State of Missouri regional COVID-19 hospitalized cases model

September 8, 2020

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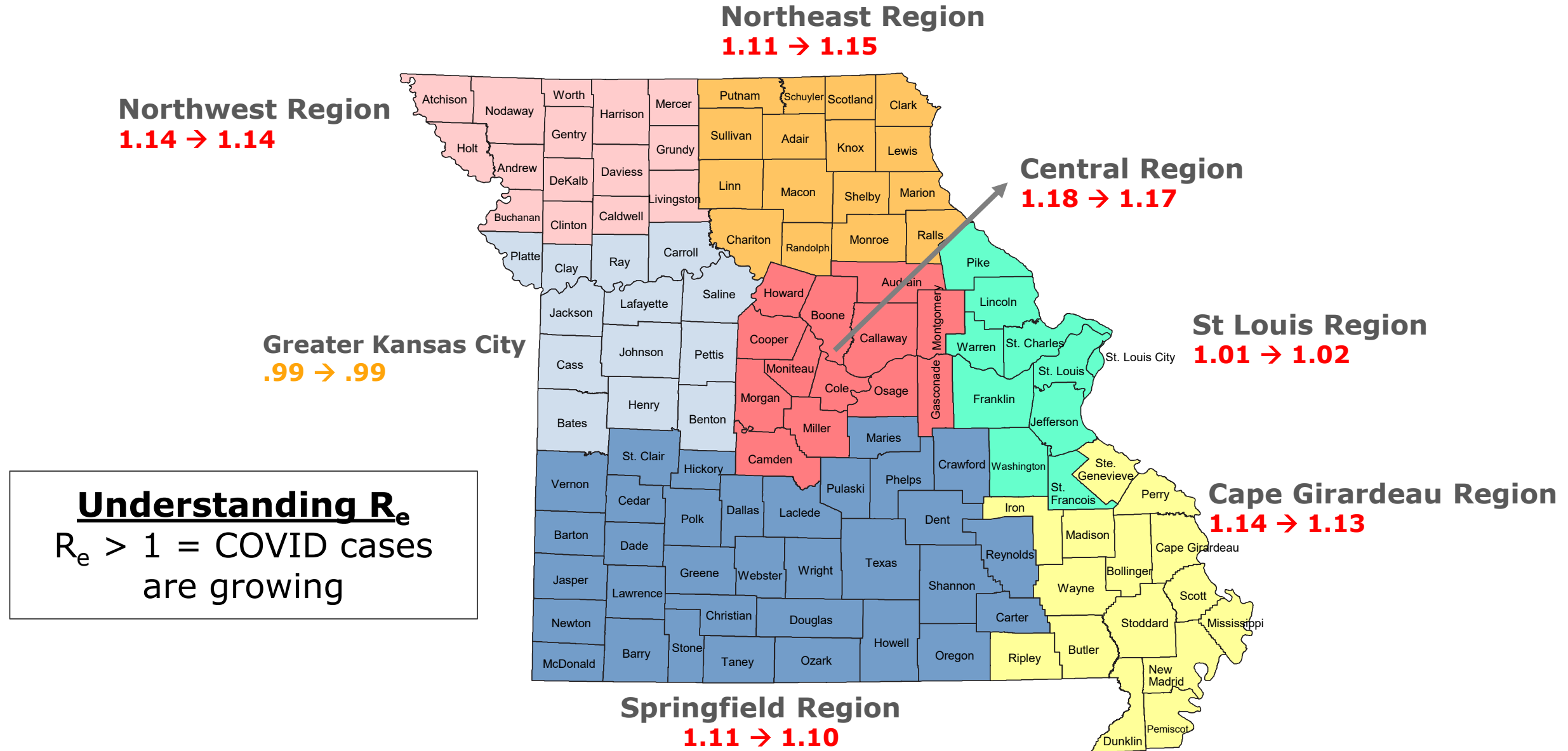
- Syndromic surveillance

- 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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RECOVERY PLAN

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

Northeast Region
1.11 → 1.15

Northwest Region
1.14 → 1.14

Central Region
1.18 → 1.17

St Louis Region
1.01 → 1.02

Greater Kansas City
.99 → .99

Cape Girardeau Region
1.14 → 1.13

Springfield Region
1.11 → 1.10

Understanding R_e
R_e > 1 = COVID cases
are growing

Central (Region F)

Central

Overview		
Population	502,486	
Cumulative Cases	7,231	
Cumulative Deaths	42	
7-day New Cases	1,501	
Wow % Case Increase	58.6%	
75% ICU Bed Capacity	207	

Reproductive Rate		
Pre-intervention	2.30	
Last Week	1.18	
This Week	1.17	
Change from LW	-0.5%	

(+/- 0.084)

Base Case Central Region

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: 9/24/20 1:00 AM, + 2 more

LEMMA Projections

■ median (best fit scenario) ▪ p5 ▪ p25 ▪ p75 ▪ p95

Hospitalizations

● Hospitalized COVID-19 cases (EMResource) ● Hospitalized COVID-19 cases (NHSN)

Hospital Beds
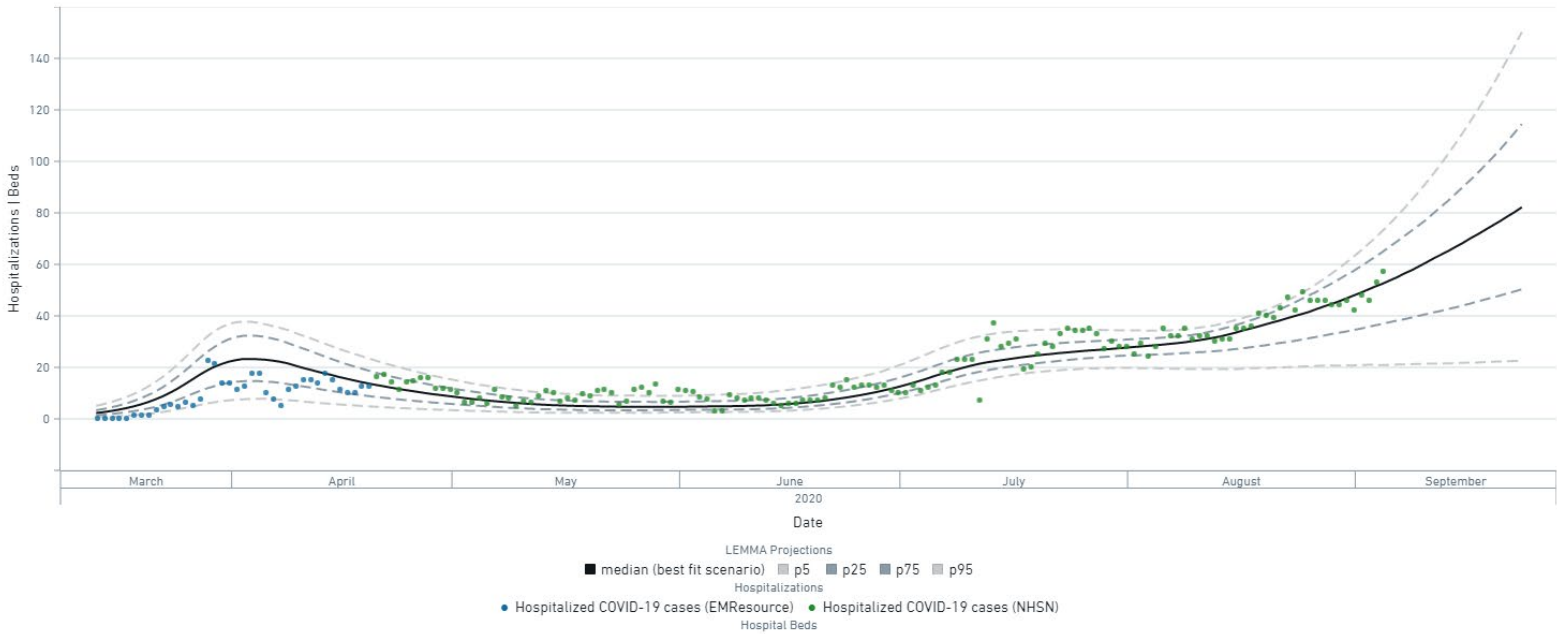
Greater Kansas City Area (Region A)

Kansas City Region

Overview		
Population	1,395,314	
Cumulative Cases	22,097	
Cumulative Deaths	263	
7-day New Cases	1,589	
Wow % Case Increase	17.3%	
75% ICU Bed Capacity	504	

Reproductive Rate		
Pre-intervention	2.80	
Last Week	0.99	
This Week	0.99	
Change from LW	0.1%	

(+/- 0.040)

Base Case Kansas City Region

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: 9/24/20 1:00 AM, + 2 more

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
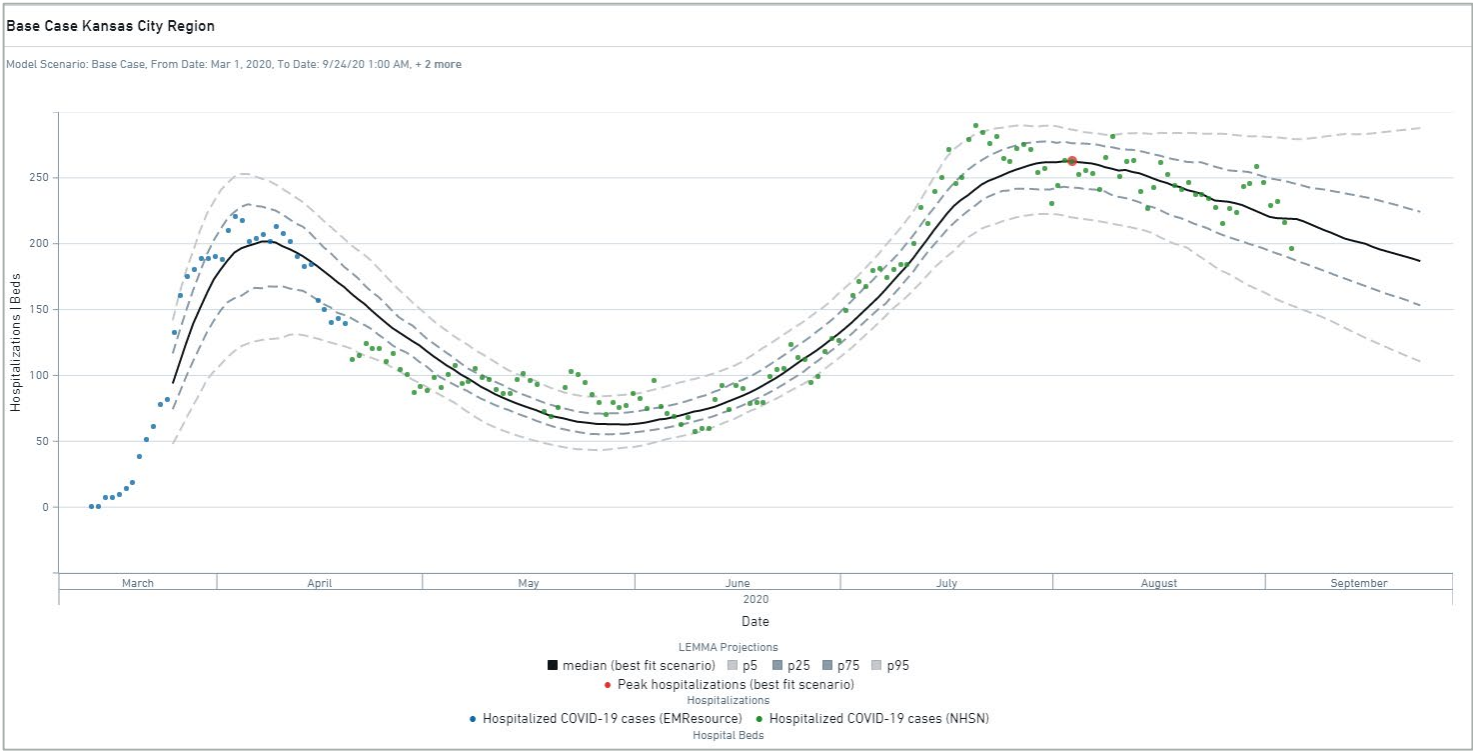
Northeast (Region B)

Northeast

Overview		
Population	179,448	
Cumulative Cases	1,804	
Cumulative Deaths	13	
7-day New Cases	225	
Wow % Case Increase	36.5%	
75% ICU Bed Capacity	31	

Reproductive Rate		
Pre-intervention	0.00	
Last Week	1.11	
This Week	1.15	
Change from LW	3.4%	

(+/- 0.097)

Base Case Northeast Region

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: 9/24/20 1:00 AM, + 2 more

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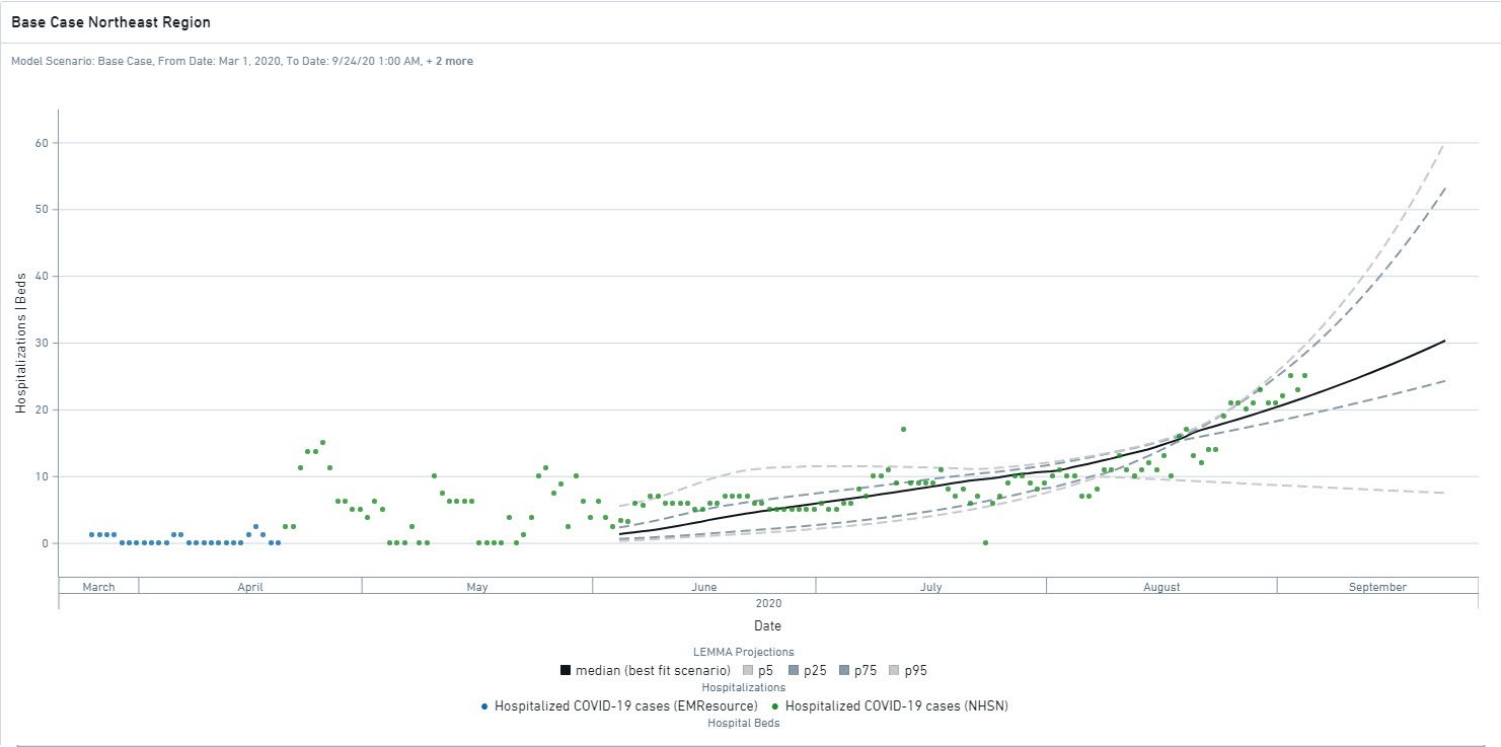
Northwest (Region H)

Northwest

Overview		
Population	234,361	
Cumulative Cases	3,204	
Cumulative Deaths	28	
7-day New Cases	692	
Wow % Case Increase	47.5%	
75% Bed Capacity	24	

Reproductive Rate		
Pre-intervention	1.24	
Last Week	1.14	
This Week	1.14	
Change from LW	0.1%	

(+/- 0.069)

Base Case Northwest Region

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: 9/24/20 1:00 AM, + 2 more

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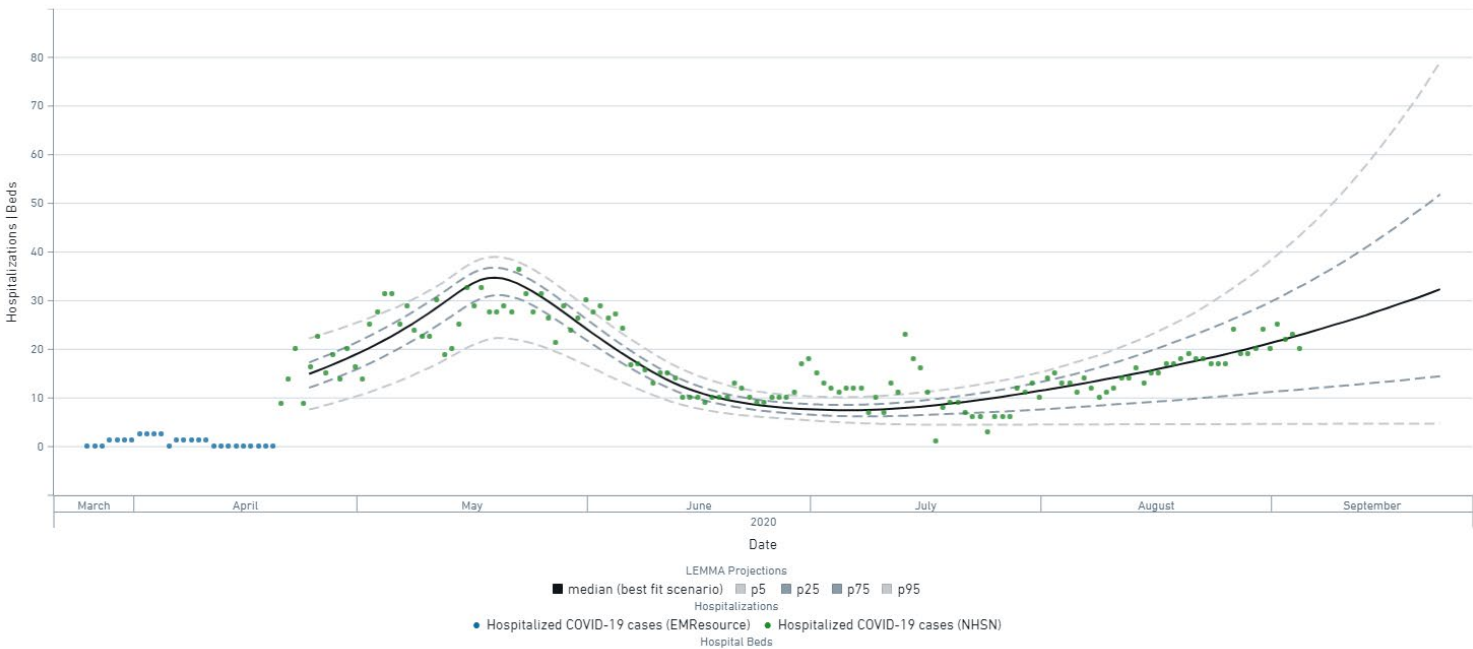
Southeast / Cape Girardeau (Region E)

Southeast

Overview		
Population	363,478	
Cumulative Cases	5,368	
Cumulative Deaths	65	
7-day New Cases	645	
Wow % Case Increase	30.9%	
75% Bed Capacity	109	

Reproductive Rate		
Pre-intervention	2.61	
Last Week	1.14	
This Week	1.13	
Change from LW	-0.9%	

(+/- 0.061)

Base Case Southeast Region

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: 9/24/20 1:00 AM, + 2 more

LEMMA Projections
■ median (best fit scenario) ■ p5 ■ p25 ■ p75 ■ p95
Hospitalizations
● Hospitalized COVID-19 cases (EMResource) ● Hospitalized COVID-19 cases (NHSN)
Hospital Beds
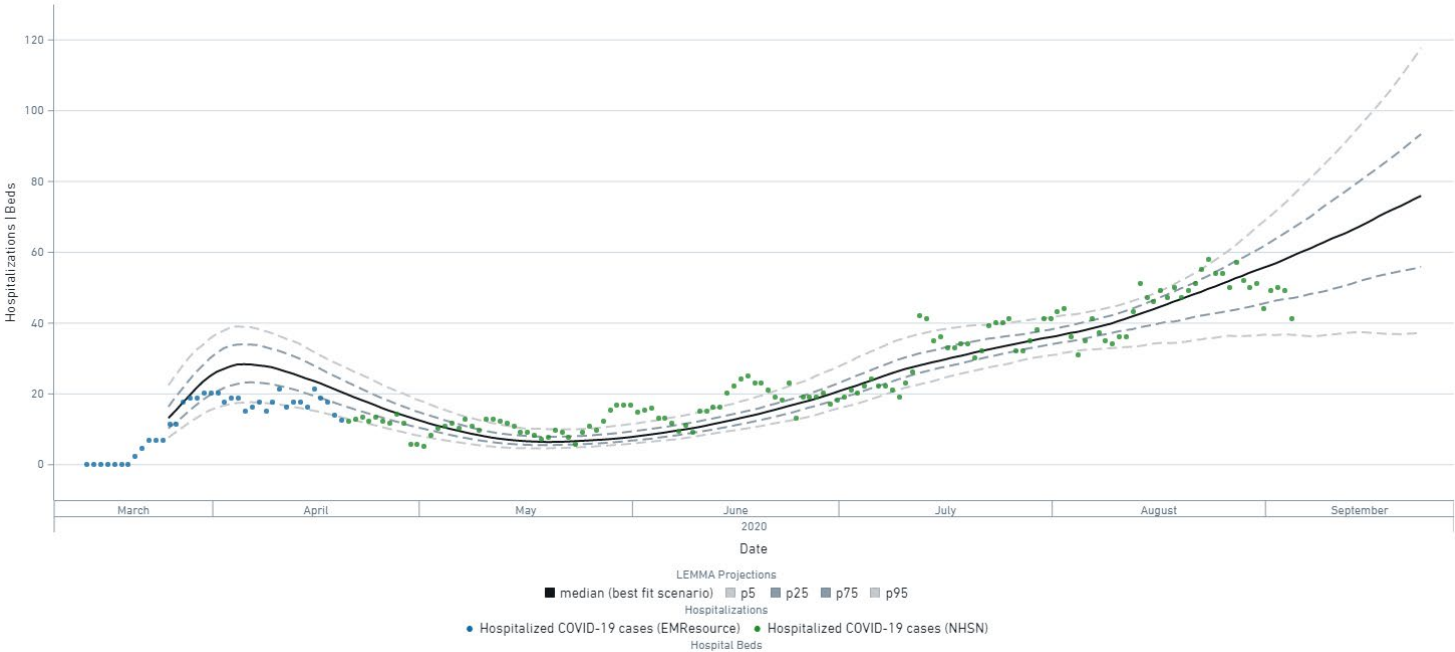
Southwest / Springfield (Regions D,G, I)

Southwest

Overview		
Population	1,221,847	
Cumulative Cases	13051	
Cumulative Deaths	106	
7-day New Cases	1821	
Wow % Case Increase	16.2%	
75% Bed Capacity	409	

Reproductive Rate		
Pre-intervention	2.36	
Last Week	1.11	
This Week	1.10	
Change from LW	-0.5%	

(+/- 0.064)

Base Case Southwest Region

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: 9/24/20 1:00 AM, + 2 more

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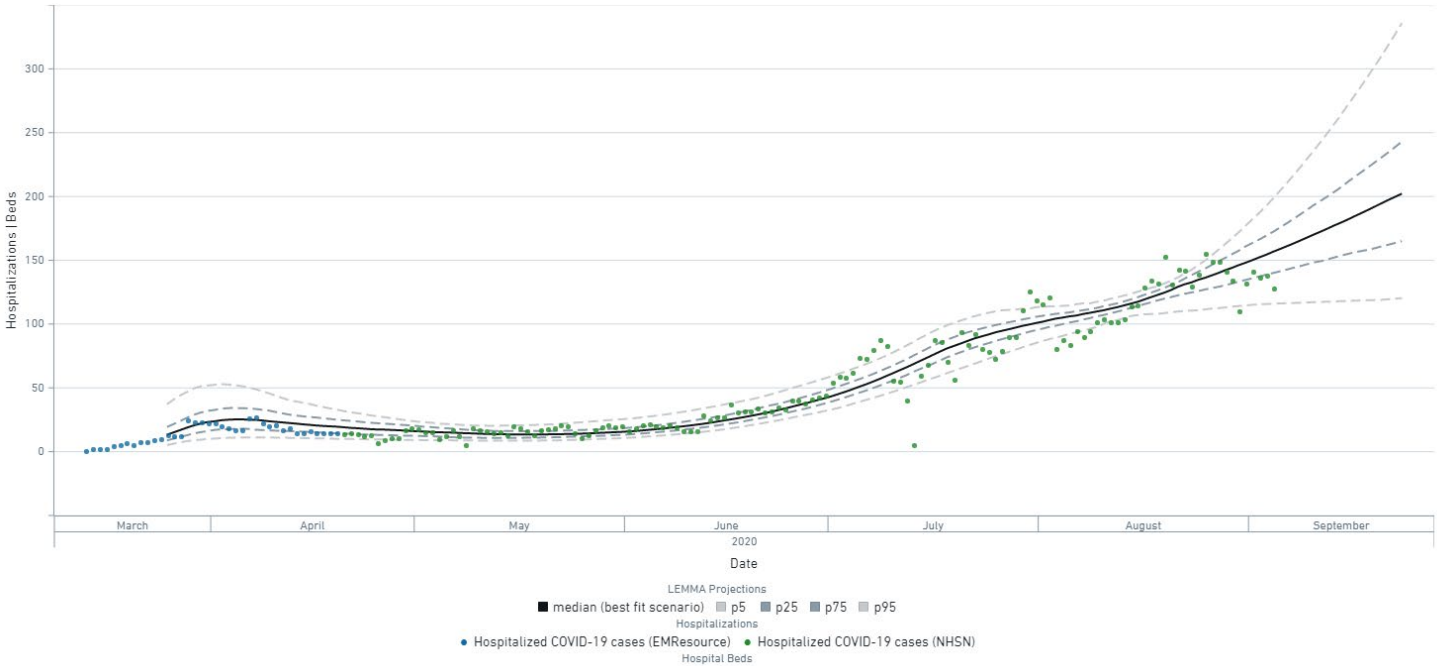
Greater St. Louis (Region C)

St. Louis Region

Overview		
Population	2,229,518	
Cumulative Cases	39,418	
Cumulative Deaths	1,118	
7-day New Cases	2,855	
Wow % Case Increase	17.0%	
75% Bed Capacity	816	

Reproductive Rate		
Pre-intervention	3.39	
Last Week	1.01	
This Week	1.02	
Change from LW	0.4%	

(+/- 0.044)

Base Case St. Louis Region

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: 9/24/20 1:00 AM, + 2 more

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

See FAQs for additional details

Link here: https://health.mo.gov/living/healthcondiseases/communicable/novel-coronavirus/pdf/modeling-faqs06032020.pdf
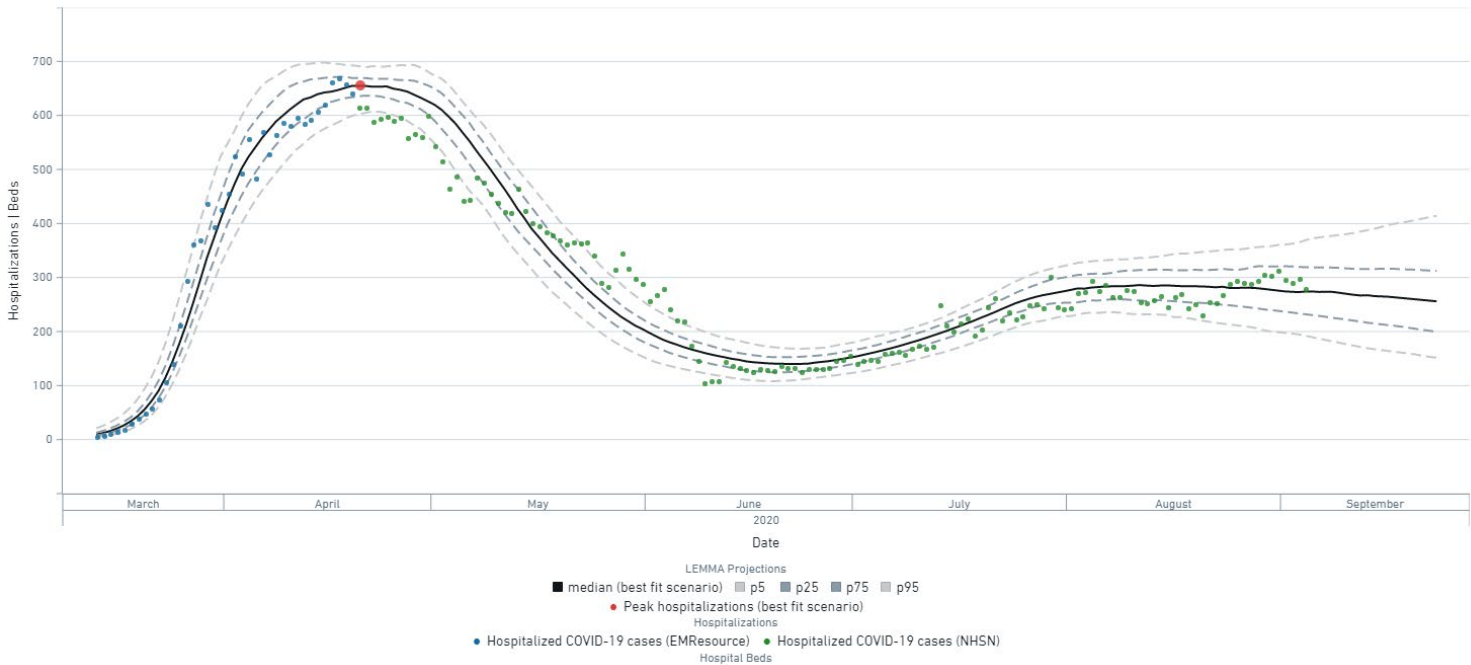
Regional COVID-19 transmission models help inform local policy, public health, and business decisions

- 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)