State of Missouri regional COVID-19 hospitalized cases model

November 10, 2020

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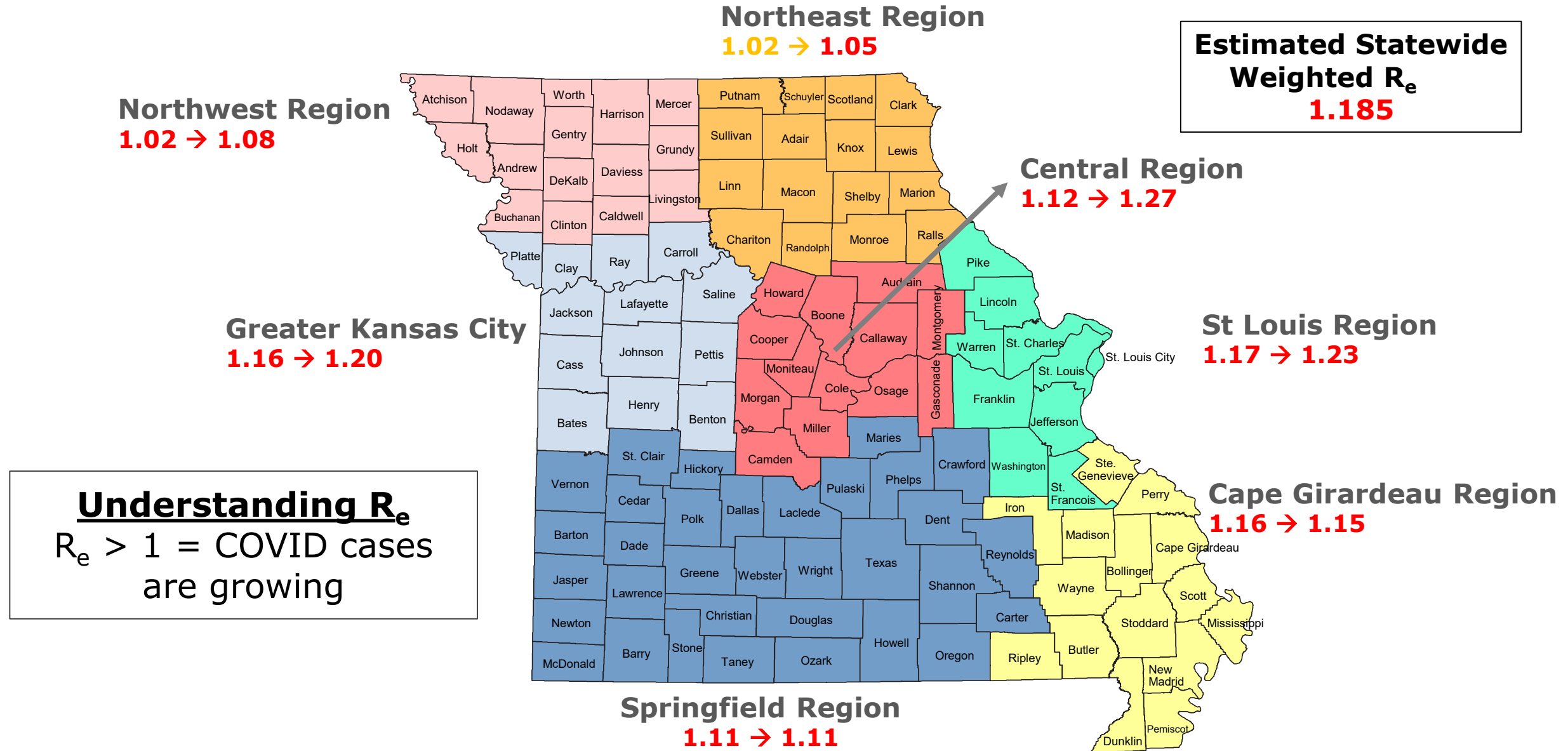
- Syndromic surveillance

- 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
1.02 → 1.05

Estimated Statewide Weighted R_e
1.185

Northwest Region
1.02 → 1.08

Central Region
1.12 → 1.27

Greater Kansas City
1.16 → 1.20

St Louis Region
1.17 → 1.23

Cape Girardeau Region
1.16 → 1.15

Understanding R_e
R_e > 1 = COVID cases are growing

Springfield Region
1.11 → 1.11

* Data date range: 11/2/20 – 11/10/20

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Central (Region F)

Overview		
Population	502,486	
Cumulative Cases	21544	
Cumulative Deaths	169	
7-day New Cases	3217	
WoW % Case Change	17.3%	

Reproductive Rate		
Pre-intervention	2.3	
Last Week	1.12	
Current Week	1.27	+/- 0.05
WoW % Change	13.1%	

Bed / Ventilator Availability		
% ICU Beds Occupied	65%	
% ICU Beds Occupied C19	20%	
% ICU Beds Free	35%	
% Ventilators in use	44%	
% Ventilators available	56%	

* % 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: 11/24/20 1:00 AM, + 2 more

Hospitalizations

[Data updated 11/10/20]
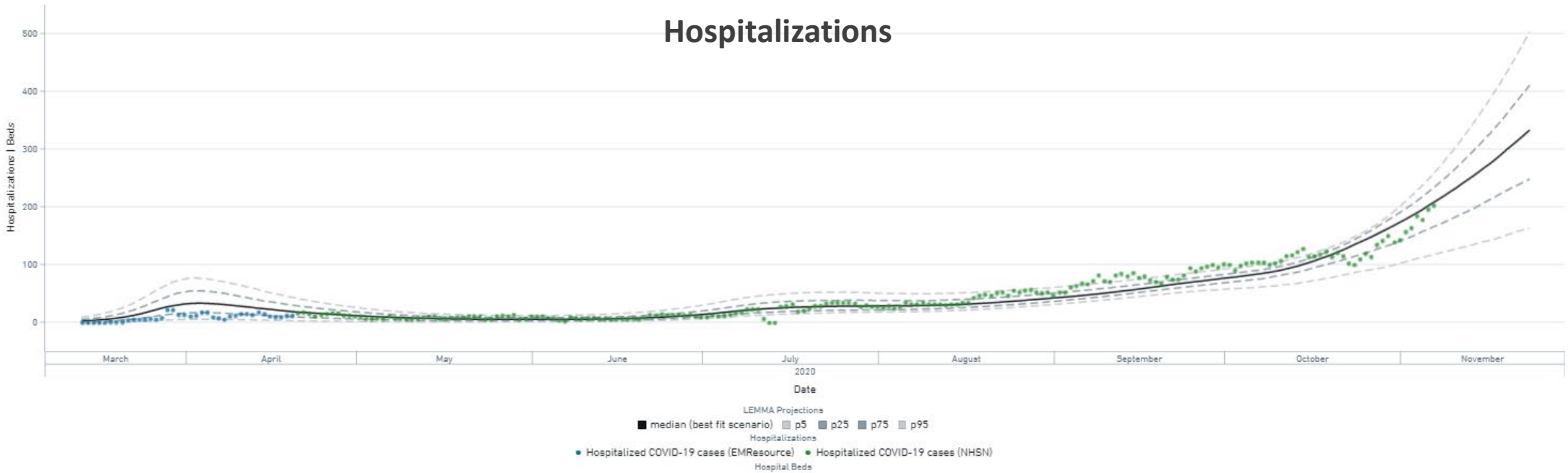
Greater Kansas City Area (Region A)

Overview		
Population	1,395,314	
Cumulative Cases	44901	
Cumulative Deaths	569	
7-day New Cases	5209	
WoW % Case Change	13.0%	

Reproductive Rate		
Pre-intervention	2.8	
Last Week	1.16	
Current Week	1.20	+/- 0.05
WoW % Change	3.5%	

Bed / Ventilator Availability		
% ICU Beds Occupied	82%	
% ICU Beds Occupied C19	18%	
% ICU Beds Free	18%	
% Ventilators in use	28%	
% Ventilators available	72%	

Base Case Kansas City Region

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: 11/24/20 1:00 AM, + 2 more

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

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 11/10/20]

Northeast (Region B)
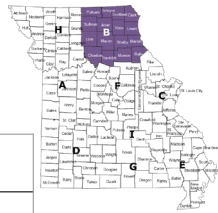
Overview		
Population	179,448	
Cumulative Cases	5290	
Cumulative Deaths	38	
7-day New Cases	944	🟥
WoW % Case Change	21.3%	🟥

Reproductive Rate		
Pre-intervention	N/A	
Last Week	1.02	
Current Week	1.05	+/- 0.06
WoW % Change	2.6%	🟥

Bed / Ventilator Availability		
% ICU Beds Occupied	98%	
% ICU Beds Occupied C19	60%	
% ICU Beds Free	2%	🟥
% Ventilators in use	24%	
% Ventilators available	76%	

Base Case Northeast Region

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: 11/24/20 1:00 AM, + 2 more

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

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 11/10/20]
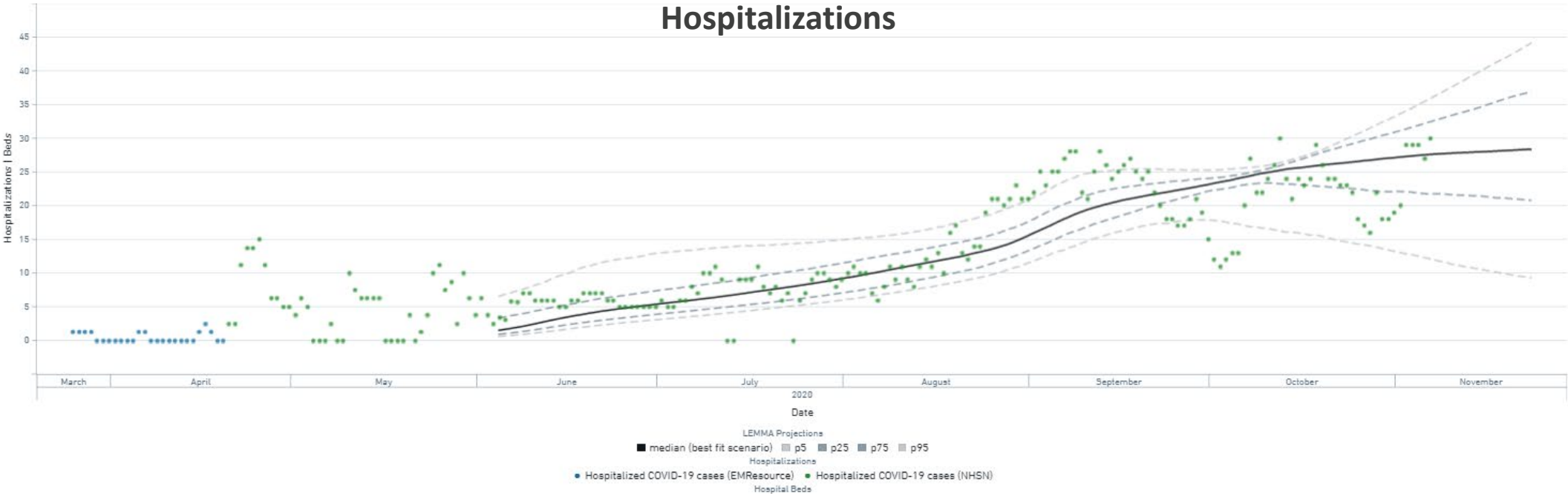
Northwest (Region H)

Overview		
Population	234,361	
Cumulative Cases	8479	
Cumulative Deaths	140	
7-day New Cases	959	🟥
WoW % Case Change	12.6%	🟥

Reproductive Rate		
Pre-intervention	1.24	
Last Week	1.02	
Current Week	1.08	+/- 0.07
WoW % Change	5.8%	🟥

Bed / Ventilator Availability		
% ICU Beds Occupied	78%	
% ICU Beds Occupied C19	31%	
% ICU Beds Free	22%	🟥
% Ventilators in use	19%	
% Ventilators available	81%	

* % 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: 11/24/20 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 11/10/20]
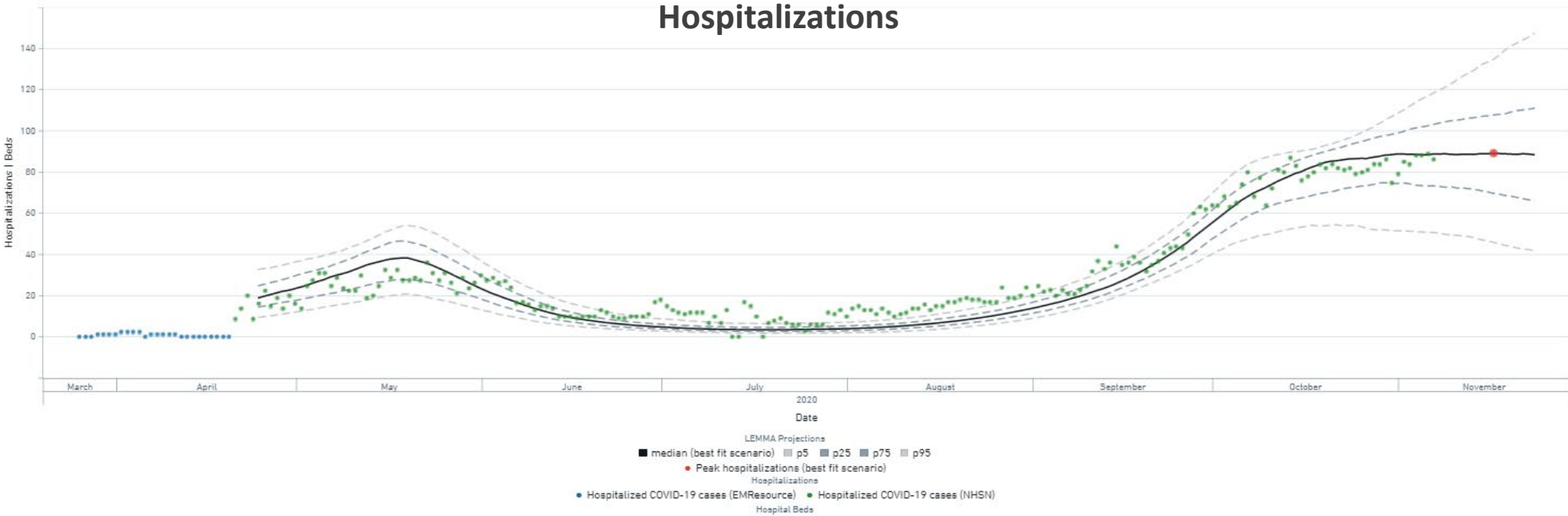
Southeast / Cape Girardeau (Region E)
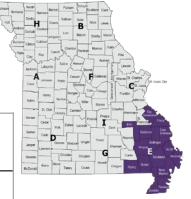
Overview		
Population	363,478	
Cumulative Cases	15219	
Cumulative Deaths	191	
7-day New Cases	1832	red
WoW % Case Change	13.5%	red

Reproductive Rate		
Pre-intervention	2.61	
Last Week	1.16	
Current Week	1.15	+/- 0.05
WoW % Change	-0.5%	

Bed / Ventilator Availability		
% ICU Beds Occupied	59%	
% ICU Beds Occupied C19	25%	
% ICU Beds Free	41%	green
% Ventilators in use	35%	
% Ventilators available	65%	

* % 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: 11/24/20 1:00 AM, + 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 11/10/20]

Southwest / Springfield (Regions D,G, I)
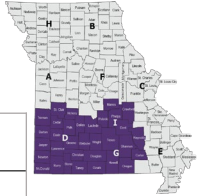
Overview		
Population	1,221,847	
Cumulative Cases	43089	
Cumulative Deaths	574	
7-day New Cases	4058	🟥
WoW % Case Change	10.3%	🟥

Reproductive Rate		
Pre-intervention	2.36	
Last Week	1.11	
Current Week	1.11	+/- 0.06
WoW % Change	-0.2%	🟧

Bed / Ventilator Availability		
% ICU Beds Occupied	64%	
% ICU Beds Occupied C19	21%	
% ICU Beds Free	36%	🟩
% Ventilators in use	37%	
% Ventilators available	63%	

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

Base Case Southwest Region

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: 11/24/20 1:00 AM, + 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
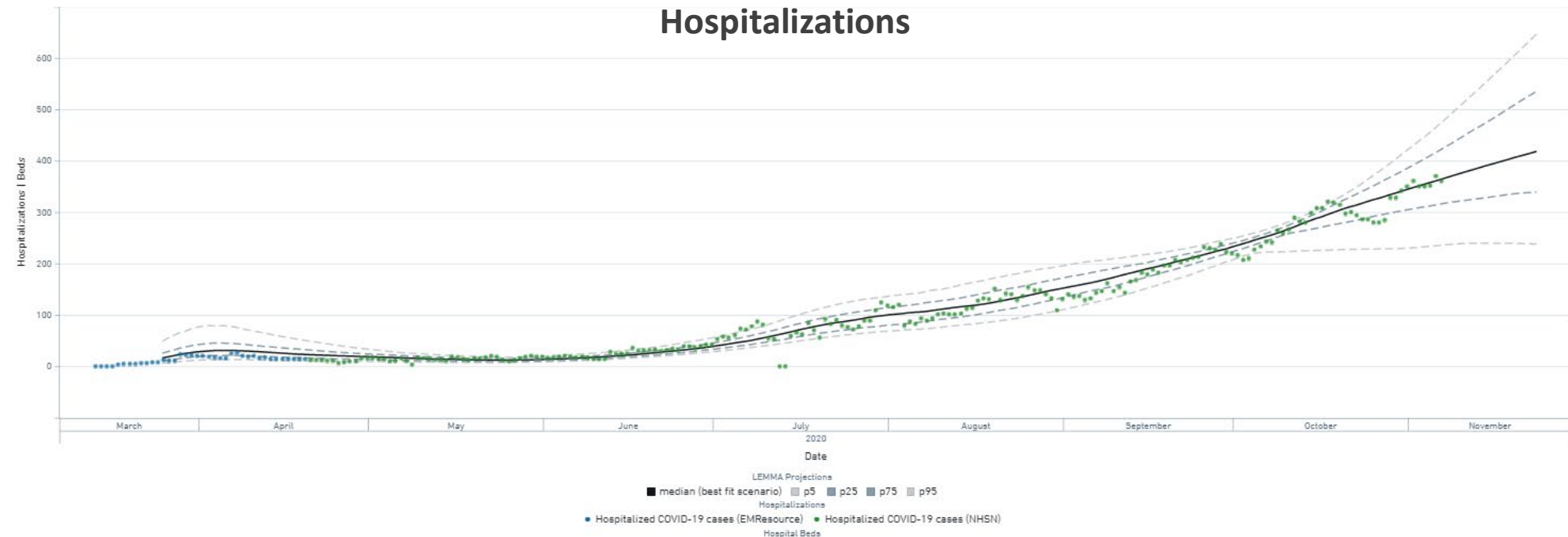
[Data updated 11/10/20]

Greater St Louis Area (Region C)

Overview		
Population	2,229,518	
Cumulative Cases	73919	
Cumulative Deaths	1472	
7-day New Cases	8038	🟥
WoW % Case Change	12.1%	🟥

Reproductive Rate		
Pre-intervention	3.39	
Last Week	1.17	
Current Week	1.23	+/- 0.03
WoW % Change	5.1%	🟥

Bed / Ventilator Availability		
% ICU Beds Occupied	63%	
% ICU Beds Occupied C19	14%	
% ICU Beds Free	37%	🟩
% Ventilators in use	40%	
% Ventilators available	60%	

Base Case St. Louis Region

Model Scenario: Base Case, From Date: Mar 1, 2020, To Date: 11/24/20 1:00 AM, + 2 more

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

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 11/10/20]

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)