-day New Cases	1865	🟥
WoW % Case Change	7.3%	🟥

Reproductive Rate		
Pre-intervention	2.8	
Last Week	1.031	
Current Week	1.083	+/- 0.03
WoW % Change	5.0%	

Bed / Ventilator Availability		
% ICU Beds Occupied	63%	
% ICU Beds Occupied C19	9%	
% ICU Beds Free	37%	🟩
% Ventilators in use	24%	
% Ventilators available	76%	

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

Base Case Kansas City Region

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: Oct 14, 2020, + 2 more

Hospitalizations

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

[Data updated 9/29/20]
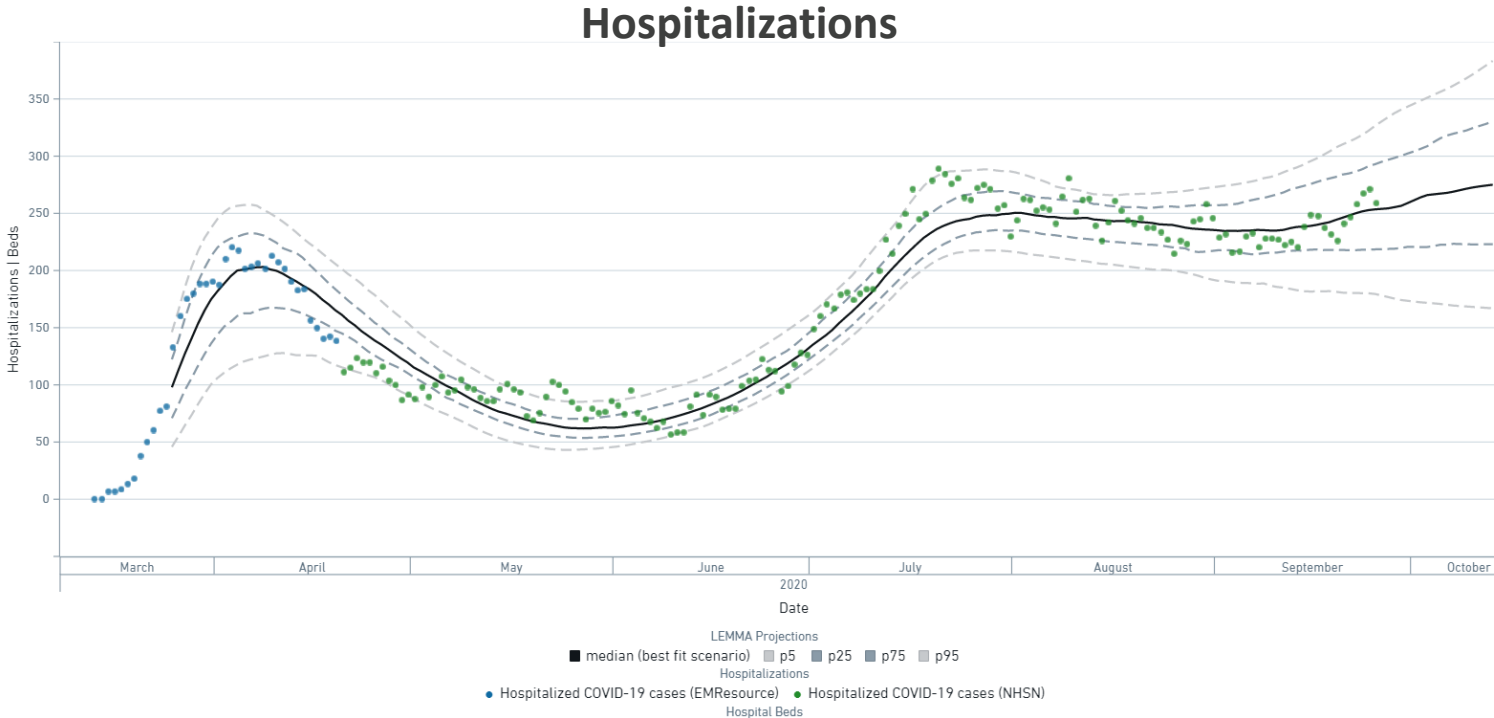
Northeast (Region B)

Overview		
Population	179,448	
Cumulative Cases	2382	
Cumulative Deaths	24	
7-day New Cases	225	
WoW % Case Change	10.4%	

Reproductive Rate		
Pre-intervention	N/A	
Last Week	1.152	
Current Week	0.818	+/- 0.07
WoW % Change	-29.0%	

Bed / Ventilator Availability		
% ICU Beds Occupied	70%	
% ICU Beds Occupied C19	49%	
% ICU Beds Free	30%	
% Ventilators in use	24%	
% Ventilators available	76%	

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

Base Case Northeast Region

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: Oct 14, 2020, + 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 9/29/20]
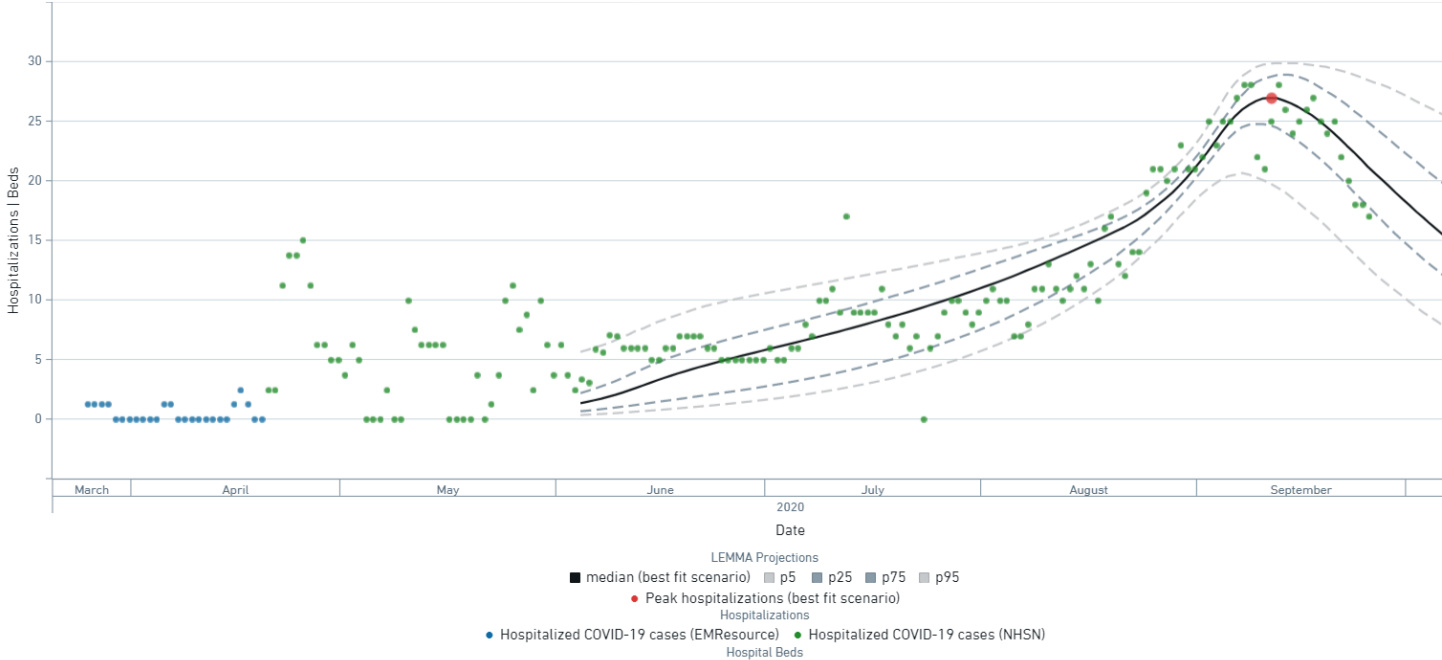
Northwest (Region H)

Overview		
Population	234,361	
Cumulative Cases	4564	
Cumulative Deaths	45	
7-day New Cases	522	
WoW % Case Change	12.9%	

Reproductive Rate		
Pre-intervention	1.24	
Last Week	1.257	
Current Week	1.257	+/- 0.08
WoW % Change	0.0%	

Bed / Ventilator Availability		
% ICU Beds Occupied	66%	
% ICU Beds Occupied C19	28%	
% ICU Beds Free	34%	
% Ventilators in use	12%	
% Ventilators available	88%	

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

Base Case Northwest Region

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: Oct 14, 2020, + 2 more

Hospitalizations

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

[Data updated 9/29/20]

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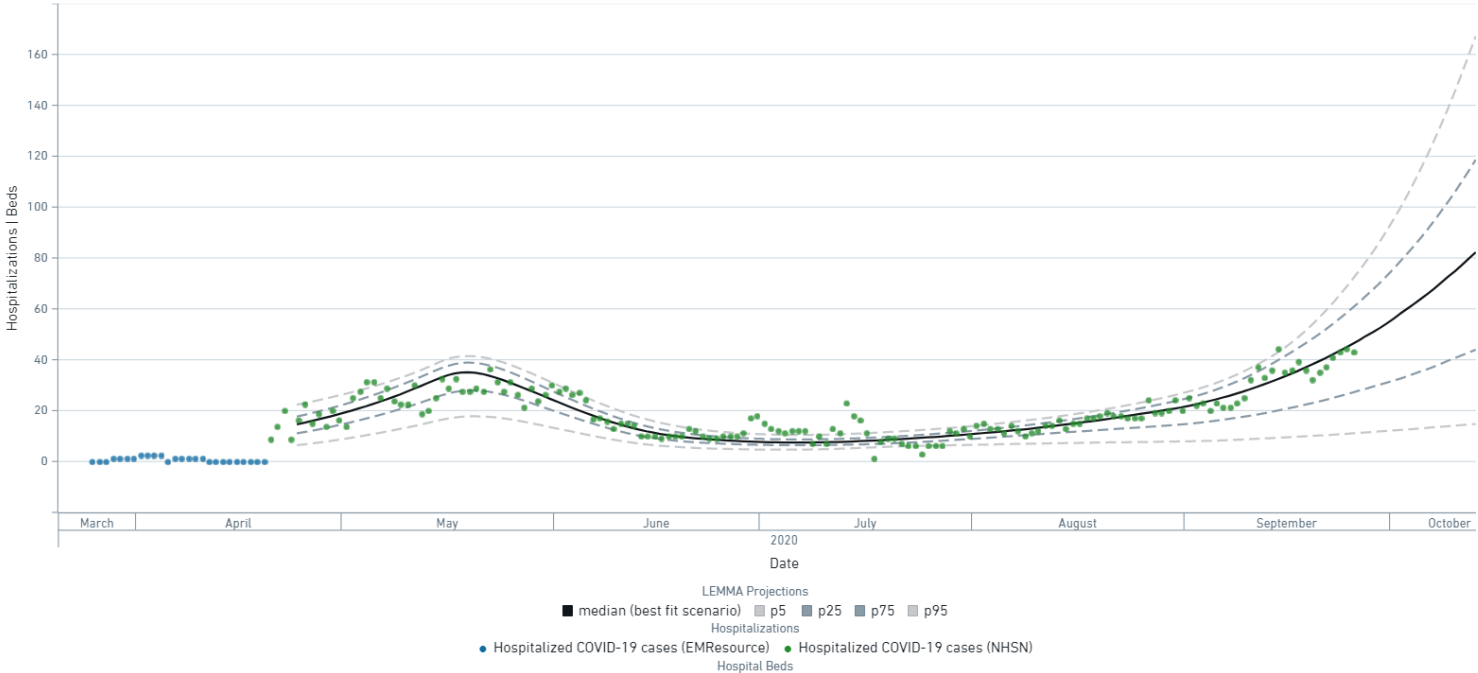
Southeast / Cape Girardeau (Region E)

Overview		
Population	363,478	
Cumulative Cases	8006	
Cumulative Deaths	99	
7-day New Cases	831	🟥
WoW % Case Change	11.6%	🟥

Reproductive Rate		
Pre-intervention	2.61	
Last Week	1.021	
Current Week	1.065	+/- 0.04
WoW % Change	4.3%	🟥

Bed / Ventilator Availability		
% ICU Beds Occupied	50%	
% ICU Beds Occupied C19	17%	
% ICU Beds Free	50%	🟩
% Ventilators in use	29%	
% Ventilators available	71%	

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

Base Case Southeast Region

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: Oct 14, 2020, + 2 more

Hospitalizations

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

[Data updated 9/29/20]
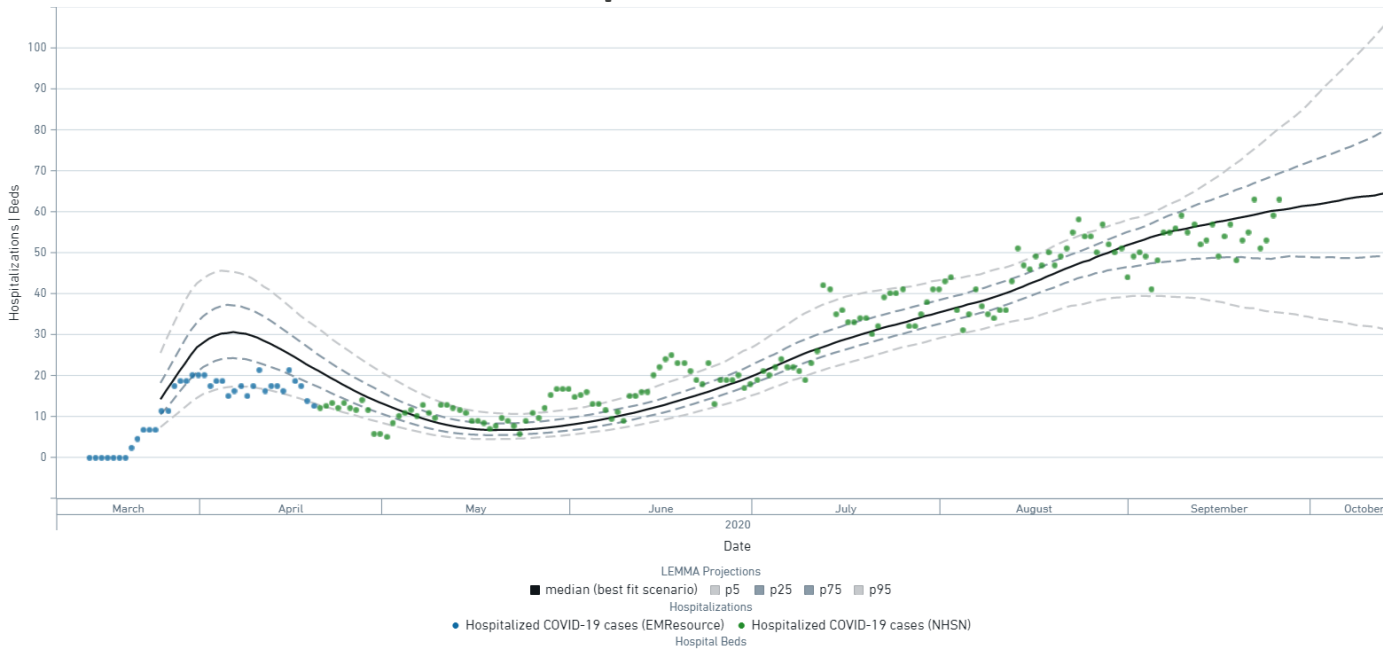
Southwest / Springfield (Regions D,G, I)

Overview		
Population	1,221,847	
Cumulative Cases	23938	
Cumulative Deaths	234	
7-day New Cases	3228	🟥
WoW % Case Change	15.6%	🟥

Reproductive Rate		
Pre-intervention	2.36	
Last Week	1.111	
Current Week	1.113	+/- 0.06
WoW % Change	0.2%	

Bed / Ventilator Availability		
% ICU Beds Occupied	61%	
% ICU Beds Occupied C19	21%	
% ICU Beds Free	39%	🟩
% Ventilators in use	29%	
% Ventilators available	71%	

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

Base Case Southwest Region

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: Oct 14, 2020, + 2 more

Hospitalizations

LEMMA Projections
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Hospitalizations
● Hospitalized COVID-19 cases (EMResource) ● Hospitalized COVID-19 cases (NHSN)
Hospital Beds

[Data updated 9/29/20]
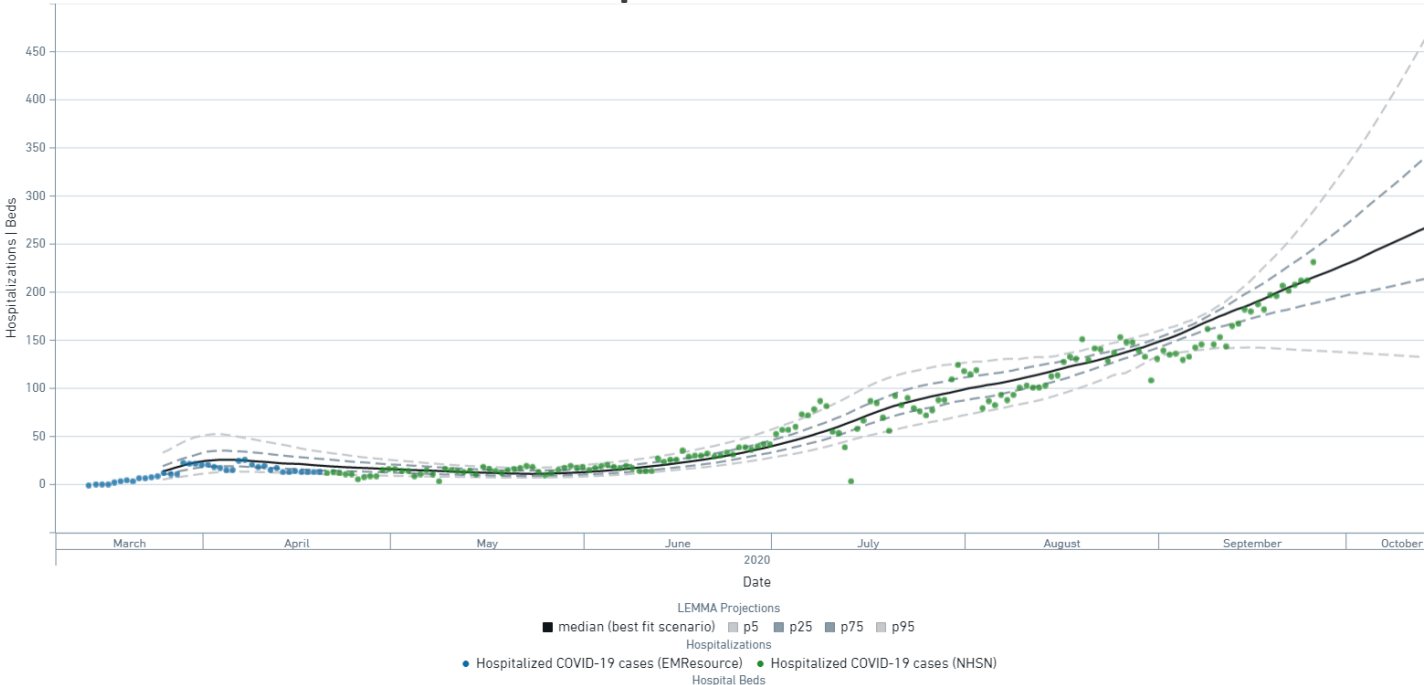
Greater St Louis Area (Region C)

Overview		
Population	2,229,518	
Cumulative Cases	47625	
Cumulative Deaths	1252	
7-day New Cases	2615	🟥
WoW % Case Change	5.8%	🟥

Reproductive Rate		
Pre-intervention	3.39	
Last Week	1.022	
Current Week	1.023	+/- 0.08
WoW % Change	0.1%	🟧

Bed / Ventilator Availability		
% ICU Beds Occupied	67%	
% ICU Beds Occupied C19	12%	
% ICU Beds Free	33%	🟩
% Ventilators in use	34%	
% Ventilators available	66%	

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

Base Case St. Louis Region

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: Oct 14, 2020, + 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 9/29/20]

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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

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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)